HAOHAN Firefly VTOL

User Guide

V1.1 2025.2

Reading Instructions

Thank you for trusting and choosing HAOHAN brand products! Based on the professionalism and safety considerations of unmanned aerial vehicle products, be sure to read this manual before flying to ensure that you can use this product correctly and safely.

▲It is marked as an important content, please be sure to know.

▲Safety Instructions

1. This product is not a toy. Please be sure to understand the control method of the fixed-wing aircraft. Please make sure you have completed the necessary exercises in the flight simulator before flying;

2. You will abide by the laws and regulations on drone management in your location, stay away from the no-fly zone and fly at legal flight altitudes, and HAOHAN will not be responsible for the consequences caused by flying in violation of laws and regulations；

3. Please fly in open areas and stay away from densely populated areas；

4. This product is suitable for people over 14 years old. Minors are advised to use it with their guardians；

5. This product is a civilian consumer product and should not be used in sensitive areas or military purposes. This is our common understanding that HAOHAN will not be responsible for the consequences caused.

▲Flight operation guidance

1. After receiving the product, do not install propellers for the first power-on and indoor debugging. Ensure that the aircraft function is normal and the power system is operating normally before installing propellers；

2. Please be sure to complete the pre-flight inspection before each flight. The inspection items include but are not limited to: aircraft structure,structure installation, the aircraft rudder surface operating status, the work status of remote controller/digital transmission /GPS and mortors, etc.；

3. Due to geomagnetic differences in different regions, please complete the aircraft compass calibration before first flight or in an unfamiliar environment. For details, please refer to the quick start section below；

4. Please make sure that GPS searches for more than 8 stars and has good positioning before takeoff；

5. The power measurement is mainly based on the voltage. The full charge voltage is 16.8V, and the recommended drop voltage is not less than 13.5V. The voltage viewing method is to click the APP's battery display interface to display the real-time battery voltage.Please do not rely to the SOC display；

6.The recommended transition altitude from hover to fixed-wing mode is above 10 meters；

▲Frequently Asked Questions

1. I only fly over the quadrotor drone, can I fly Firefly？

Answer: Firefly has two flight modes: vertical take-off and landing and fixed wing. The flight control logic of the vertical lift mode is exactly the same as that of the quadrotor. You only need to pay attention to the throttle unlocking method and the throttle lever that will not physically return to the center. The operation logic of the aircraft in fixed wing mode is different from that of multi-rotors. It requires users to be familiar with it and it is best to practice on the simulator. When flying in fixed wings, with flight control assistance, the maximum pitch angle and roll angle of the aircraft are limited to 45°, which greatly reduces the difficulty of user operation, and novices can also get started flying very quickly.

2.What are the necessary knowledge points for fixed wing flight？

Answer:

1. Stall: When the flight speed of a fixed-wing aircraft is extremely low, it needs to flow relatively at a larger angle of attack (head up). The wing will suddenly stall when the angle of attack is too high to a certain extent, and the aircraft will completely lose lift and fall. Therefore, it is necessary to Avoid the plane entering a stall state. Firefly has optimized the design for stalling. With flight control assistance, it will not enter the stalling state under normal operating conditions, but it is necessary to avoid the aircraft approaching this dangerous state. Firefly recommends cruising speed of 16m/S. At this time, the aircraft is the best efficiency, with stall speed below 10m/S, and the recommended flight speed is not less than 12m/S. When stall occurs, increase the throttle or push rod dive to allow the aircraft to regain speed, and then change to a level flight.

2. Center of gravity: Fixed-wing aircraft can fly stably and control well when the center of gravity is appropriate. If the center of gravity is in front, it will have obvious characteristics of flying down (lossing heights). If the center of gravity is in back, it will obviously fly up and fly up or even diverge in stability (hard to control). Therefore, the center of gravity of the aircraft needs to be determined before flight. Firefly's center of gravity is located at the CG mark on the lower surface of the wing. After installing the battery, place the CG point with both hands to lift the aircraft. The overall level of the aircraft is that the center of gravity is good. When the center of gravity is deviated, you can use the method of moving the battery back and forth to level it.

3. Fixed wings have much faster flight speed than rotors. Please make sure that the surrounding ground and airspace are open when flying, and do not fly in densely populated areas, buildings, and mountains with many obstacles.

   4. Fixed wing height lift mainly depends on the elevator, but it should be noted that the aircraft loses speed when climbing high. If the accelerator is not recharged in time, there is a risk of entering the first point of stall. Therefore, the throttle needs to be increased when climbing the pull rod, otherwise when lowering the height. The throttle can be reduced, and the appropriateness of the throttle can be judged by the aircraft speed.

3. How to unlock and lock the motor？

Answer: Unlock - pull the throttle to 0%, and the rudder lever is full to the right and keep it for 3 seconds; lock - pull the throttle to 0%, and the rudder lever is full to the left and keep it for 3 seconds。

4. How to judge the power of the aircraft? What happens if the battery is overloaded？

Answer: As determined by the voltage above, the battery is 16.8V full charge, the recommended

landing voltage is 14V, and the minimum landing voltage is 13.5V. If the aircraft is lower than 13V, there is a risk that the aircraft cannot maintain altitude in the vtol mode. High drop rate and heavy drop.

The aircraft has low power protection function. When the voltage is below 14V, the aircraft will automatically return and land on the spot when it is below 13V.

5. What ground station is used for flight？

Answer: Currently, the entire machine version is pre-installed with two ground station APPs, QGC and Fly GCS. For Classic version users, please use Fly GCS directly. You can complete gimbal control, taking photos and recording operations through the ground station. For 4K and Night vision versions, it is recommended to use HAOHAN customized QGC ground station. The gimbal control, photography and video recording, zooming, AI target recognition and other operations can be completed through the ground station. QGC ground stations can quickly change the parameters of the aircraft (before change, be sure to know the meaning of the parameters you change, otherwise it may have a significant impact on the aircraft flight)。

6.About flight modes

Answer: The aircraft flight mode switching is set in the remote control channel 5 (three-stage switch on the left hand), from left to right, Q Loiter (vtol mode), FBWA (fixed wing self-stabilization mode), RTL (One-click return mode). A typical operation process is: after the aircraft completes the pre-flight inspection and the GPS star search is normal, take off in Q Loiter mode, and after the aircraft reaches a safe altitude of more than 10m, switch to FBWA mode for fixed wing cruise, switch to QLoiter mode for landing after completing the flight . During flight, the RTL mode can be switched, and the aircraft will fly to the takeoff point and land automatically. The aircraft can also switch to other flight modes, and experienced pilots can switch to the ground station according to their needs.

7. What is the logic of the automatic return of the aircraft？

Answer: Automatic return will be triggered by triggering the manual lever or the remote control is lost. If the aircraft is far from the takeoff point, the aircraft will return to the takeoff point in fixed wing mode, circle for one or two times, switch to the multi-rotor mode and land automatically; if the aircraft is very close to the takeoff point and is in multi-rotor mode, the aircraft will directly fly to the takeoff point and land.
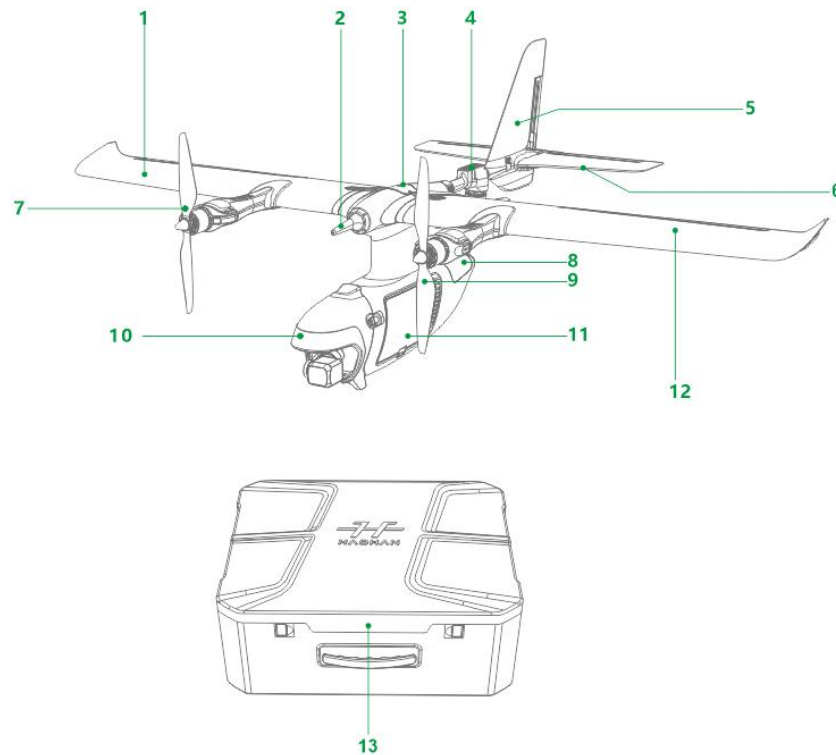
Contents

一、 **Product Overview**

1.Product Overview

（1） Product composition

1.Right wing	2.Airspeed tube	3.GPS	4.Tail motor	5.Vertical tail
6.Horizontal tail	7.Right-tilt arm	8.Aerial storage	9.Left-tilt arm	10.Loading cabin
11.Battery warehouse	12.Left wing	13.EPP case		

（2） Main features

Modular quick disassembly design of the entire machine, with fast disassembly design of the fuselage, wing, tail and vertical tail. The assembly time of the entire machine is <1min；

The standard portable EPP box can hold a Firefly aircraft, one with screen control, three long endurance batteries (4S2P 21700) or six lightweight batteries (4S1P 21700), a charger and spare hood, blades, etc. Storage space is less, more convenient to carry out and safe;

Mount HD three-axis cloud head camera, eliminate aerial picture shake, and can freely adjust the Angle of view；

Equipped with screen control, integrated to achieve FPV first perspective flight；

Equipped with a flight control system supporting Ardupilot and INAV firmware, with

automatic route flight capability；

Excellent industrial design, won a number of industrial design awards, positioning consumer

UAV + lightweight inspection application platform；

（3）Main parameters

Machine size	1080×690×370mm
Storage box size	583×453×265mm
Standard take-off weight	~1500g（4S1P battery）, ~1800g（4S2P battery）
Maximum take-off weight	<2300g
Cruising speed	16m/s
Flight speed	10 - 28m/s
Maximum flight duration (empty load)	50min（4S1P）, 90min（4S2P）
Maximum range (empty load)	50km（4S1P）, 90km（4S2P）
Wind resistance	Vtol：level4，Fix wing：level6
working temperature	-10 - 50℃

二、Quick Start

1.First-flight operation (for the complete machine version)

1.1 Notes for the first flight

Be sure to complete the aircraft compass calibration before the first flight. Reference to the ground station function description-reference part，If the calibration fails, please keep the aircraft away from interference sources such as strong magnetic forces and wires. At the same time, the wing tail assembly can be pulled out to further reduce interference and improve the pass rate.

Users who are not familiar with the ground station, please read the following function description before the first flight.

1.2 First flight operation process

（1）Complete the compass calibration;

（2）Complete the pre-flight inspection, the inspection items include but are not limited to: the aircraft structure is not damaged, the structure is installed in place, the aircraft rudder surface system is working normally and the action direction is correct, the remote control and map transmission link is working normally, GPS search more than 8, the power system works normally, etc.;

（3）The flight mode switches to Q loiter, unlock the throttle (throttle to the end, heading to the right full), slowly push the throttle to more than 50%, the plane takes off in the hanging mode, gradually test the plane front and back flat flight, heading rotation and other normal, stable attitude;

（4）The flight altitude is raised to a safe altitude of more than 10m, the head is facing the headwind, the flight mode is switched to FBWA mode, and the aircraft independently completes the flight switch of fixed wing mode and starts the fixed wing flight.(Keep throttle above 50%);

（5）The aircraft enters the aerial cruise stage. Please pay attention to the aircraft flight speed and altitude. The cruise speed of Firefly should be about 16 m/s, and the stall speed should be below 10 m/s；

（6）Observe whether the flight of the aircraft is stable and whether the operation response is flexible. If the aircraft is unstable in the fixed wing mode or the response does not follow, switch to Autotune automatic adjustment mode through the ground station to carry out large rudder surface flight in real time (refer to the appendix "Flight mode" -> "Autotune automatic adjustment mode" for details).

If the autostatic mode is unstable, avoid long-distance flights to prevent the aircraft from failing to maintain posture and crash after switching the return mode.

（7）Fly the aircraft to the take-off point in fixed-wing mode, and switch the lever to Q loiter mode 50m from the take-off point, then the aircraft will automatically switch to the vertical mode and can perform the landing. Note that the throttle is 50% hover, climb and fall.

Landing the plane to the takeoff point, lock the throttle (throttle to the end, heading to the left), complete the first flight.

1.3Automatic return

The automatic return logic of the aircraft as described above (refer to FAQ), switch the flight mode to RTL for one-button return. When the flight is too far or the remote connection is disconnected, the aircraft will automatically switch to RTL mode and perform the return flight.

Please note that the default return height of fixed wing mode is 120m. Please do not fly to obstacles above the height of 120m to avoid remote occlusion and return impact obstacles. The height of the low power automatic return in the vertical mode is 10m.

2.Description of the ground station function

2.1 QGroundControl（QGC）

QGroundControl (QGC for short) is an open source ground station software used for communication and control with drones. Firefly Vtol versions with screen remote control have been installed and configured.

(1) Operation interface (flight view)

The flight view is used to display and control the flight information of the UAV during the flight process.

（2）Automatic route flight

Under this interface, users can fly automatic flights, please explore or consult the official website documentation:
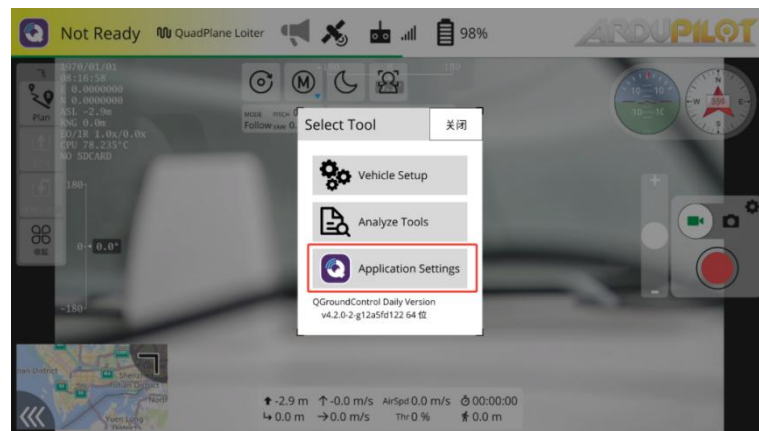
https://docs.qgroundcontrol.com/master/en/qgc-user-guide/plan_view/plan_view.html

（3）Set up

The following settings are completed at the factory.

I.Set the communication connection

Click on the upper left corner to enter Application Settings

Select the communication connection interface and click Add

Select G12, click OK and check the Auto Connect

II. Set up the video streaming system

Into the Application Settings, Find the Video Settings in the routine, Set the Source to "RTSP Video stream", The Pro 4K and Night vision version address is "rtsp://192.168.144.108/1" (6.5 firmware version later updated to "rtsp: / / 192.168.144.108"), Classic The version address is "rtsp: / / 192.168.144.108:554 / stream=0", Check the low-latency mode.


When the setting is completed, a video screen will appear in the lower left corner of the flight interface, which can be clicked to zoom in to the full screen.

（3）Reference interface

Click on the upper left corner to enter the Vehicle Settings

After establishing the connection to the plane, all the parameters of the plane can be changed in this interface.

Do not change the parameters during the flight, please be sure to know the meaning of the changed parameters and the expected results before changing, otherwise the aircraft may be abnormal!
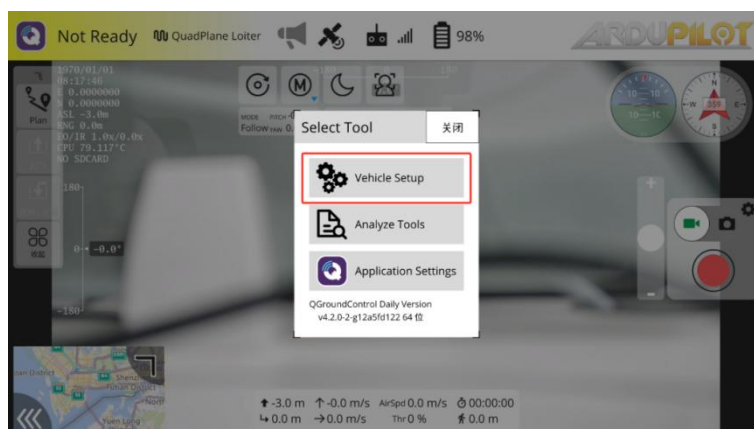

Compass calibration

The first flight after receiving the aircraft and before the remote flight shall be calibrated,After clicking OK in the sensor-compass, rotate the three axes of the plane until the progress bar is full, and the signal quality of the compass is within the green part. After successful calibration, the plane can be restarted to fly.
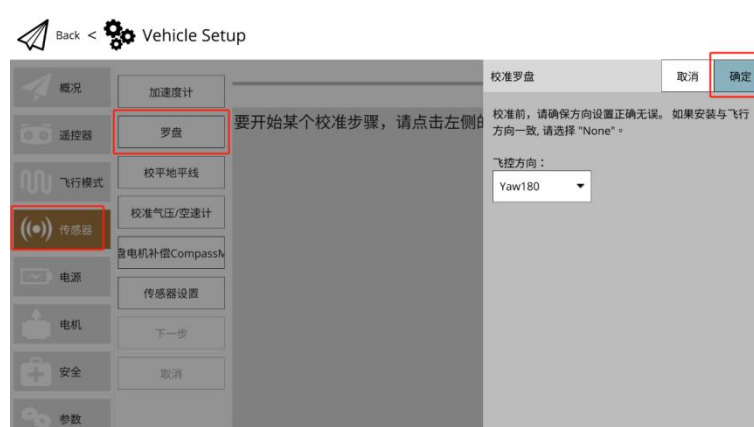
Horizontal alignment

Good calibration of flight control level is crucial to the stability of aircraft control. The judgment method is that the attitude meter level is good when the plane is flat on the ground. If the attitude ball and the horizon are obviously inclined or low / raised, the calibration level is required.

Place the aircraft on the flat ground, ensure the level, click OK in the sensor-calibration horizon, 2-3 seconds after the ground station shows success, check the attitude ball level is complete.
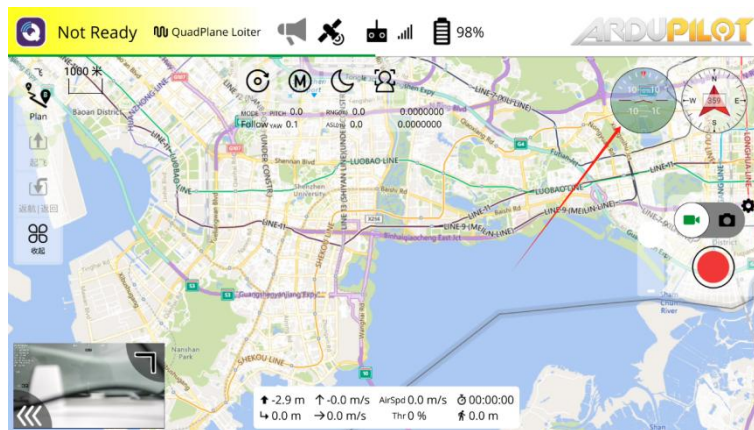
2.2 Fly ground station

The Fly ground station is used to monitor and control the aircraft during flight, and also includes route planning and other functions. The remote control version in the FireFly has been installed and set up.

Fly ground station is not completely customized for Firefly, but can be used for first view flight and route drawing. Do not use this ground station for flight control setting.

To install this software, please on the official website:

http://www.skydroid.xin/?type=news&S_id=7&page=2

Main functions and related operation instructions.

（1）Flight interface

（2）FPV interface

Click on the lower left corner screen to switch to the FPV interface
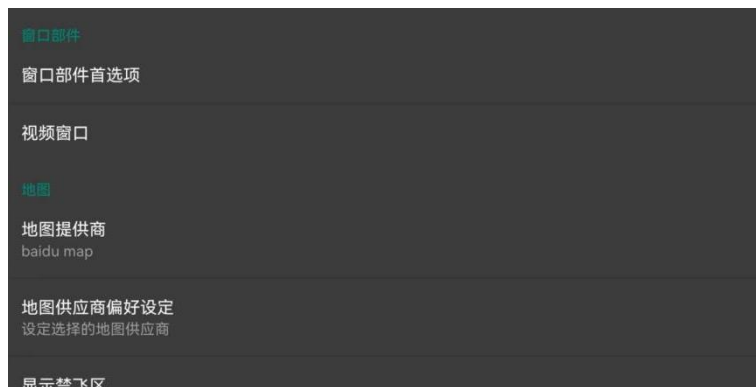

（3）Route planning

Click the upper left corner button to enter the Settings interface, you can switch to the route planning interface.

（4）Set up

I. Image Settings

Click on the upper left corner to enter the Common Settings-Other settings-user interface

Click on the video window

For the Classic version, set the video window to "C10 / C10Pro / single head"

Address: rtsp: / / 192.168.144.108:554 / stream=0

For the Pro 4K and Night vision versions, set the video window to Custom

Address: rtsp://192.168.144.108/1 (6.5 firmware version changed to rtsp: / / 192.168.144.108)

After setting up, return to the flight interface, and the ground station can display the FPV video.

Compass calibration

Click the flight control adjustment parameter,the password is 999.

Select ellipsoid calibration in the flight control calibration, click Start, then rotate around the three axes of the aircraft until the progress bar is full and shows the calibration is successful, repower the plane.

Fly ground station is not fully developed for fixed-wing aircraft. At present, only compass calibration (ellipsoid calibration) is recommended in the flight control parameter, with no other flight control settings.

# 三、 Installed capacity guidance and equipment introduction

1.FireFly VTOL SEMI Installation introduction

1. Open the GPS cover plate on the top of the fuselage, plug in the GPS wire, stick the 3M glue on the GPS back, fix the GPS on the GPS seat, and thread the wire harness into the fuselage;
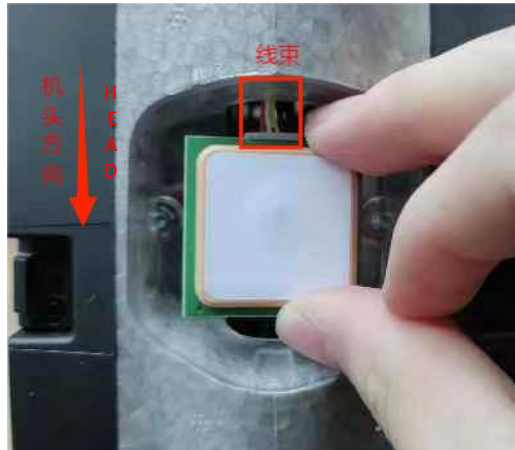
2.Take out the flight control, connect the computer through USB interface, use Mission Planner or QGC ground station to check the correct version of flight control firmware (factory is Arduplane4.5.6), and the posture and all kinds of information are normal (the direction of power cord is the direction of the nose)：

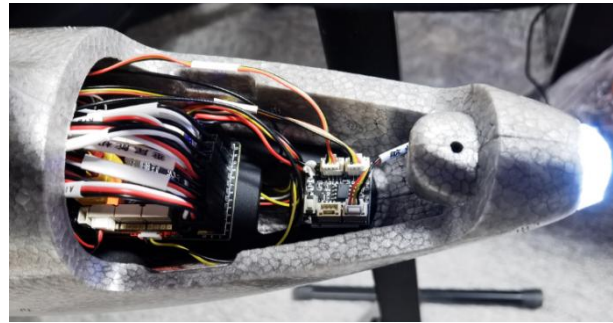3. Fix the flight control to the flight control installation board;
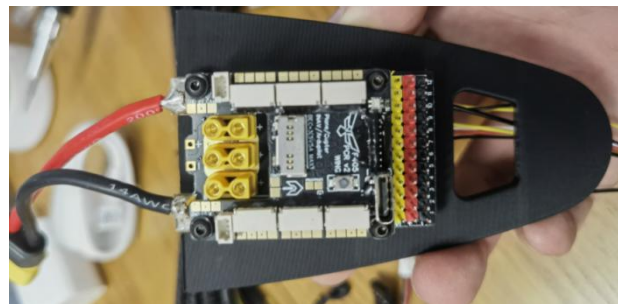
4. Install the receiver on the back of the flight control, and have good contact with the heat sink (users can design and install it according to their own receiver)

5. Apply foam glue to the flight control board installation slot in the fuselage equipment cabin, and insert the flight control mounting board in place from the installation slot：

6. Plug the power cord of the LED control board into the flight control PWM port to get the power supply：

7. Plug the wire harness to the corresponding flight control port according to the line mark instructions. The factory port setting of each channel can refer to the flight control part below;

8.LED light control board interface definition as shown in the figure, a total of 4 roads, 1 LED1,2 LED2,3 taillight LED3,4 reserved interface, the user can expand the WS2812 navigation light. And can switch through the keys on the LED control board for a total of three groups:

Group 1:1 red strobe, 2 green strobe, 3 white breathing light, 4 white always bright;

The second group: 1 red always bright, 2 green always bright, 3 white always bright, 4 white always bright;

Group 3: all out;
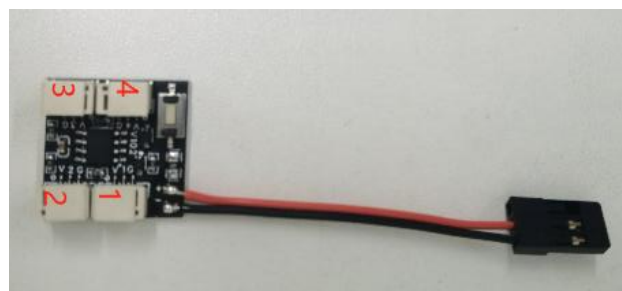
8. Insert the remote control receiver and FPV data control device according to the flight control port instructions：

9. Check that the wiring and setting are correct, install the aircraft in place, and power on the test function. Check that the flight control power on normally, the navigation light works normally, after the flight control self-test, the manual mode aileron, flat tail and vertical tail rudder response is normal and the median value is accurate, calibrate the Angle of the rudder, unlock the flight control, and the motor works normally (do not install the propeller in the power-on test). Date transmission,video transmission works normally. The flight control autostability mode rudder surface feedback is normal. If there is a problem of reverse rudder

surface or inaccurate return, the parameters can be adjusted through MP or QGC ground station。

10. Through MP or QGC ground station, the flight control horizontal calibration, remote control calibration, electrical calibration, voltage calibration, check the aircraft battery voltage, current, height, speed, GPS status and other information is normal without fluctuation;

11.For test flight, it is recommended to use Q Stabilize mode for the first takeoff, which can obtain large throttle and attitude control authority. After the aircraft attitude debugging is stable, use Q loiter mode to obtain fixed point and switch fixed wing flight.

2.FireFly Flight controller

2.1 Introduction of Flight Controller

The flight controller supports the Ardupilot and INAV firmware. It has various flight modes and can perform autonomous flight missions. The flight control adopts full connector design, no welding, and supports GPS modules and various peripheral connections.
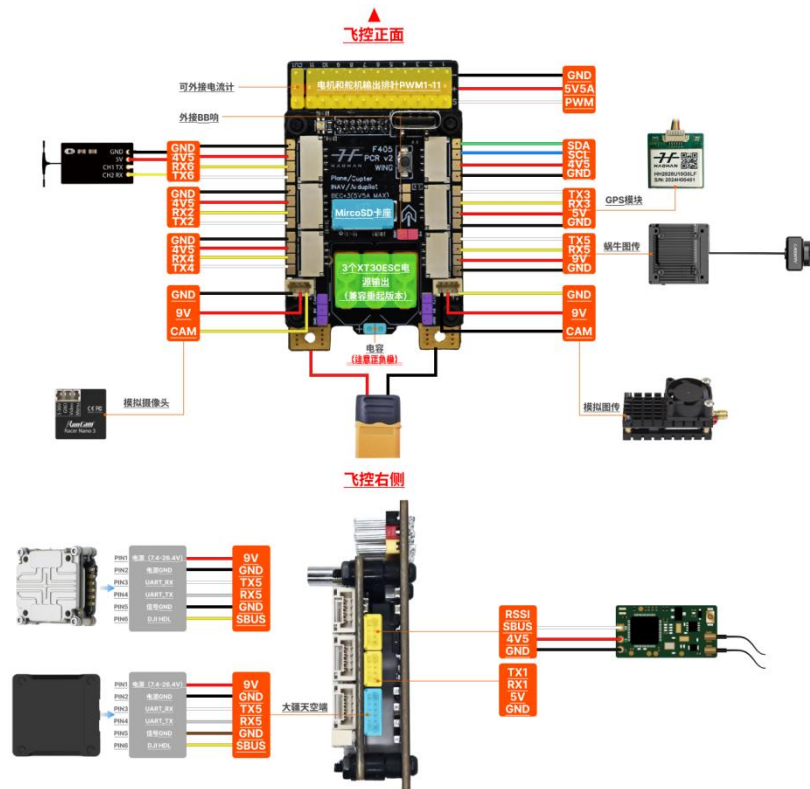
规格参数

MCU：168MHz STM32F405RGT6
IMU：ICM42688-P（SPI）
气压计：DPS310（I2C）
OSD：AT7456E（SPI）
黑匣子：MicroSD卡槽（SPI）
6个UART，1个Softserial_Tx选项（INAV/BF）
11个PWM输出（8个Dshot兼容BF/ArduPilot）
1个I2C
4个ADC（VBAT、电流、RSSI、空速）
1个备用PINIO
3个XT30ESC电源输出
内置反相器用于UART2-RX的SBUS输入

PMU规格参数

输入：9-36V（3-8S电池）
PDB：3× 35A（最大3× 50A）
BEC：5V 5A
BEC：12V 2A
LDO 3.3V：200mA

电流传感器：220A，3.3V模数转换器（INAV/BF比例150，ArduPilot 66.7 A/V）
电池分压器 1K:20K（INAV-2100，BF-210，ArduPilot BATT_VOLT_MULT 21.0）

尺寸：33 × 55 × 19 毫米
重量：10克

Flight controller channel definition

PWM 5V tolerant I/O	S1	PWM1 GPIO50	TIM8_CH4	DMA/DShot	Group1
	S2	PWM2 GPIO51	TIM8_CH3	DMA/DShot	
	S3	PWM3 GPIO52	TIM1_CH3N	DMA/DShot	Group2
	S4	PWM4 GPIO53	TIM1_CH1	DMA/DShot	
	S5	PWM5 GPIO54	TIM2_CH4	DMA/DShot	Gourp3
	S6	PWM6 GPIO55	TIM2_CH3	DMA/DShot	
	S7	PWM7 GPIO56	TIM2_CH2	DMA/DShot	
	S8	PWM8 GPIO57	TIM2_CH1	DMA/DShot	
	S9	PWM9 GPIO58	TIM12_CH1	NO DMA	Gourp4
	S10	PWM10 GPIO59	TIM13_CH1	NO DMA	Gourp5
	–	–	–	–	–
	LED pad	PWM12 GPIO61	TIM3_CH4	DMA/DShot	Gourp7
		SERVO12_FUNCTION 120, NTF_LED_TYPES neopixel			

ADC	Vbat Pad	1K:20K divider builtin 0~60V	on board battery voltage	BATT_VOLT_PIN BATT_VOLT_MULT	14 21.0
	Curr pad	0~3.3V	on board current sensor	BATT_CURR_PIN BATT_AMP_PERVLT	15 66.7
	RSSI Pad	0~3.3V	RSSI ADC, Analog RSSI	RSSI_ANA_PIN RSSI_TYPE	8 2
	ADC	0~3.3V	AirS ADC, Analog Airspeed	ARSPD_PIN ARSPD_TYPE	10 2
I2C	I2C1	5V tolerant I/O	Compass	COMPASS_AUTODEC	1
			onboard Baro SPL06-001	Address	0x76
			Digital Airspeed I2C MS4525 DLVR-L10D	ARSPD_BUS ARSPD_TYPE ARSPD_TYPE	1 1 9

UART 5V tolerant I/O	USB	USB		console	SERIAL0
	TX1 RX1	USART1	with DMA	telem1	SERIAL1
	TX3 RX3	USART3	NO DMA	telem2	SERIAL2
	TX5 RX5	UART5	NO DMA	GPS1	SERIAL3
	TX4 RX4	UART4	NO DMA	USER	SERIAL4
	TX6 RX6	USART6	TX6 with DMA	USER	SERIAL5
	TX2 RX2 SBUS	USART2	with DMA	RC input/Receiver	SERIAL6
		RX2	IBUS/DSM/PPM	BRD_ALT_CONFIG 0 Default	
		Sbs pad	SBUS		
		TX2 & RX2	CRSF	BRD_ALT_CONFIG 1 SERIAL6_PROTOCOL 23	SERIAL6_OPTIONS 0
		TX2	uninverted FPort (hacked)		SERIAL6_OPTIONS 4
		TX2	SRXL2		SERIAL6_OPTIONS 4

Firmware version:

Ardupilot: matek 405-TE

INAV: MATEKF405TE_SD

BetaFlight: MATEKF405TE_SD

2.2 Factory Settings

（1） PWM Channel Settings

Channel number	Definition	Line mark
PWM1	Aileron servo	Aeliron
PWM2	Aileron servo	Aeliron
PWM3	Elevator servo	Elevator
PWM4	Rudder servo	Rudder
PWM5	Left tilt servo	Left tilt
PWM6	Right tilt servo	Right tilt
PWM7	Right wing motor	Mortor1
PWM8	Left wing motor	Mortor2
PWM9	Reserved	/
PWM10	Tail motor	Mortor3
PWM11	Reserved	/
PWM12	Airlight power supply	/

（2）Digital transmission channel settings（Factory-burned Arduplane firmware）

USB	/	Serial 0
TX1 RX1	Reserved	Serial 1
TX2 RX2	Reserved	Serial 6
TX3 RX3	GPS module （GPS 2pin wires）	Serial 2
TX4 RX4	Gimbal communication	Serial 4
TX5 RX5	Gimbal 9V power supply	Serial 3
TX6 RX6	Digital transmission	Serial 5
SCASDA	External compass（GPS 4pin wires）	

3.Remote controller with screen

3.1 Product Parameter

Remote controller parameters			
Display screen	5.5 inches	Resolution ratio	1080P
Processor	Qualcomm 6nm processor	System	Android 13
Dimensions	194*282*95mm	Weight	683g
Battery	10000mAh	Duration	4-8h
RAM	4G	ROM	64G
Work frequency band	2.4/5.8G	Number of channels	12
Dynamic FM	Automatic frequency hopping	RF power	23dBm@CE/FCC
Remote control distance	5-20KM（Earth-to-space, viewing）	Working temperature	-10-55℃
USB	TYPE C	Peripheral interface	Serial port、USB、SIM card slot、TYPE-C

| Receiver parameters			
Work frequency band	2.4G/5.8G	Serial port port rate	57600/115200/921600
Voltage of power supply	5V±5%	Working current	5V/2A
Number of digital transmission	1	Air interface rate	200Kbps~160Mbps
internet access	1	SBUS output	1
Power	3.25W	Working temperature	-10-55℃
Channel bandwidth	1.25MHz/2.5MHz/5MHz/10MHz/20MHz/40MHz		

3.2 Function description
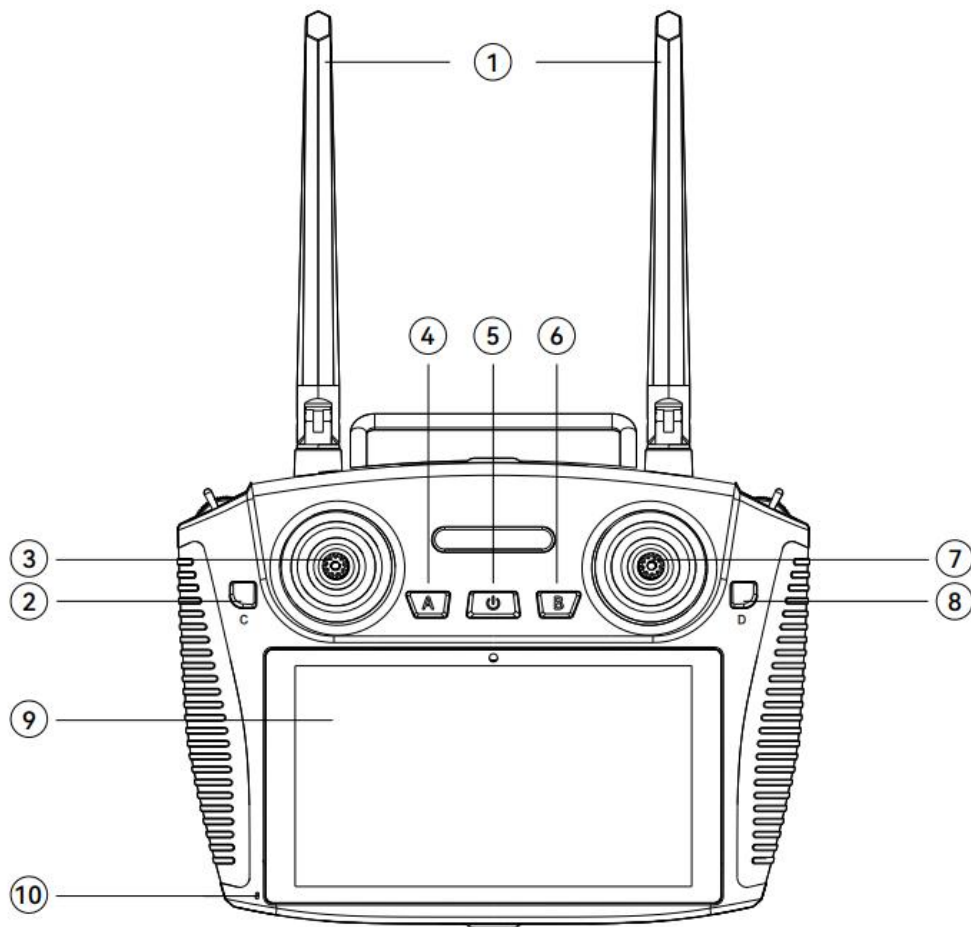
No.	Instruction	No.	Instruction
1	2.4G/5.8G 4dBm antenna	6	Button B（Automatic flight mode）
2	Button C（Reserved）	7	Right stick X2、Y2
3	LeftstickX1、Y1	8	Button D（Reserved）
4	Button A（Take off mode）	9	Display screen
5	Power button	10	MIC
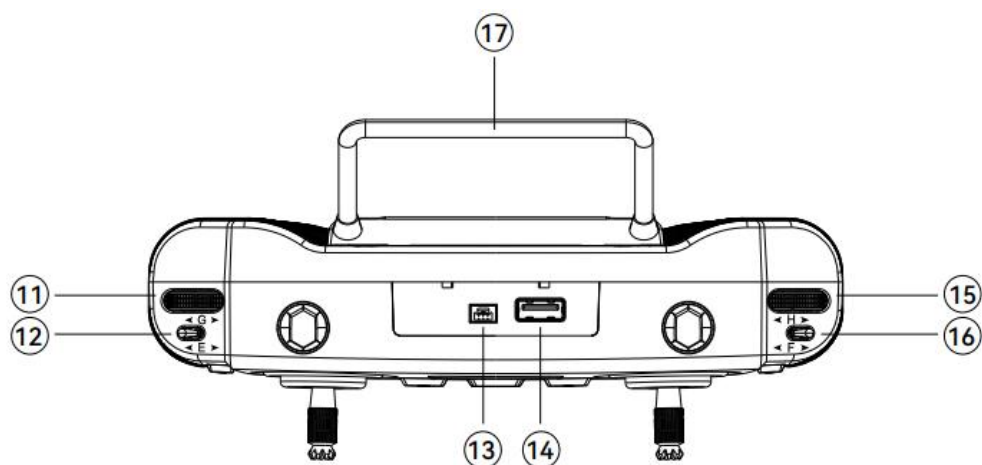
No.	Instruction	No.	Instruction
11	Dial G（Gimbal pitch / yaw）	15	Dial G（Gimbal pitch / yaw）
12	Three-stage switch E (Flight Mode switch)	16	Three-stage switch F（Reserved）
13	Serial port	17	Remote Control Handle
14	USB port		
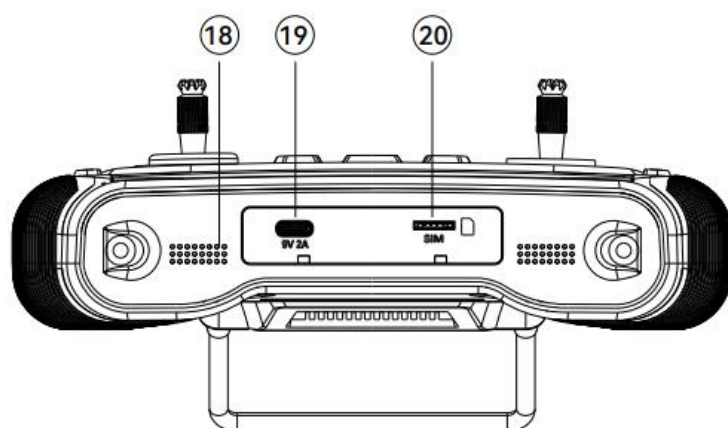
No.	Instruction	No.	Instruction
18	Speaker	20	SIM card slot
19	TYPE-C（Charging port）		

3.3 Usage method

Remote control antenna angle

（1）Adjust the antenna angle of the remote control to direct the flight direction of the aircraft;

（2）Antennas do not form blocks or cross each other.

Proper operation

3.4 Usage environment conditions

Attention

A）Ambient temperature :-10℃～+55℃。

B）Relative humidity：Not exceed 85%。

C）Atmospheric pressure:86kPa~106kPa。

D）The medium with explosion risk is not allowed in the use place, and the surrounding medium shall not contain the gas and conductive medium that corrode the metal and destroy the insulation, and it is not allowed to fill with water vapor and have serious mold existence.

E）The place of use shall have facilities to guard against rain, snow, wind, sand and ash.

3.5 Working conditions

Power supply mode and precautions

The remote control has built-in integrated rechargeable lithium battery, which is compatible with the market standard TYPE-C interface. Please use the original charger to charge. In the case, do not continue to charge the ground end, please return to the factory for maintenance. Do not charge the product in the baby touch area to avoid electric shock risk. Do not charge the product in conditions greater than 60 C.

四、Advanced guide

1. Mission Planner

（1）Summary

The most representative and widely used ground station.

Applicable platform：Windows，Mac OS（Use Mono）

Licence：Open Source（GPLv3）

Download accessible：

https://ardupilot.org/plane/docs/common-choosing-a-ground-station.html

（2） Connection establishment

After opening the MISSION PLANNER, connect the flight controller and the computer using USB. Select the COM port (with ArduPilot) in the upper right corner and set the port rate to 115200 and click the link button to establish the connection. This allows you to start trying to debug it.
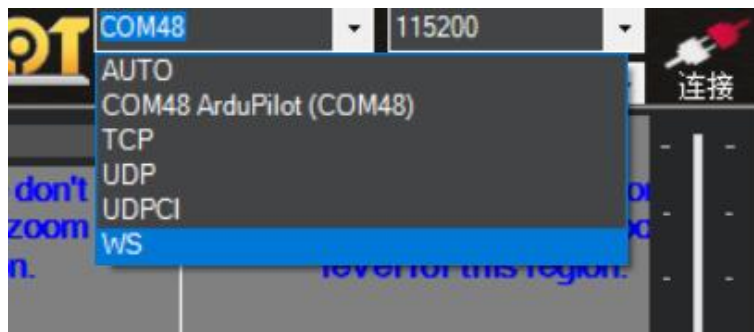

2.Sensor reference

2.1 Accelerometer Calibration (in necessary hardware for initial setup)

The accelerometer calibration is divided into [six calibration Calibration Accel] and [horizontal calibration Calibration Level]. The six calibration must be completed on a completely flat desktop, so please complete it before the flight control installation.

Horizontal calibration is completed after the installation.
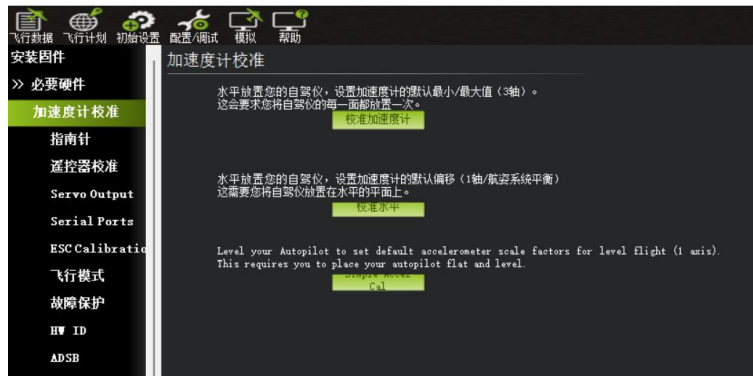
(1) Six-sided calibration

After clicking on the calibrated accelerometer, it becomes "finish click". Below, there is a prompt on how to place the flight control for a six-sided calibration. For each action, click the top button to jump to the next action. This process will lead you to gradually complete the six-side calibration of the flight control.

（2）Horizontal alignment

After the flight control installation, the aircraft is placed flat, and then click "Calibration Level" to perform a calibration.

2.2 Compass calibration

The compass should be carried out after the completion of the installation.

Click to enter the compass interface, identify the compass and select the compass. Click to calibrate the compass, and a progress bar will be displayed below. You need to rotate the aircraft along each axis until the progress bar is fully filled. At this point, the system will prompt the compass calibration to complete and need to restart the flight control.

If the calibration fails, check for magnetic objects and try again.

3.Remote control setup

（1）Remote control calibration

Ensure correct wiring (remote control channel is consistent with flight controller channel).
Enter the remote control calibration interface:
When the remote control rolls right, the roll value shifts to the right.
When the remote control rolls left, the roll value shifts to the left
When the throttle lever is pulled up, the thortle value shifts upward
When the throttle lever is pulled down, the thortle value shifts downward
On left yaw, the yaw value shifts to the left
On the right yaw, the yaw value shifts to the right
The pitch value shifts downward when the pitch lever is pulled up

The pitch value is shifted upward when the pitch bar pulls down

If the performance is not consistent with the above, please change the remote control channel or reverse the channel in the remote control (try not to check the reverse in the calibration interface of MISSION PLANNER, especially the throttle channel, otherwise it may cause log analysis problems and extension problems).

Click on Start Calibration。

After starting the calibration, please hit each joystick on the remote control to the limit position of the left and right (or up and down) back and forth several times, and each switch on the remote control should also switch back and forth. At this time, you will see the red line of the left and right (or up and down) in the calibration page, and the red line is the minimum and maximum travel amount of each channel of the remote control.

Finally, click "Calibration Complete". After waiting for a few seconds, a list on the calibration page will appear, telling you the amount of travel of each channel, and the calibration can be completed after checking correctly。

Remote control calibration must be performed before setting the flight mode and the electrical calibration.

4.Voltage calibration

After powering up the drone, enter the Mission Planner and enter the initial Settings-> necessary Hardware-> Battery Monitor 1 interface to ensure that the voltage displayed on it is the same as the battery voltage measured with the current meter, and if different, it should be modified to be consistent with the ammeter measurement.

5.Flight mode setting

Fixed-wing aircraft have a variety of built-in flight modes. The flight mode and options you choose determine that your aircraft is a simple flight stability system, a complex autopilot system,

a training system, or a safe flight system.

The flight mode can be switched using a radio transmitter by sending mission instructions, or controlled by instructions from the ground station.

Further details of the flight mode can be found in Appendix I.

Enter the flight mode setting, select the appropriate mode through the drop-down menu, and set it according to personal preferences.

If you use a three-section switch, set the two adjacent channels to the same mode

6.Output Settings

（1）Channel configuration

Enter the SERVO OUTPUT to set up the flight control channels.

Select the following channel according to the wiring and serve as the plane rudder surface and throttle.

（2）Electric calibration

Do not install the paddle on time and confirm that the remote control has been calibrated.

(1)   Power off FC，connect US to MISSION PLANNER.

(2)   Enter the flight data interface, find the action bar, and click to unlock it.

(3)   Forced unlock.

(4)   Push up the throttle bar of the remote control to power up the flight controller.

(5)   After the calibration sound is over, pull the throttle lever to the lowest level immediately。

(6)   Electrical calibration is completed. Push the throttle to see if the motor steering matches the paddle and works linearly with the throttle lever.

（3）Rudder surface inspection

Switch to manual (Manual) on remote control to check the correct steering feedback through pitch, lifting and direction. If the rudder is reversed, you can find the corresponding channel in the "SERVO OUTPUT" interface.

After checking the manual (Manual) steering plane, cut the remote control to the autostable (FBWA) .

Simulate the air attitude and observe the feedback of the aircraft. For example, bow the plane at its head and see if the rudder will turn up, to help the plane look up, restore its flat attitude, and so on to test the roll and yaw.

If the steering gear feedback is inconsistent, return to the remote control calibration step to check the steering gear wiring.

7. Error protection

7.1 Set the low power level protection

Set the protection voltage according to the power consumption of the aircraft, the size of the battery and the flight distance. When the voltage is lower, there can be enough battery to allow the plane to return, set the low power value (this value is set according to the size of the battery, when you have a long flight, please set in 3.7V, voltage value of 3.7 * S number, 4S battery is 3.7*3=14.8V; when close range, you can set a single 3.5V), set the action as RTL (return)

7.2 Set the remote control for runaway protection

Check the throttle fault protection in the initial setting-necessary hardware-fault protection, and set the fault protection PWM (generally do not need to change).

When the FireFly is disconnected from the remote control during the flight, it will enter the original hover within 1 second. If it is not reconnect within 8 seconds, it will enter the return mode and return to the take-off point.

8.Commonly used reference

8.1Remote control channel settings

In the full parameter table, find FLTMODE _ CH can modify the channel to switch the flight mode.

If you need to assign a specific flight mode to a separate channel, if we have not set the unlock switch, now set it on 5, and perform the following steps:

The corresponding RC5_OPTION 0 was searched and modified its value to 153.

Configure the fifth channel on the remote control to bind to the required switch to understand the lock switch setting.

In this way, you can unlock and lock the plane by defining the corresponding switch.

8.2 Throsolution (top) lock mode setting

In the full parameter table, find the ARMING_RUDDER to modify the solution (top) throttle lock mode (based on the rudder).

（1）Setting ARMING_RUDDER to 1 means you can use the joystick to lock the throttle .

（2）Setting ARMING_RUDDER to 2 means you can lock/unlock the throttle with joystick.

（3）Setting ARMING_RUDDER to 0 means you can only solve (top) lock the throttle with the ground station or the remote control channel input.

五、Product maintenance

1.   The body material of Firefly is EPP material, if there is damage, can be repaired with foam glue, recommended B-7000 glue, curing after one day can completely restore the strength before the damage

2.   The tail pin and the wing pin are electrically connected, and the connector is relatively precise, so unnecessary collisions and dirt should be avoided. If damaged, you need to purchase spare parts from Haohan official channels to replace them.
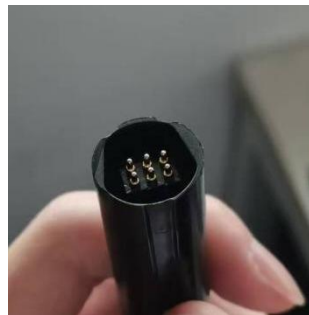
3. Haohan official provides various components and accessories for aircraft for repair. If damage is made, you can access Haohan official sales channels to purchase.

七、 Appendix

1.Introduction to flight mode

(1) Manual mode

manually control the deflection of the rudder surface and the speed of the motor. All the joystick input directly through the flight control output, the plane will not automatically return to the level, without any feedback.

(2) FBWA mode

The most commonly used mode in the fixed-wing mode is suitable for inexperienced novices.

In this mode, the aircraft uses a joystick to maintain the specified roll and pitch movements. When controlling the large angle roll, the aircraft maintains the pitch level and the roll angle is restricted by LIM _ ROLL _ CD, and the minimum and maximum angles of pitch are set by LIM _ PITCH _ MIN and LIM _ PITCH _ MAX. The aircraft's pitch level will be limited between these two angles.The output range of the throttle is limited by the THU _ MIN and THU _ MAX.The rudder is controlled by manual and flight control coordination.

(3) FBWB mode

FBWB mode is similar to FBWA mode.

In this mode, the aircraft perfectly maintains the height at which it is located. The roll control is the same as the FBWA mode, the height is raised by controlling the pitch, and the throttle controls the flight speed.

The control altitude through the pitch lift channel, the pitch back to the middle, the aircraft maintains the current height.

The speed of aircraft altitude change depends on the size of the FBWB _ CLIMB _ RATE parameter, which controls the rate of altitude change, generally with a default value of 2 m per second.

If you have an air tachometer on your plane, you can adjust your air speed range by setting the parameters ARSPD _ FBW _ MIN and ARSPD _ FBW _ MAX. When the throttle is lowest, the plane will try to fly under ARSPD _ FBW _ MIN, and when the throttle is highest, it will try to fly under ARSPD _ FBW _ MAX.

If there is no air meter, the throttle will adjust the output to meet the required high requirements, and the throttle bar is preferably greater than the calculated required value, allowing the aircraft to fly faster.

The rudder, like FBWA, is coordinated and mixed-controlled.

(4) CRUISE mode

Cruise mode is similar to FBWB, but it locks the course, best for long-distance FPV flight, you can point the plane to a distant object, and it will track the target accurately, constantly changing course, altitude and airspeed.

The specific working methods are shown as follows:

-If you operate the ailerons and the rudder, they change similar to the FBWB mode. The aircraft will remain high until you control the lift and fall, with the speed controlled by the throttle.

-When you release the rocker control for more than 0.5 seconds, you will set the current point as the starting point and keep the current course for a kilometer.(Course locking requires GPS locking and ground speed over 3 m per second).

-Always update the target point, always stay a kilometer ahead of your current position, and the aircraft cancels the current target point once you operate the aileron and rudder.

-As long as you don't touch the aileron and rudder, it stays on the ground even under changing winds.

One advantage of cruise mode is that if you control the rudder, the flight control controls the wing level, making a "horizontal" turn through the rudder, which allows you to rotate around the flight point and then in any direction you want to go. When you release the rudder, it goes straight in that direction.

(5) AUTOTUNE automatic reference mode

Getting a good set of roll / pitch adjustment parameters for your aircraft is essential for a stable and accurate flight. To address this issue, it is strongly recommended that you use the autotuning mode described below.

The automatic parameter mode is a flight mode whose flight manipulation is similar to FBWA, but uses the user-entered flight attitude to learn the key values for roll and pitch adjustment. Therefore, the user needs to adjust the aircraft to the automatic adjustment mode through the remote control, and fly for a certain time (a few minutes). During this process, the user needs to operate the aircraft at a large Angle as quickly as possible, and the aircraft will automatically learn the adjustment mode.

AUTOTUNE _ LEVEL can be used to select the adjustment level, the default is level 6, which will produce a medium tone, suitable for beginners to intermediate pilots, higher level, the aircraft adjustment will be more intense and faster, more suitable for experienced pilots.

After entering the automatic parameter adjustment mode:

-The flight controller sets I and D for the roll and pitch, and the maximum rate depends on the default values, and these values depend on the parameter level.

-The flight control automatically detects the rate of roll and pitch required by the operator (depending on your remote control operation), and triggers the automatic learning adjustment to the maximum when the required rate is greater than 80% of the maximum rate.

-Every ten seconds saves the adjustment parameters from ten seconds ago, which means that once the aircraft adjustment causes instability, you have 10 seconds to adjust to the other flight modes, and when you exit the adjustment mode, the last saved parameters will be saved.

-When you use the default parameters, you will find that the plane is operating quite slowly, but as the parameter moves slowly, you will find that the plane is getting better and better. And make sure that the flight space is large enough for a slow turn.

The key to success is fast input, for roll and pitch, should be only in one direction at a time, and quickly hit the maximum in this direction.

In the direction of rolling, you should play to the left and then to the right. You don't need to wait for the plane to level back, and only wait 2 seconds after each operation to reverse. Each sudden reversal can bring a 5% adjustment, so you theoretically need to make 20 adjustments.

In the pitch direction, you should be like a roller coaster, rising fast and falling quickly, so repeated 20 times.

When your initial adjustment value is too low, you may find that the aircraft becomes more sensitive with the adjustment, causing it to become unstable. At this point, you should quit the automatic adjustment mode.

20 times is just advice, you can lengthen the time according to the flight attitude and operation experience.

(6) RTL mode

In the return mode, the aircraft will return home (under GPS positioning, unlocked position) and stay in the circle until the next step or the battery is exhausted. The altitude in the return mode can be set by the ALT _ HOID _ RTL parameter. When this parameter is set to-1, the aircraft will return at the altitude when unlocked.

(7) LOITER mode

In LOITER mode, the aircraft will circle at the altitude of entering stay mode, the radius is set through WP _ LOITER _ RAD, but also subject to the NAV _ ROLL _ CD limit and adjustment of the NAVL 1 _ PERIOD parameter, which requires good GPS positioning and can be slightly controlled

with the remote control.

(8) STABILIZE mode

The aircraft is simple and stable through flight control. If the aircraft is let go, it will automatically fly flat, and the tilt and maneuvering of the aircraft will become not easy. It is best to use FBWA mode to replace the stability of the aircraft。

(9) More flight mode

CIRCLE   Circle mode

TRAINING   Training mode

ACRO   Stunt mode

AUTO   Automatic mode

AVOIDADSB   ADSB avoidance mode

GUIDED   Guide mode

QSTABLIZE   Autostabilization in vtol mode

QHOVER   Fixed elevation in vtol mode

QLOITER   Fixed elevation and fixed point in vtol mode

QLAND   Landing in vtol mode

QRTL   RTL in vtol mode

2.After-sales service and technical support

You can obtain after-sales support for HAOHAN Firefly products through the following channels

官方网站   QQ群   售后邮箱

3. Instruction

HAOHAN Innovation has the final interpretation right of the guide, and this guide is subject to updates without notice.

HAOHAN innovation, all the copyright。

You can check the latest version of the user guide on HAOHAN's website：

https://www.haohaninnovation.com/support