Related downloads

Freeman 2100/2300 user guide download

http://fw.makeflyeasy.com/Freeman/

Freeman 2100/2300 parameters download

http://fw.makeflyeasy.com/Frame_params/

MP download

http://fw.makeflyeasy.com/Mission Planner VTOL Survey/

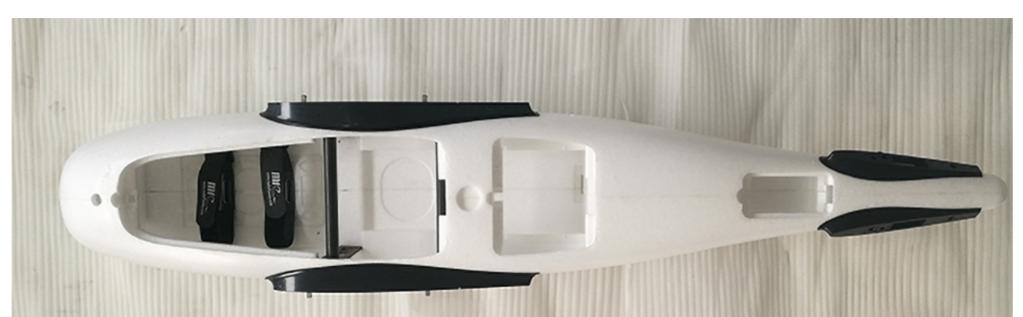
Freeman Fixed Wing Installation Notes

Assembly and notes

• I use the Freeman 2300 for installation, and the Freeman 2100 is similar, only the wing is 20cm longer, the fuselage and tail section is the same.

1.1 Fuselage tail section

• Fuselage assembly can refer to **Believer Hand Throw Fixed Wing Installation Notes**, Check whether the parts to be embedded are installed before closing the mold.





• To increase the longitudinal stability of the aircraft, I cut a vertical tail by hand and glued it on with hot melt glue. This way the flight path offset is smaller.



• The part of the wing docking is the metal locking hook, pay attention to the installation of flat, to ensure smooth plugging and unplugging.



• After the fuselage is bonded, it is recommended to increase the strength of the aircraft with fiber adhesive to improve the durability of the aircraft.



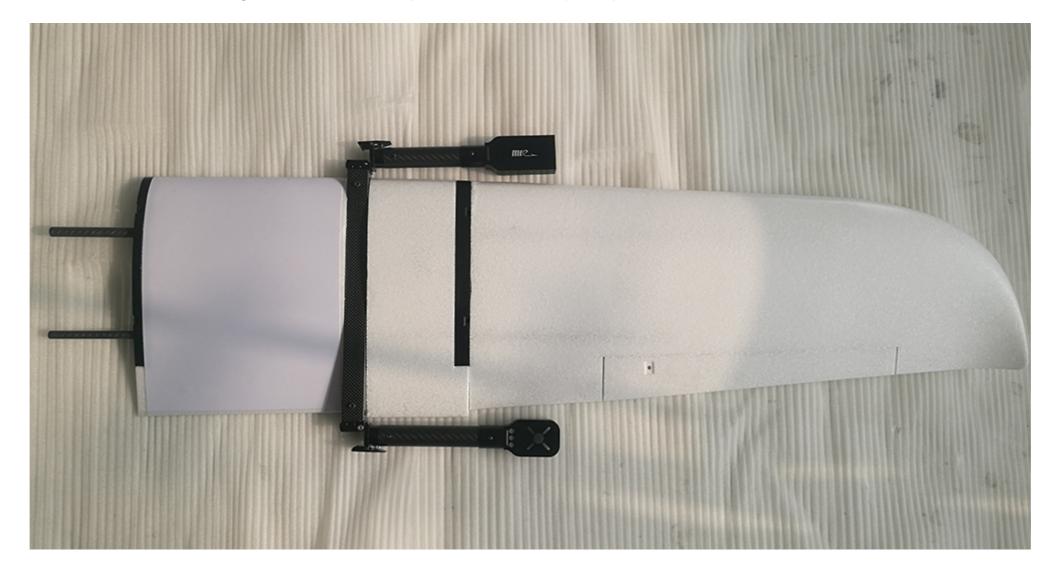
• Before the tail is installed, it is recommended that the rudder surface is repeatedly folded by hand several times to reduce the resistance of the rudder surface rotation.



• The rudder surface of the tail can also be reinforced with fiber adhesive to increase the strength of the rudder surface and improve the precision of control.

1.2 Wing section

• The rudder surface of the wing also needs to be manually folded several times repeatedly to reduce the resistance of the rudder surface rotation.



• Check whether the screws of the folding machine arm are tightened.



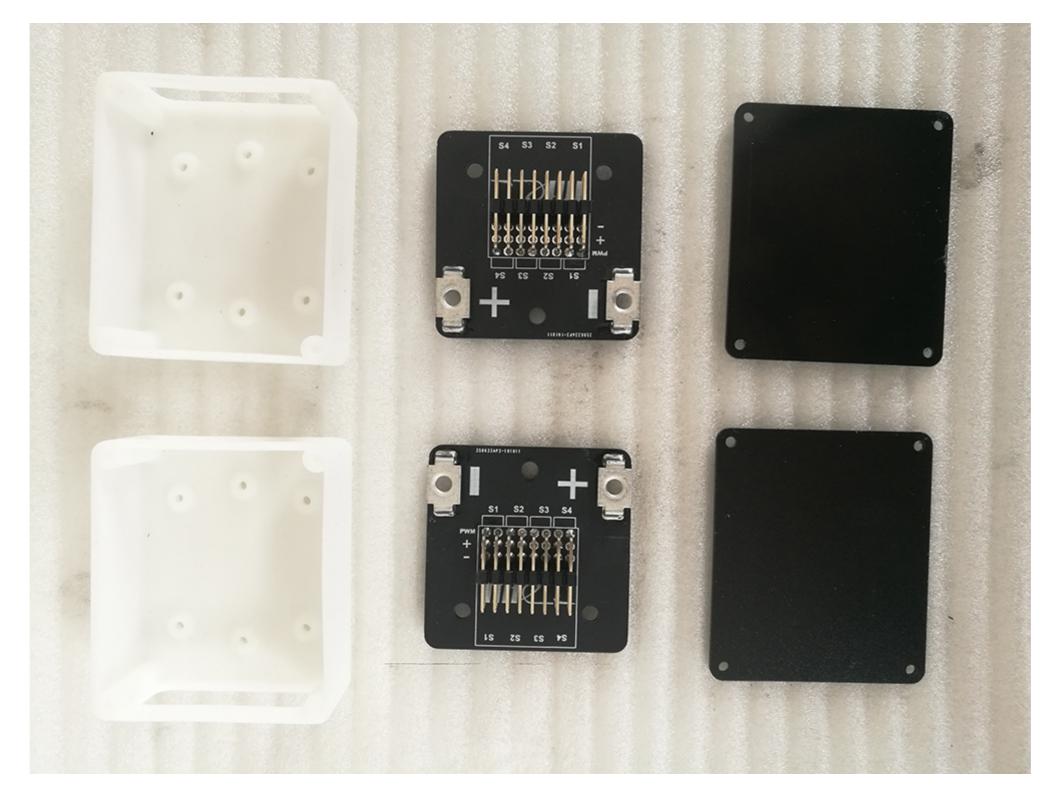
• I installed a waterproof and dustproof version of the motor mount, the internal space of this motor mount can accommodate Lotte 40A and Lotte 60A ESC (Attention to thermal conductivity and heat dissipation during ESC installation).



• For quick assembly and repair, I dug a hole in the wing and hand-made an adapter plate for modification(The official version does not have this thing, hope to add later).



• I first 3D printed a mounting base to facilitate the installation of the adapter plate, and then CNC machined a cover plate so that the appearance looks more beautiful.



• Pre-install it first and see how it works(If there is no adapter plate, you need to directly solder the line, some connectors need to be cut and then soldered together, the effect is the same).



Initial setup of flight control system

2.1 Installation of mission planer ground station

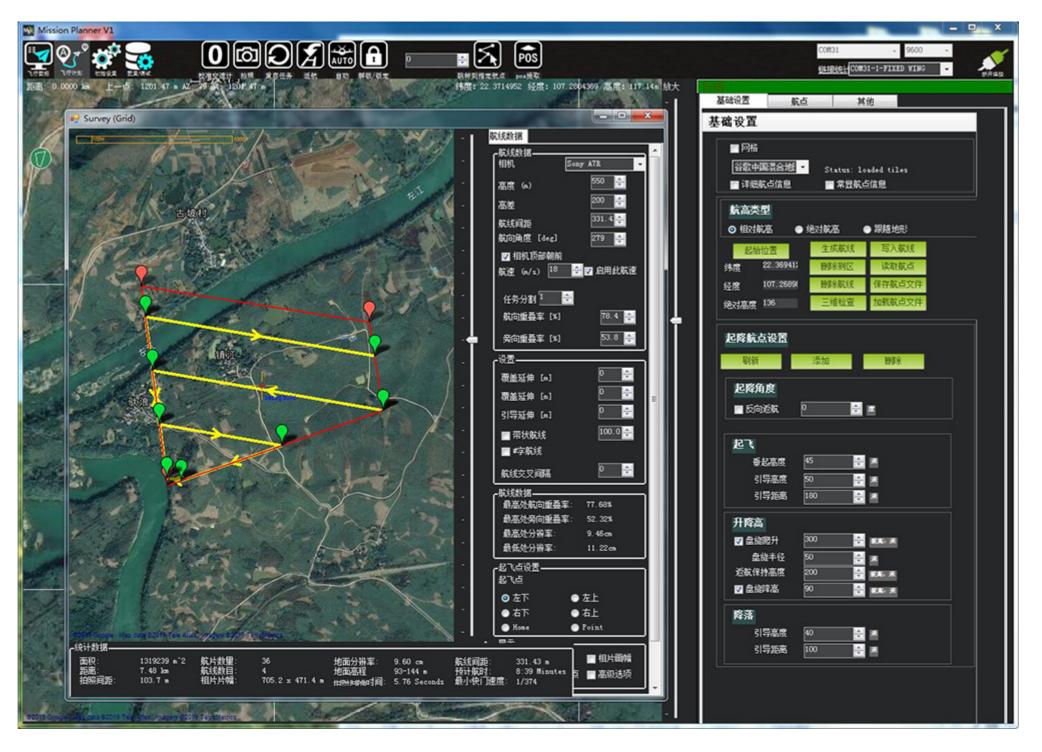
• I use Mission planer modified ground station, Mission planer VTOL suvey is also permanently free to use, specifically optimized for VTOL fixed wing.

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7 库	MetaDataExtractor.pdb	2019-04-02 上午 10:23	PDB 文件	68 KB		
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→ 音乐	Microsoft.Scripting.Metadata.dll	2018-02-05 下午 1:23	应用程序扩展	88 KB		
	Nicrosoft.VisualStudio.CodeCoverag	2018-02-05 下午 1:23	应用程序扩展	23 KB		
🖳 计算机	Microsoft.Win32.Primitives.dll	2019-03-02 下午 1:47	应用程序扩展	21 KB		
🏭 系统 (C:)	Microsoft.Win32.Registry.dll	2019-03-02 下午 1:51	应用程序扩展	31 KB		
🕞 本地磁盘 (D:)	MissionPlanner.Antenna.dll	2019-04-02 上午 10:24	应用程序扩展	16 KB		
D (E:)	MissionPlanner.Antenna.pdb	2019-04-02 上午 10:24	PDB 文件	6 KB		
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	MissionPlanner.ArduPilot.pdb	2019-04-02 上午 10:24	PDB 文件	77 KB		
🕞 数据 (G:)	MissionPlanner.Comms.dll	2019-04-02 上午 10:23	应用程序扩展	52 KB		
	MissionPlanner.Comms.pdb	2019-04-02 上午 10:23	PDB 文件	24 KB		
🙀 网络	MissionPlanner.Controls.dll	2019-04-02 上午 10:24	应用程序扩展	221 KB		
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	MissionPlanner.exe	2019-04-02 上午 10:24	应用程序	8,220 KB		
	MissionPlanner.exe.config	2019-04-02 上午 10:24	CONFIG 文件	26 KB		
	MissionPlanner.HIL.dll	2019-04-02 上午 10:24	应用程序扩展	27 KB		
	MissionPlanner.HIL.pdb	2019-04-02 上午 10:24	PDB 文件	8 KB		
	MissionPlanner.Maps.dll	2019-04-02 上午 10:24	应用程序扩展	2,993 KB		
	MissionPlanner.Maps.pdb	2019-04-02 上午 10:24	PDB 文件	30 KB		
	MissionPlanner.pdb	2019-04-02 上午 10:24	PDB 文件	726 KB		
	MissionPlanner.Strings.dll	2019-04-02 上午 10:24	应用程序扩展	37 KB		
	MissionPlanner.Strings.pdb	2019-04-02 上午 10:24	PDB 文件	8 KB		
	MissionPlanner.Utilities.dll	2019-04-02 上午 10:24	应用程序扩展	483 KB		
	MissionPlanner.Utilities.pdb	2019-04-02 上午 10:24	PDB 文件	222 KB		
	🚳 Mono.Posix.dll	2014-06-24 下午 3:54	应用程序扩展	183 KB		
	Planner.exe					
应用程序	修改日期: 2019-04-02 上午 10:24					
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• If the port number is not correctly recognized after inserting the flight control, you need to load the driver manually.

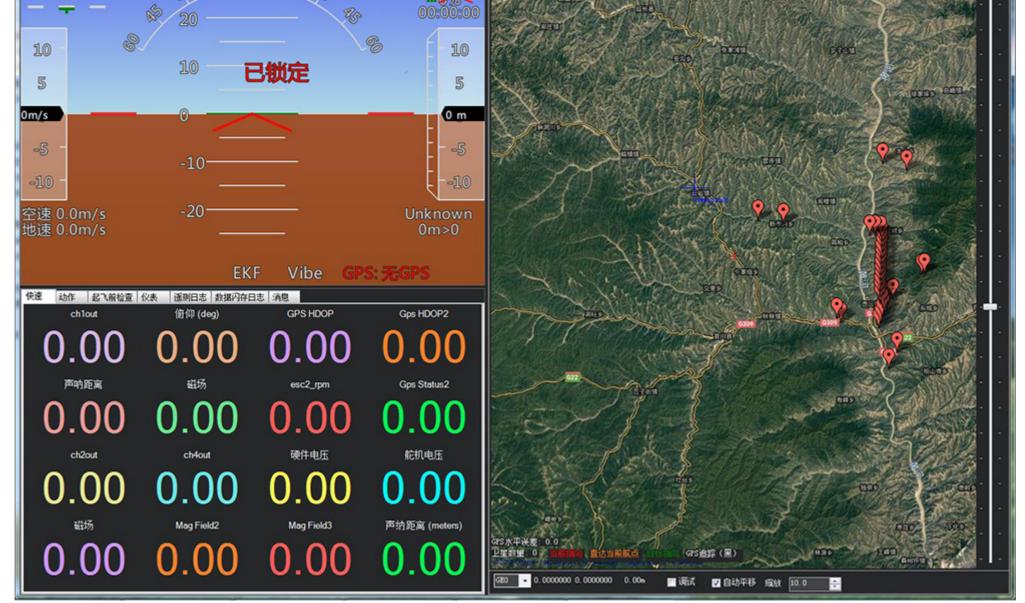
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• The VTOL fixed-wing route design has been heavily optimized to facilitate rapid route generation.



• The frequently used "Airspeed Calibration", "Photo", "Return", "Auto", "Unlock" and "Jump to Waypoint" are all located in the header section for ease of use.

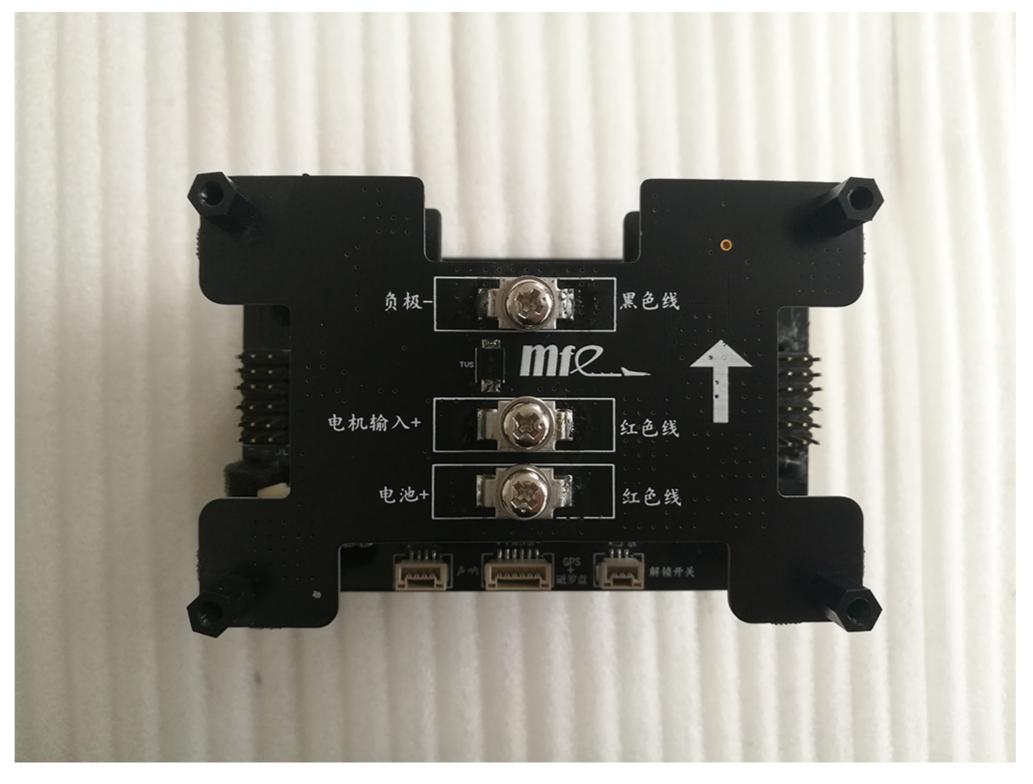




2.2 Program flight control firmware

• Tilting VTOL fixed wing can program the official Ardupilot firmware, or the Kris version, which has a smoother transition between multi-rotor and fixed wing. I use Kris20190319 version here as an example to load custom firmware, for the sake of disassembly and assembly convenience, I use a flight control based on Pixhawk V3 version flight control for system integration, named Pixsuvey.

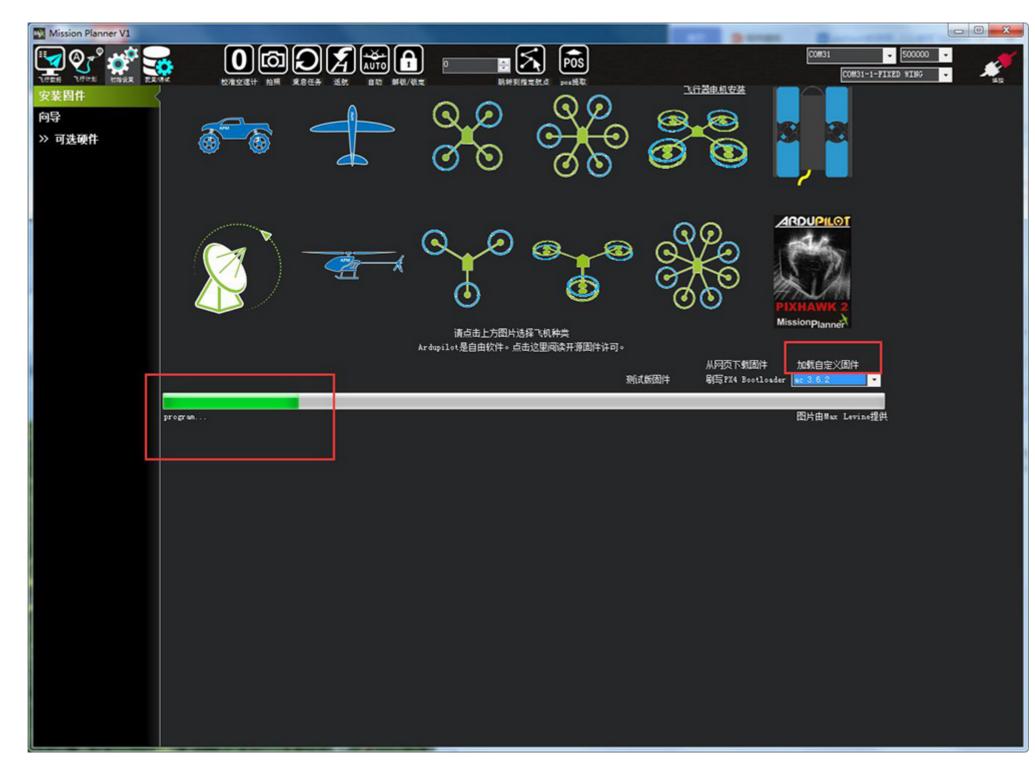
The process of programming the firmware is the same as for the CUAV's Pixhack V3 and the HEX's PIXHAWK2.



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📃 桌面	ArduPlane_F4BY.apj	2019-03-18 下午 9:51	APJ 文件	776 KB		
📃 最近访问的位置	ArdaPlane_FMU_V2.apj	2019 03 18 下午 8.29	APJ 交件	042 KB	2	
2345Downloads	ArduPlane_FMU_V3.apj	2019-03-18 下午 8:31	APJ 文件	910 KB	÷	
	ArduPlane_FMU_V4.apj	2019-03-18 下午 8:34	APJ 文件	1,077 KB	2	
7 库	ArduPlane_FMU_V5.apj	2019-02-27 上午 3:20	APJ 文件	1,103 KB		
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• Reboot after programming the firmware to check if the programming was successful.



2.3 Write configuration parameters

• Tilting VTOL fixed wing parameters can refer to my parameters, or you can configure yourself individually.

Mission Planner V1							
🕎 🔮 🗱 🙀	0	d)			POS COM31		000 - NG -
飞行模式		值	单位	自助 解极/极定 税特到指定机点 违项	t poggt	Fav	1055
	ACRO_LOCKING	0	742	0:Disabled 1:Enabled	Enable attitude locking when sticks are released		
基本调参	ACRO_PITCH_RATE	180	deg/s	10 500	The maximum pitch rate at full stick deflection in ACRO mode		保存
标准参数	ACRO_ROLL_RATE	180	deg/s	10 500	The maximum roll rate at full stick deflection in ACRO mode		写入参数
高级参数	ADSB_ENABLE	0		0:Disabled 1:Enabled	Enable ADS-8		刷新能数
全部参数表	AFS_ENABLE	0			This enables the advanced failsafe system. If this is set to zero (disable) then all the other AFS options have no effect		比较能数
全部参数树	AHRS_COMP_BETA	0.1		0.001 0.5	This controls the time constant for the cross-over frequency used to fuse AHRS (airspeed and heading) and GPS data to estimate ground velocity. Time constant is 0.1/beta. A larger time constant will use GPS data less and a small time constant will use air data less.	-	
Planner	AHRS_CUSTOM_PIT	0	deg	-180 180	Autoplict mounting position pitch offset. Positive values = pitch up, negative values = pitch down. This parameter is only used when AHRS_ORIENTATION is set to CUSTOM.		所有单位都会以原始 格式储存,不会被编述
	AHRS_CUSTOM_ROLL	0	deg	-180 180	Autoplict mounting position roll offset. Positive values = roll right, negative values = roll left. This parameter is only used when AHRS_ORIENTATION is set to CUSTOM.		3DR_Iris+_AC34 -
	AHRS_CUSTOM_YAW	0	deg	-180 180	Autoplict mounting position yaw offset. Positive values = yaw right, negative values = yaw left. This parameter is only used when AHRS_ORIENTATION is set to CUSTOM.		加戰能数
	AHRS_EKF_TYPE	2		0:Disabled 2:Enable EKF2 3:Enable EKF3	This controls which NavEKF Kalman filter version is used for attitude and position estimation		重责为默认值
	AHRS_GPS_GAIN	1		0.0 1.0	This controls how much to use the GPS to correct the attitude. This should never be set to zero for a plane as it would result in the plane losing control in turns. For a plane please use the default value of 1.0.	-	投索
	AHRS_GPS_MINSATS	6		0 10	Minimum number of satellites visible to use GPS for velocity based corrections attitude correction. This defaults to 6, which is about the point at which the velocity numbers from a GPS become too unreliable for accurate correction of the accelerometers.		Modified 🛛
	AHRS_GPS_USE	1		0.Disabled 1:Enabled	This controls whether to use dead-reckoning or GPS based navigation. If set to 0 then the GPS wont be used for navigation, and only dead reckoning will be used. A value of zero should never be used for normal flight. Currently this affects only the DCM-based AHRS: the EKF uses GPS whenever it is available.		
	AHRS_ORIENTATION	6		0.None 1.Yaw45 2.Yaw90 3.Yaw135 4.Yaw180 5.Yaw225 6.Yaw270 7.Yaw315 8.Rol180 9.Rol180/Yaw45 10.Rol180/Yaw90 11.Rol180Yaw270 15.Rol180Yaw315 16.Rol90 17.Rol90/Yaw45 18.Rol80Yaw315 16.Rol90 20.Rol270 21.Rol270Yaw45 22.Rol270Yaw90 23.Rol270Yaw135 24.Ptch80 25.Ptch270 26.Ptch180/Yaw90 27.Ptch180/Yaw270 28.Rol90Ptch90 29.Rol180Ptch50 30.Rol270Ptch50 31.Rol90Ptch180 32.Rol270Ptch50 33.Rol90Ptch270 34.Rol90Ptch270 35.Rol270Ptch270 36.Rol90Ptch180 39.Rol90Ptch180 38.Yaw2397tch68R0180 39.Ptch315 40.Rol90Ptch315 100.Custom	Overall board orientation relative to the standard orientation for the board type. This rotates the IMU and compass readings to allow the board to be oriented in your vehicle at any 90 or 45 degree angle. This option takes affect on next boot. After changing you will need to re-level your vehicle.	-	
	AHRS_RP_P	0.2		0.10.4	This controls how fast the accelerometers correct the attitude		
	AHRS_TRIM_X	0.006602562	rad	-0.1745 +0.1745	Compensates for the roll angle difference between the control board and the frame. Positive values make the vehicle roll right.	-	
	AHRS_TRIM_Y	-0.00442849	rad	-0.1745 +0.1745	Compensates for the pitch angle difference between the control board and the frame. Positive values make the vehicle pitch up/back.		
	AHRS_TRIM_Z	0	rad	-0.1745 +0.1745	Not Used		
	AHRS_WIND_MAX	5	m/s	0 127	This sets the maximum allowable difference between ground speed and airspeed. This allows the plane to cope with a failing airspeed sensor. A value of zero means to use the airspeed as is.		
	AHRS_YAW_P	0.2		0.1 0.4	This controls the weight the compass or GPS has on the heading. A higher value means the heading will track the yaw source (GPS or compass) more rapidly.		
	ALT_CTRL_ALG	0		0.Automatic	This sets what algorithm will be used for altitude control. The default is zero, which selects the most appropriate algorithm for your airframe. Currently the default is to use TECS total energy control system). From time to time we will add other experimental altitude control algorithms which will be selected using this parameter.		
	ALT_HOLD_FBWCM	0	cm		This is the minimum attude in centimeters that F8WB and CRUISE modes will allow. If you attempt to descend below this attude then the plane will level off. A value of zero means no limit.		
	ALT_HOLD_RTL	4	cm		Return to launch target altitude. This is the relative altitude the plane will aim for and lotter at when returning home. If this is negative (usually -1) then the plane will use the current altitude at the time of entering RTL. Note that when transiting to a Rally Point the altitude of the Rally Point is used instead of ALT_HOLD_RTL.		
	ALT OFFSET	0	m	-3767 Tarce	This is added to the target altitude in automatic flight. It can be used to add a global altitude offset to		*

• The parameters need to be swiped twice, the first time q_enable is enabled, after restarting the flight control, the hidden parameters at the beginning of q_ can be loaded. The parameters at the beginning of q_ are written successfully only after the second swipe.

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校准空运计		-	自助 解积/积定 跳转到指定机会	2 pot:微权	-
	值	单位	选项 0 1800000.Disabled 30000.VerySlow 72000.Slow	描述	Fav
Q_A_ACCEL_P_MAX	30000	cdeg/s/s	108000:Medium 162000:Fast	Maximum acceleration in pitch axis	
Q_A_ACCEL_R_MAX	30000	cdeg/s/s	0 1800000:Disabled 30000:VerySlow 72000:Slow 108000:Medium 162000:Fast	Maximum acceleration in roll axis	
Q_A_ACCEL_Y_MAX	5991.586	cdeg/s/s	0 720000 Disabled 9000 VerySlow 18000 Slow 36000 Medium 54000 Fast	Maximum acceleration in yaw axis	
Q_A_ANG_LIM_TC	1		0.5 10.0	Angle Limit (to maintain altitude) Time Constant	
Q_A_ANG_PIT_P	8		3.000 12.000	Ptch axis angle controller P gain. Converts the error between the desired ptch angle and actual angle to a desired ptch rate	
Q_A_ANG_RLL_P	8		3.000 12.000	Roll axis angle controller 9 gain. Converts the error between the desired roll angle and actual angle to a desired roll rate	
Q_A_ANG_YAW_P	5,613107		3.000 6.000	Yaw axis angle controller P gain. Converts the error between the desired yaw angle and actual	
Q_A_ANGLE_BOOST	1		0:Disabled 1:Enabled	angle to a desired yaw rate Angle Boost increases output throttle as the vehicle leans to reduce loss of altitude	-
Q_A_INPUT_TC	0.2		0 10.5.Very Soft 0.2.Soft 0.15.Medium 0.1.Crisp	Attude control input time constant. Low numbers lead to sharper response, higher numbers to	
			0.05-Very Crisp	softer response Pitch axis rate controller D gain. Compensates for short-term change in desired pitch rate vs actual	
Q_A_RAT_PIT_D	0.006767157		0.0 0.02	ptch rate	
Q_A_RAT_PIT_FF	0		00.5	Pitch axis rate controller feed forward	
Q_A_RAT_PIT_FILT	10	Hz	1 100	Pitch axis rate controller input frequency in Hz	
Q_A_RAT_PIT_I	0.2297929		0.01 2.0	Pitch axis rate controller I gain. Corrects long-term difference in desired pitch rate vs actual pitch rate	
Q_A_RAT_PIT_IMAX	0.5	2	01	Pitch axis rate controller I gain maximum. Constrains the maximum motor output that the I gain will output	
Q_A_RAT_PIT_P	0.2297929		0.05 0.50	Pitch axis rate controller P gain. Converts the difference between desired pitch rate and actual pitch rate into a motor speed output	
Q_A_RAT_RLL_D	0.0067		0.0 0.02	Roll axis rate controller D gain. Compensates for short-term change in desired roll rate vs actual roll rate	
Q_A_RAT_RLL_FF	0		00.5	Roll axis rate controller feed forward	
Q_A_RAT_RLL_FILT	10	Hz	1 100	Roll axis rate controller input frequency in Hz	
Q_A_RAT_RLL_I	0.393624		0.01 2.0	Roll axis rate controller I gain. Corrects long term difference in desired roll rate vs actual roll rate	
Q_A_RAT_RLL_IMAX	0.5	%	01	Roll axis rate controller I gain maximum. Constrains the maximum motor output that the I gain will output	
Q_A_RAT_RLL_P	0.393624		0.05 0.5	Roll axis rate controller P gain. Converts the difference between desired roll rate and actual roll rate into a motor speed output	
Q_A_RAT_YAW_D	0		0.000 0.02	Yaw axis rate controller D gain. Compensates for short-term change in desired yaw rate vs actual	
Q_A_RAT_YAW_FF	0		00.5	yaw rate Yaw axis rate controller feed forward	
Q_A_RAT_YAW_FILT	4.75		1 10	Yaw axis rate controller input frequency in Hz	
Q_A_RAT_YAW_I	0.1671699		0.010 1.0	Yaw axis rate controller I gain. Corrects long+erm difference in desired yaw rate vs actual yaw rate	
Q_A_RAT_YAW_IMAX	0.5	2	01	Yaw axis rate controller I gain maximum. Constrains the maximum motor output that the I gain will output	
Q_A_RAT_YAW_P	1.671699		0.10 2.50	Yaw axis rate controller P gain. Converts the difference between desired yaw rate and actual yaw	
Q_A_RATE_FF_ENAB	1		0.Disabled 1:Enabled	rate into a motor speed output Controls whether body-frame rate feedfoward is enabled or disabled	
Q_A_RATE_P_MAX	0		0 10800 Disabled 360 Slow 720 Medium 1080 Fast		
Q_A_RATE_R_MAX	0	_	0 10800 Disabled 360 Slow 720 Medium 1080 Fast		
Q_A_RATE_Y_MAX	0		0 10800 Disabled 360 Slow 720 Medium 1080 Fast		
Q_A_SLEW_YAW	6000		500 18000	Maximum rate the yaw target can be updated in Loter, RTL, Auto flight modes	
Q_A_THR_MIX_MAN	0.5		0.10.9	Throttle vs attitude control prioritisation used during manual flight (higher values mean we prioritise attitude control over throttle)	
Q_A_THR_MIX_MAX	0.5		0.5 0.9	Throttle vs attitude control prioritisation used during active flight (higher values mean we prioritise attitude control over throttle)	
Q_A_THR_MIX_MIN	0.1		0.1 0.25	Throttle vs attitude control prioritisation used when landing (higher values mean we prioritise attitude control over throttle)	
Q_ACCEL_Z	200	cm/s/s	50 500	The vertical acceleration used when plot is controlling the altitude	
Q_ANGLE_MAX	1500	cdeg	1000 8000	Maximum lean angle in all VTOL flight modes	

2.4 Six-sided method for accelerometer calibration

• This calibration must be done, and the horizontal calibration is only a small angular fine adjustment compared to the initial calibration of the accelerometer.

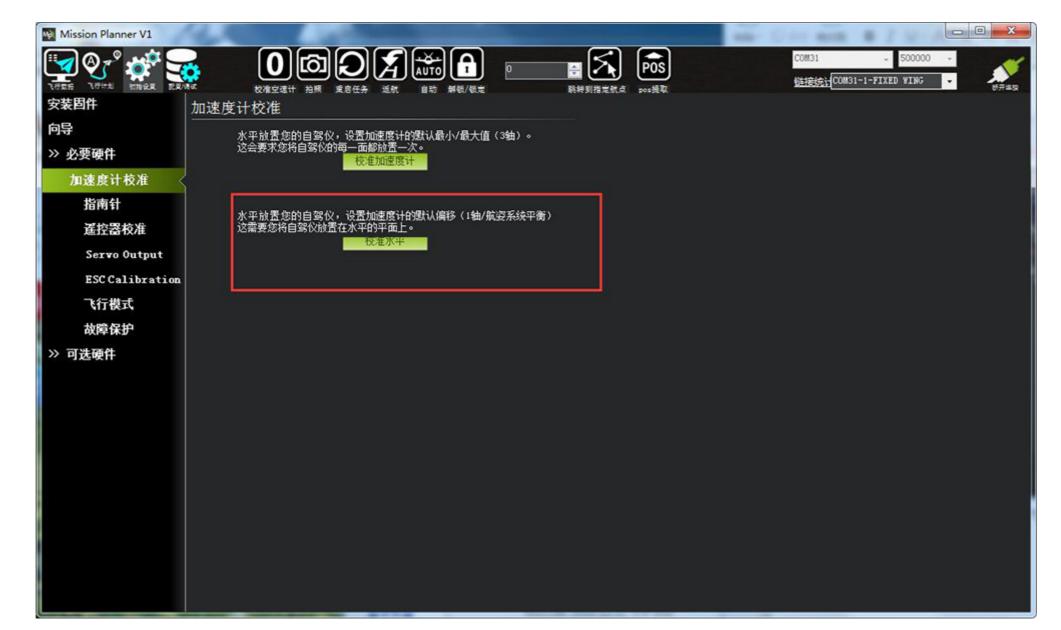
Acceleration calibration sequence:

Placed horizontally - left tilt 90 degrees - right tilt 90 degrees - low head 90 degrees - tilted head 90 degrees - placed horizontally upside down



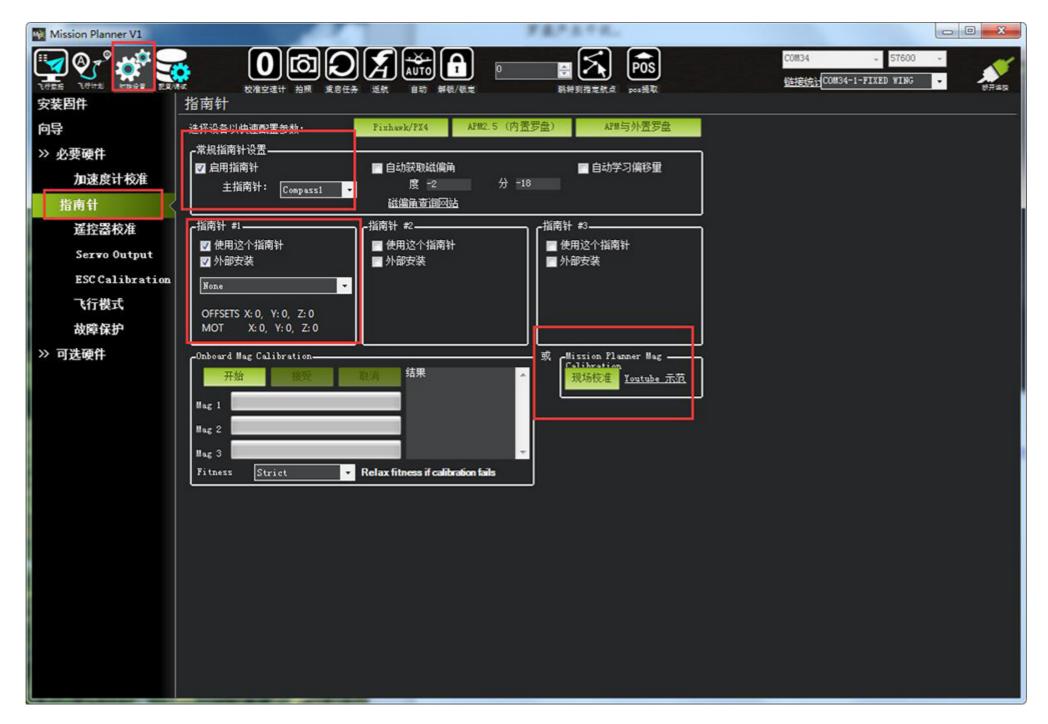


• Many aircraft course deviations have a lot to do with the aircraft not being calibrated level(Keep the level of flight control in line with the level of the aircraft).

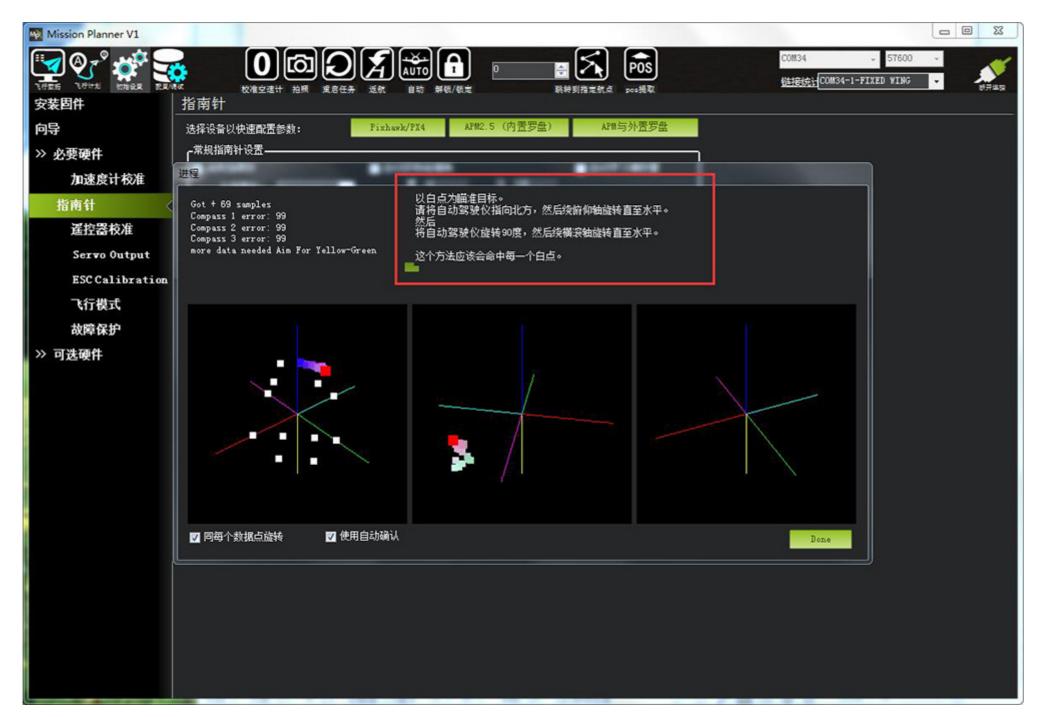


2.5 Configure and calibrate the magnetic compass

• Because the VTOL fixed wing has a multi-rotor part, so it need to configure the external compass, I am disabling the built-in compass, because the built-in compass inside the flight control, the cabin electromagnetic environment is more complex, power wires, BEC may have interference with the compass.



• I use field calibration, the nose points north, rotate 360 degrees along the pitch axis, then rotate the nose horizontally by 90 degrees, and then rotate 360 degrees in a horizontal roll to complete the calibration. Generally, when using the field calibration outdoors, you need to remove the keys, cell phones, belt buckles and other iron-containing items from your body, and keep the aircraft away from sources of interference such as aircraft support bays and vehicles during calibration.



Compensation parameters:

In the northern hemisphere, the compensation of Z should be positive, the compensation value of pitch low X should be increased, and the compensation value of cross roll right Y should be increased.

Common compass error messages:

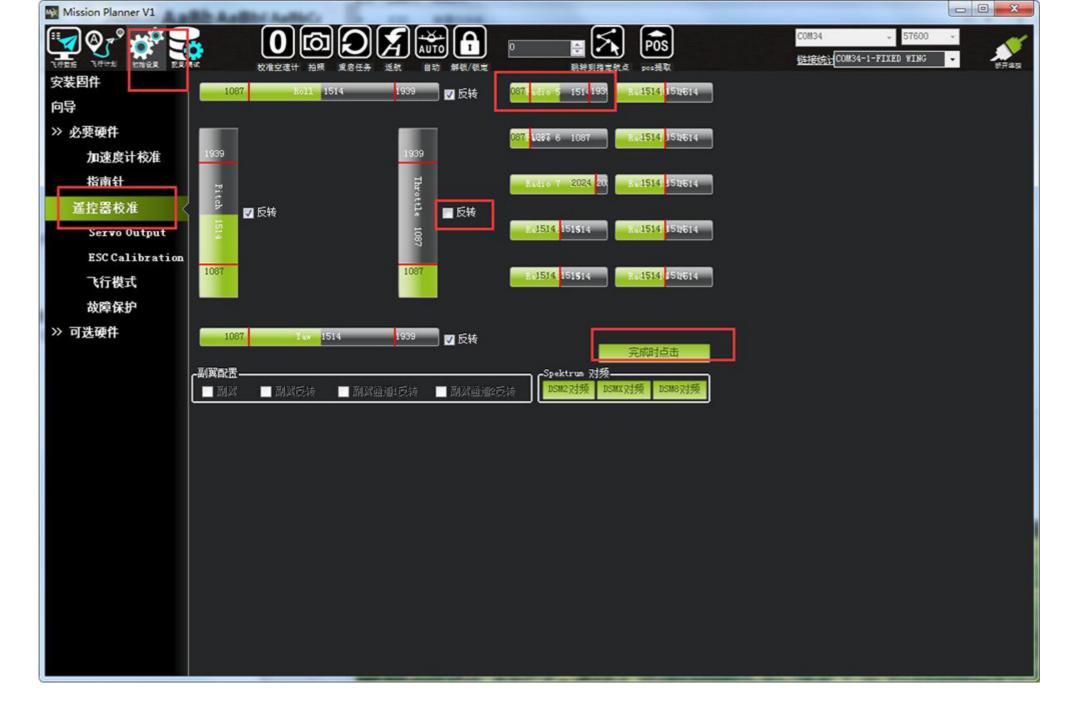
Compass Unhealth: The compass did not send a signal for at least half a second. Compass Variance:In the EKF path, the compass heading does not match the heading estimates from the other inertial sensors. Clicking on the EKF button on the mission planning screen will display the specific error. Compass Not Calibrated: The compass needs to be calibrated. Compass Offsets High: One of your compass offsets is more than 600, Indicates possible magnetic interference, check the source of interference and recalibrate.

2.6 Configure and calibrate the remote control

• Set the mode switch channel, I use the WFT07 remote control, configure channel 5 three-segment switch as the mode switch.

Mission Planner V1	101.00	1. 10		X 48	Auros 45	
LIVER LIVER LIVER	した 校准空速計			AUTO 自动 新板/板主 取特到指定机。	COM34 COM34 設施接続计COM34-1	- 57600 -
飞行模式	命 令	值	单位	选项	描述	Fav ^个 加载
基本调参 标准参数 高级参数	FBWB_CLIMB_RATE	2	m/s	1 10	This sets the rate in m/s at which FBWB and CRUISE modes will change its target altitude for full elevator deflection. Note that the actual climb rate of the aircraft can be lower than this, depending on your airspeed and throttle control settings. If you have this parameter set to the default value of 2.0, then holding the elevator at maximum deflection for 10 seconds would change the target altitude by 20 meters.	保存 写入参数 刷新参数 比较参数
全部参数表 全部参数树	FBWB_ELEV_REV	0		0:Disabled 1:Enabled	Reverse sense of elevator in FBWB and CRUISE modes. When set to 0 up elevator (pulling back on the stick) means to lower altitude. When set to 1, up elevator means to raise altitude.	■ 所有单位都会以
Planner	FENCE_ACTION	0		0:None 1:GuidedMode 2:ReportOnly 3:GuidedModeThrPass 4:RTL_Mode	What to do on fence breach. If this is set to 0 then no action is taken, and geofencing is disabled. If this is set to 1 then the plane will enter GUIDED mode, with the target waypoint as the fence return point. If this is set to 2 then the fence breach is reported to the ground station, but no other action is taken. If set to 3 then the plane enters guided mode but the plot retains manual throttle control. If set to 4 the plane enters 0.1. mode, with the target waypoint as the	格式体存,不会行 3DR_Irist_AC3(加载参数 重责为默认值 搜索
					closest rally point (or home point if there are no rally points).	pode
	FLTMODE_CH	5			RC Channel to use for flight mode control	
	FLTMODE1	17		0:Manual 1:CIRCLE 2:STABILIZE 3:TRAINING 4:ACRO 5:FBWA 6:FBWB 7:CRUISE 8:AUTOTUNE 10:Auto 11:RTL 12:Loiter 14:AVOID_ADSB 15:Guided 17:QSTABILIZE 18:QHOVER 19:QLOITER 20:QLAND 21:QRTL	Flight mode for switch position 1 (910 to 1230 and above 2049)	Modified
	FLTMODE2	11		0:Manual 1:CIRCLE 2:STABILIZE 3:TRAINING 4:ACRO 5:FBWA 6:FBWB 7:CRUISE 8:AUTOTUNE 10:Auto 11:RTL 12:Lotter 14:AVOID_ADSB 15:Guided 17:QSTABILIZE 18:QHOVER 19:QLOITER 20:QLAND 21:QRTL	Flight mode for switch position 2 (1231 to 1360)	•
	FLTMODE3	11		0:Manual 1:CIRCLE 2:STABILIZE 3:TRAINING 4:ACRO 5:FBWA 6:FBWB 7:CRUISE 8:AUTOTUNE 10:Auto 11:RTL 12:Loter 14:AVOID_ADSB 15:Guided 17:QSTABILIZE 18:QHOVER 19:QLOITER 20:QLAND 21:QRTL	Flight mode for switch position 3 (1361 to 1490)	•
	FLTMODE4	19		0:Manual 1:CIRCLE 2:STABILIZE 3:TRAINING 4:ACRO 5:FBWA 6:FBWB 7:CRUISE 8:AUTOTUNE 10:Auto 11:RTL 12:Loiter 14:AVOID_ADSB 15:Guided 17:QSTABILIZE 18:QHOVER 19:QLOITER 20:QLAND 21:QRTL	Flight mode for switch position 4 (1491 to 1620)	
	FLTMODE5	11		0:Manual 1:CIRCLE 2:STABILIZE 3:TRAINING 4:ACRO 5:FBWA 6:FBWB 7:CRUISE 8:AUTOTUNE 10:Auto 11:RTL 12:Loter 14:AVOID_ADSB 15:Guided 17:QSTABILIZE 18:QHOVER 19:QLOITER 20:QLAND 21:QRTL	Flight mode for switch position 5 (1621 to 1749)	•
	FLTMODE6	19		0:Manual 1:CIRCLE 2:STABILIZE 3:TRAINING 4:ACRO 5:FBWA 6:FBWB 7:CRUISE 8:AUTOTUNE 10:Auto 11:RTL 12:Loter 14:AVOID_ADSB 15:Guided 17:QSTABILIZE 18:QHOVER	Flight mode for switch position 6 (1750 to 2049)	•

• Calibrate the remote control, hit the maximum and minimum values for each channel as prompted, and finally keep the throttle at low and all other channels at neutral. This way the flight control completes the recording of the maximum, minimum and median values Save.



• Click "Reverse" is to modify the remote control channel positive and negative, more convenient. This operation and directly modify the remote control channel output positive and negative is the same effect.

2.7 Configure and check GPS

• Connect GPS to check if the search satellite is normal, I am connected indoors, so the number of satellites is very small, and the EKF red color has not disappeared, the GPS is not completely locked.



About GPS

- Most civilian GPS receivers use pseudo-orange data (C/A code) on the GPS L1 channel (1575.42 MHz) and can also optionally receive SBAS DGPS corrections to obtain meter accuracy.
- Advanced and expensive civilian GPS receivers can use previous methods plus carrier phase smoothing, carrier phase correction (RTK), and L2 channel P(Y) code semi-coded tracking (1227.60 MHz) for real-time local ionospheric correction, providing centimeter or even millimeter accuracy.
- Some of the more advanced GNSS receivers can combine DGPS and RTK correction with the ability to receive other GNSS satellites GLONASS and GALILEO) and other channels (L2C, L5) to improve accuracy and reliability.
- The military GPS receiver is capable of decoding the P(Y) codes available on the L1 and L2 channels, providing 10 times the real-time accuracy compared to the basic decode of pseudo-orange.

About GPS multi-Paths

• Multi-paths make GPS positioning errors difficult to detect and compensate for. Multiple GNSS receivers are better suited for filtering out multi-paths due to the availability of more visible satellites at the same time.

About GPS interference signal propagation

Ionospheric disturbances and magnetic storms (solar activity) can cause signal delays. This can be partially compensated using SBAS and L1/L2 decoding.
 Simultaneous decoding of L1 and L2 channels does allow real-time ionospheric correction by differential techniques. Unlike the SBAS broadcast ionospheric correction, this method can better match the local conditions of the ionosphere.

2.8 Configure and check the digital transmission

- I prefer to use the RFD900 digital transmission, there are several advantages:
- The transmission distance is relatively long, more than 40km is used in Xinjiang region.
 The digital transmission ID can be modified directly through the ground station, and multiple aircraft can work simultaneously.
- 3.It is also convenient to modify the baud rate, transmit power, and transmission mode, without the need to connect other software separately.

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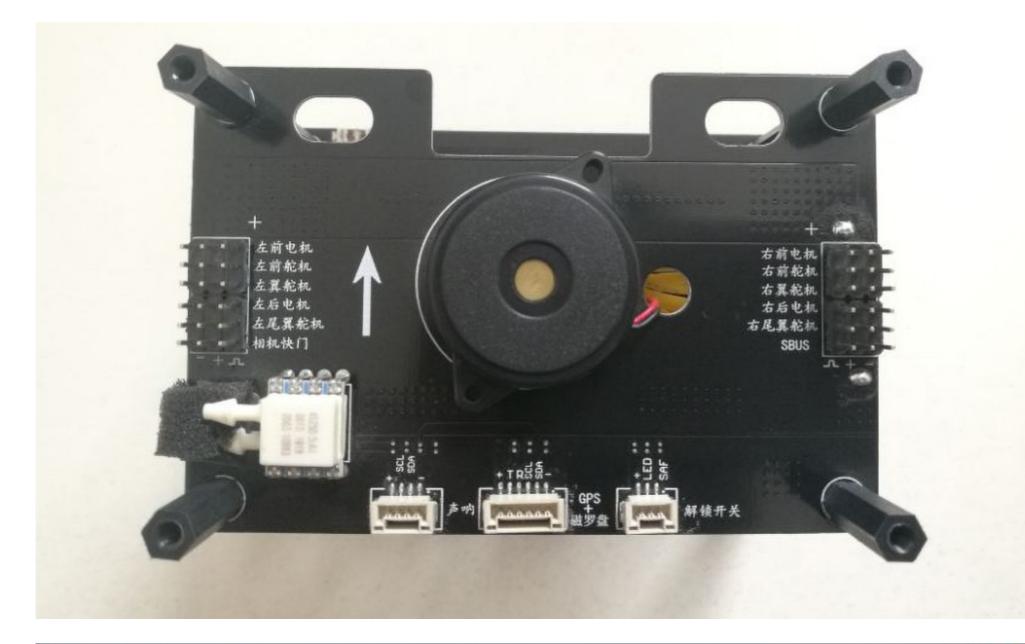
2.9 Configure and check the current-voltage module

- I use the Pixhawk V3 version, set the detection of voltage and current mode, the common power module on the market can only detect 60A, there may be over-range, I DIY a current meter can detect up to 99A, to meet the maximum current detection in the multi-rotor tilt state.
- Set the battery capacity, so that the battery estimates the percentage of power to be relatively accurate.



2.10 Configure and check the airspeed meter

• I use a 4525D0 airspeed meter with I²C interface and configured interface. When airspeed proportional correction, to observe the airspeed and ground speed difference is not large in the absence of wind. If the airspeed is larger than the ground speed, reduce the ratio, if the airspeed is smaller than the ground speed, increase the ratio. I used the airspeed extension tube, my ARSPD_RATIO = 1.59 is more appropriate, note that the above is the dynamic pressure tube.



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LORG LOUI HARR REAR	校准空速计	拍照 建启任务	F IER	自动解锁/锁定	脉转到指定航点		-FIXED WING	172g
飞行模式 命	i\$ 4	值	单位	选项		描述	Fav.	加载
高级参数	RSPD_AUTOCAL	0				If this is enabled then the APM will automatically adjust the ARSPD_RATIO during flight, based upon an estimation filter using ground speed and true airspeed. The automatic calibration will save the new ratio to EEPROM every 2 minutes if it changes by more than 5%. This option should be enabled for a calibration flight then disabled again when calibration is complete. Leaving it enabled all the time is not recommended.	•	保存 写入参数 刷新参数 比较参数
	RSPD_BUS	1		0:Bus0(internal) 1:Bus1(external)	:Bus2(auxillary)	The bus number of the I2C bus to look for the sensor on		
全部参数树 Planner 4R	RSPD_FBW_MAX	26 r	m/s	5 100		This is the maximum airspeed that you want to allow for your airframe in auto-throttle modes. You should ensure that this value is sufficiently above the ARSPD_FBW_MIN value to allow for a sufficient flight envelope to accurately control altitude using airspeed. A value at least 50% above ARSPD_FBW_MIN is recommended.		所有单位都会以原始 格式儲存,不会被缩於 3DR_Iris+_AC34 -
			m/s	5 100		This is the minimum airspeed you want to fly at in modes where the autopilot controls the airspeed. This should be set to a value around 20% higher than the level flight stall speed for the airframe. This value is also used in the STALL_PREVENTION code.	-	加载参数 重责为默认值 搜索
		112.0238				Airspeed calibration offset		ar sp
AR	SPD_OPTIONS	0				The pin number that the airspeed sensor is connected to for		Modified
AR	RSPD_PIN	65				analog sensors. Set to 15 on the Pixhawk for the analog airspeed port.	•	
AR	SPD_PRIMARY	0		0:FirstSensor 1:2ndSensor		This selects which airspeed sensor will be the primary if multiple sensors are found		
AR	SPD PSI RANGE	1		_		This parameter allows you to to set the PSI (pounds per square inch) range for your sensor. You should not change this unless you examine the datasheet for your device		
AR	RSPD_RATIO	1.59				Airspeed calibration ratio		
AR	RSPD_SKIP_CAL	0		0:Disable 1:Enable		This parameter allows you to skip airspeed offset calibration on startup, instead using the offset from the last calibration. This may be desirable if the offset variance between flights for your sensor is low and you want to avoid having to cover the pitot tube on each boot.	•	
AR	RSPD_TUBE_ORDER	2				This parameter allows you to control whether the order in which the tubes are attached to your pitot tube matters. If you set this to 0 then the top connector on the sensor needs to be the dynamic pressure. If set to 1 then the bottom connector needs to be the dynamic pressure. If set to 2 the default) then the airspeed driver will accept either order. The reason you may wish to specify the order is it will allow your airspeed sensor to detect if the aircraft it receiving excessive pressure on the static port, which would otherwise be seen as a positive airspeed.	-	
AR	RSPD_TYPE	1		0:None 1:I2C-MS4525D0 2:Analo 4:I2C-MS5525 (0x76) 5:I2C-MS55 6:I2C-SDP3X	525 (0x77)	Type of airspeed sensor		
						use airspeed for flight control. When set to 0 airspeed		

• The calibration of airspeed is done in the main interface, and it is normal for the value of airspeed to fluctuate within 3.



2.11 Configure and check the camera shutter

- The camera shutter uses a relay trigger mode, which requires careful configuration of the parameters of the flight control correctly.
- CAM_DURATION=2 represents a high level duration of 0.2S .
- CAM_RELAY_ON=1 The default is low and the trigger is high.

CAM_TRIGG_TYPE=1 The camera uses a relay trigger mode.

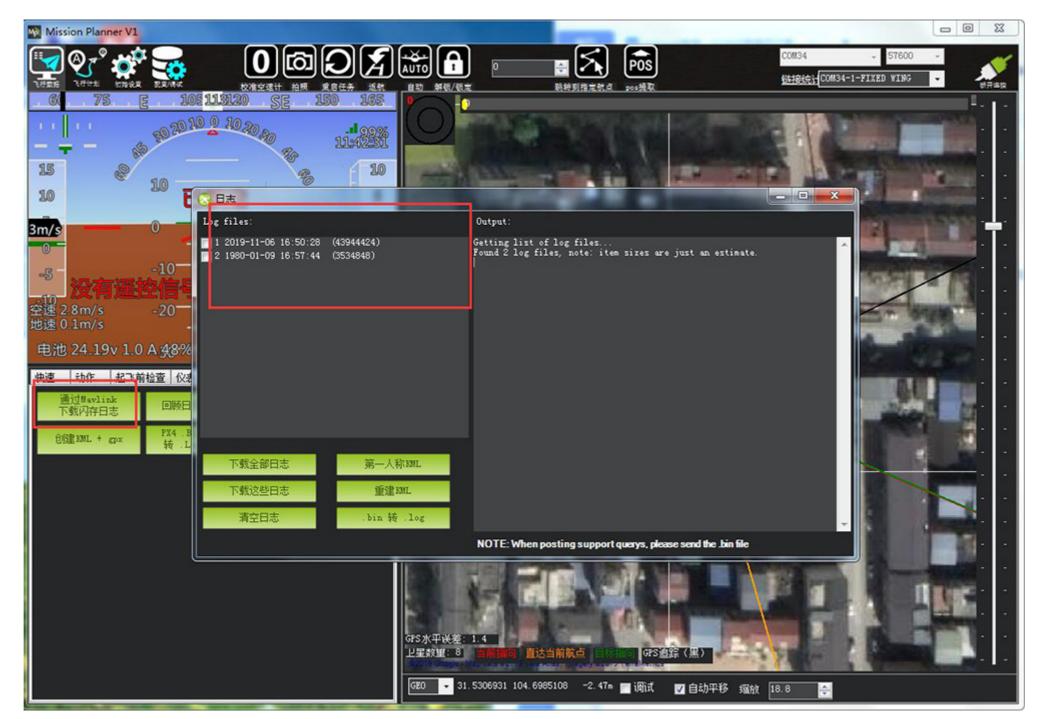
RELAY_PIN=54 AUX5 The channel is a relay channel.

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11755 1174 K 1514 K					COM34 POS 章 pos 操取	- 57600 -
飞行模式	命 令 △	值	单位	选项	描述	Fav加载
基本调参	CAM_AUTO_ONLY	0		0:Always 1:Only when in AUTO	When enabled, trigging by distance is done in AUTO mode only.	保存
标准参数	CAM_DURATION	2	ds	0 50	How long the shutter will be held open in 10ths of a second (i.e. enter 10 for 1second, 50 for 5seconds)	写入参数
高级参数 全部参数表 全部参数树 Planner	CAM_FEEDBACK_PIN	-1		-1:Disabled 50:PX4 AUX1 51:PX4 AUX2 52:PX4 AUX3 53:PX4 AUX4(fast capture) 54:PX4 AUX5 55:PX4 AUX6	pin number to use for save accurate camera feedback messages. If set to -1 then don't use a pin flag for this, otherwise this is a pin number which if held high after a picture trigger order, will save camera messages when camera really takes a picture. A universal camera hot shoe is needed. The pin should be held high for at least 2 milliseconds for reliable trigger detection. See also the CAM_FEEDBACK_POL option. If using AUX4 pin on a Pixhawk then a fast capture method is used that allows for the trigger time to be as short as one microsecond.	刷新參数 比较參数 所有单位都会以原始 格式諸存,不会被缩於
	CAM_FEEDBACK_POL	1		0:TriggerLow 1:TriggerHigh	Polarity for feedback pin. If this is 1 then the feedback pin should go high on trigger. If set to 0 then it should go low	3DR_Iris+_AC3(- 加载参数
	CAM_MAX_ROLL	0	deg	0 180	Postpone shooting if roll is greater than limit. (0=Disable, will shoot regardless of roll).	重要为默认值
		0	ms	0.10000	Postpone shooting if previous picture was taken less than preset time(ms) ago.	1 提索
	CAM_RELAY_ON	1		0:Low 1:High	This sets whether the relay goes high or low when it triggers. Note that you should also set RELAY_DEFAULT appropriately for your camera	Modified
	CAM_SERVO_OFF	1100	PWM	1000 2000	PWM value in microseconds to move servo to when shutter is deactivated	
	CAM_SERVO_ON	1300	PWM	1000 2000	PWM value in microseconds to move servo to when shutter is activated	
	CAM_TRIGG_DIST	0	m	0 1000	Distance in meters between camera triggers. If this value is non-zero then the camera will trigger whenever the GPS position changes by this number of meters regardless of what mode the APM is in. Note that this parameter can also be set in an auto mission using the DO_SET_CAM_TRIGG_DIST command, allowing you to enable/disable the triggering of the camera during the flight.	•
	CAM_TRIGG_TYPE	1		0:Servo 1:Relay	how to trigger the camera to take a picture	
	CAM_TYPE	0)				
	LOG_BITMASK	65535		0:Disabled 65535:PX4/Pixhawk-Default	Bitmap of what log types to enable in dataflash. This values is made up of the sum of each of the log types you want to be saved on dataflash. On a PX4 or Pixhawk the large storage size of a micro SD card means it is usually best just to enable all log types by setting this to 65535. On APM2 the smaller 4 MByte dataflash means you need to be more selective in your logging or you may run out of log space while flying (in which case it will wrap and overwrite the start of the log). The individual bits are ATTITUDE_FAST=1. ATTITUDE_MEDIUM=2, GPS=4. PerformanceMonitoring=8, Control Tuning=16. Navigation Tuning=32, Mode=64, IMU=128. Commands=256, Battery=512, Compass=1024, TECS=2048, Camera=4096, RCandServo=8192, Sonar=16384, Aming=32768, FullLogs=65535	

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					POS pos操取 维接统社COM34-1	-FIXED WING	
飞行模式	命令	值	单位	选项	描述	Fav ^	加载
基本调参	CAM_TRIGG_TYPE	1		0:Servo 1:Relay	how to trigger the camera to take a picture		保存
	CAM_TYPE	0					DALT.
标准参数 高级参数 全部参数表					Bitmap of what log types to enable in dataflash. This values is made up of the sum of each of the log types you want to be saved on dataflash. On a PX4 or Pixhawk the large storage size of a microSD card means it is usually best just to enable all log types by setting this to 65535. On APM2		写入参数 刷新参数 比较参数
全部参数树 Planner	LOG_BITMASK	65535		0:Disabled 65535:PX4/Pothawk-Default	the smaller 4 MByte dataflash means you need to be more selective in your logging or you may run out of log space while flying (in which case it will wrap and overwrite the start of the log). The individual bits are ATTITUDE_FAST=1. ATTITUDE_MEDIUM=2, GPS=4, PerformanceMonitoring=8, ControlTuning=16, NavigationTuning=32, Mode=64, IMU=128, Commands=256, Battery=512, Compass=1024, TECS=2048, Camera=4096, RCandServo=8192, Sonor=16384, Aming=32769, FullLogs=C5535		所有单位都会以原始 格式緒存,不会被缩於 3DR_Iris+_AC3< マ 加载参数
	RELAY_PIN	54		-1:Disabled 13:APM2 A9 pin 47:APM1 relay 49:BB Blue GP0 pin 4 50:Pixhawk AUXOUT1 51:Pixhawk AUXOUT2 52:Pixhawk AUXOUT3 53:Pixhawk AUXOUT4 54:Pixhawk AUXOUT5 55:Pixhawk AUXOUT6 57:BB Blue GP0 pin 3 111:PX4 FMU Relay1 112:PX4 FMU Relay2 113:PX4IO Relay1/BB Blue GP0 pin 6 114:PX4IO Relay2 115:PX4IO ACC1 116:PX4IO ACC2/BB Blue GP0 pin 5	Digital pin number for first relay control. This is the pin used for camera control.	•	重责为默认值 搜索 cam Modified
	SERVO1_FUNCTION	4		1-Disabled 1-BCPase Thou 2-Bao 3-Bao auto 4:Aleron 6:mount_pan 7:mount_tit 8:mount_roll 9:mount_open 10:camera_trigger 11:release 12:mount2_pan 13:mount2_tit 14:mount2_roll 15:mount2_open 16:DifferentialSpoilerLeft1 17:DifferentialSpoilerRight 186:DifferentialSpoilerLeft2 87:DifferentialSpoilerRight 2 19:Elevator 21:Rudder 24:RaperonLeft 25:RaperonRight 26:GroundSteering 27:Parachute 28:EPM 29:LandingGear 30:EngineRunEnable 31:HelRSC 32:HeliTailRSC 33:Motor1 34:Motor2 35:Motor3 36:Motor4 37:Motor5 38:Motor6 39:Motor7 40:Motor8 41:MotorTit 51:RCIN1 52:RCIN2 53:RCIN3 54:RCIN4 55:RCIN5 56:RCIN6 57:RCIN7 53:RCIN3 54:RCIN4 55:RCIN5 56:RCIN6 57:RCIN12 63:RCIN13 64:RCIN14 65:RCIN15 66:RCIN16 67:Ignition 68:Choke 69:Starter 70:Throttle 71:TrackerYaw 72:TrackerPitch 73:ThrottleLeft 74:ThrottleRight 75:titMotorLeft 76:titMotorRight 77:ElevonLeft 78:ElevonRight 79:VTailLeft 80:VTailRight 81:BoostThrottle 82:Motor9 83:Motor10 84:Motor11 85:Motor12 88:Winch	Function assigned to this servo. Seeing this to Disabled(0) will setup this output for control by auto missions or MAVLink servo set commands. any other value will enable the corresponding function		
				0:Disabled 1:RCPassThru 2:Rap 3:Rap_auto 4:Aleron 6:mount_pan 7:mount_tit 8:mount_roll 9:mount_open 10:camera_trigger 11:release 12:mount2_pan 13:mount2_tit 14:mount2_roll 15:mount2_open 16:DfferentialSpolerLeft 17:DfferentialSpolerLeft 1			

2.12 Configure and check whether SD card records are normal

- The SD card of the flight control must be replaced with a high-speed card, be sure to check the card equipped with the flight control manufacturer, otherwise there will be BAD LOG or POS data recording is incomplete, resulting in logs somehow directly not recorded.
- MP support online download logs, but the number of slow transmission, I usually take the card directly.



Power system installation and commissioning

3.1 Battery voltage check and charge/discharge

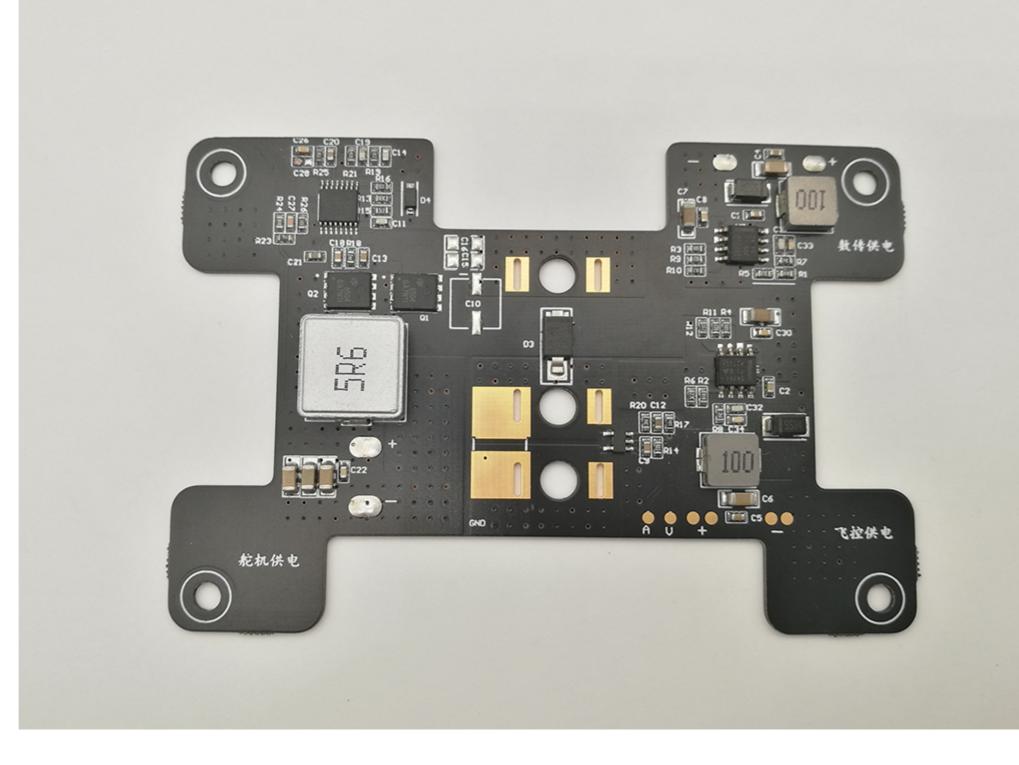
• When testing, pay attention to the battery do not over-discharge, the minimum voltage of 22.2V, fully charged 25.2V, long-term non-use, battery storage voltage of 23V or so, extend battery life.

3.2 Flight control power supply check

• Mainly check the flight control power supply module, the voltage is generally 5.3V, different versions of the flight control mixed, pay attention to the order of current and voltage detection pins, the order of VCC and GND.

3.3 Servo power supply check

The main check is whether the voltage of the BEC supplying power to the servo is within 6V, more than 6V, the Silverbird ES3054 servo will burn. The current supply capacity of BEC shall be more than 10a, avoid multiple servos working at the same time, otherwise the power supply of servos is insufficient. Note that the power supply of the servo BEC can not be used as a digital transmission power supply, the ripple of the servo BEC is very large, will directly burn the digital transmission.



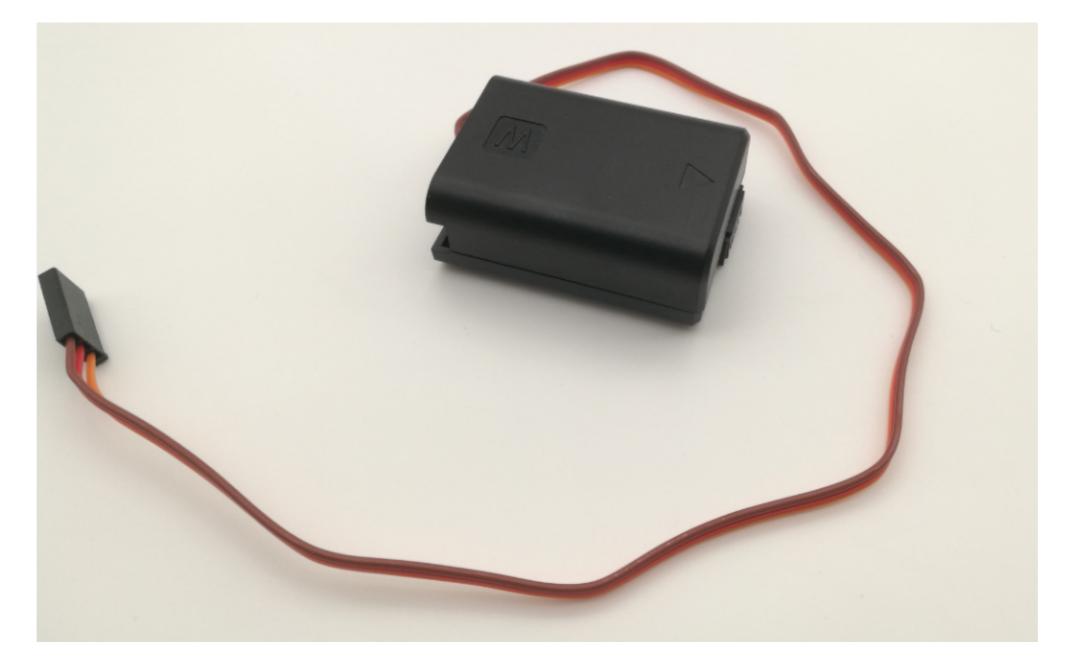
3.4 Digital transmission power supply check

• To improve the stability of the power supply, the digital transmission I powered separately for 2 main reasons:

- 1. Digital transmission directly in the flight control to take power, digital transmission transmit instantaneous power is relatively large, will lead to increased ripple and voltage fluctuations in the flight control power supply.
- 2. Many manufacturers produce the flight control power supply module for the flow capacity of the nominal 3A, some PCBA 3A can not reach, the test directly burned.

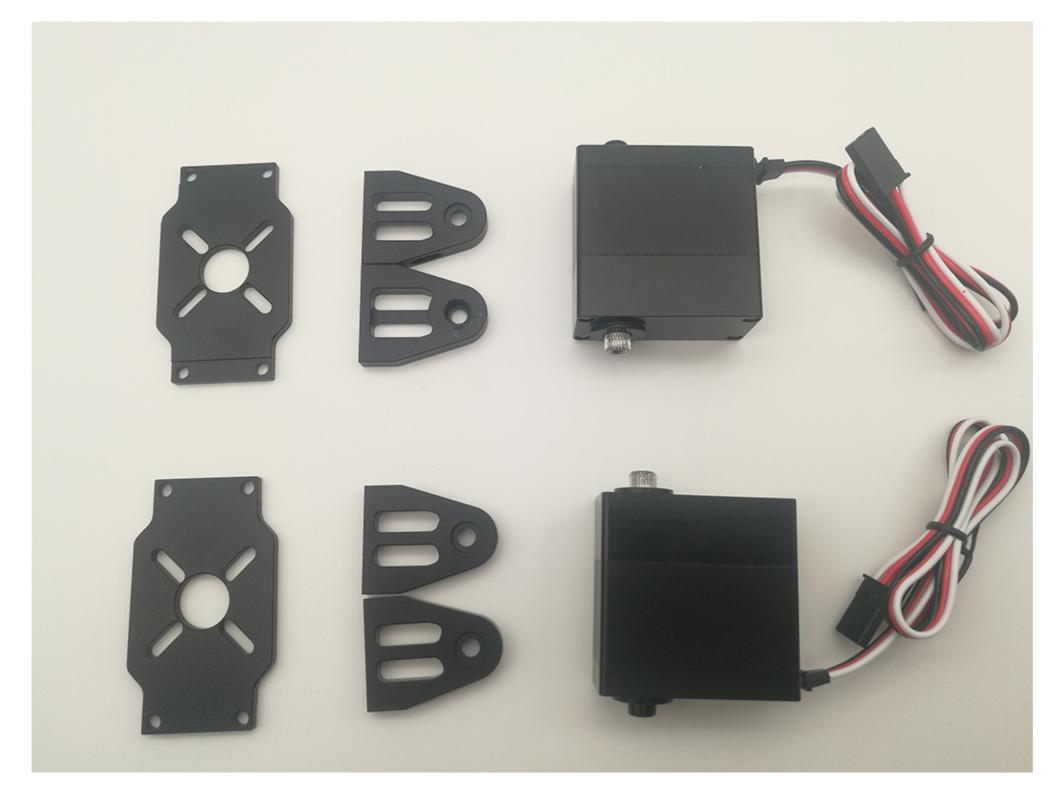
3.5 Camera potassium battery power check

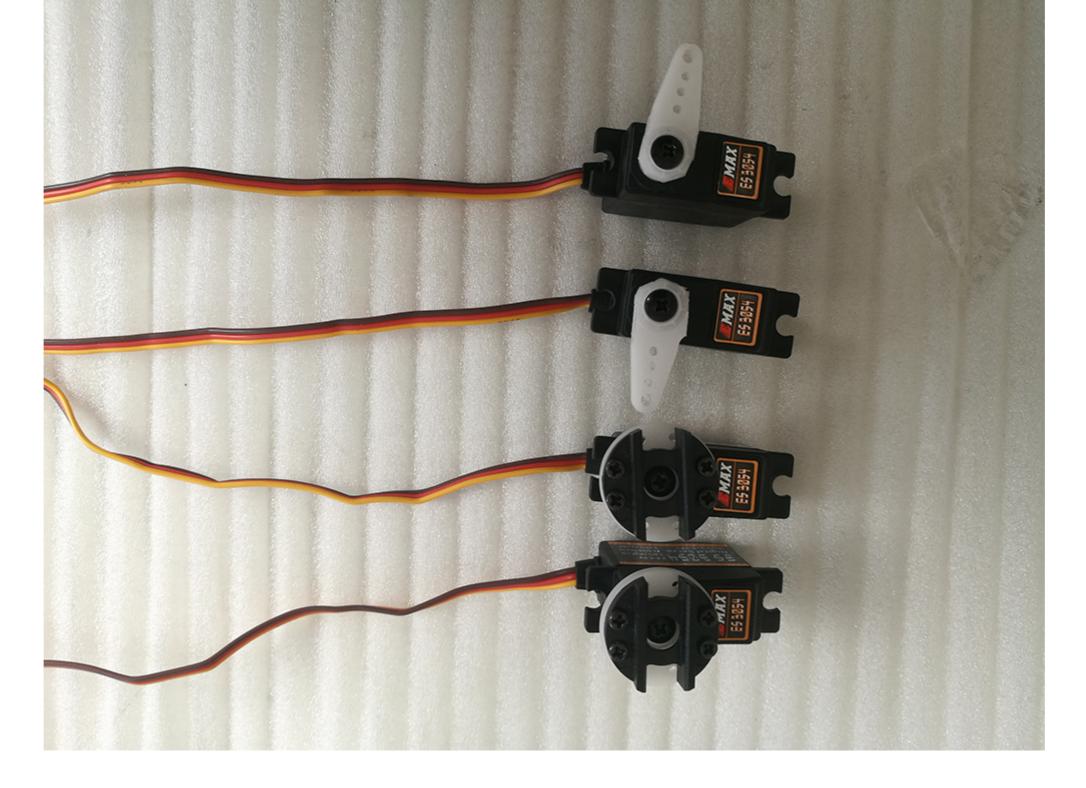
• Potassium batteries are checked before leaving the factory, mainly to exclude some small probability events, the potassium battery supply voltage is 12-26V, the output voltage of about 8V. Provide full range for the camera.



3.6 Installation and check of the servo

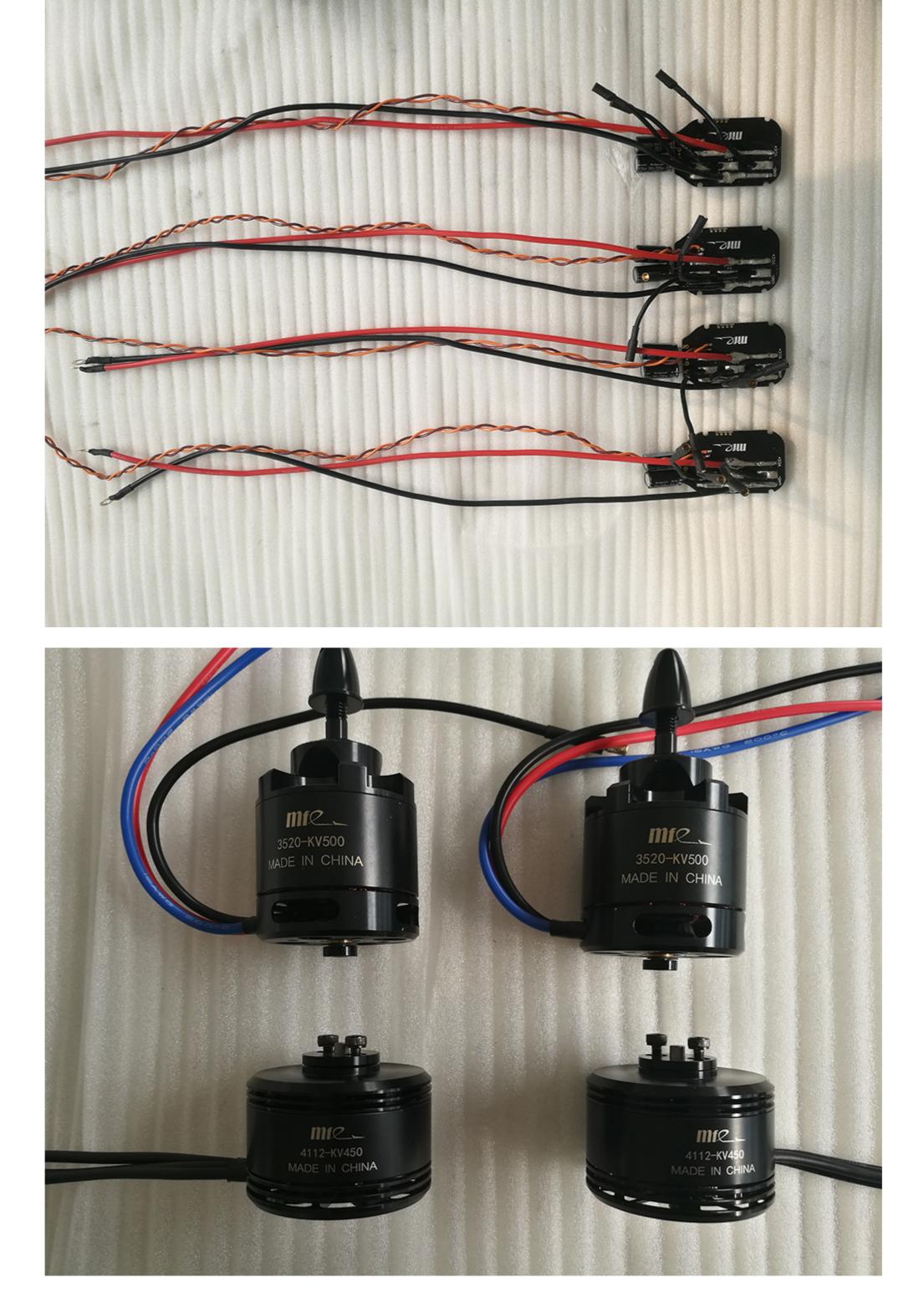
• The rudder is also checked to rule out small probability events. Servo power supply is generally 5-6V, using a servo tester, the servo can swing normally.





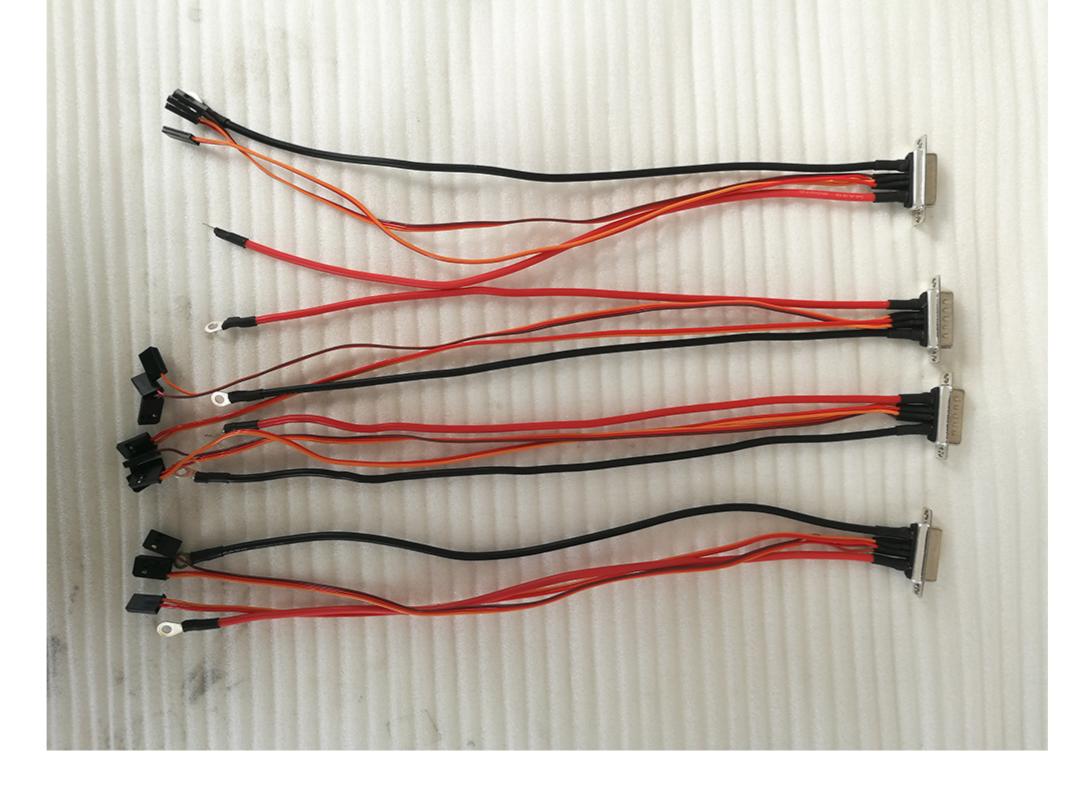
3.7 Installation and check of electric ESC

- The check of the motor ESC is also mainly to exclude small probable faults and check whether the motor and ESC can work properly.
- In order to facilitate the assembly, I DIY a few 60A ESC, they are perfectly matched with the motor mount(The official standard is HAOYING's 60A/40A ESC).
- ESC calibration:
 - 1. Only power up the flight control, do not power up the motor ESC. If your flight control and motor power supply can not be cut off independently, then you can use the USB wire to power the flight control.
 - 2. When setting Q_ESC_CAL=1, flight mode switch to QSTABILIZE, unlock flight control, at this time the ESC PWM input is equal to the remote control through ottle value, remote control throttle push to the maximum, then power up the ESC, etc. When the ESC ticks, indicating that the ESC recognizes the maximum throttle value, and the throttle is pulled to the minimum, you should hear a tick, indicating that the ESC recognizes the throttle travel.
 - 3. The purpose of the parameter Q_ESC_CAL=1 is that it can be used to test the response of the motors. You can control all rotor motors directly by throttling. Also you can use the tachometer to test the speed of the motors at different throttle values.



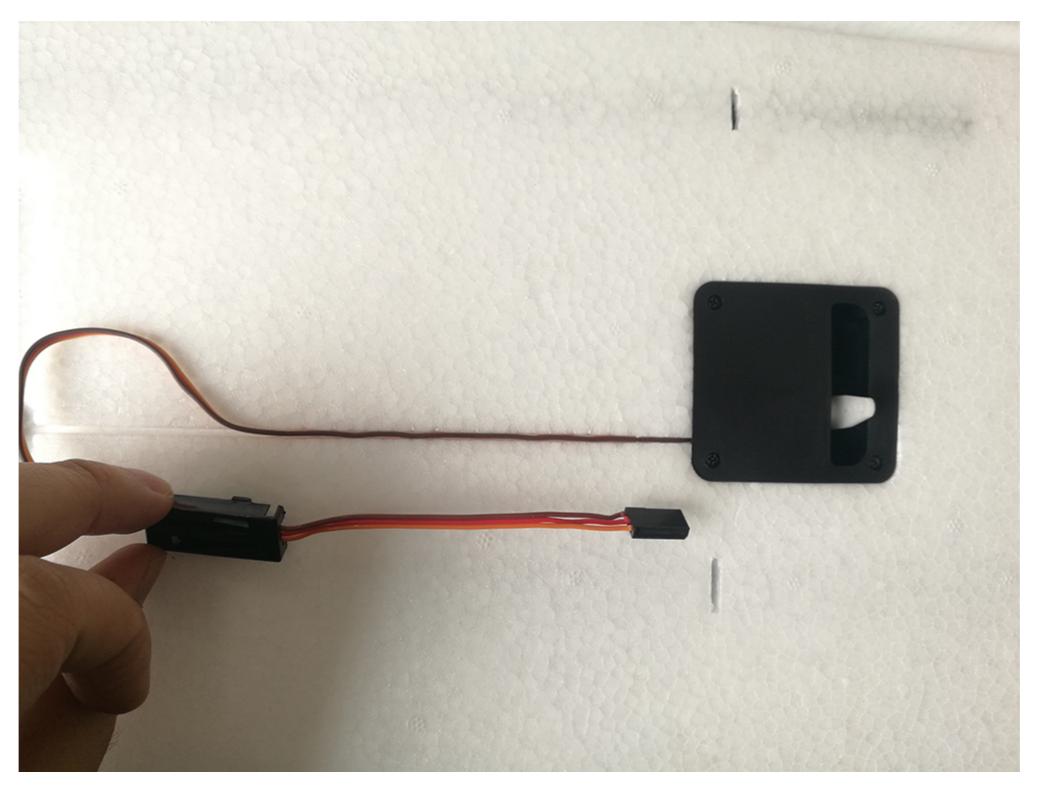
3.8 Soldering of connector wire

- For wiring convenience, I used a 14 size red and black silicone wire with 2.5-4 cold crimp terminal, screwed directly into place.
- My connector wiring sequence:
- A1-Power supply negative terminal A2-Power supply positive terminal 1—Aileron servo signal wire 60 core (橙色) 2—Servo power supply 60 core (红色) 3—Rear motor signal wire 30 cores (棕色) 4—Tilt servo signal wire 30 cores (橙色) 5—Front motor signal wire 30 cores (橙色)



3.9 Installation of wing power section

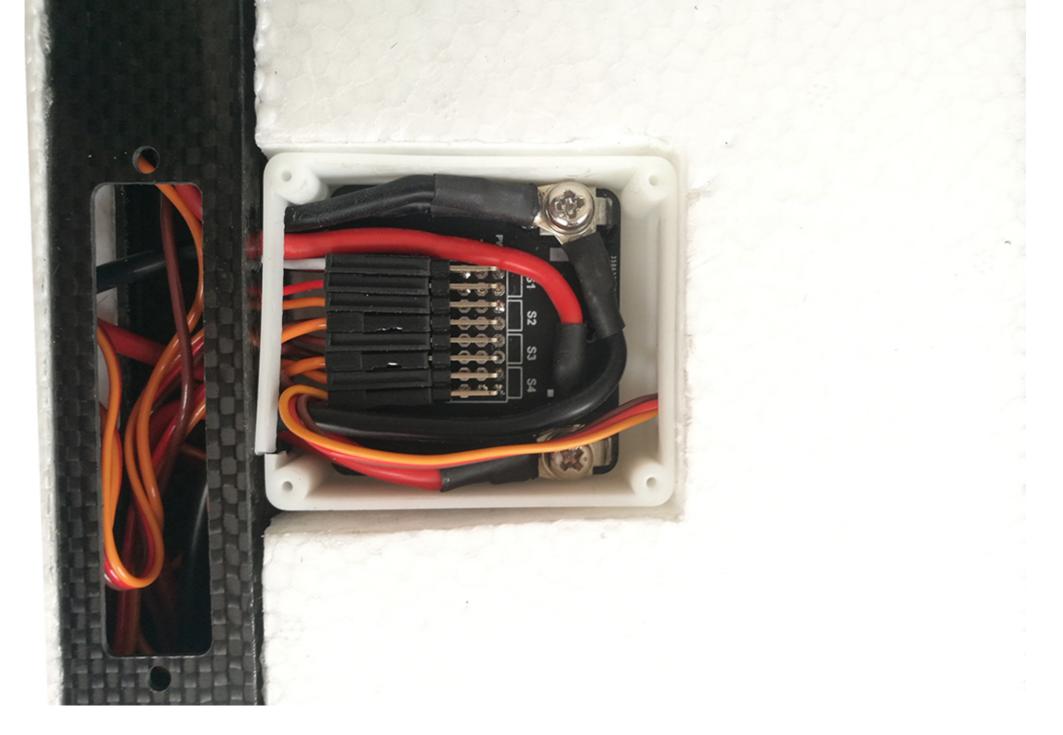
• ES3054 servo original wire length is not enough, I put 10CM long Y wire minus 1 male part, as an extension cable, with a bayonet fixed.





• The tail servo also needs to be extended, and each side servo needs to be fixed directly with 1 self-tapping screw.

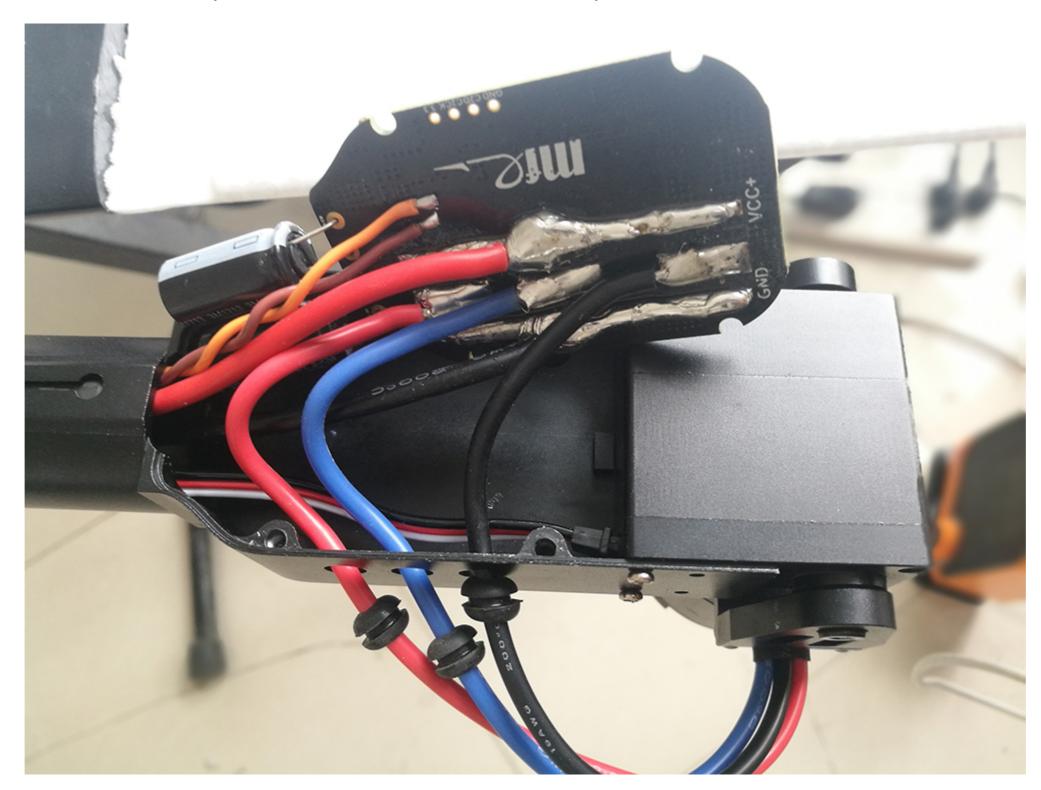




• Adapter plate S1 S2 S3 S4 were connected in parallel with the 2-way row of pins, the adapter plate is only the role of the adapter, in order to install the convenience of the machine, it is the same effect as the direct soldering.



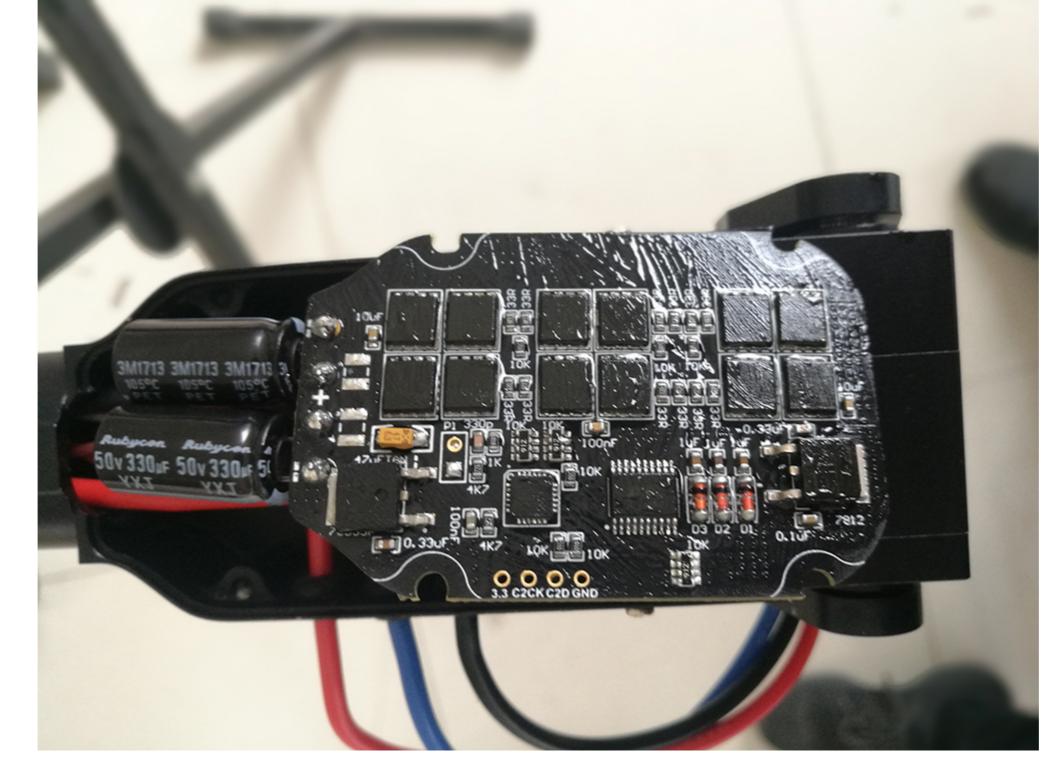
• The connector for the body is also installed, and I used a female connector for the body.



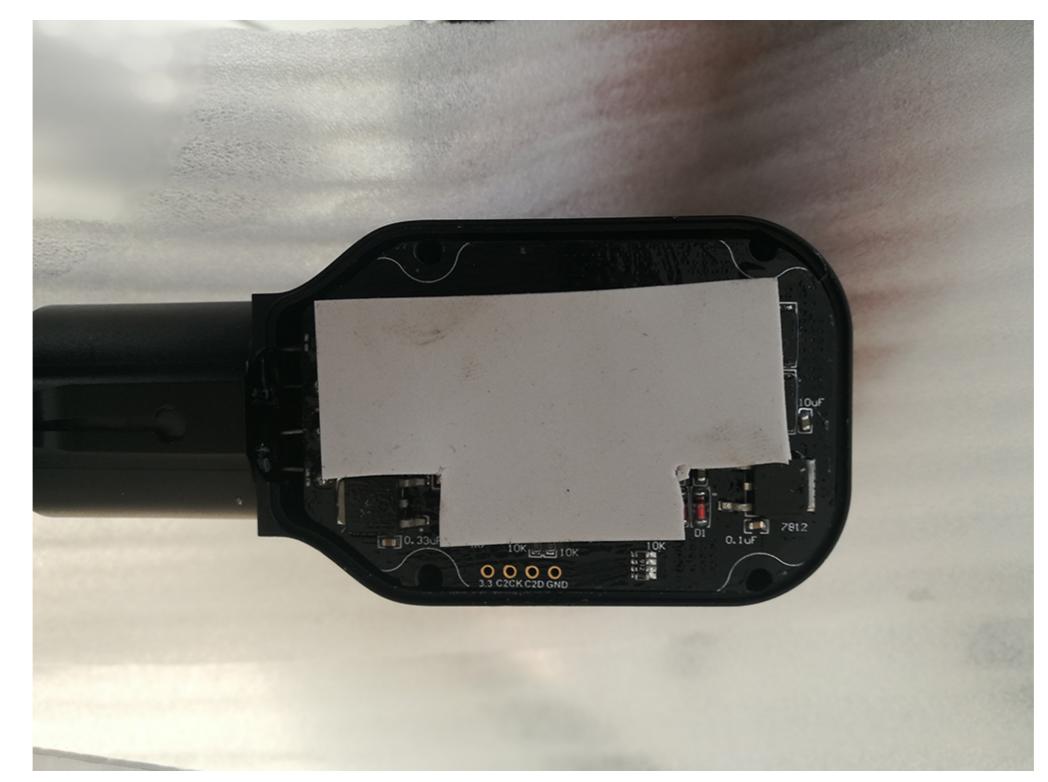
• When the ESC is installed, you need to check the forward and reverse rotation first, and remember to put on the silicone sheath.

SERVO9_FUNCTION = 33 SERVO10_FUNCTION = 34 SERVO11_FUNCTION = 35 SERVO12_FUNCTION = 36 SERVO5_FUNCTION = 75 SERVO6_FUNCTION = 76

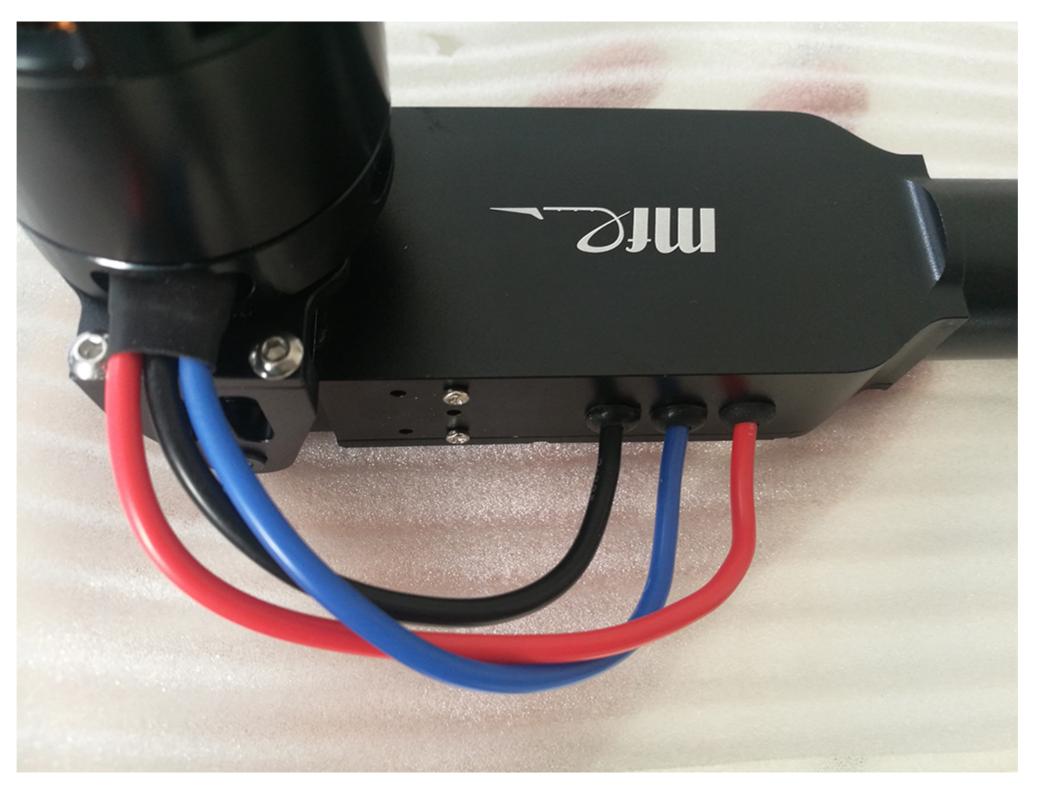
Channel AUX1(CH9)- Right front motor (counterclockwise rotation)
Channel AUX2(CH10)-Left rear motor (counterclockwise rotation)
Channel AUX3(CH11)-Left front motor (clockwise rotation)
Channel AUX4(CH12)-Left rear motor (clockwise rotation)
Channel CH5-Left-tilting servo
Channel CH6-Right-tilting servo



• After the completion of the soldering, I gave the PCB a layer of three-proof paint, mainly insulation, dust-proof role.



• I cut a piece of heat-conductive silicone paste, heat can be quickly transferred to the aluminum to accelerate heat dissipation.



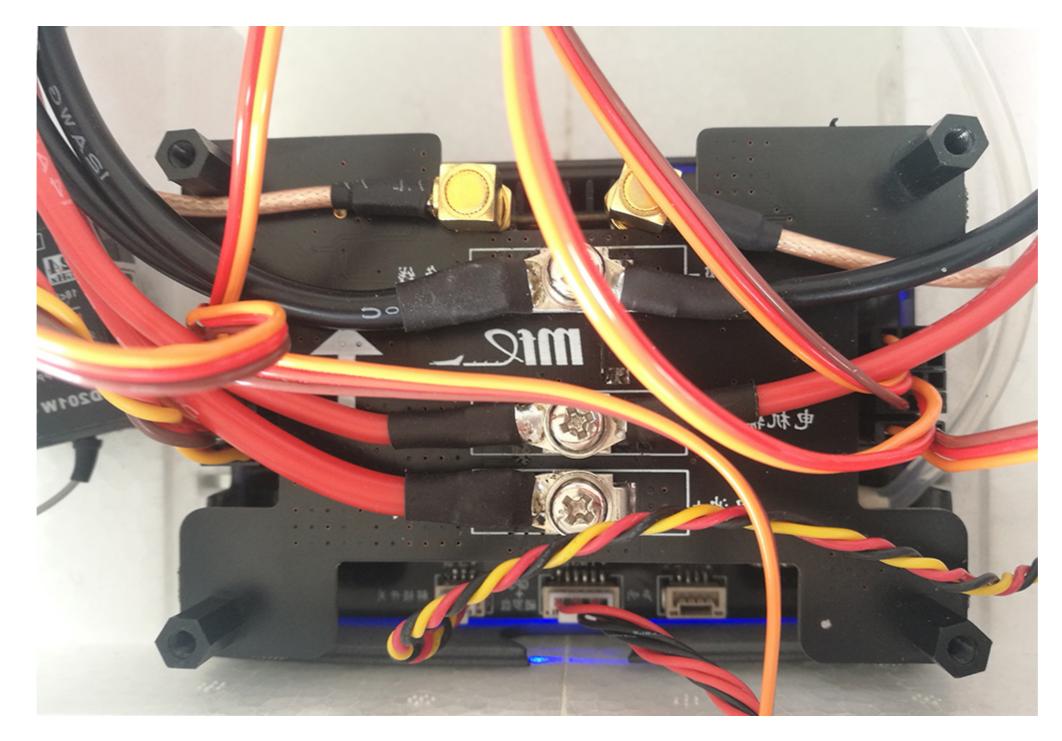
• Adjust the length of the motor wire, ensure that the motor horizontal and vertical state wire length is appropriate.



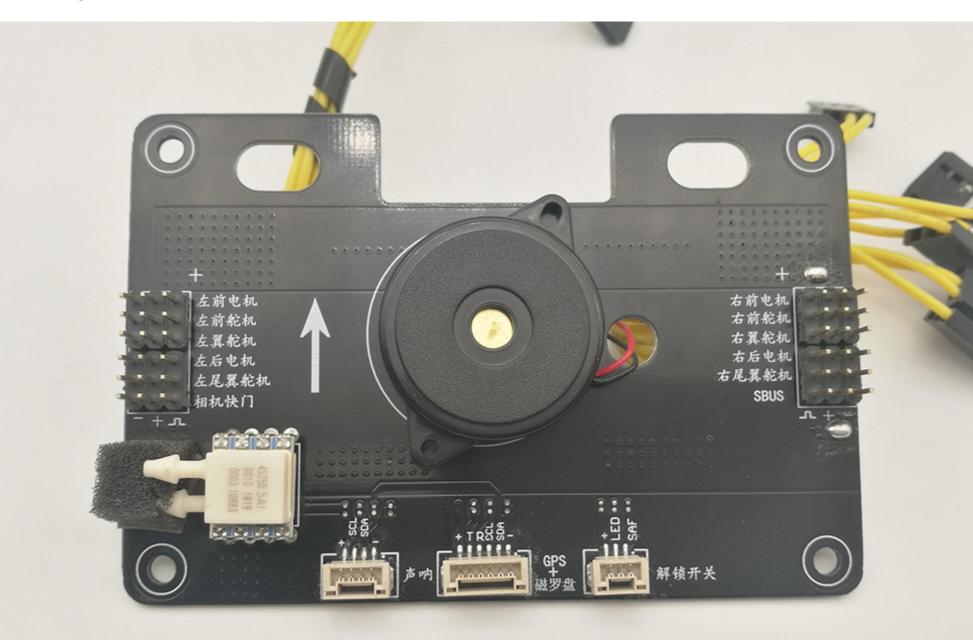
• Tilt servo, out of the wire end of each side of 2 screws can be unscrewed, and then fixed directly on top of the mount.

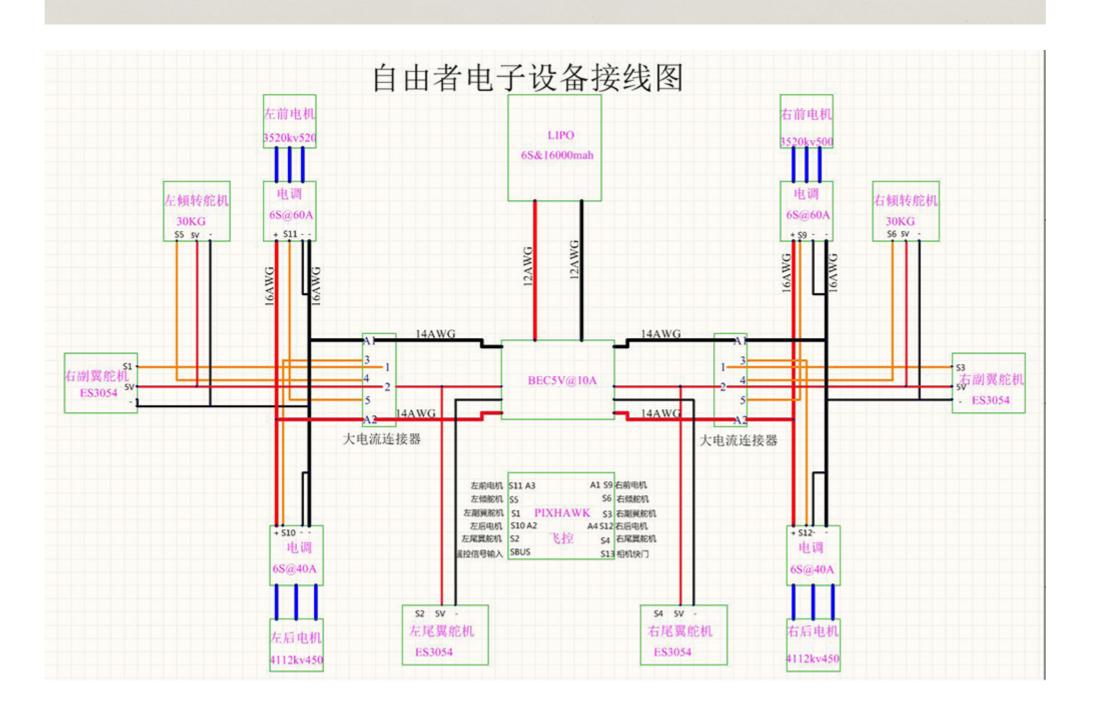
Installation and commissioning of avionics equipment

4.1 Installation and commissioning of flight control



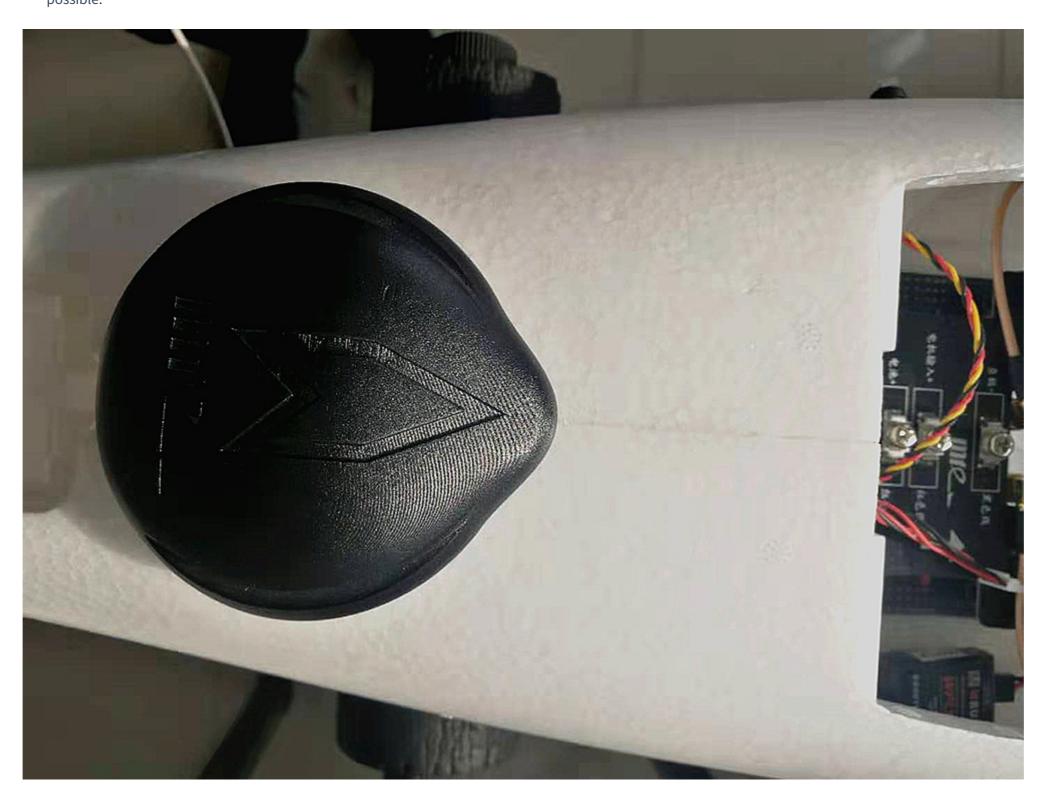
• The flight control box is fixed in the EPO flight control compartment with hot melt adhesive, and the wires are fixed directly according to the wiring sequence of the flight control.





4.2 Installation of GPS & magnetic compass

• The installation of the compass needs to pay attention to the installation direction, I use the default installation, as far away from the sub-power board as possible.



4.3 Airspeed tube installation and wiring

• The airspeed tube is installed in the head position, mainly to avoid the influence of airflow.



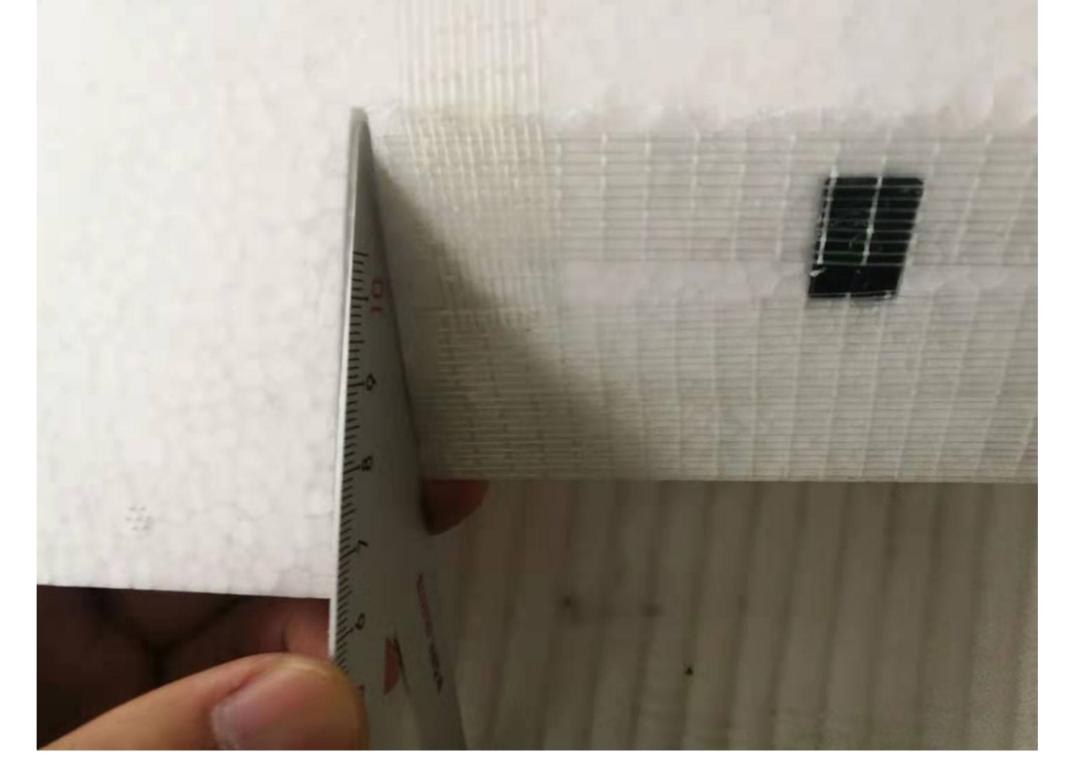
4.4 Installation of digital transmission antenna

• The two digital transmission antennas I use the vertical installation, mainly because the aerial survey aircraft generally fly higher and farther.



4.5 Adjust the flatness of the rudder surface

• In manual mode, the rudder surface should be flat, the rudder in the upper and lower rudder angle I generally control at 30 degrees, 30 degrees within the rudder surface efficiency is very high.



• The angle of the rudder control can be adjusted by adjusting the maximum and minimum output range of the corresponding channel.



Six电台(数传)
电池监测器
电池监测器2
CAR
指南针/电机 校准
声呐
空速
PX4F1ow 光凌
光漆
OSD
相机云台
电机测试
苯五次型

4.6 FBWA check rudder direction

• First of all, check whether the direction of the remote control rudder surface is correct in manual mode.

Remote control input channel	Actions performed by the corresponding rudder surface
Roll channel toggle the rocker to the right	Downward movement of left aileron, upward movement of right aileron
Roll channel toggle the rocker to the left	Left aileron moves upward, right aileron moves downward
Pitch channel toggle down the rocker	Upward movement of the left tail fin, upward movement of the right tail fin
Pitch channel toggle the rocker upwards	Downward movement of the left tail fin, downward movement of the right tail fin
Directional channel toggle the rocker to the left	Downward movement of the left tail fin, upward movement of the right tail fin
Directional channel toggle the rocker to the right	Upward movement of the left tail fin, downward movement of the right tail fin

• Check again in FBWA mode if the rudder surface of the flight control correction is oriented correctly.

Aircraft tilt direction	Rudder action situation
Tilt to the right on a horizontal roll	Left aileron moves upward, right aileron moves downward
Tilt to the left on a horizontal roll	Downward movement of left aileron, upward movement of right aileron
Pitch upward tilt	Downward movement of the left tail fin, downward movement of the right tail fin
Pitch down tilt	Upward movement of the left tail fin, upward movement of the right tail fin
Direction horizontal movement to the left	Upward movement of the left tail fin, downward movement of the right tail fin
Direction horizontal movement to the right	Downward movement of the left tail fin, upward movement of the right tail fin

Pre-takeoff Checks

• The pre-takeoff check is performed outdoors to check for hidden problems before takeoff and to minimize the probability of failure in the air.

5.1 Check the magnetic compass

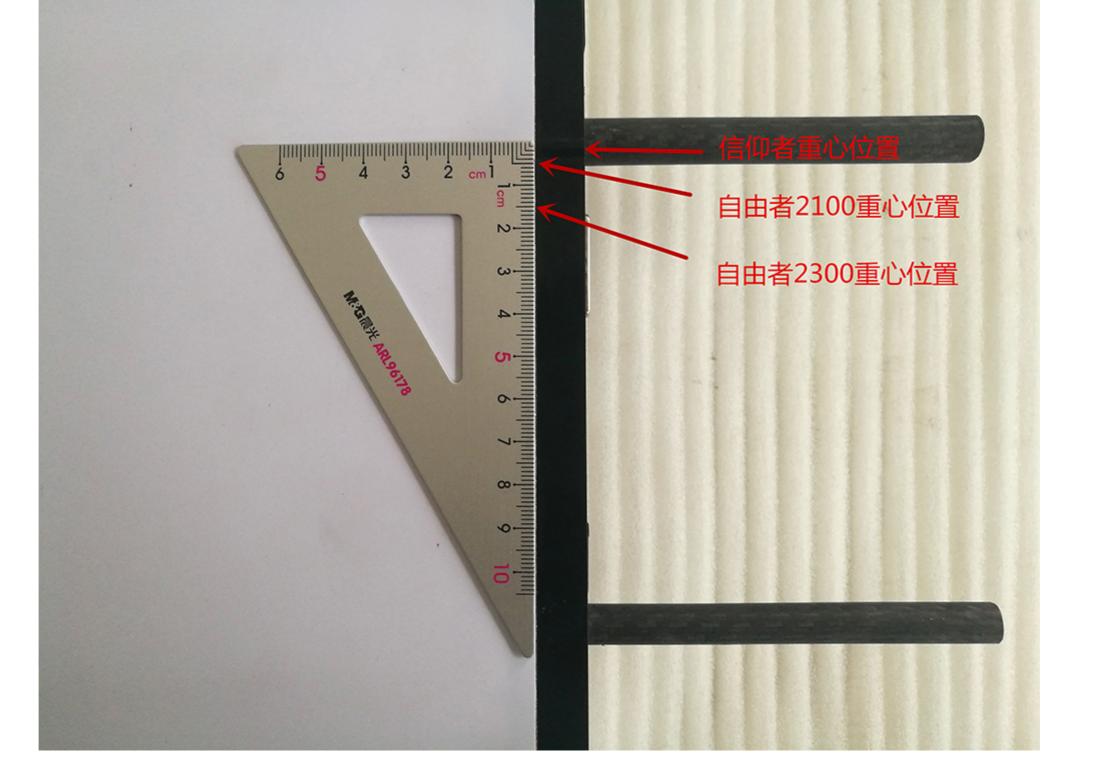
• When the flight control is powered on and started, do not move the aircraft, the flight control is self-testing until you hear the 1-2-3 sound, which means the

- flight control is started successfully. First point the nose to the north, check the actual direction and the aircraft nose direction error. The error is generally acceptable within 3 degrees, if there is a large deviation, you need to calibrate the compass again outdoors in accordance with the previous steps.
- The aircraft's compass has too much error at the time of multi-rotor, which will lead to unstable multi-rotor motor output and the aircraft nose flap.
- Too much error in the aircraft's compass when it is fixed wing will cause the aircraft to be on a straight course with the overall trajectory left or right.
- After calibrating the compass, simulating a large angle turn left and right and a large angle pitch on the ground, the compass part of the display EKF, which does not show red, does not show yellow, and always keeps the green part.

5.2 Check the center of gravity of the aircraft

• When checking the center of gravity, you need to break the front motor all to the horizontal position, and the center of gravity of the aircraft is based on the fixed wing. The center of gravity of the Freeman 2100 and 2300 is slightly different, please note the difference between:

Freeman 2100 center of gravity - located at the lower projection of the wing root plastic part shifted by 5mm in the direction of the tail Freeman 2300 center of gravity - located at the lower projection of the wing root plastic part moves 15mm in the direction of the tail.



5.3 Check if the tilting servo is shaking

- Switch the aircraft to q_stable mode (multi-axis stabilization), you need 2 people to hold the aircraft wings down, press the flight control safety switch, unlock the motor, then push the throttle, the motor starts to rotate, the throttle is generally controlled between 40%-80%, observe whether the tilting rudder is swinging back and forth and other abnormal conditions.
- Possible causes if the tilting servo is jerking:

1.Troubleshoot digital transmission antenna interference to the tilt servo signal wire.

2. The rocker screw of the tilting servo is screwed too tightly, resulting in a large load even when the servo is stationary, causing power fluctuations.

3. Check the servo power supply BEC, in the case of high current discharge of the battery, resulting in relatively large fluctuations in BEC output.

4.Switch the flight control to manual mode, under normal circumstances aileron and tail servo will not have a noise, if there is a noise, usually caused by the continuous force on the tilting steering gear when the front motor is horizontal.

5.4 Check if tilting after reaching airspeed

• The main purpose is to check if the tilt function of the rudder is normal. Note that this needs to be done with the propeller removed.

- The flight control is powered on, the remote control cut to q_stable mode, press the safety switch, unlock the motor, the motor starts to rotate, throttle to about 60%, switch to FBWA mode, you can see the tilt rudder starts to tilt to a fixed angle, the angle of tilt is controlled by Q_TILT_MAX, I set 35 degrees, is the angle of tilt and vertical, the rate of tilt is controlled by Q_TILT_ RATE_DN control, I set it to 10 degrees per second, tilt 35 degrees, it takes about 3.5S.
- Then we blow air into the airspeed tube, you can see the airspeed increase, Q_ASSIST_SPEED I set is 14, when the airspeed reaches 14m/s, Q_TRANSITI ON_MS duration after 3S, the tilt rudder starts to turn to fixed wing mode.
- When the airspeed is below 14m/s, the tilting rudder returns to the 35 degree multi-axis acceleration forward.
- Q_ASSIST_ANGLE is the protection angle when the aircraft is switched to multi-rotor acceleration state, I set it to 45 degrees. When the aircraft is flying in FBWA, AUTO mode, and encounter high wind, the aircraft attitude tilt more than 45 degrees, the multi-axis protection will work.



5.5 Multi-rotor vectoring function

- Multi-rotor vectoring is mainly to improve the wind resistance of the aircraft in multi-rotor mode, and the front two motors can be vectored up and down.
- After the flight control is powered on, switch to q_stable mode, press the flight control safety switch, be careful not to unlock, push the throttle to about 30%, the motor does not turn. Hit the rudder of the remote control, we can see that the front and rear two servos are still differential.
- Q_TILT_YAW_ANGLE parameter controls the angle of the rudder vector, I set it to 10 degrees, the angle should not be too big, otherwise the paddle will easily cut to the carbon tube.

5.6 Fixed wing vectoring function

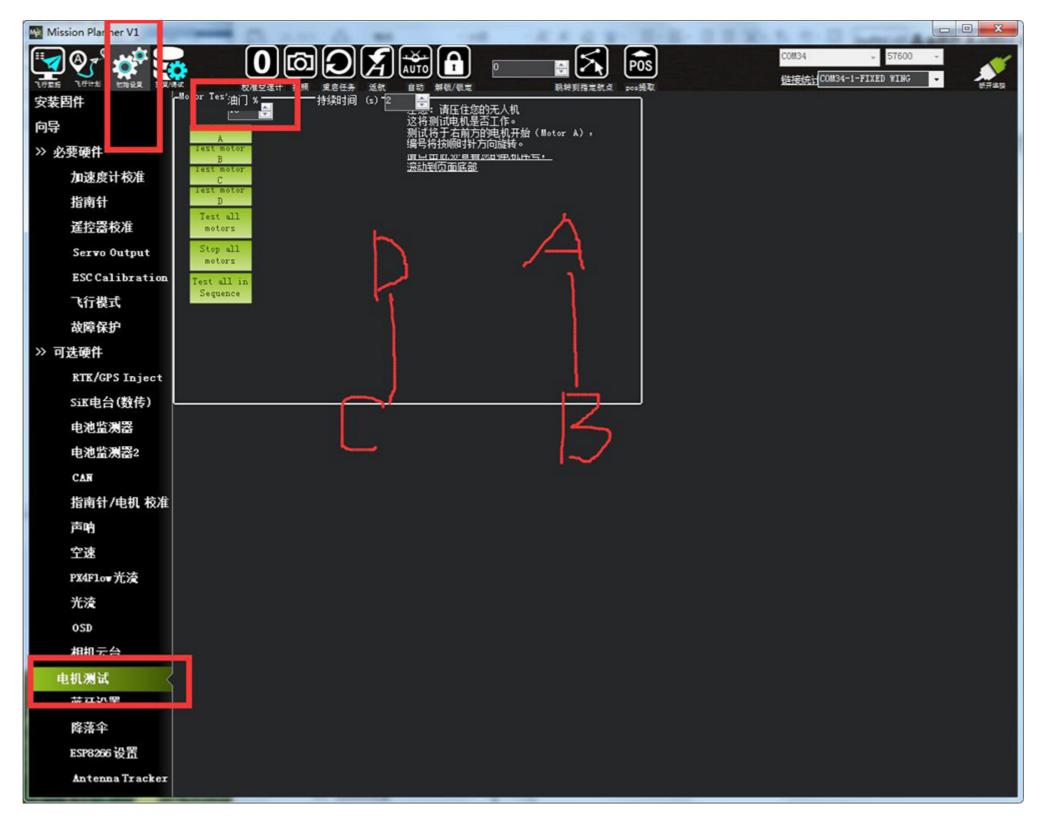
- The fixed wing vectoring function I usually turn off, mainly 2 parameter system: Q_TILT_FIX_ANGLE control angle, Q_TILT_FIX_GAIN control sense, can be simply understood as the control of tilt fast and slow. Vector can assist fixed-wing rudder surface correction, rudder failure still has some control ability.
- Test method: Temporarily set the following 2 parameters
- Q_TILT_FIX_ANGLE=10(Fixed wing vector angle,0=off,10=10 degrees) Q_TILT_FIX_GAIN=100(Fixed wing vector sense,0=off,100=100%)
- Switch to manual mode, push the throttle (do not unlock), hit the elevator to try the angle (will be the same as above and below), hit the aileron to try the angle (will be a front and a back)
- Switch to FBWA mode, push the throttle (do not unlock), tilt the fuselage forward, then the rudder angle up, tilt the fuselage to the right, then the rudder angle up.

◆ Low altitude multi-rotor test

The low-altitude multi-rotor test focuses on testing the stability of the multi-axis portion of the aircraft.

6.1 Motor steering test

- If the motor steering is wrong, the multi-rotor will not fly and the plane will roll on the ground. Be sure to check the motor steering and the direction of the paddles before taking off.
- Motor test input throttle 10%-15%, test motor ABCD, motor start in the order of right front A right rear B left rear C left front D.
- If the motor rotates in the wrong direction, you need to manually swap any 2 motor wires.
- Set motor start idle speed parameters:
- Q_M_SPIN_ARM=0.1



6.2 Roll PID commissioning

The roll is controlled by a 2-stage series type PID.

• The parameters of the outer ring are generally adjusted first:

Q_A_ANG_RLL_P=8 indicates the error gain between the actual roll angle and the desired angle, and the phenomenon is that the larger the value, the

stronger the aircraft correction.

• If the aircraft is not easy to adjust the stability, you need to adjust the inner ring parameters:

Q_A_RAT_RLL_D=0.006 indicates differentiation. The cross-roller axis starts high-frequency small-amplitude oscillation, that is, this value is on the large side, debugging the parameters of the 0 more, pay attention not to enter the wrong.

Q_A_RAT_RLL_I=0.3 indicates integration. This value generally does not exceed the corresponding P value. For example, multi-axis state I hit the roll 15 degrees (the angle limit at 15 degrees Q_ANGLE_MAX=1500 after hit the rocker), but the aircraft has been stable at 14 degrees will not go up, in this case, you need to increase the I value.

Q_A_RAT_RLL_P=0.3 indicates the ratio. The higher the value, the stronger the motor output, and the larger the value, the greater the low frequency oscillation of the aircraft.

• As far as the frame allows, the same aircraft can be tuned with multiple sets of parameters from large to small sensitivities.

6.3俯仰PID调试

Pitch is controlled by a 2-stage series-type PID.

• The parameters of the outer ring are generally adjusted first:

Q_A_ANG_PIT_P=6 indicates the error gain between the actual pitch angle and the desired angle, and the phenomenon is that the larger the value, the stronger the aircraft correction.

• If the aircraft is not easy to adjust the stability, you need to adjust the inner ring parameters:

Q_A_RAT_PIT_D=0.006 means differentiation. The pitch axis starts high-frequency small-amplitude oscillation , that is, this value is on the large side, the debugging parameters of the 0 more, pay attention not to enter the wrong. Q_A_RAT_PIT_I=0.3 indicates integration. This value generally does not exceed the corresponding P value. For example, multi-axis state I play pitch 15 degrees (after hitting the rocker, the angle is limited to 15 degrees Q_ANGLE_MAX=1500), but the aircraft has been stabilized at 14 degrees will not go up, in this case you need to increase the I value to eliminate the stability error. Q_A_RAT_PIT_P=0.3 indicates the ratio. The larger the value, the stronger the motor output. If the value is too large, the aircraft will have large oscill-ations at low frequencies , and if the value is too small, the aircraft will be soft and have poor wind resistance.

• As far as the frame allows, the same aircraft can be tuned with multiple sets of parameters from large to small sensitivities.

6.4 Directional PID commissioning

The pitch is controlled by a 2-stage series-type PID.

• The parameters of the outer ring are generally adjusted first:

Q_A_ANG_YAW_P=5 indicates the error gain between the actual direction angle and the desired direction angle, and the phenomenon is that the larger the value is, the stronger the aircraft correction is.

• If the aircraft is not easy to adjust the stability, you need to adjust the inner ring parameters:

Q_A_RAT_YAW_D=0.001 means differentiation. The direction axis starts high-frequency small-amplitude oscillation, that is, this value is on the large side, debugging parameters of the 0 more, pay attention not to enter the wrong.

Q_A_RAT_YAW_I=0.16 indicates integration. This value usually does not exceed the P value. For example, if I hit the direction 5 degrees in the multiaxis state, I release the stick, but the aircraft direction will go back to 4 degrees, and you can see this obvious change in the air. In this case it is necessary to increase the I value to eliminate the stability error.

Q_A_RAT_YAW_P=0.16 indicates the ratio. The larger the value, the stronger the motor output. If the value is too large, the plane will oscillate at low frequencies, and if the value is too small, the plane will not steer much.

• As far as the frame allows, the same aircraft can be tuned with multiple sets of parameters from large to small sensitivities.

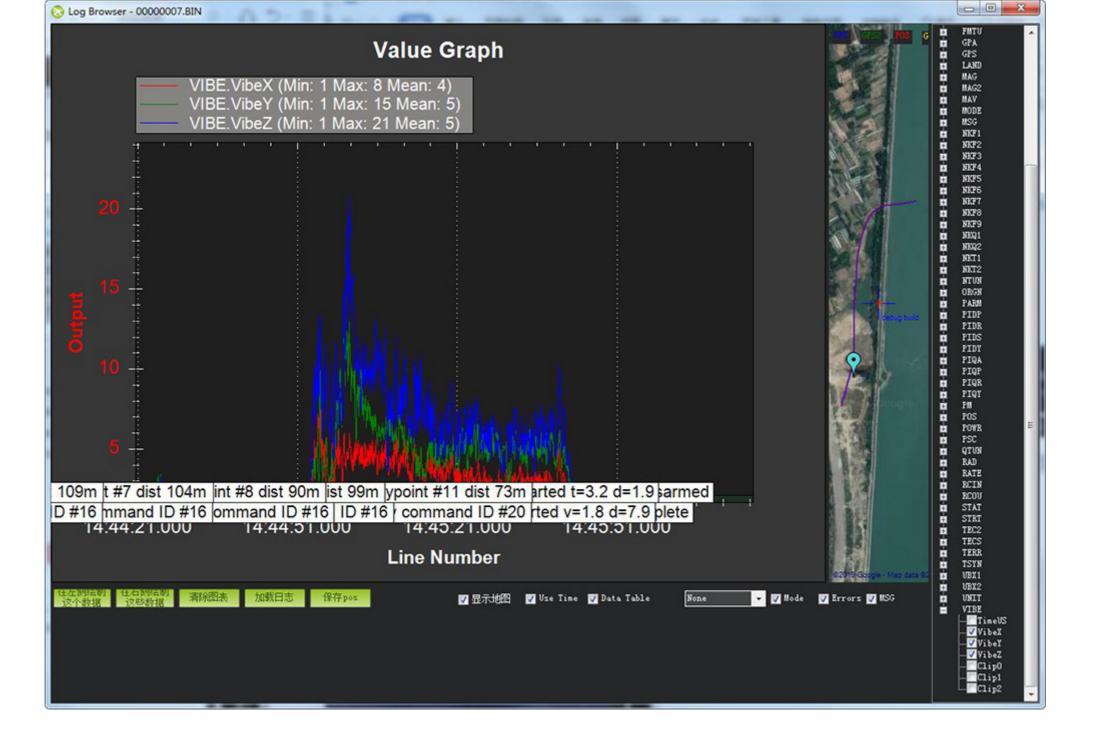
6.5 Several parameters the remote control multi-axis need to adjust

• In q_loiter mode,

Q_LOIT_BRK_ACCEL=100 Maximum acceleration in cm/s/s when braking (e.g. rocker back to center), higher values make the aircraft stop faster. Q_LOIT_BRK_DELAY=0.5S The delay time to start braking when the rocker is back in the center, in seconds.

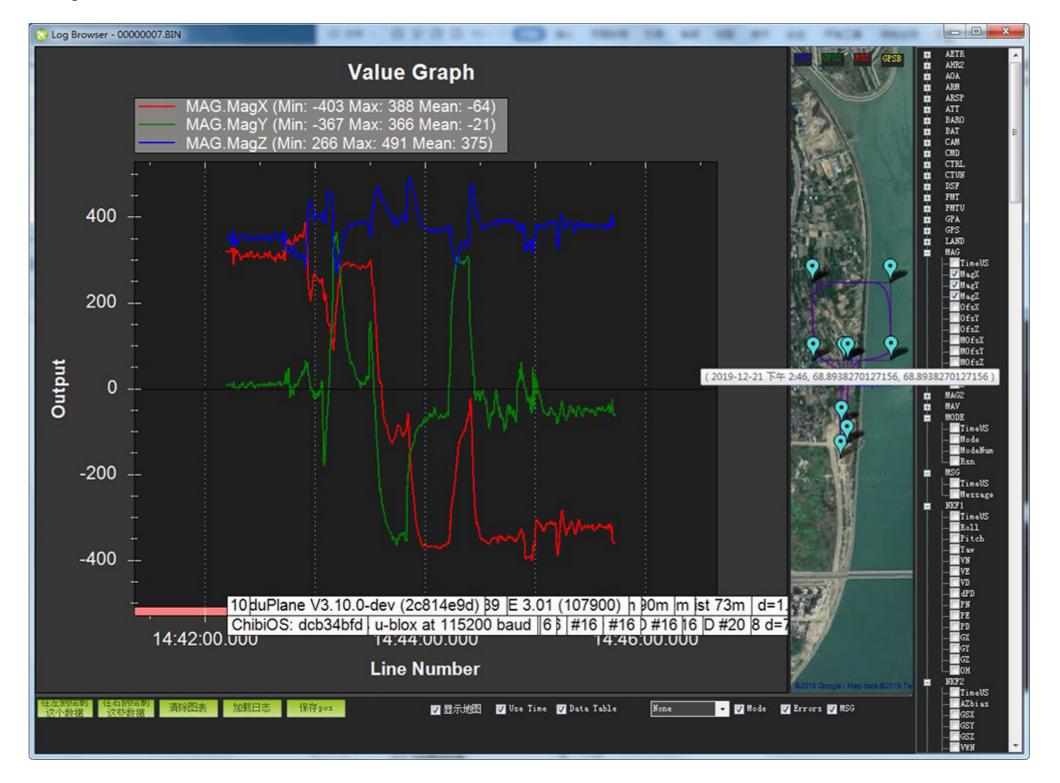
6.6 Flight control vibration check

• Vibe1,Vibe2,Vibe3 these three parameters are within 30 is normal.



6.7 Magnetic compass interference check

• Here check the magnetic compass interference, mainly check whether the air flight process compass is normal. Under normal circumstances, MagX, MagY, MagZ values within 600 are normal.



Aerial remote control flight

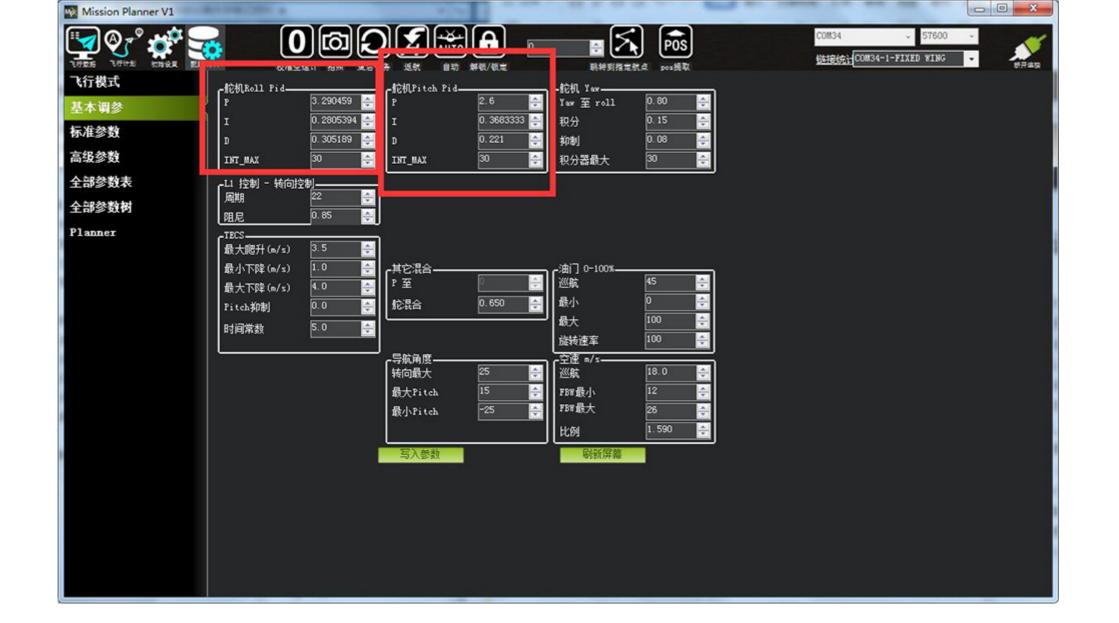
7.1 Fixed-wing automatic parameter adjustment





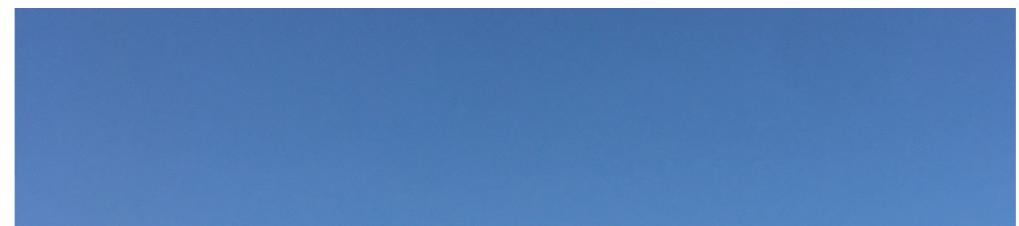
The tuning parameter for fixed wing is the same as the hand thrower part. the higher the value of AUTOTUNE_LEVEL=6, the higher the gain of the aircraft and the faster the response of the aircraft.

- First manual takeoff, flying to 60-80 meters to switch to "AUTOTUN" mode, now the roll and pitch have a little stabilizing effect, but not very suitable, may not be good to fly, do not panic.
- Automatically adjust the parameters to calibrate the roll, quickly toggle the roll rocker's to the left to the end, and then to the right to the end, toggle 20 times in a row, as long as the aircraft does not fall, quickly toggle the stick to play rudder, slowly you will find that the roll stability of the aircraft is improved. If you don't think so, repeat a few more times.
- Auto tuning parameters to calibrate the pitch, it is recommended to fly the aircraft higher first, so as not to save the height of the aircraft is not enough, quickly dial the pitch rocker top to bottom, 20 times in a row, you can see the aircraft flying wave line, back to the center gradually find that the aircraft pitch has improved, if not improve continue to calibrate.
- After the calibration is completed, switch to FBWA mode and feel the handling state of the aircraft until you are satisfied.
- Each aircraft's remote control travel is different, the rudder's neutral position is different, the position of the connecting rod to the rudder surface is different, the takeoff weight of the aircraft is different and other factors, resulting in slight differences in the PID of each aircraft after the automatic parameter adjustment, which is normal.
- Note: The parameter value after the fixed-wing parameter adjustment, generally large, may be out of range, you can change the appropriate smaller.



7.2 Multi-rotor to fixed-wing switching

- First I use q_loiter multi-axis fixed point mode takeoff, in order to prevent falling high when tilting. You can climb to 40-50m. Switch to FBWA mode, this time the aircraft accelerates forward, the remote control can not control the aircraft aileron and pitch, do not panic! You must push the throttle to complete the switch automatically. The distance needed for the switching process is about 100-200 meters. After the switch is completed, the aircraft control and fixed-wing FBWA feeling is the same.
- You can switch between q_loiter and FBWA modes several times in the air to feel if there are any abnormalities in the switching process of the aircraft.
- If everything is normal in FBWA, reduce the throttle and intentionally let the aircraft stall speed below 14m/s, and observe whether the aircraft switches to multi-axis assist mode.
- With everything normal in FBWA, reduce the throttle, pull the stick and deliberately stall the aircraft and roll it over. If the roll angle is greater than 45 degrees, observe if the aircraft switches to multi-axis assist mode.





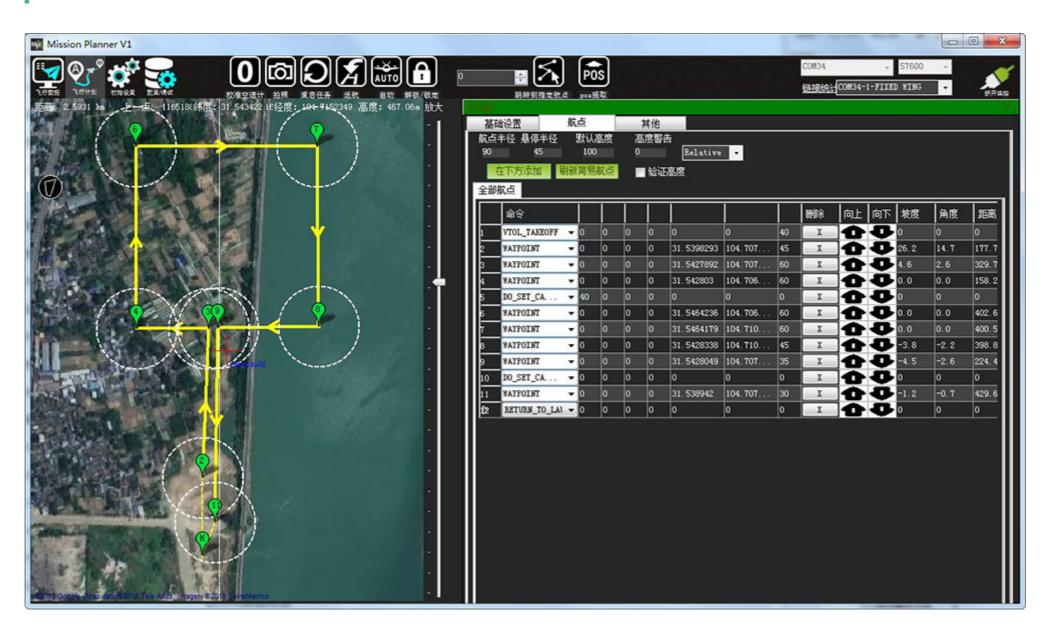
♦ MP Auto Flight

8.1 VTOL route test

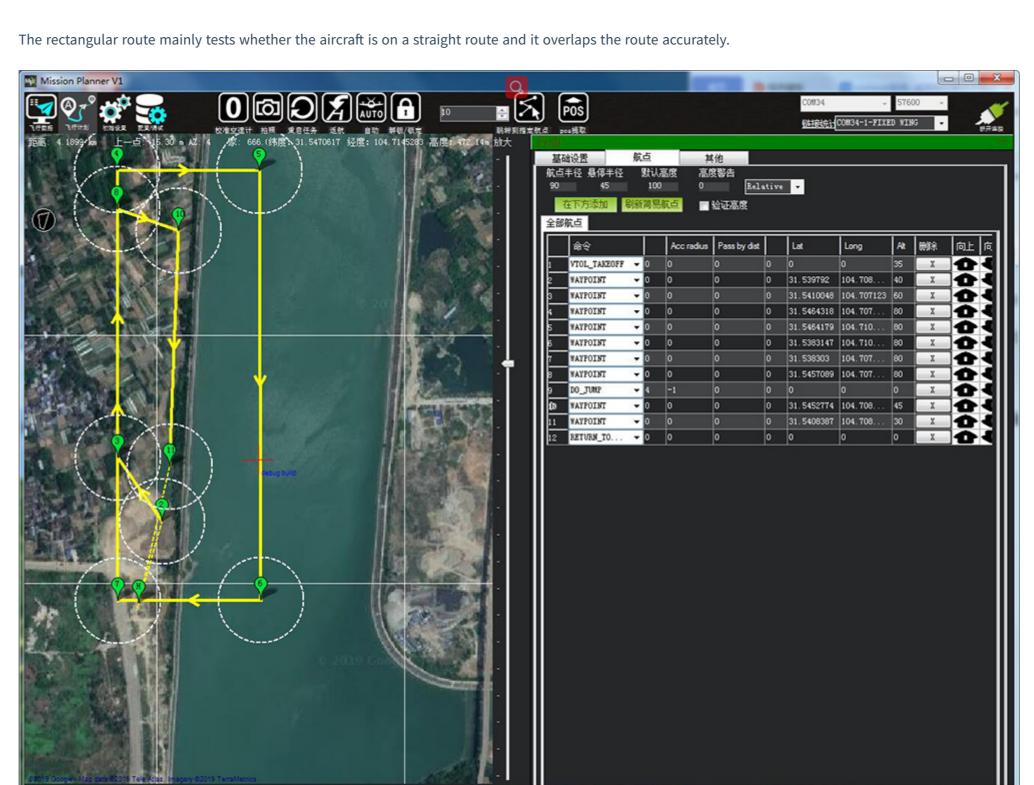
The VTOL route mainly tests whether the aircraft is normal under automatic takeoff and landing.

• Several commands are required:

VTOL_TAKEOFF Multi-rotor mode takeoff with 40m height setting



If the multi-rotor takeoff elevation speed is too fast, you can adjust this parameter Q_VELZ_MAX = 150. I set the multi-axis climb speed is 1.5m / s.
 Multi-axis to fixed-wing tilt if dropped high, you can change these parameters.



8.2 Rectangular infinite loop route test

• After the locking is complete, parameters that let all rudder surfaces return neutral

LAND_THEN_NEUTRL=1

Q_LAND_DETECT=3

• Parameters for getting the aircraft locked up quickly after landing is complete:

Q_LAND_FINAL_ALT=6 Secondary landing speed at 6 meters from the ground Q_LAND_SPEED=40 The speed of secondary landing is 0.4m/s

• Set the altitude and speed parameters for multi-rotor secondary landing:

Q_VELZ_MAX=150 Multi-axis ascending and descending speed is 1.5m/s

• The speed of the multi-axis descent and the speed of the ascent are controlled by the same parameter:

Q_TRANS_DECEL=4 The higher the value, the stronger the braking force

owing parameters:

• Return fixed-wing to multi-axis hover position if more than HOME point, indicating that the aircraft braking strength is not enough, you can change the foll-

Q_TILT_RATE_UP=60 Upward tilting rudder rate can be reduced Q_TILT_THR_UP=15 The throttle size for upward tilting can be reduced

• Fixed wing to multi-axis if climbing high, you can change the following parameters:

Q_TILT_RATE_DN=10 Downward tilting rate of 10deg/s

Q_TILT_MAX=35 Downward tilt acceleration angle can be changed to smaller

Q_TILT_THR_DN=90 A downward tilting throttle can increase

	命令		WP #	Repeat#				s		刪除	向上	向下	城
1	VTOL_TAKEOFF	•	0	0	0	0	0	0	35	X		•	0
2	WAYPOINT	•	0	0	0	D	31.539792	104. 708	40	X]0	Ð	22
3	WAYPOINT	•	0	0	0	0	31.5410048	104. 707123	60	X		Ð	12
4	WAYPOINT	•	0	0	0	0	31.5464318	104.707	80	X]0	Ð	3.3
5	WAYPOINT	•	0	0	0	0	31.5464179	104.710	80	X		Ð	0.1
6	WAYPOINT	•	0	0	0	0	31.5383147	104.710	80	X		Ð	0.1
7	WAYPOINT	•	0	0	0	0	31.538303	104. 707	80	X		•	0.1
8	WAYPOINT	•	0	0	0	0	31.5457089	104.707	80	X		Ð	0.1
۲	DO_JUMP	•	4	-1	0	0	0	0	0	X		Ð	0
10	WAYPOINT	•	0	0	0	D	31.5452774	104. 708	45	X		Ð	-2!
11	WAYPOINT	•	0	0	0	0	31.5408387	104. 708	30	X		Ð	-3
12	RETURN_TO	•	0	0	0	0	0	0	0	X		0	0

Relative 💌

#4 stands for: after #8, automatically jumps to #4 -1 stands for: infinite loop

默认高度

100

高度警告

0

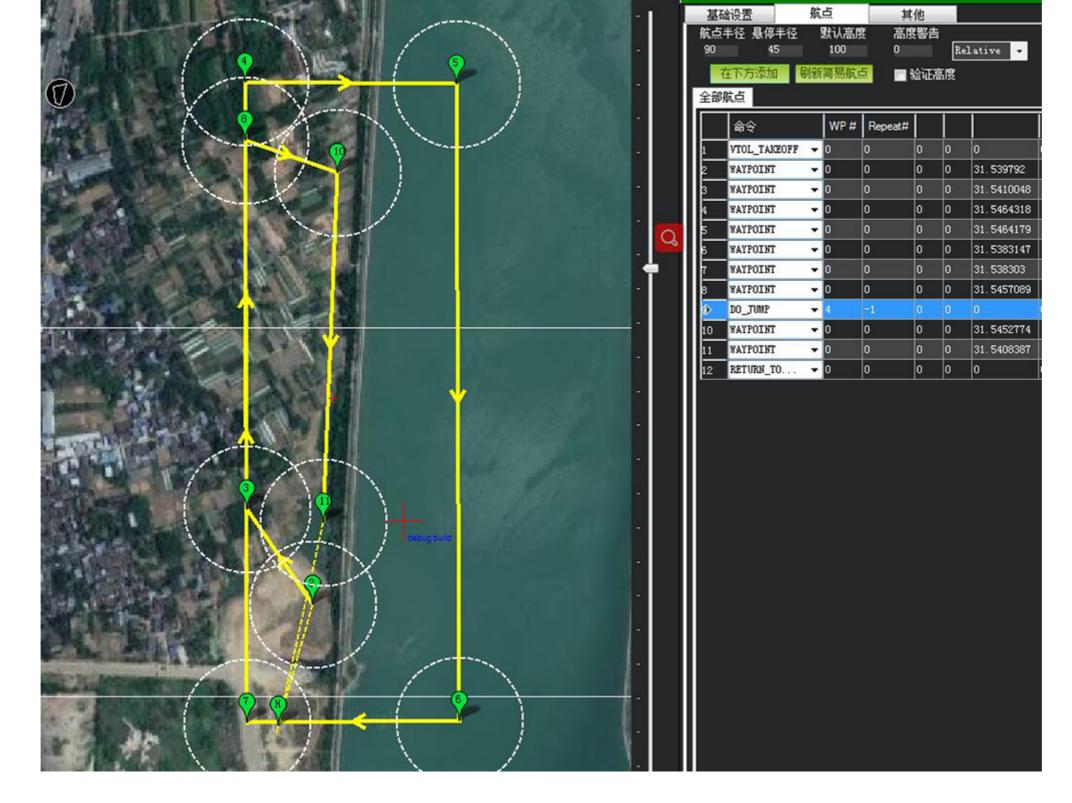
• In this route, I used the jump command DO_JUNP

45

航点半径 悬停半径

90

• Inside this waypoint, I designed a return route #10 and #11 so that when I want the plane to come down, I can set a jump command to point #10 and lift the infinite loop.



• This is a function to jump to a specified waypoint:





• In the event of an actual track and course offset, check in the following order:

1.Manual mode to check if the tail and pitch rudder surface are level and the ventral fin is installed vertically.

- 2.Is the motor installed horizontally in fixed wing mode
- 3.Is the compass abnormal, is the GPS completely fixed before taking off.
- 4.Whether the aircraft was moved during the aircraft power-on self-test.
- 5.Is the acceleration level of the flight control calibrated correctly.

8.3 Camera photo test

The camera photo test is mainly to confirm whether the photo function of the aircraft is normal, whether the camera mount is fixed properly, and whether the number of POS data and photo data are consistent.

Check whether the camera SD card has enough space, whether it is a high-speed card, check the shutter setting 1/1000S, check the manual photo taking, check whether the camera works properly.
 Connect the battery and shutter wire, and click "take picture" on the ground station to see if you can hear the shutter sound of the camera.



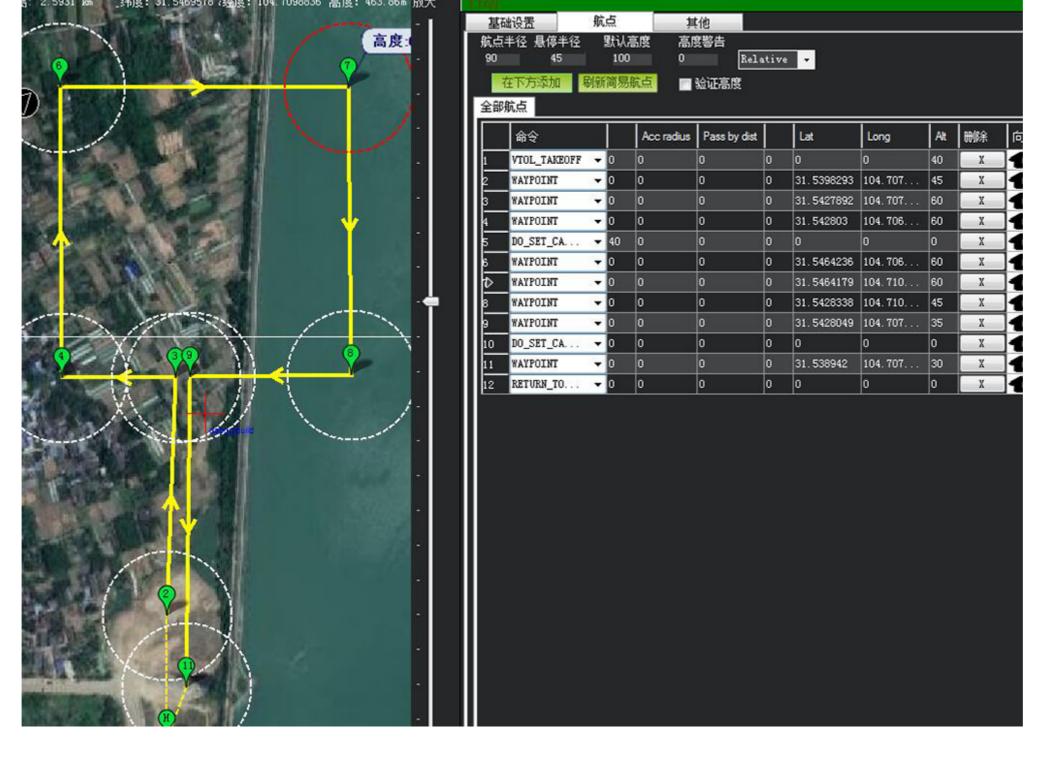




• After checking, you can use the Take off and landing route add photo command, and you can automatically take photos on the route.

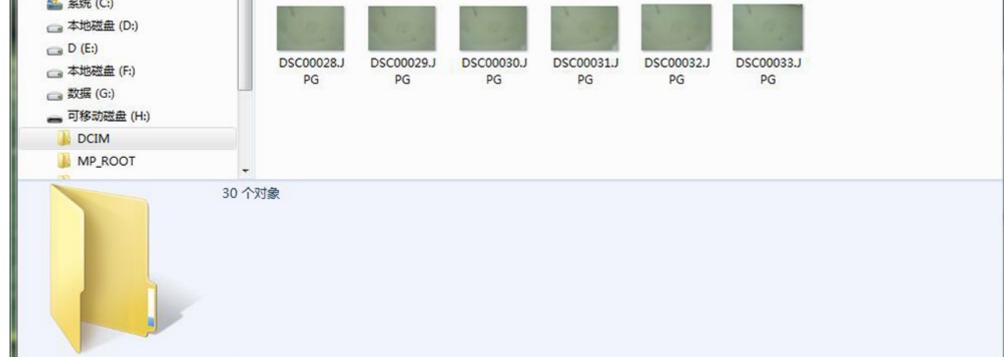
DO_SET_CAM_TRIGG_DIST=40 means 40 meters isometric photo once

DO_SET_CAM_TRIGG_DIST=0 means close the photo command

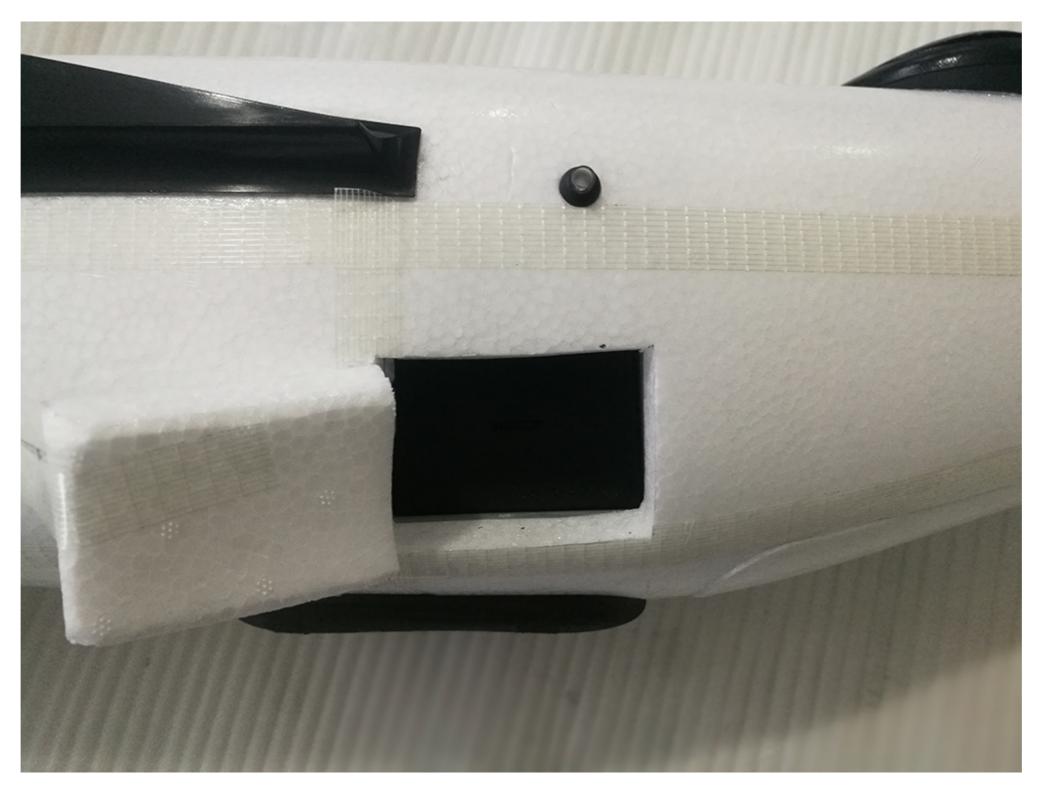


• After the takeoff and landing is completed, first check the number of photos 30 (only the part in the air, not on the ground).

1.1		10.000			-			- - X
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组织 ▼ 共享 ▼ 新建文件夹								• 🔟 🔞
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₽ <mark>■</mark> 计算机 备 系统 (C:)	DSC00020.J PG	DSC00021.J PG	DSC00022.J PG	DSC00023.J PG	DSC00024.J PG	DSC00025.J PG	DSC00026.J PG	DSC00027.J PG



• I cut a hole in the body to make it easy to take the memory card.



• Next click on the ground station "POS Extraction" - import the .bin file - click on POS point extraction - save .Then you can save the required POS data.



• The number of POS is also 30 sheets, which just matches.

	序号	TimeUS	GPS时间	GPSweek	纬度	经度	高度	真实高度
导入. bin文件	> 0	119742567	542609600	2084	31.5427192	104.7067863	522.93	62.36
+30	1	121942470	542611800	2084	31.5429831	104. 7064777	523. 41	62.84
	2	124142203	542614000	2084	31.5433048	104.7062798	522.71	62.14
DSC	3	126341810	542616200	2084	31.5436517	104. 7061653	522.12	61.55
	4	128741640	542618600	2084	31.5440382	104.7060982	521.68	61.11
+扩展名 · ·	5	131141491	542621000	2084	31.544421	104.7060603	520.63	60.06
jps -	6	133541216	542623400	2084	31.5448071	104.7060411	520.6	60.03
- +起始编号	7	135740898	542625600	2084	31.5451688	104.7060286	519.77	59.2
0001	8	137940693	542627800	2084	31.5455387	104.7060172	520, 34	59.77
	< [III					Þ
	序号	照片名称	GPS时间	GPSweek	纬度	经度	高度	真实高度
	> 0	DSCOO1.jpg	542609600	2084	31.5427192	104.7067863	522.93	62.36
	1	DSC002.jpg	542611800	2084	31.5429831	104.7064777	523, 41	62.84
Ī	2	DSC003.jpg	542614000	2084	31.5433048	104.7062798	522.71	62.14
Ī	3	DSC004.jpg	542616200	2084	31.5436517	104.7061653	522.12	61.55
	4	DSC005.jpg	542618600	2084	31.5440382	104. 7060982	521.68	61.11
pos点提取	5	DSC006.jpg	542621000	2084	31.544421	104.7060603	520.63	60.06
P - ANDERA	6	DSCOO7.jpg	542623400	2084	31.5448071	104.7060411	520.6	60.03

Ending

Here the whole assembly and commissioning of the VTOL is completed. In the actual flight process, we will encounter various problems, some are caused by hardware equipment, some are caused by imperfect flight control software, and some are caused by improper commissioning and use.

No matter when and where, always full of love and reverence for flying, encounter problems must be solved, do not let go of any safety hazards, constantly sum up experience, and constantly progress forward.

Finally, I wish all drone enthusiasts a great flight every day!