

FOXTECH AYK-350 VTOL

User Manual

V1.0 2021.11



FOXTECH

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Specifications

Item Name	FOXTECH AYK-350 VTOL
Version	RTF Combo
Material	Carbon Fiber
Wingspan	3500mm
Length	1880mm
Clearance to Ground	120mm
Max. Flying Height	2000m
Max. Cruising Speed	26m/s
Stall Speed	19m/s
RTF Weight (excluding battery)	15.5kg
Max. Take-off Weight	35kg
Flight Controller	Pixhawk 2.1 Standard Set with Here 3 GNSS
Radio Controller	DA16S+ Radio Controller x1

Basic Theory

AYK-350 is a heavy load VTOL, which can be used for cargo delivery or load heavy gimbal/mapping/multispectral cameras for inspection and survey jobs.

The whole body of AYK-350 VTOL adopts quick-detach design, including the wings, arms and tail part, ensuring a short assembly time and small packing size. The detachable payload cabin is also convenient for loading different task equipment. Foxtech AYK-350 is made of carbon fiber and composite material, which makes the whole body light and durable, the aerodynamic design and smooth surface ensure a low air resistance. AYK-350 has three reserved GPS positions, so it can be equipped with dual GPS(DGPS) to improve positioning accuracy, anti-interference ability and flight stability.

With large loading capacity, long flight time and stable flight performance AYK-350 VTOL can be used for cargo delivery, for inspection and survey by loading different gimbal cameras or mapping cameras, such as Foxtech 10x/30x zoom cameras, 3DM-V4 oblique camera and MS600 multispectral camera etc.



Calibration

Check Radio Control

1. Check transmitter mode (left hand throttle or right hand throttle).
2. Check channels on the transmitter.

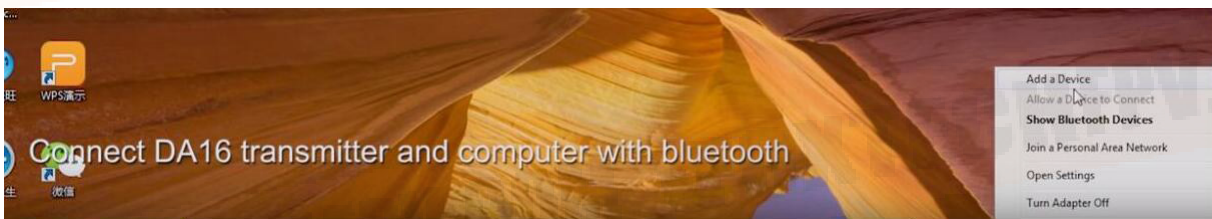
Download Mission Planner

Download the latest Mission planner online or copy it from the SD card. Download link:

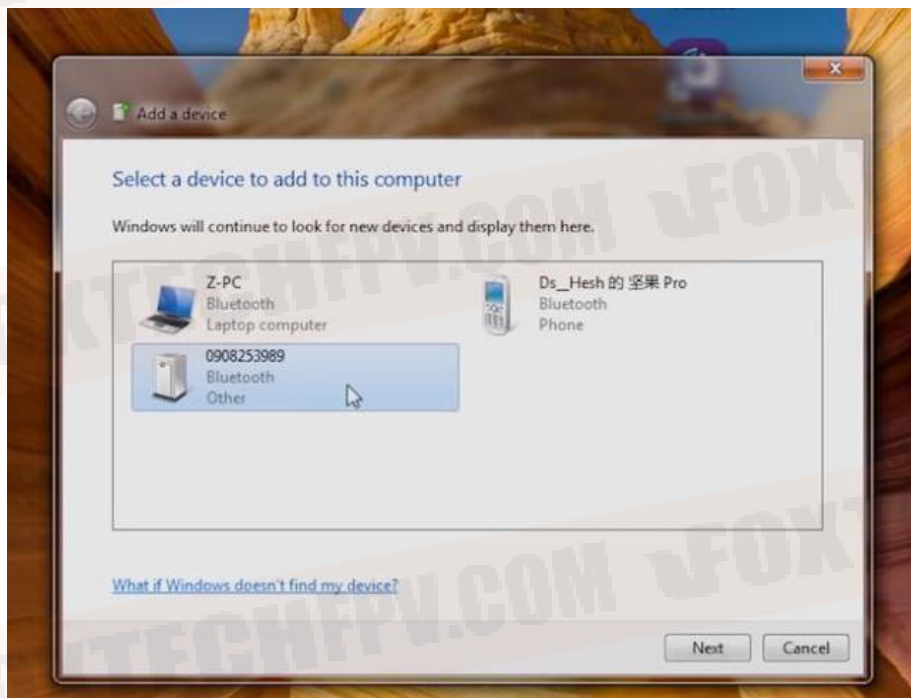
Download link: <http://firmware.ardupilot.org/Tools/MissionPlanner/>

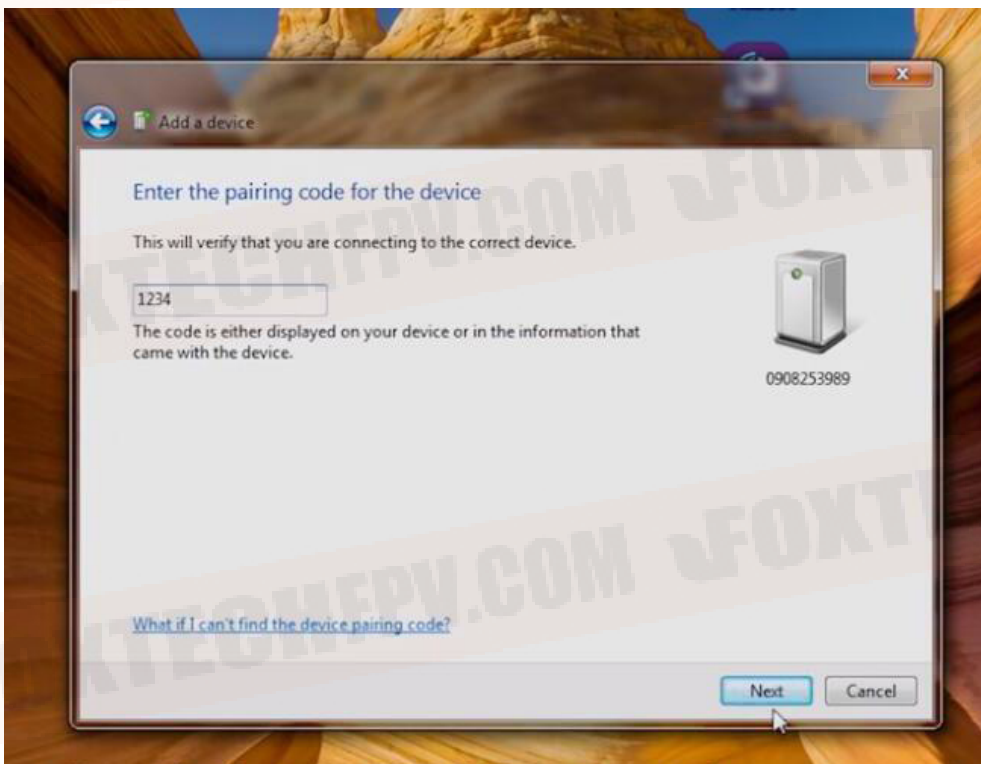
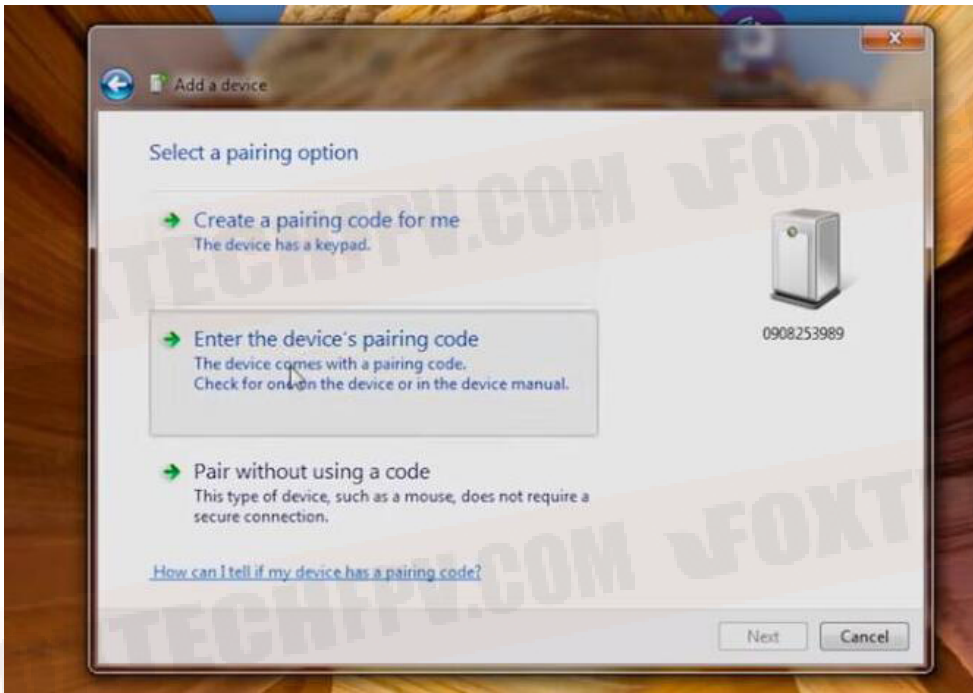
Connect AYK-350 to Computer

1. Connect DA16S+ transmitter and computer with bluetooth.

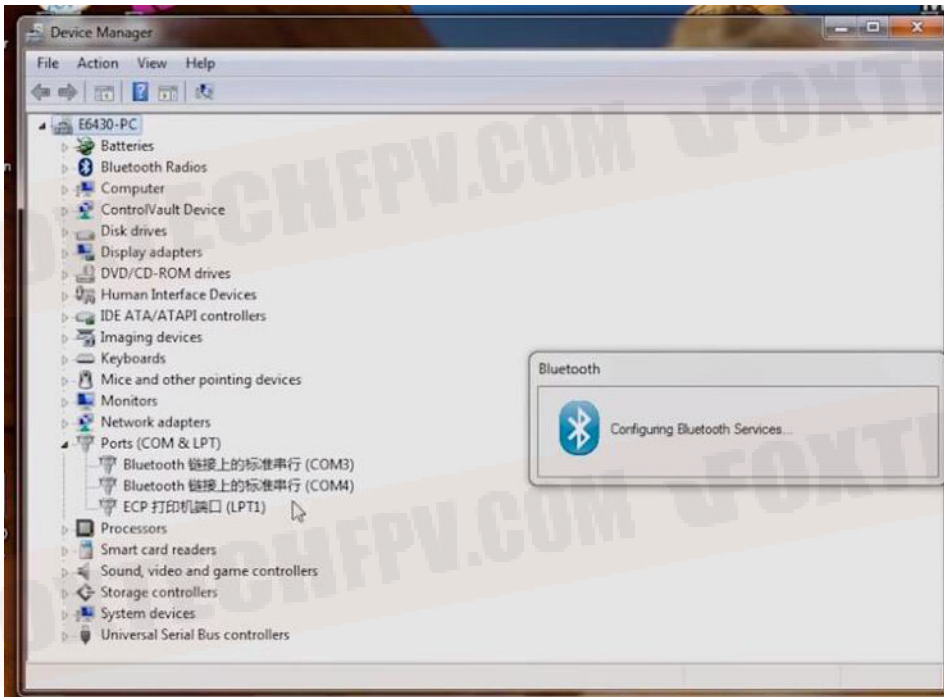


2. Find the corresponding device and enter password.





3. Enter the "Device Manager" interface and find its COM.



4. Select correct Com port, and click CONNECT



5. Connection completed.



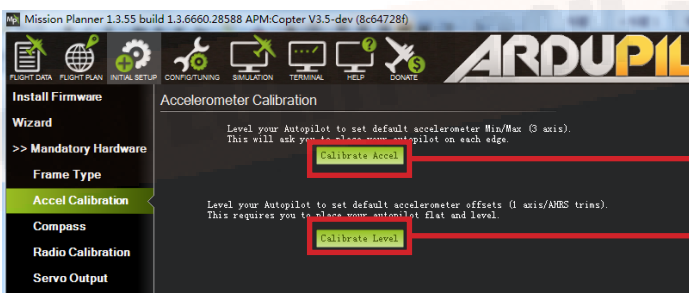
Connect the Datalink and Check Flight Controller

1. Calibrate the Accelerometer

Although the accelerometer was calibrated already for the PNP version before shipping, please calibrate it again since it might be affected in the transportation.

Under Initial Setup, select Accel Calibration from the left-side menu. Mission Planner will prompt you to place the vehicle each calibration position. Press any key to indicate that the autopilot is in position and then proceed to the next orientation.

The calibration positions are: level, on right side, left side, nose down, nose up and on its back.



Click this button to begin accelerometer calibration.

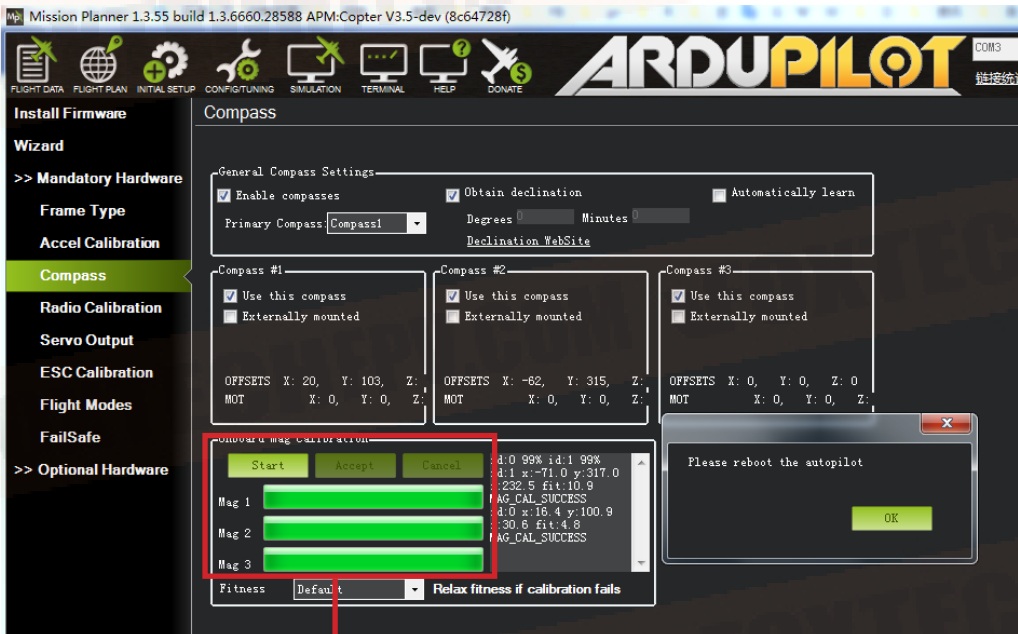
This accelerometer trim can be used to level the HUD horizon.

1. It is important that the vehicle is kept still immediately after pressing the key for each step.
2. The level position is the most important to get right as this will be the attitude that your controller considers level while flying.

2. Compass Calibration

AYK-350 VTOL uses high sensitivity compass and it has to be re-calibrated when fly in a new place.

Enter the compass setting page and click "start", hold the plane and rotate it in order to hit all directions on a sphere to calibrate the compass, when it's done, a new offset would be given to the flight controller, and a reboot is necessary.

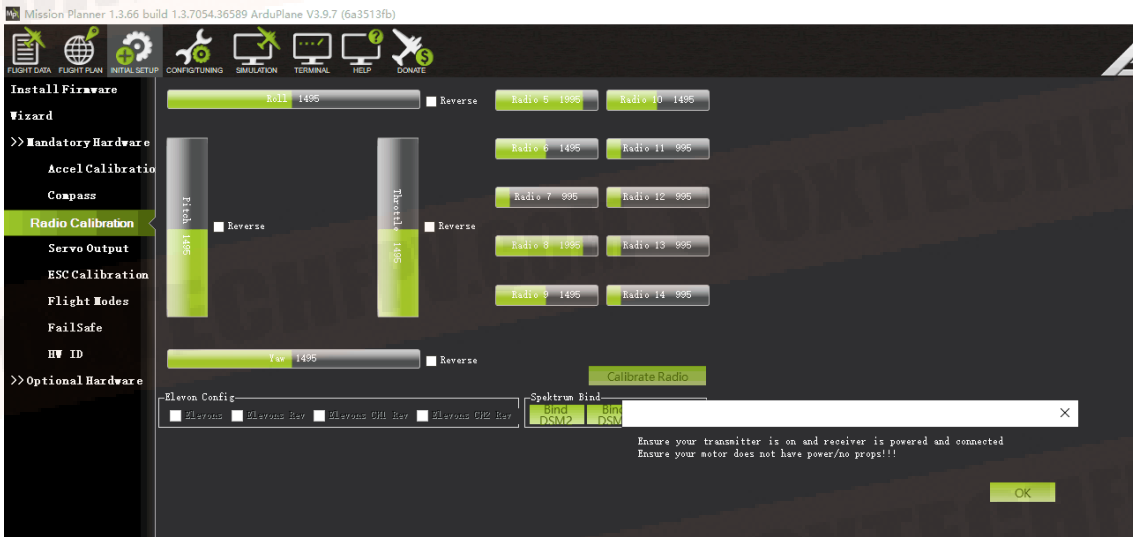
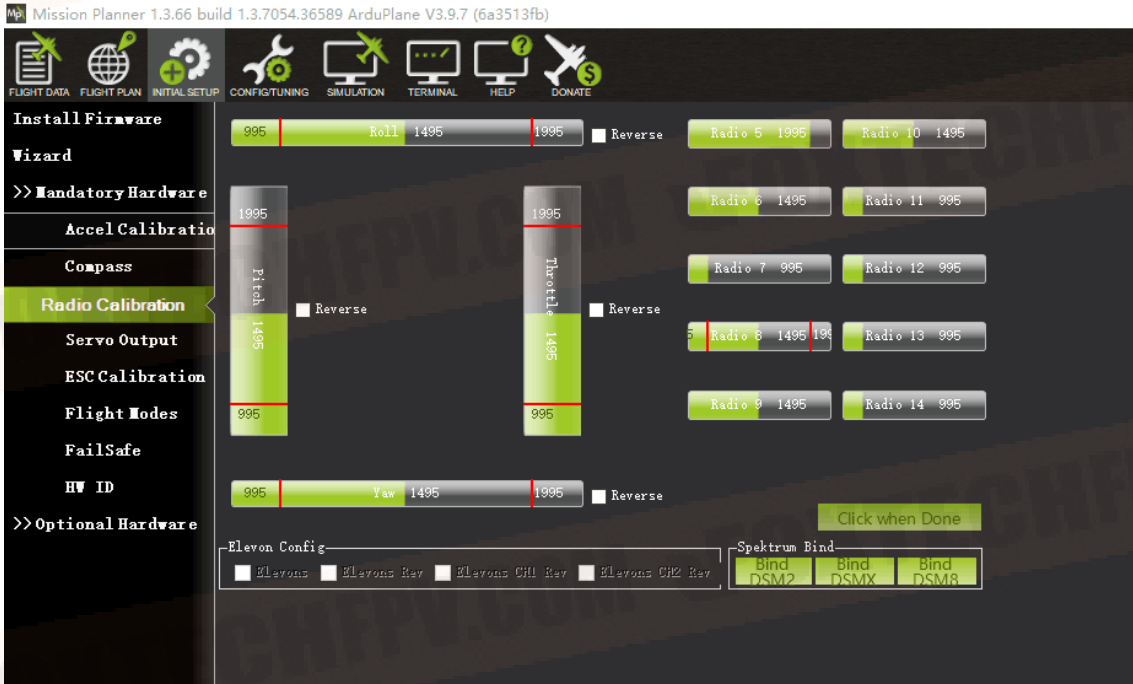


Onboard calibration produces better results.

3. Radio Control Calibration

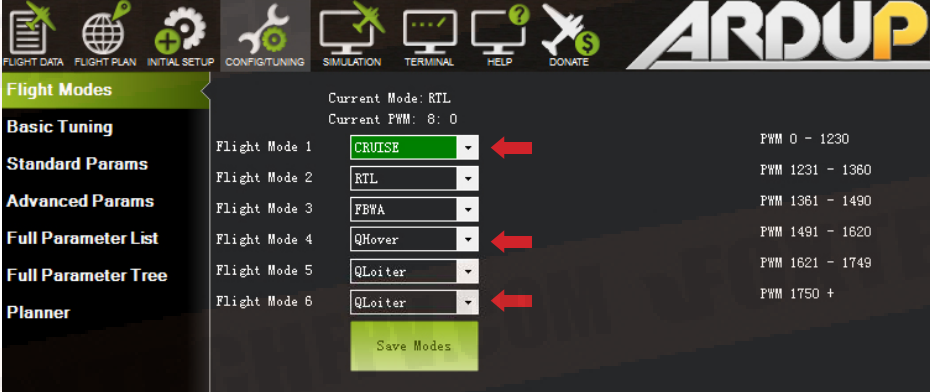
Calibrating each of the transmitter controls/channels is a straightforward process - simply move each of the enabled sticks/switches through their full range and record the maximum and minimum positions.







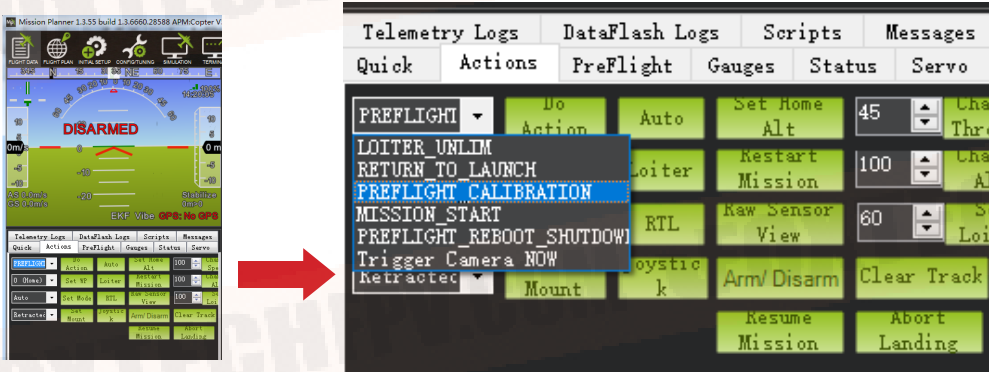
4. Check Flight Modes. (Cruise, QHover, QLoiter)



5. Calibrate the Airspeed Sensor

It is critical that you calibrate airspeed meter to ensure that it is working correctly, and ensure that it is correctly zeroed.

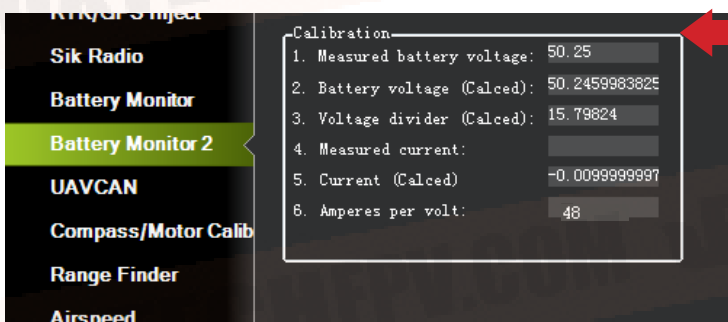
After you start up APM on your aircraft you should wait at least 1 minute for your electronics to warm up, preferably longer, and then do a pre-flight calibration of your airspeed sensor. Your ground station software should have a menu for doing this, usually called “Preflight Calibration”. You need to loosely cover your airspeed sensor to stop wind from affecting the result, then press the button. The calibration will take a couple of seconds.



Choosing that action will re-calibrate both your ground barometric pressure and your airspeed sensor. Next you should check that your airspeed sensor is working correctly before takeoff. To do that you should blow into the airspeed sensor and make sure that the "AS" airspeed sensor value in your HUD rises as you blow into it.

6. Check the Two Batteries Voltages

If you find the voltages are not correct, Enter the voltages according to the hand-held volt meter in the “Measured Battery Voltage” field, Press tab or click out of the field and the “Voltage Divider (Calced)” value will update and the “Battery voltage (Calced)” should now equal the measured voltage.



7. Check Before Flight

- (1) Connect the internet and load the map.
- (2) The plane direction should be same with its direction in mission planner, if not, please calibrate again.
- (3) Check plane status, altitude, voltage airspeed meter working fine.



Checklist before Every Flight

1. Make sure all items are checked before every flight.
2. The aircraft connection is stable and normal.
3. All screws and nuts are not loose.
4. The propeller is in the normal direction and is fastened.
5. All Rudders' direction-correction is correct.
6. The airspeed meter reads correctly.
7. Aircraft voltage is normal.
8. The compass is toward the right direction.
9. More than 15 GPS satellite, or displays GPS FIX.
10. No warning words on the ground station.
11. Device SD card is normal.
12. Recording device records normally.
13. Mapping camera photo test is normal.
14. Exposure check is normal.
15. The remote controller power is normal.
16. Ground station power is normal.
17. Data connection strength is normal.
18. Aircraft H point positioning is normal.
19. Upload and download to check the routes.
20. The antenna is placed in the normal direction, the antenna of the aircraft is facing down or up, and the two antennas of the receiver are not in contact.
21. Ground device recording is on.
22. Aircraft onboard camera is turned on.
23. Height setting of Return Home Point is normal.
24. Out of control return-to-launch setting is normal.
25. Try to vertically take off and land, make sure the direction-correction and direction control are normal.
26. Start flying.

Test Flight

Before the first flight, it's suggest to check if every component is well connected, Servos working properly, motors spinning to the correct direction and all control surfaces are moving to the desired directions.

It's suggested to use 3 modes, Cruise, Qhover and Qloiter as the labeled modes on a three position switch. It's suggested to do the first flight in a very open area with no buildings or big trees around, and a flat taking off area is necessary.

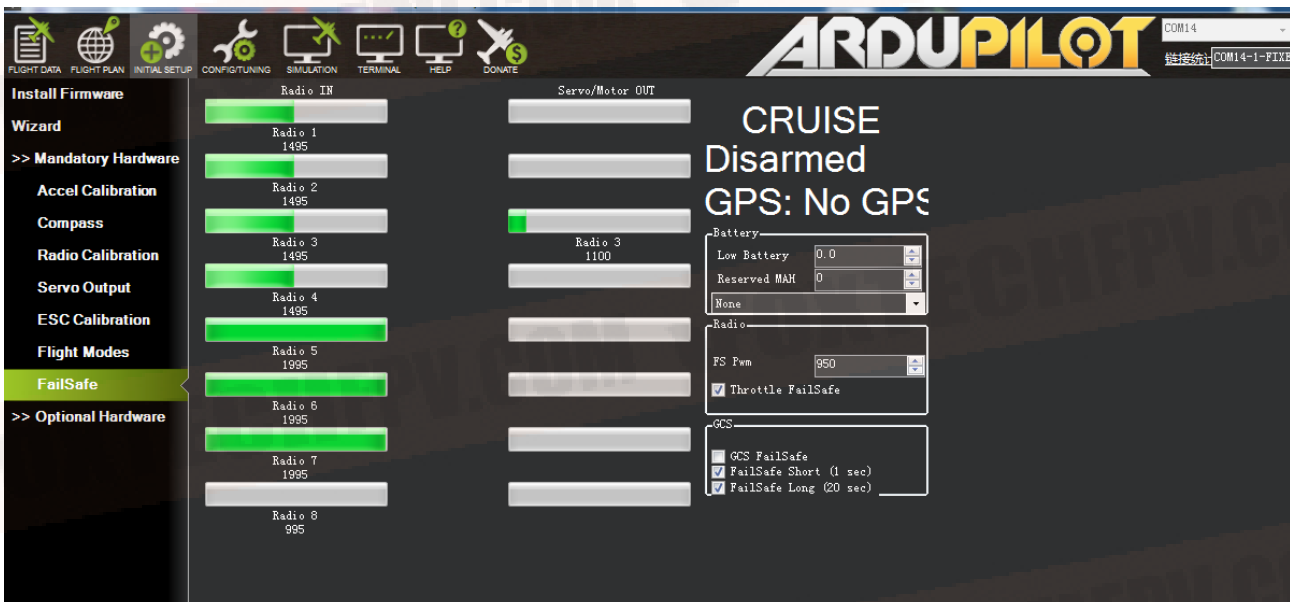
Use the Qhover(or Qloiter) mode, start the motors by pushing the rudder all to the right with the throttle at the lowest position, the motors should start to spin, gradually increase the throttle until the plane is ready to lift from the ground, move aileron, elevator and rudder stick gently to check if the plane is moving as desired.

Continue to push the throttle until the plane is lifted from ground, it may swing a bit since there should be big airflow hitting the wing, lift the plane to around 3 meters and try to fly it as a multicopter, it should not be a problem for anyone who can play a multi-copter.


When you are familiar with all controls, lift the plane to at least 50m from the ground and make sure there is not obstacle in front of the plane.

Switch it to Cruise mode, the AYK-350 VTOL rear motor should work, once the speed is reaching at least 19m/s, the multi-copter motors will stop spinning, then the AYK-350 is now transferred to fixed wing.

It's also suggested to active the short and long failsafe, the default action is respectively CIRCLE and RTH. So in case the plane lose RC control, it will go back all by itself.



You can fly a while and see if the plane could go straight, if you find the plane is tilting left for example, don't try to trim the aileron with your radio, the trim to aileron(SERVO1) must be done in parameter setting. (If the elevator trim is necessary, please trim the SERVO2 and SERVO4 at the same time with the same trim amount.)

 GCS FAILSAFE disabled as default setting for DA16(S+) radio or the control range will be greatly affected.

Command	Value	Unit	Range	Description
SERVO1				
SERVO1_FUNCTION	4			
SERVO1_MAX	1900			
SERVO1_MIN	1100			
SERVO1_REVERSED	1			
SERVO1_TRIM	1460			
SERVO10				

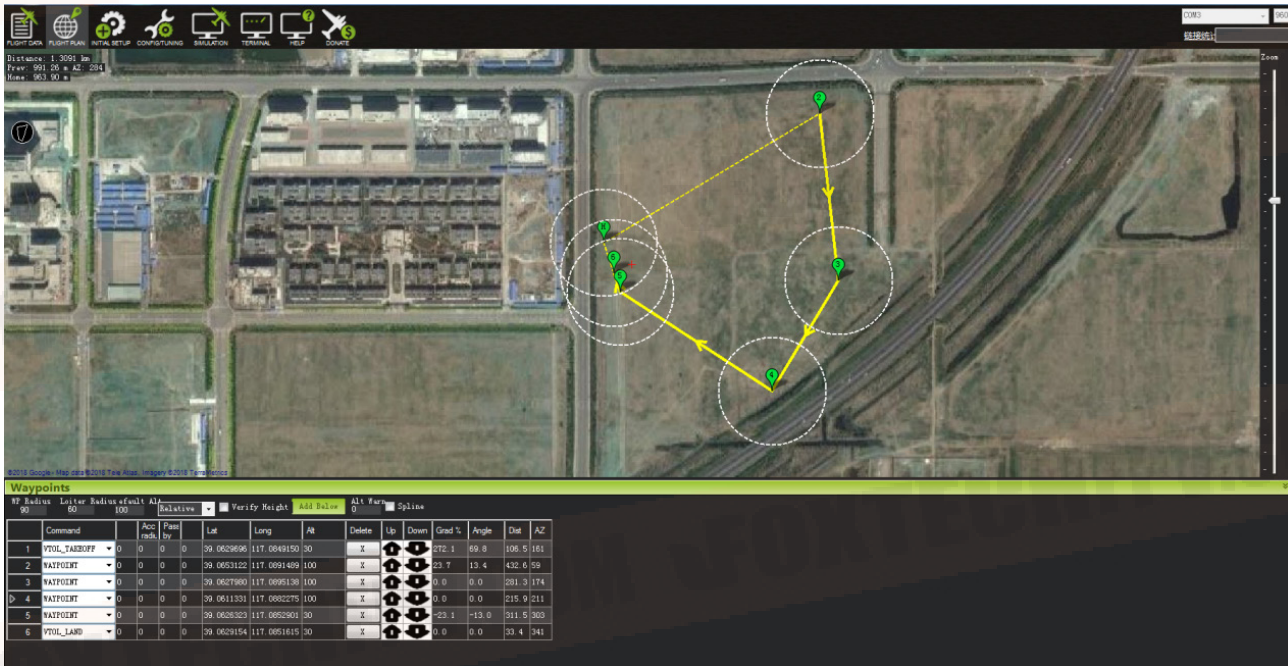
If everything goes well, you can try to land. First, reduce the altitude by pushing forward the elevator and when the altitude is around 50m above the ground, switch to Q-hover(or Q-loiter) Mode. Then become a multi-copter again, then you can land it just as a normal multi-copter.

Autopilot

After the first flight, you can try to do autopilot.

You can choose to take off and land either by manual control or automatically.

To use automatic taking off and landing, you can change the first waypoint to VTOL_TAKE OFF, and set an altitude like 50m for this action, then set the next waypoint a bit far (like 100m) from the first waypoint, the AYK-350 will take off as a multi-copter, when it reaches the wanted altitude, it will switch to fixed wing and fly waypoints or missions like a fixed wing.



The VTOL landing is also the similar, you can set the last waypoint to VTOL_LAND, but it's suggested to set one waypoint which is around 100m from this one, since the plane will try to turn to multi-copter before the last waypoint, if the waypoint before VTOL_LAND is too far, the AYK-350 will finish the final distance all in multi-copter mode, the power consumption in multi-copter mode is 5 times more than in fixed wing mode.



Q_RTL is enabled as default, if the VTOL land command is not added, then the VTOL will go back to HOME position and home altitude (default 50m) and performs automatical VTOL land.



NOTICE

It is needed to switch to the remote control mode (Q-HOVER, Q-Loiter, FBWA, Cruise, etc.) when the aircraft is flying in auto mode. After the mode is switched, continuously toggle the Yaw joystick (left and right direction of the left hand in model 1 and Mode 2) 3-4 times to realize the drone control. (Because in auto mode, due to the RC signal interruption and reconnection, the aircraft will automatically switch to the current mode of the remote controller, which will lead to an accident.)

Applications

- 3D Survey and Mapping
- Surveillance and Inspection

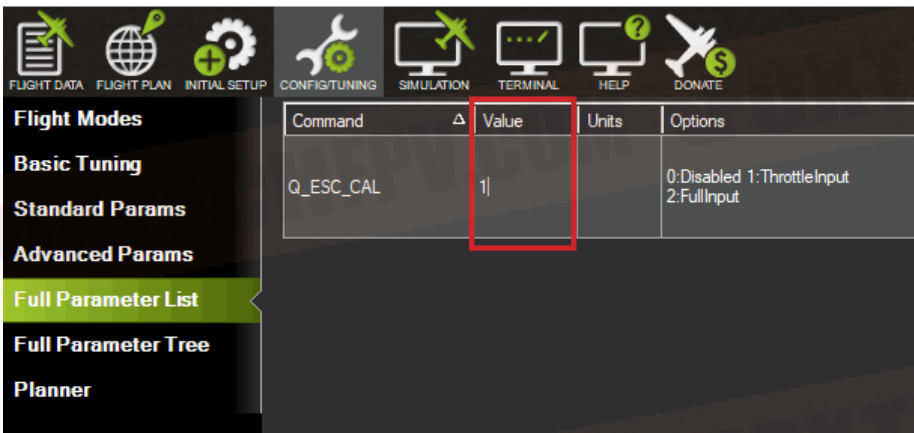
More autopilot mode can be found in Mission planner manual, like circle survey, Grid, drop an object with hook at desired waypoint

Appendix

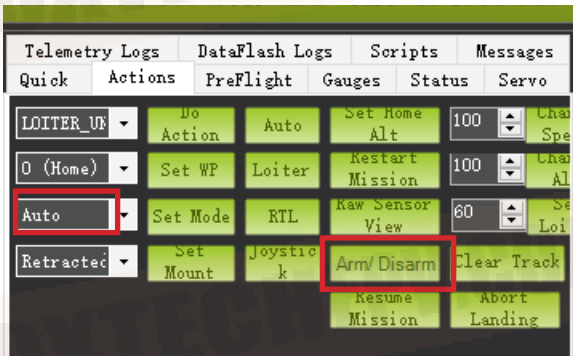
The following calibrations are for Customers who bought AYK-350 VTOL Kit. For the customers who bought AYK-350 RTF combo, the following calibrations are done before shipping. Please do not change any settings. If the settings are changed by accident, please recover from the param. document in the SD card.

ESC Calibration in Multirotor Mode

1. Cut off AYK-350 VTOL power supply and take off all propellers. Connect Pixhawk flight controller with Mission planner with USB cable. Change “Q_ESC_CAL” value to 1 and write params.



2. Click Auto and chose Q-stabilize, then click Set mode, finally click Arm/Disarm, There will be a sound “Du~”



4. In the following demonstration, Take Left hand throttle as an example. Push throttle to Max.(Pic 4-1), connect AYK-350 with power, when there is “di di ~ di” sound quickly push throttle to Min.(Pic 4-2) When there is “di di di di ~di” sound, ESC calibration is successful. Then cut off power.



Pic 4-1

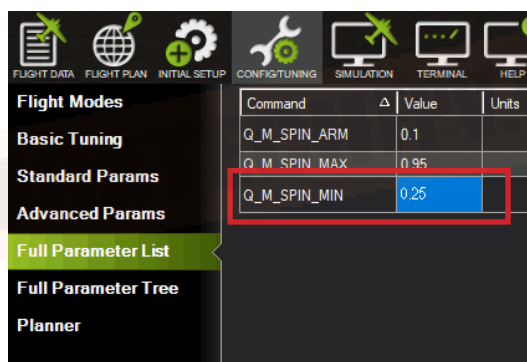


Pic 4-2

5. Connect AYK-350 with power again. Long press GPS safety switch. Radio throttle push to Min, direction stick push to right(Pic 5-1), disarm AYK-350, you can adjust “Q_M_SPIN_MIN”in mission planner. The default value is 0.25. Write the value, it is complete.



Pic 5-1



Servo Checking and Required Mode Modification

Check the stick function of remote controller. (The follow example is demonstrated as transmitter Mode2 which means left hand is throttle.)

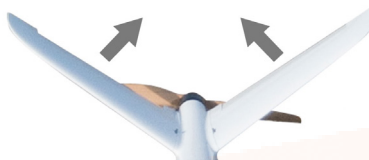
💡 Please take off all propellers before the following calibrations in case any danger occurs.

Under Manual Mode :

1. Make sure the aircraft is in center position.
2. Push the throttle-stick the tail motor speed will increase, and pull back the throttle-stick, the motor speed will decrease.
3. Push the pitch-stick the two V-type tail will go down.



4. Pull back the pitch-stick the two V-type tail will go up.



5. Turn the aileron-stick to the left, the left aileron will go up, and the right one will go down.



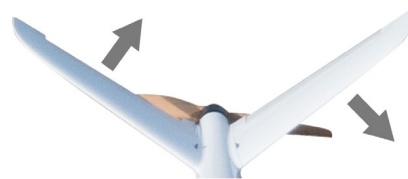
6. Turn the aileron-stick to the right, the right aileron will go up, and the left one will go down.



7. Turn the direction-stick to the left, the left V-type tail will go up, and the right tail will go down.



8. Turn the direction-stick to the right, the right V-type tail will go up, and the left tail will go down.



Under the Q_STABLIZE Mode

1. Unlock the plane under the Q_STABLIZE mode. (set the throttle at minimum speed and turn the direction stick to the far right.)

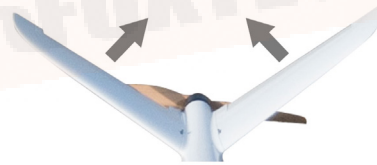


2. Check the throttle stick: when you push the throttle-stick, the motors speed will increase, and pull back the throttle-stick, the motors speed will decrease.

3. Push the pitch-stick, the speed of the front motor will decrease and the back motor will increase, the two V-type tails will go down.



4. Pull the pitch-stick, the speed of the front motor will increase and the back motor will decrease, the two V-type tail will go up.



5. Turn the aileron-stick to the left, the left motor speed will decrease, and the right motor speed will increase left aileron goes up, and the right aileron goes down at the same time.



6. Turn the aileron-stick to the right, the right motor speed will decrease, and the left motor speed will increase left aileron goes down, and the right aileron goes up at the same time.



Angle Deviation Compensation Checking

Unlock the plane under the Q_STABILIZE mode:

1. Plane leans forward, the speed of the front motors will increase, the back motor-decrease, the two V-type tails go up.



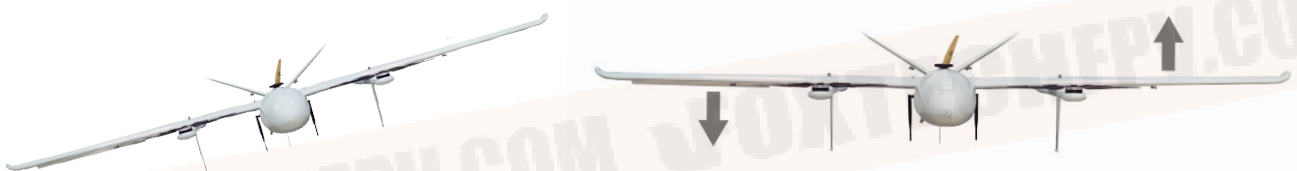
2. Plane leans back, the speed of front motors will decrease, the back motor-increase, the two V-type tails go down.



3. Plane leans to the left, left aileron will go down, and the right aileron will go up, the speed of left motor increases, and the right motor decreases.



4. Plane leans to the right, left aileron will go down, and the right aileron will go up, the speed of left motor decreases, and the right motor increases;



Default Settings

Some default settings in Pixhawk for AYK-350.

ALT_HOLD_RTL	-1	cm
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Target altitude above home for RTL mode. Maintains current altitude if set to -1. Rally point altitudes are used if plane does not return to home.

BRD_SAFETYENABLE	0	0:Disabled 1:Enabled
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This controls the default state of the safety switch at startup. When set to 1 the safety switch will start in the safe state (flashing) at boot. When set to zero the safety switch will start in the unsafe state (solid) at startup. Note that if a safety switch is fitted the user can still control the safety state after startup using the switch. The safety state can also be controlled in software using a MAVLink message.

ARMING_CHECK	1	
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Checks prior to arming motor. This is a bitmask of checks that will be performed before allowing arming. For most users it is recommended to leave this at the default of 1 (all checks enabled). You can select whatever checks you prefer by adding together the values of each check type to set this parameter. For example, to only allow arming when you have GPS lock and no RC failsafe you would set ARMING_CHECK to 72.

Q_WP_SPEED	500	cm/s	20 2000
Q_WP_SPEED_DN	150	cm/s	10 500

Defines the speed in cm/s which the aircraft will attempt to maintain while descending during a WP mission

Defines the speed in cm/s which the aircraft will attempt to maintain while climbing during a WP mission

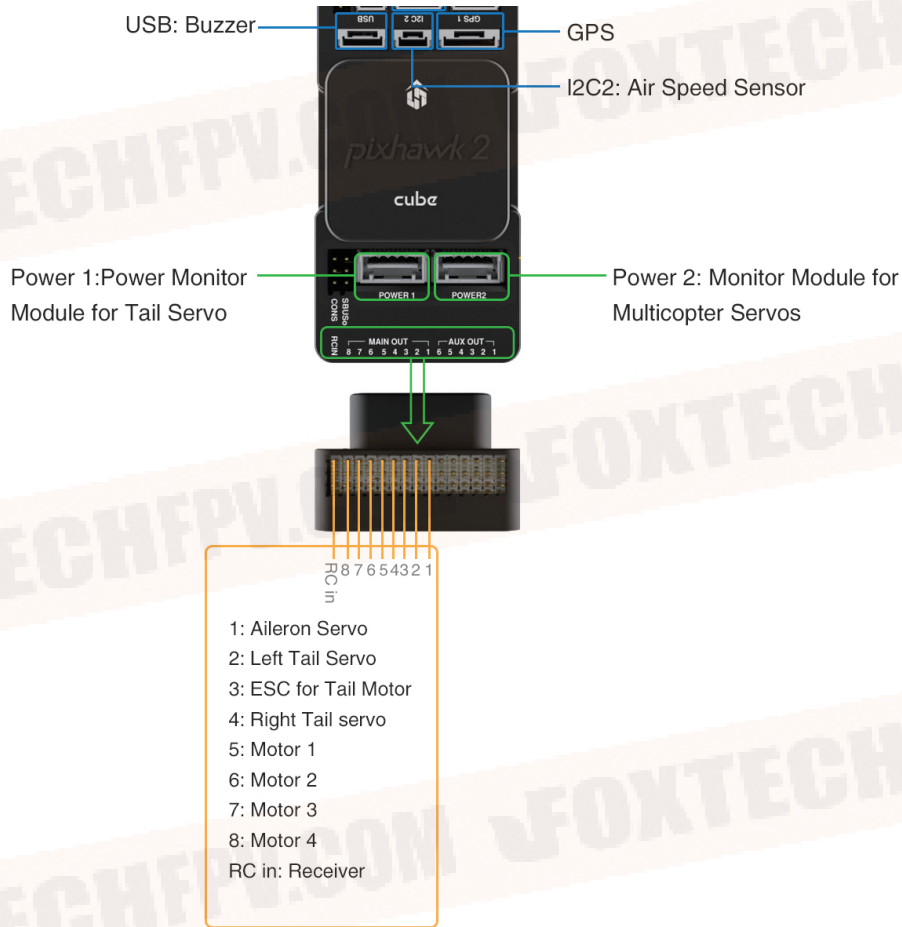
Q_TRAN_PIT_MAX	3	deg	0 30
----------------	---	-----	------

Maximum pitch during transition to auto fixed wing flight

Q_ASSIST_ANGLE	30	deg	0 90
----------------	----	-----	------

This is the angular error in attitude beyond which the quadplane VTOL motors will provide stability assistance. This will only be used if Q_ASSIST_SPEED is also non-zero. Assistance will be given if the attitude is outside the normal attitude limits by at least 5 degrees and the angular error in roll or pitch is greater than this angle for at least Q_ASSIST_DELAY seconds. Set to zero to disable angle assistance.

Pixhawk Connections



This content is subject to change.

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