PALADIN Flight Control System

User Manual V3.0

FOXTECH Technology Co., Ltd.

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Statement

- Users will be deemed to have accepted this statement by using PALADIN flight control system.
- Please read this manual carefully before using PALADIN flight control system. If you have any questions, please contact us.
- The PALADIN flight control system is a special aviation equipment. Users should use it in accordance with relevant regulations and be responsible for the use of PALADIN.
- FOXTEH reserves the right to modify any part of this manual without prior notice to users in order to provide users with the latest and most advanced products. Users can download the latest information through FOXTEH official website.

System Introduction

- It has a comprehensive flight status monitoring and alarm function and a complete emergency protection mechanism, and the PALADIN system can realize the reorganization of the control law.
- Under the condition that part of the sensor or attitude solution fails, thus maximizing the safe operation of the system.
- It provides highly integrated ground station software BoyingGCS with the functions of flight data monitoring, dashboard display, abnormal status alarm, flight remote controller, electronic map, route planning, etc.
- PALADIN system has high measurement accuracy and reduces the probability of attitude divergence, ensuring the reliability and safety of the system.
- It closely integrates with the remote controller, and the control mode of the PALADIN system can be switched through the remote controller, ensuring that the operators can control in time during multi-rotor drone taking off and landing.
- The functions of route planning and mission control allow users to easily develop diversified missions by using ground station software.
- The PALADIN system integrates high precision inertial and satellite navigation sensors. Sensor data through the preprocessing course, drift compensation in adaptable temperature range (-15 ° ~60 °),

and data fusion can acquire parameters such as flight attitude, position coordinates and working status in real time, and complete high-precision attitude and route control for multi-rotor drone.

- PALADIN system integrates two CPU and sensors. Each can be automatically detected and switched automatically to ensure flight safety.

Configuration and Installation

System supporting list

PALADIN system checklist			
	Main module		Data transmission – Bluetooth relay station
	High precision and high sensitivity GPS+ external compass positioning and orientation module		Altimetry radar for terrain following, accuracy low altitude altimetry
	Power Conversion & Monitoring Module		Handheld surveying and mapping equipment
	Flight indicator light		Water pump governor
	Airborne 2.4GHz data transfer radio		Level sensor for protection when pesticide using up
	4G module for transmitting flight operation data to the cloud background (optional)		Bluetooth module for users who use the package ‘Point A&B’ (optional)

Flight control system connection diagram

The flight control and peripheral equipment must pay attention to the main control direction during installation, and the installation should be firm. The connection diagram of the flight control peripheral is as follows:

Basic Introduction

Connector

Name	Usage	Remark
BY-RTK	For airborne terminal of differential GPS	
LEVEL	For liquid level	Non-contact liquid level needs to be glued to the bottom of the medicine box with nail-free glue
4G	For 4G	4Gmodule connector
RADAR	For radar	Unobstructed within 15° below the radar, away from the satellite navigation module
RADIO	For data transfer radio	Away from the satellite navigation module
LED	For flight indicator flight	The lights of the flight control board will not work when accessing the external indicator.
POWER	For power	Input: 6s～12s Output: DC 5V
S.BUS	For receiver	
CH1~CH8	For motor signal output	CH1~CH8 correspond to motors No.1~8. the signal line divides into two. Short-line is connected to the odd-numbered motor, and the long-line is connected to the even-numbered motor.
PUMP/NOZ	For pump / centrifugal nozzle signal	Long-line connect to pump, short-line connect to centrifugal nozzle
BUP-POW	For flow meter	

Description of power supply system

- V2 version of the flight control power module power supply range: 6S-12S
- RTK base station power supply range: 6S-12S
- RTK airborne board power supply: 3S-12S
- Water pump module power supply range: input DC 24V, output DC 12V

Introduction of flight mode

Flight control mode	Control method	Characteristic	备注
Height holding mode	Manual control	When joystick returns to the center, the aircraft will automatically maintain the attitude, and the middle position of the throttle can determine the height, but the precise fixed-point hovering cannot be achieved, so manual correction is required.	
Position holding mode	Manual control	When the satellite signal is good, it can be hovered with high precision and speed can be limited.	
GNSS assist mode	Manual control	When the satellite signal is good, it can be hovered with high precision and angle can be limited.	
Fully automatic /AB point mode	Automatic	Automatic/semi-automatic flight according to the mission route/AB point set by the ground station. It's Dependent on satellite.	The throttle can still control the height, and the throttle will maintain the current height in the middle.

Description of flight indicator light

PALADIN working status indicator light, as defined below:

Number	status	Malfunction status	Instruction
1	Light is not on	Light malfunction or updating log	
2	Any color light is always on and the ground station cannot be connected	System halted	
2	Red and white lights alternately flash	Flight control initialization	
3	Red, yellow, blue and green lights	Device is not calibrated	Remote controller, compass,

	alternately flash		accelerometer
4	Red, blue and green lights alternately flash	Equipment calibration or testing	Motor test, ESC calibration
5	Yellow lights flash	Remote controller malfunction, Low voltage primary protection, pesticide running up protection	
6	Yellow lights flash quickly	Low voltage secondary protection	Execution is forced landing
7	Purple lights flash	Magnetic compass malfunction	
8	Purple lights flash twice	Accelerometer malfunction	
9	Purple lights flash quickly	Other malfunctions before unlocking	Or initialization is not finished
10	Red lights are always on	Log storage device malfunction	
11	Red and yellow lights alternately flash	GPS malfunction	
13	Blue / green lights flash	No / GPS，not unlocked	
14	Blue / green lights are always on	No / GPS，unlock	
15	Green lights flash quickly	GPS high accuracy positioning	

Remote controller channel setting

The PALALDIN system can communicate with S.BUS-enabled receivers (such as Futaba) via the S.BUS protocol. If the remote controller does not support the S.BUS function. A separate PPM encoder is required. The definition of each channel is as shown in the following table. The receiver must be paired with the remote controller before use. For the pairing operation, please refer to the remote-control instructions.

RC receiver channel definition (Japan hand)		
Receiver channel number	Definition	remarks
1	Rolling	
2	Pitch	
3	Accelerator	
4	Course	
5	Flight mode	Can be calibrated via magnetic compass through this channel
6	Water pump	Two-phase switch --- trigger high gear
7	Return	Return---trigger high gear
8	Breakpoint	Two-phase switch --- in Auto / Point A&B mode,

		toggle the trigger once.

After configuration, please connect to PALADIN for verification. In manual mode, the remote controller can control the motor (no propellers)

Unlock and lock

Unlockable mode: height hold / GNSS assist / position hold mode

Lockable mode: height hold / GNSS assist / position hold mode

Unlocking mode: maximum pitch, minimum throttle, maximum throttle to right (flight direction), maximum throttle to left (rolling), status indicator light changes flash to being on, indicating unlocked。

As shown below:

Unlocking requirements:

The height hold mode can be unlocked by passing the self-test (the blue light is flashed).

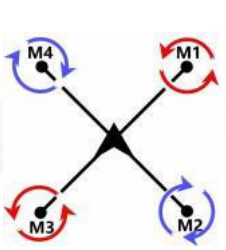
GNSS assist / position hold mode, the satellite has been positioned, and the indicator light is green.

Locking mode: maximum pitch, minimum throttle, maximum throttle to left (flight direction), maximum throttle to right (rolling), lock immediately. The indicator light starts to flash, indicating that the locking is successful. As shown below:

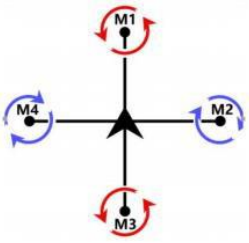
Basic Settings

Rack types settings

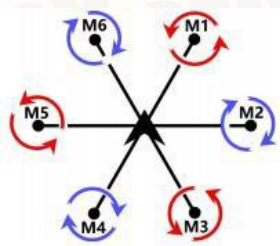
PALADIN flight control is suitable for many general multi-rotor models. The ground station APP can manually set the rack type to meet the needs of users. PALADIN provides 10 rack types, as shown in the figure:



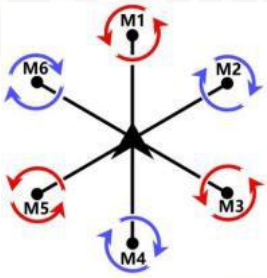
Quadrotor "X" type



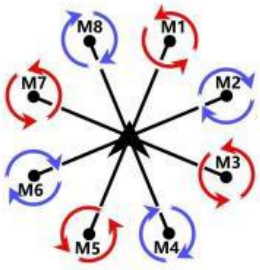
Quadrotor "+" type



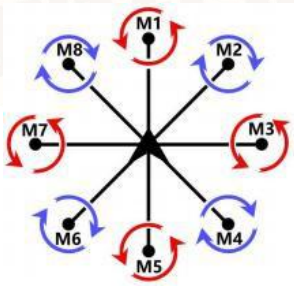
Hexarotor "X" type



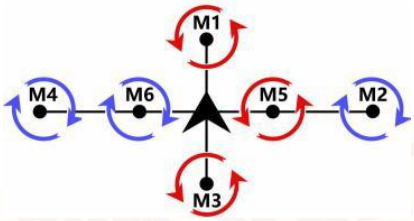
Hexarotor "+" type



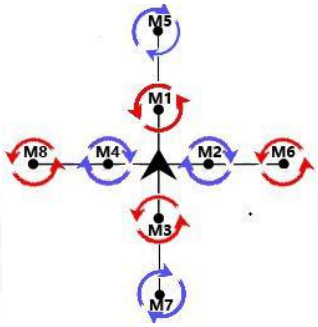
Octorotor "X" type



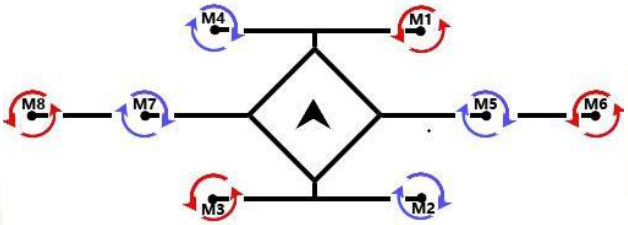
Octorotor "+" type

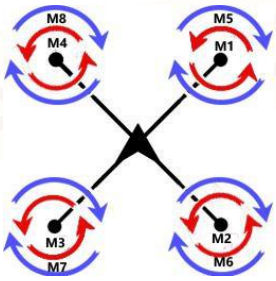


Special shape "4+2" type



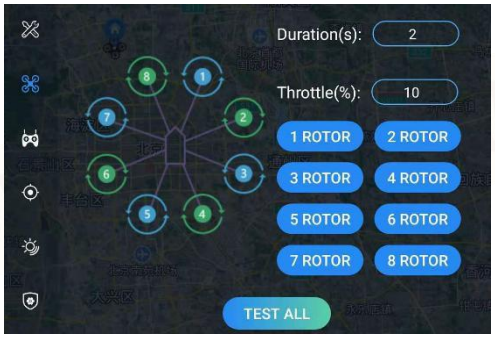
Quardrotor, 8 rotors, "+" type





Special shape "4+4" Quardrotor, 8 rotors, "+" type

Connect the flight control and APP, enter the settings – rack settings, select the corresponding rack type, and restart flight control.



Motor testing

Motor test is used to test whether the connection of signal line and motor steering is correct. Be sure to test the motor before taking off to make sure that the motor steering and ESC signal lines are connected to the main control in the correct order.

⚠ **The motor testing is very important, it is recommended to carry out after the initial installation or replacement of the flight control. The idle speed of different motors is not equal. Please pay attention to the initial throttle amount during the test, and do not set it too high.**

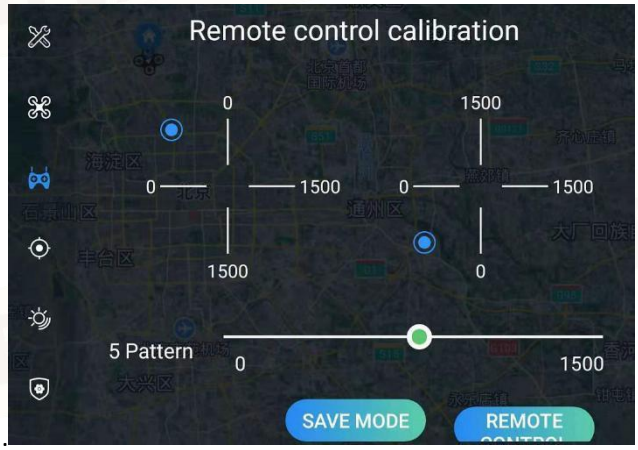
Flight mode settings

Connect flight control and mobile phone ground station 3.0, enter the interface of remote-control calibration. Setting different flight mode in three gears of channel 5 respectively.

Calibration Settings

Remote controller calibration

After the remote controller of the aircraft is installed or replaced for the first time, and the receiver is paired with the remote controller successfully, the maximum and minimum values of the remote controller channel need to be calibrated. In the calibration process, each joystick is calibrated successively, as shown in the figure below:



Don't install propellers when calibrating remote controller.

Electronic speed controller (ESC) calibration

The purpose of ESC calibration is to make the PWM value of flight control output and the range of PWM value that can be received by ESC matched. The general calibration methods are as follows:

- The remote controllerler is powered on, the throttle is pushed to the highest position, and the flight control is powered on, the flight indicator light flashes red and blue, indicating that the flight control has access to the ESC calibration mode. The flight control is powered off, and the remote-control throttle always maintains the highest position.
- The flight control is powered on again, and the power system is powered up. When the ESC is heard "Di-Di", pull the throttle quickly to the lowest position. At this time, a long sound "Di—" will be

heard, and then push the throttle, the motor will rotate. The ESC calibration is finished.

⚠ During the ESC calibration, the aircraft should be without propellers. Different manufacturers have Different prompt tones of the ESC calibration, please refer to the ESC manual.

Accelerometer calibration

When PALADIN flight control is unveiled from the factory, the acceleration has been calibrated. In general, it is not necessary to calibrate again. However, in some specific cases, the accelerometer needs to be calibrated to ensure the stability of attitude and flight safety. The method is as follow:

- Enter settings – calibration Settings page, click CALIBRATION
- Put flight control / aircraft horizontal, click "Next step", according to prompt, put the aircraft / flight control front respectively to the left, right, and nose down, up and front reverse.
- When calibration is successful, the calibration will be completed and the flight control should be restarted.

Horizon calibration

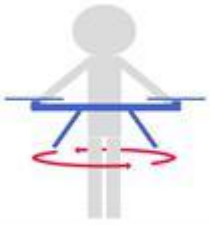
The horizon calibration is mainly used to correct the installation error. Put the aircraft horizonal, in

Calibration settings page, click CALIBRATION, and the correction is finished.

Magnetic compass calibration

The magnetic compass calibration makes the aircraft course more accurate. When flying in different environments and regions, the magnetic compass needs to be recalibrated to ensure that the flight control can adapt to the local magnetic field environment. The method of PALADIN flight control magnetic compass calibration:

- Quickly toggle the "mode channel" switch for more than 6 times. When the status indicator light flashes red and blue alternately, it indicates entering the horizontal calibration mode of magnetic compass.
- Rotate the aircraft horizontally and slowly 360 degrees until the green light is always on and then the horizontal calibration is finished.
- The aircraft head is vertically downward, waiting until the red and green light cycle flashes, indicating it's in the magnetic compass vertical calibration mode.
- Rotate the aircraft slowly for 360 degrees again. When the status indicator lights stop flashing and the blue light remains on, the vertical calibration is finished.
- Restart the flight control.



Horizontal rotation for 360°

vertical rotation for 360°

Rotate the aircraft horizontally and uniformly for 30s per axis. If the red light is always on during the rotation, the calibration fails, please recalibrate.

Dynamic balance calibration

The purpose of dynamic balance calibration is to adjust the speed difference between the clockwise motor

and anticlockwise motors, and control it in the minimum range to ensure smooth flight. Adjustment method:

The aircraft takes off and hover in position hold mode / GNSS assist mode. Click dynamic balance calibration, it will prompt the average speed and difference value of the clockwise and anticlockwise motor 30 seconds later. If the difference value is less than 50, it means normal. The direction of the motor to be corrected is displayed in the "results" column.

Flow meter calibration

After installing the flow meter properly, add a certain amount of water to the pesticide tank for ground or air spraying. After the water is sprayed, Observe the flow values displayed by the ground station, and fill in the actual water addition and display of water consumption respectively, and click “Flow meter calibration”.

Protection Mechanism

Return flight:

Return flight is one of the important protection methods for safe flight. The process is the aircraft climbs 2 meters (the default value can be modified) from the current position, it flies horizontally to the safe site, hover, and waits for being controlled.

Fail Safe for remote controller:

PALADIN has a complete measure of safeguard of remote controller to keep aircraft safe and finish spraying work in large area as well. Fail Safe can be set through ground station. It should be noted that multi-optional settings of Fail Safe for remote controller works only in “Full Auto mode”. In manual mode and point A&B mode, Fail Safe is on by default and cannot turn off.

Fail Safe for data link:

PALADIN set the ground station to be non-synchronous required equipment to improve the convenience of using. During the process of flight, users can observe the aircraft state through the ground station, or judge the working condition by aircraft and indicator light under the circumstance of disconnecting the data link. Fail Safe for data link settings only work in Full Auto mode with the signal loss of remote controller to keep working from instability of data transmission link.

Low voltage protection

PALADIN provides voltage protection based on modifiable voltage values. Users can modify the voltage values measured by flight control (If there is a difference between the actual value and the measured value, the measured value can be modified by this function), Flight control detects monolithic voltage and protects it.

Limited area protection

In certain cases, the aircraft needs to be limited to a certain range. PALADIN provides limits for height and distance to protect aircraft.

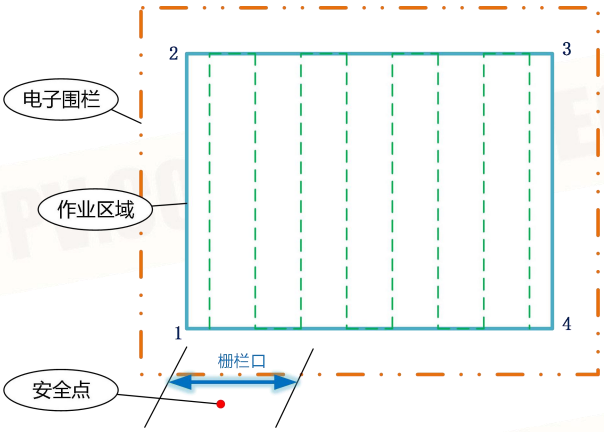
Full Auto Mode

Open the ground station 3.0 version, click  and enter the route planning page. Survey and map by surveying and mapping equipment, design the working area and plan the flight route. Set the parameters, and the ground station will automatically generate flight routes. Affirm and upload the flight information to flight control and the aircraft will start to work.

For details, please refer to **Boying mobile phone ground station users’ manual V3.0.**

Notice for full Auto mode

- Please put the aircraft to the safe position of working area before switch to the automatic flight route. If the distance between aircraft and working area is more than 100 meters when switching to the automatic flight route, the aircraft will not follow the route.
- The flight control will record current position as “Home” when switching to Auto mode.
- There is “polygonal” electronic fence in Auto mode (flight control has received the right waypoint file), and cannot be turned off by default. The fence boundary extends 10 meters outward for each boundary of the current working area.
- In Auto mode, flight control will open automatically a “opening” in take-off site around the fencing area to make sure the aircraft return to the safety site, as show in the following figure：



If switch to the manual mode when operation in Auto, “polygonal” fence will not disappear. If switch to “Return flight” (including break point), and then switch to “manual mode” when operation in Auto, “polygonal” electronic fence will disappear.

The operation of aircraft can be set in safety settings if needed after finishing the work.

Break points settings

Break point is memory point added when low battery or exhausted pesticide which interrupt the flight during the automatic flight or point A&B flight to make sure starting work again will not repeat or omit the spraying area.

Add the point automatically: in Auto or Point A&B mode, when triggering the Fail Safe (remote controller, exhausted pesticide, or low battery), or during switching flight mode (enable the function "cancel adding the break points automatically"), the break points will be added automatically without manual control.

Add the point manually: in Auto or Point A&B mode, points will be added through toggling the channel 8 (break point) once**.**

Clear the break points in Full Auto mode: re-uploading the flight route in non-Auto mode can clear the break points.

Clear the break points in Point A&B mode: clear point A and B means clearing break points in this mode.

⚠ **Break points only can be cleared when adding waypoints in the mode of altitude hold and position hold**

Point A&B Mode

Point A&B normal operation

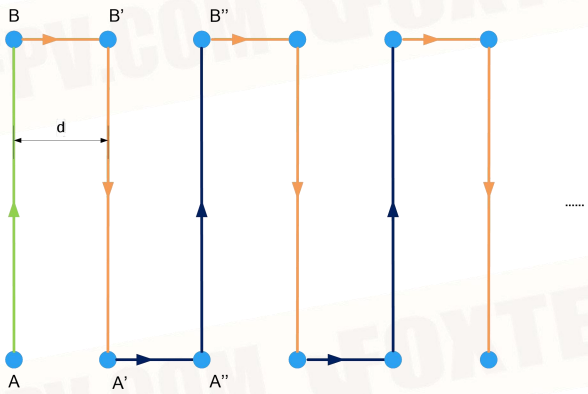
In order to meet the needs of users (the function of automatic spray can still be used when working on small-area and regular-shaped plots), and at the same time effectively reduce the user's operating intensity, the PALADIN system has a very practical mode "Point A&B mode". This mode is to control the aircraft to perform the L-shaped route (the L-shaped route is a "course unit"). This operation mode can meet the requirements of fast operation and ensure uniformity of spraying.

- **Preparation for take-off:** place all the channels of the remote controller in the low position, add the pesticide to the medicine tank, and control the aircraft to take off.
- **Preparation for record:** control the aircraft to fly to the point A and then switch to the "position hold mode" or "GNSS assist mode".
- **Recording point A:** remote controller channel 8 is set to upper position, record point A. If it's successful, the flight indicator light flashes blue and white alternately 4 times. The ground station has

the mark of "point A". Turns on the water pump manually.

- **Recording point B:** remote controller channel 8 is set to the lower position, record point B. If it's successful, the flight indicator light flashes green and white alternately 4 times. The ground station has the mark of "point B". Shuts off the water pump manually.
- **Point A&B mode:** After the AB point is successfully planned, the mode channel is switched to the automatic mode, and the current position is less than 100 meters from point A or point B. The aircraft will execute the AB point mode and fly to the point A or B closest to the current position, then hover, waiting for fine adjustments or the commands of turning to the next line, and the aircraft enters the preparation for working.
- **Starting work:** According to the working needs, move the roll bar to the left/right and keep it for more than 1 second. Then the aircraft will turn to next line according to the corresponding direction and fly in parallel with the AB line. The pump will start automatically.
- **Turning-to -next-line work:** During the flight of point A&B mode, move the roll joystick and keep it for 1 second. When aircraft reaches the next point of the spraying route, it will directly follow the direction of the joystick to fly to the next point. If the rolling channel is not moved during the flight, the aircraft will hover when arriving at the end of a single spraying route and waits for a new command. The aircraft continues to perform the spraying task when the roll joystick issue the new command.

The turning-to-next-line instruction is effective only when manual turning to line is enabled and manual obstacle avoidance is not enabled.



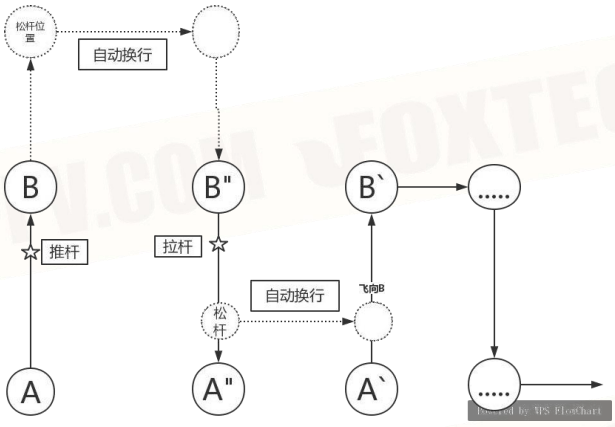
- **Data storage:** If pesticide uses up (detection function is on), battery voltage is low (detection function

is on), or trigger remote controller Fail Safe, etc., it will automatically add breakpoints and aircraft will return, or manually toggle the channel 8 to add breakpoints manually and aircraft will return.

- **Clearing of the point A&B:** It is recommended to clear before pinpoint A&B or after the completion of the work. When the aircraft is landing and locked, the remote controller channel 8 are quickly moved back and forth twice according to the "low position → up position → low position". If the clearing is successful, the indicator lights flash red and blue 4 times.
- **Coverage record of point A&B:** When point A&B is recorded incorrectly or need to re-recorded, the user does not need to clear the point A&B and then take off to re-pinpoint, but directly re-record the A and B points on the original basis. The new points will cover the original points A and B.

Point A&B real-time fine tuning

In order to improve the adaptability of aircraft to small irregular plots in plant protection operations, it is often necessary to fine-tune certain point A&B routes in actual operations. Thus, Boying aircraft has the function of fine-tuning point A and B in real time through manual intervention (during the point A&B operation, by pitching operation, adjust the point A&B route respectively, extend or shorten the point A&B route, and finish the work. The method is as follows:



Notice when fine-tuning:

- In automatic point A&B route, push and pull pitching joystick, the aircraft will follow the instruction of the joystick. The timing of the line change depends on the operator's handling.
- After loosening the joystick, the aircraft will automatically turn to the next line and fly in the opposite

direction, and the position of the original point A and B will not change.

- In the process of manual obstacle avoidance, fine-tuning cannot be performed.

Obstacle Avoidance

Boying flight control cover all functions of obstacle avoidance on the market. Convenient for users to choose, suitable for different work grounds.

Temporary obstacle avoidance

Automatic flight / point A&B mode support temporary obstacle avoidance: used for small size obstacles in work area. Operating steps: switch to the manual mode (height hold / position hold), control the aircraft to avoid obstacles and then switch to automatic mode, aircraft continue to work (spraying). Water pump will turn off when avoiding the obstacles and turn on when continue to work.

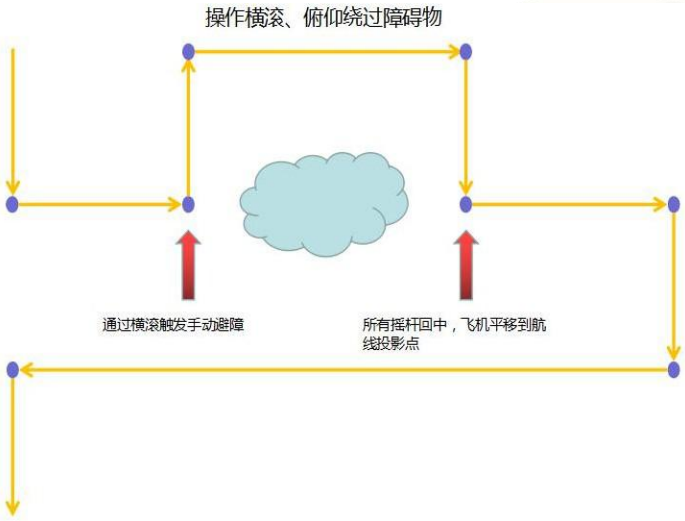
The premise is the function of adding the break point by exiting Auto mode is not enabled. Please refer to the agriculture settings for details

Manual obstacle avoidance

According to the customer's usage habits, Boying provides the scheme of manual obstacle avoidance – not switching the flight mode, and directly avoids obstacles in the automatic flying process.

The operation method is as follows:

The ground station turns on the function of “manual obstacle avoidance”. In the automatic mode or the AB point mode flight, operate the roll directly to trigger the manual obstacle avoidance mode. In this case, the aircraft stops the planning flight, following instruction to roll left or right. At this time, users can use the operation of pitching to make the aircraft rounds the obstacle. Then all the joysticks are returned, the flight route will translate to the planning route, automatically exit the obstacle avoidance mode, and continue to fly according to the planning route.

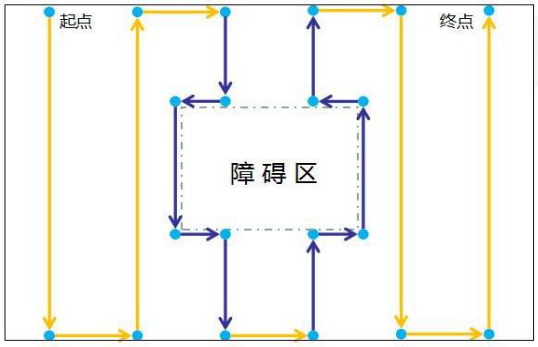


Avoid obstacles in planning areas

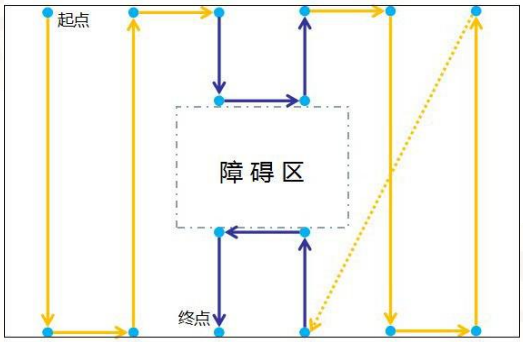
Connect the test equipment through the mobile phone ground station to obtain the obstacle area. The route is planned to be uploaded to the flight control. During the operation, the aircraft will automatically avoid the obstacle area according to the route.

This method is more suitable for the ground with larger obstacles. For details of the operation method, please refer to the **Mobile Phone Ground Station User Manual 3.0.**

There are two ways to avoid obstacles in the planning area. Users can choose the planning route – whether to round the obstacle area – according to the real situation. As shown in the following figure:



A. Round the obstacle area

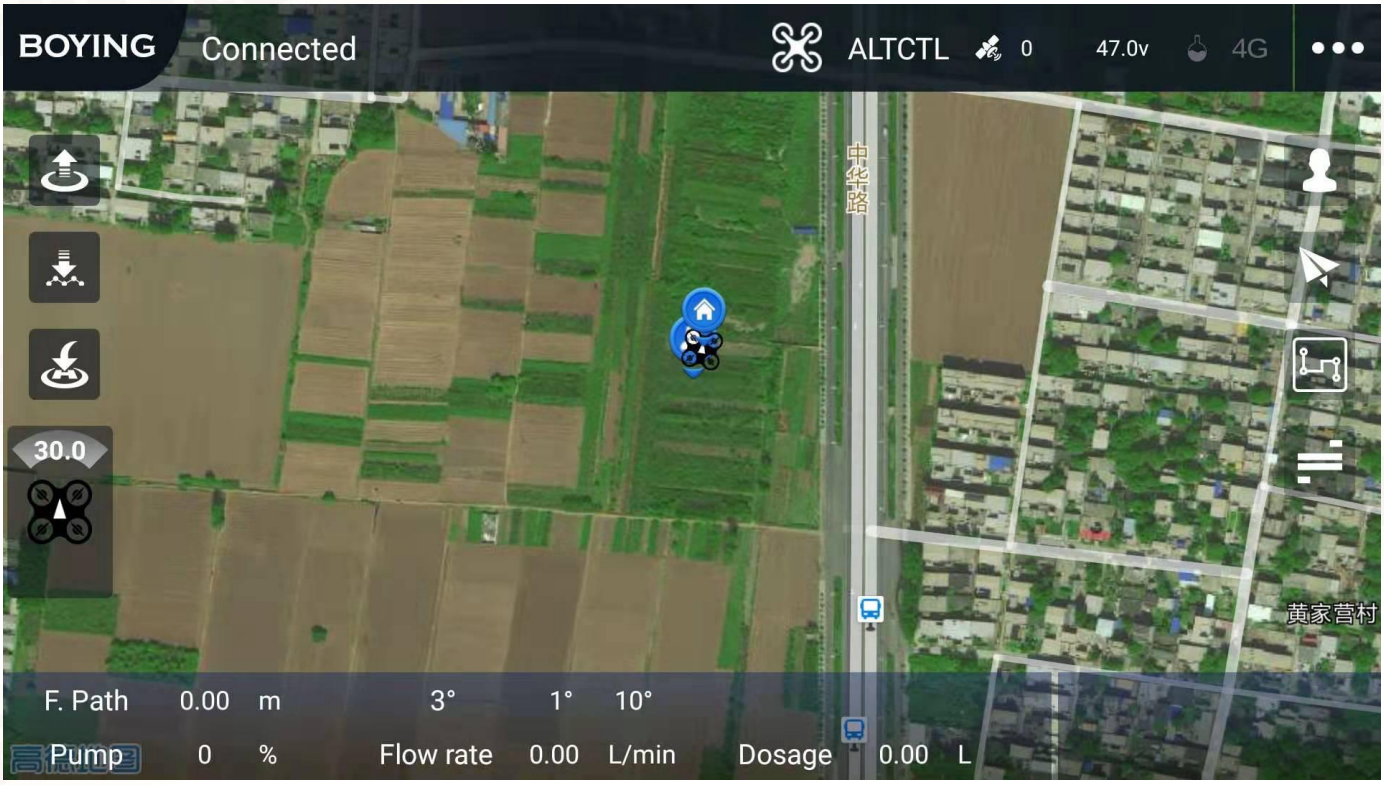


B. Not round the obstacle area

In the scheme of not round the obstacle area, there are many situations in the automatic planning path. The illustration is one of them. Users are advised to fine-tune the route according to actual needs to achieve the optimal effect.

Automatic obstacle avoidance

Automatic obstacle avoidance is currently the most intelligent way. The premise of using is to pre-install obstacle-avoidance radar.



Installing and turn on the obstacle avoidance radar. When radar detects the obstacle, the ground station displays the distance between the aircraft and the obstacle. The obstacle avoidance hover mode is triggered when the aircraft approaches the obstacle. At this time, the obstacle avoidance hover mode can only be cancelled by pulling the pitch joystick backward. The automatic obstacle avoidance function is applicable in both manual and automatic modes.

⚠ **The final distance between the aircraft and the obstacle depends on the speed at which the aircraft flies to the obstacle. It is not a fixed value. Please use it with caution.**

Flight Restriction

PALADIN flight control provides a "polygonal" electronic fence and a "cylindrical" electronic fence.

The "cylindrical" electronic fence can be set to open, partially open or closed by the ground station. The "cylindrical" area parameters are as follows:

- Flight area limit enabling: when not turned on, the default protection height is 30 meters; when turned on, the set value is the standard.
- Protection type: height / radius / height + radius
- Action: hover or notification only can be chosen, default is hover.
- Maximum height: the height limit defined by the area. After reaching the protection height, it will not be able to control the aircraft to continue climbing, but it can be lowered.
- Maximum radius: the position where the aircraft is unlocked is the radius of the center circle.
- Automatic take-off height: full-automatic mode or AB mode, one-button take-off height

⚠ **When the aircraft flies to the maximum flight radius, it will enter the hover. Only the flight mode can be switched to regain control of the remote controller. However, after the mode is switched, the flight control will increase the fence range by 20 meters by default. When the aircraft exceeds the safety radius by 100 meters, the landing will be forced.**

Installation Settings

Go to **Settings – Rack Settings:**

- **Orientation of flight control installation:** the direction of the nose and the installation direction of the main control should be subject to the satellite navigation module direction.
- **Maximum attitude angle:** The maximum attitude Angle of the aircraft during flight

Since the satellite navigation module has a built-in compass, the following two installation methods should be noted:

- **Standard installation:** The orientation of satellite navigation module should be consistent with that of flight control. Satellite navigation module should be installed away from the strong interference source (such as: high power ESC, high current divider, etc.). Satellite navigation module should be installed away from the microwave radar.
- **Nonstandard installation:** When the flight control installation orientation is 90° clockwise and 90°

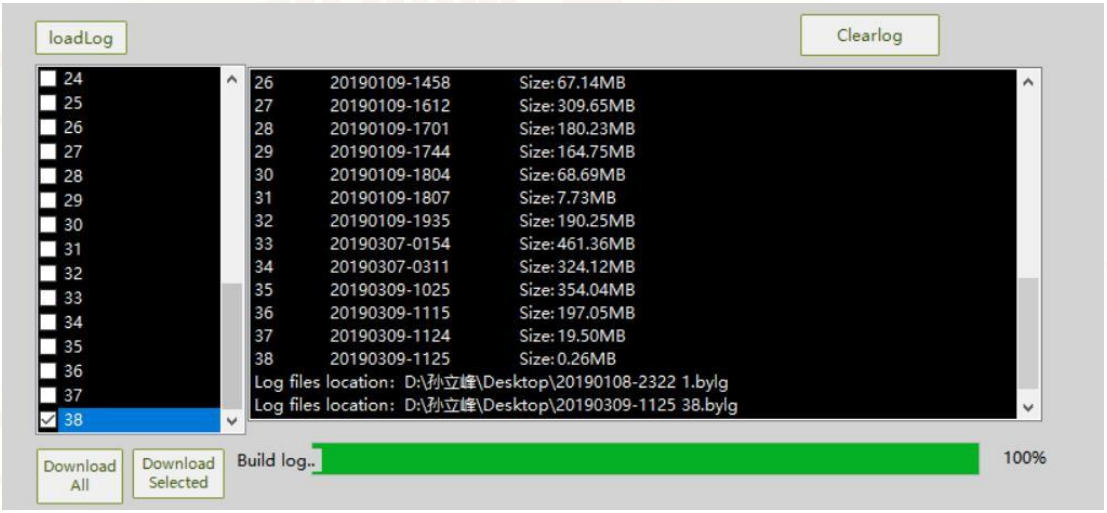
counterclockwise, it means that the flight control is rotated 90° to the right or 90° to the left, and the satellite navigation module still points to the nose. The motor wiring sequence is the same as the flight control standard installation.

- **Course correction:** when the flight direction angle is deviated during flight, it can be corrected. The method is input the flight deviation angle and restart the flight control.

Log Download

PC ground station download

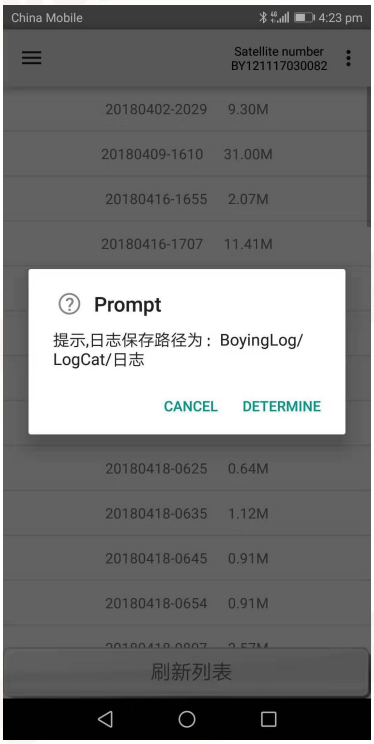
The flight log is saved in the internal SD card of the main control. The download method is to connect the PC ground station and the main control with a USB cable. When connection is successful, click "Load Log". After the log is loaded, select the log to be downloaded, click "Select Download", set the download path, and when the progress bar below shows 100%, the download is completed, as shown below:



Mobile phone APP download

Users can install our mobile phone log download tool on Android phone to complete the log download. Open the app, use the OTG cable to connect the main control and mobile phone, click "Connect UAV" in the upper right corner to get the log list, select the corresponding log and save path, and follow the prompts

to complete the download.

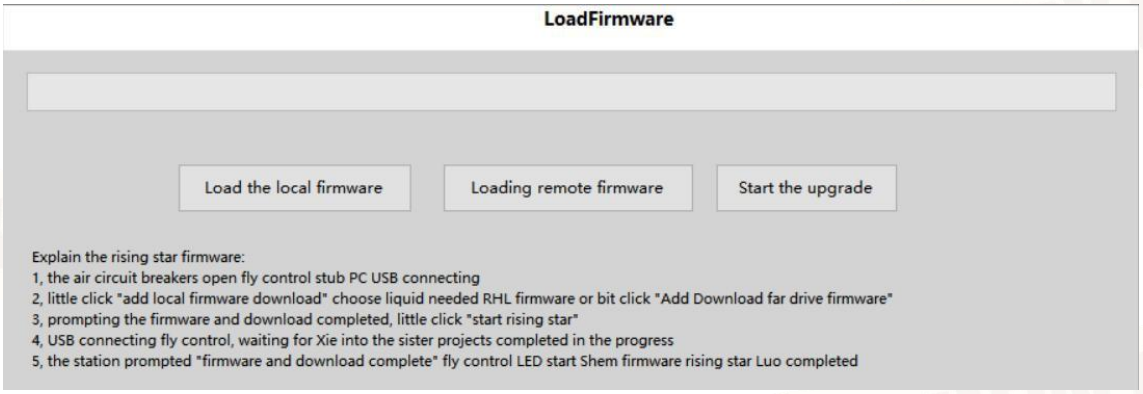


For PC ground station and mobile phone log download tools, please visit www.byaero.com to download.

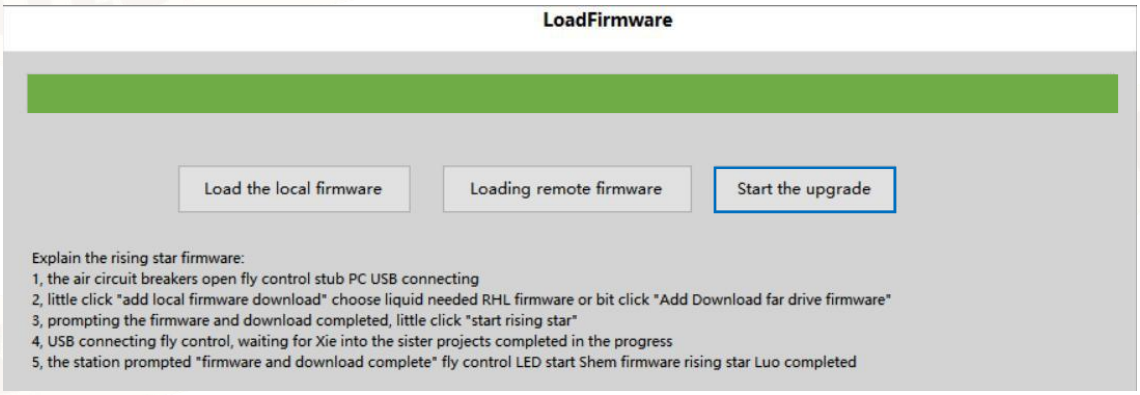
Firmware Upgrade

PC ground station upgrade

Upgrading the flight control firmware requires PC ground station. Open the PC ground station and select "Firmware Upgrade". The following interface pops up:



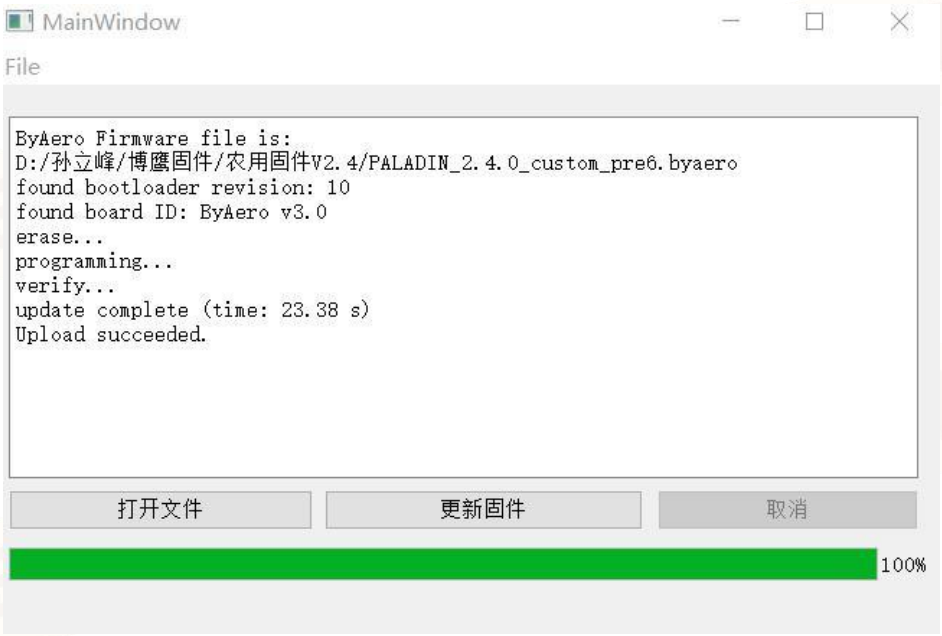
Click "Load local firmware", select pre-update firmware (file ending with **.byaero**), confirm and click "Start upgrade", connect USB cable to the main control, wait for about 10 seconds, the progress bar is completed, the main control indicator lights up, the firmware upgrade is finished.



Special tool upgrade

We provide a special firmware upgrade tool. Start the software, click "Open File", select the pre-upgrade firmware, and click "Update Firmware". Then insert the USB cable connected to the main control into the computer and wait for the update to complete.

There is no need to link the main control and the ground station to update the firmware, just plug in the USB cable. Special firmware upgrade tools can be downloaded from the official website www.byaero.com.



The process of firmware update requires no battery power

Concise Operation Procedure

1. Check whether the connecting line between power source and external equipment and flight control is correct.

2. Start the ground station and open the Bo Ying ground station.

3. Turn on the RC remote controller device.

4. The aircraft system is powered up and links to the ground station.

5. Calibrate the remote controller, if it is already calibrated, skip this step.

6. Calibrate the ESC (do not install the propeller), if it is already calibrated, skip this step.

7. Turn on the motor test function of the ground station to ensure that the motor steering and motor serial number are consistent with the above.

8. Calibrate the accelerometer, if it is already calibrated, skip this step.

9. Calibrate the magnetic compass, if it is already calibrated, skip this step.

10. Set up the flight mode.

11. Set up Fail Safe.

12. Check the ground station for warning information, analyze the cause and solve it.

13. Check whether the key data is normal, such as: attitude data, heading data, GPS data. Move the aircraft and observe whether the data changes normally.

14. Check whether the GPS installation is firm and the installation direction is correct.

15. Check the flight control installation direction and shock absorption.

16. Check whether the motor rotation direction and propeller installation direction are correct and whether the installation is firm.

17. Toggle the flight mode switch to observe whether the display area of ground station flight mode is normally switched.

18. Set the route task, upload and download to confirm the route planning is correct.

⚠ **Unlock in GPS mode only if the GPS has been positioned.**

Announcement

Environment factors:

1. Familiar with the flight environment. During flight, keep away from obstacles, crowds, etc.

2. Do not fly when you are in poor spirits.

3. Do not fly after drinking or taking psychotropic substances to avoid accidents caused by human factors.

4. Do not fly in thunderstorms and windy weather to avoid flight risks and damage to electronic equipment.

5.Sunglasses are recommended for manual flight in strong light.

6. Keep away from high temperature heat sources to avoid damage to electronic components.

7. Beginners should fly under the guidance of an experienced pilot.

8. Prepare the necessary tools before flight, such as wrenches, screwdrivers, spare paddles, telescopes, walkie-talkies, sunglasses, medical first aid kits, etc.

9. Do not take off and fly under overload to avoid damage to the aircraft structure and flight hazard.

10. Keep away from the high-speed rotating propeller and keep your body away.

11. Check the equipment of the aircraft before flight. If the key equipment is not working properly, it is forbidden to fly to avoid accidents.

Equipment factors:

1. It is recommended to debug the aircraft without propeller, check that the remote controller and the motor are working properly, and install the propeller after all going well.
2. Keep the throttle to a minimum before aircraft taking off.
3. Check for co-channel interference between devices before flight;
4. 2.4G wireless obstacle avoidance ability is weak, please keep the visibility between the airborne antenna and the ground antenna during flight. The ground antenna should be vertical upward as high as possible; the airborne antenna should be placed as vertically low as possible to increase the transmission distance.
5. Check whether each equipment works normally.
6. Make sure the battery (aircraft battery, remote controller battery etc.) can meet your needs of flight time.
7. Check whether the propeller is rotating in the right direction
8. Strictly follow the manual.

After-sale Service

Warranty

- Due to the failure caused by product quality, FOXTEH promises limited quality assurance to the electronic circuit.
- The warranty period is six months from the date of purchase based on the purchase certificate.
- During the warranty period and within the warranty period, FOXTEH provides free replacement or repair services.

Not in the warranty

- Not installation or operation as directed by FOXTEH's official manual
- Performance failure caused by improper handling or chemical agents
- Performance failure due to the use of unofficial parts
- Electronic equipment performance failure due to liquid infiltration
- Performance failure due to unauthorized modification
- Performance failure due to electrical interference

- Performance failure due to use of poor power and failure to follow standard voltage input;
- Damage to aircraft due to human factors (transportation, operational errors, collisions, etc.)
- Equipment damage caused by external irresistible factors (earthquake, typhoon, thunderstorm, fire, etc.).