

NAGA PRO

User Manual

(MX16 Version)



 **FOXTECH**

Content

一.	Assembly.....	1
	1. Unfold the Arm.....	1
	2. Turn on MX16 GCS.....	3
	3. Install Battery.....	5
	4. Install Propeller.....	10
二.	MX16 Introduction.....	14
	1. MX16 GCS Diagram.....	14
	2. Air Unit Interface.....	15
	3. Status Prompt Bar.....	16
	4. MX16 Assistant.....	17
	5. Frequency Matching.....	17
	6. Mode Changing.....	18
	7. Channel Reverse.....	20
	8. Image Connection and Setting.....	23
	9. Joystick Calibration.....	24
	10. Video Transmission Information Displayed on Ground Station.....	24
	11. Connect FC and Datalink in QGC.....	25
	12. Share Network, Video and Data information.....	27
三.	Mission Planner Operation Guide.....	29
	1. Download Mission Planner.....	29
	2. Connect Mission Planner to The Cube.....	30

3. Loading Firmware to The Cube.....	30
4. Basic Hardware Calibration and Parameter Setting.....	31
4.1 Frame Type Configuration.....	31
4.2 Accelerometer and Compass Calibration.....	32
4.2.1 Accelerometer Calibration.....	32
4.2.2 Level Calibration.....	36
4.2.3 Compass Calibration.....	37
4.2.4 Remote Controller Calibration.....	39
4.2.5 ESC Calibration.....	40
4.2.6 Select Flight Modes.....	41
四. Mission Planner RTK Setting.....	43
1. Basic Setting.....	43
2. How to Use Base Station.....	47
五. First Take-off.....	48
1. Self-checking.....	48
2. Meaning of LED Indicator Light:.....	49
3. First Flight.....	49
3.1 Arm the Drone.....	49
3.2 Disarm the drone.....	52
4. Take-off Precautions.....	52
六. Automatic Mission Planning.....	52
七. How to Use Oblique Camera.....	55
1. Camera Function Buttons.....	55

2. Camera and Aircraft Connection.....55

3. Photo Taking Test.....56

八. FAQ..... 58

九. Troubleshooting Guide.....63

十. How to Use QGC.....64

一. Assembly

NAGA PRO(MX16 version) accessories are shown in the following figure, including 1x NAGA Pro UAV, 4x Propeller, 1x landing gear, 1x MX16 GCS, 1x charger, 2x battery.

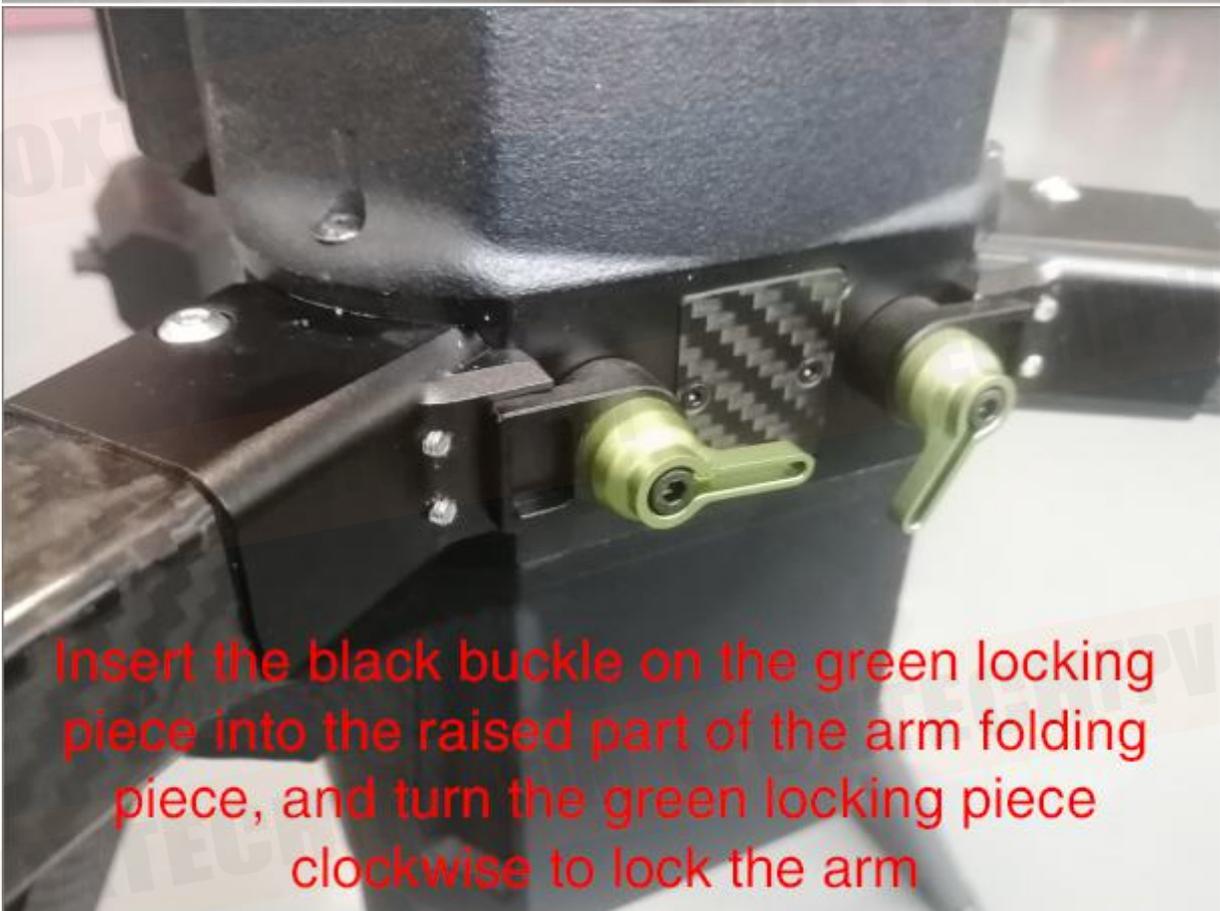
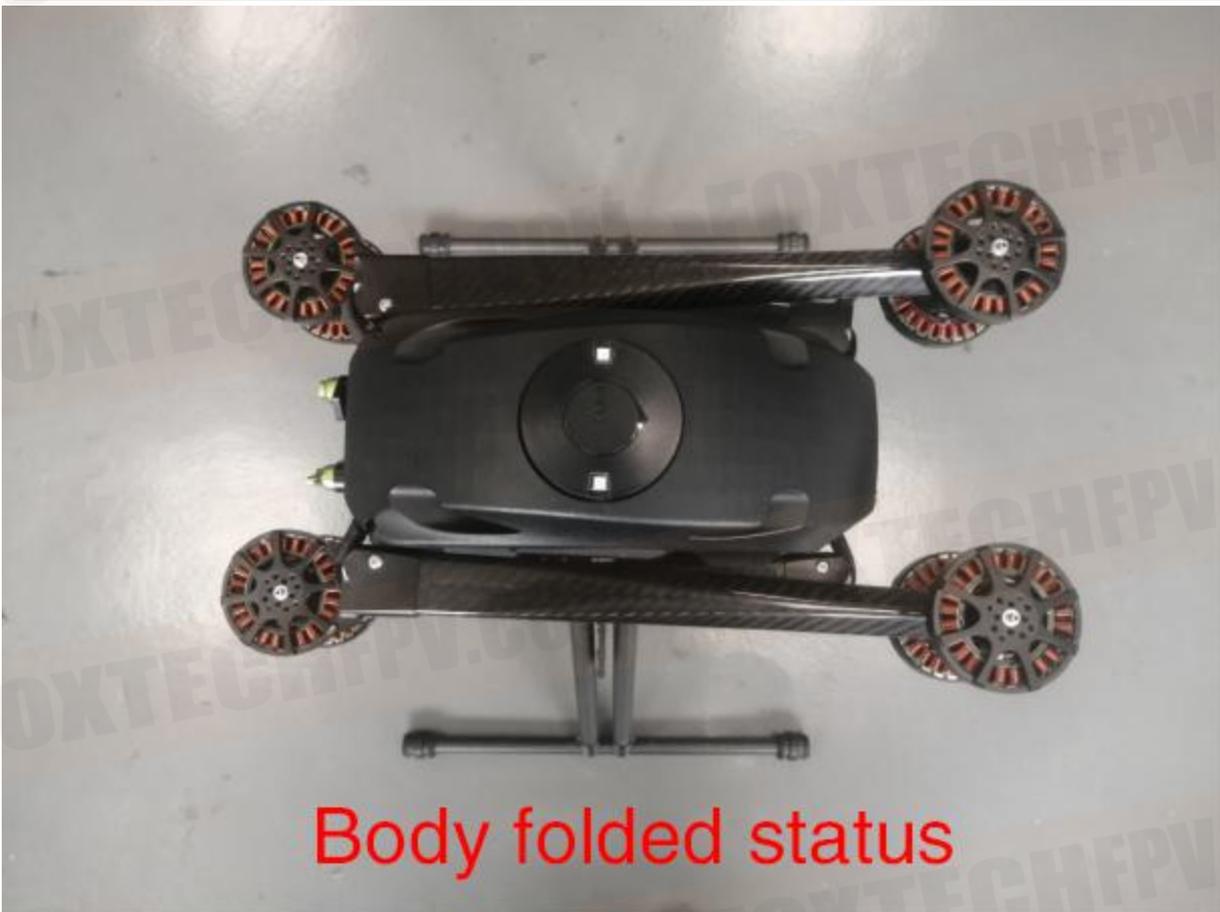


MX16 Remote Controller



1. Unfold the Arm

First unfold the lower arm of the fuselage around the rotation axis, and then unfold the upper arm, snap the arm buckle into the green locking piece, and turn the green locking piece clockwise to lock the arm.





2. Turn on MX16 GCS

Long press the power button to turn on MX16, and then click the QGC icon to enter the ground station software.



Enter the ground station software and wait for the aircraft to automatically connect.

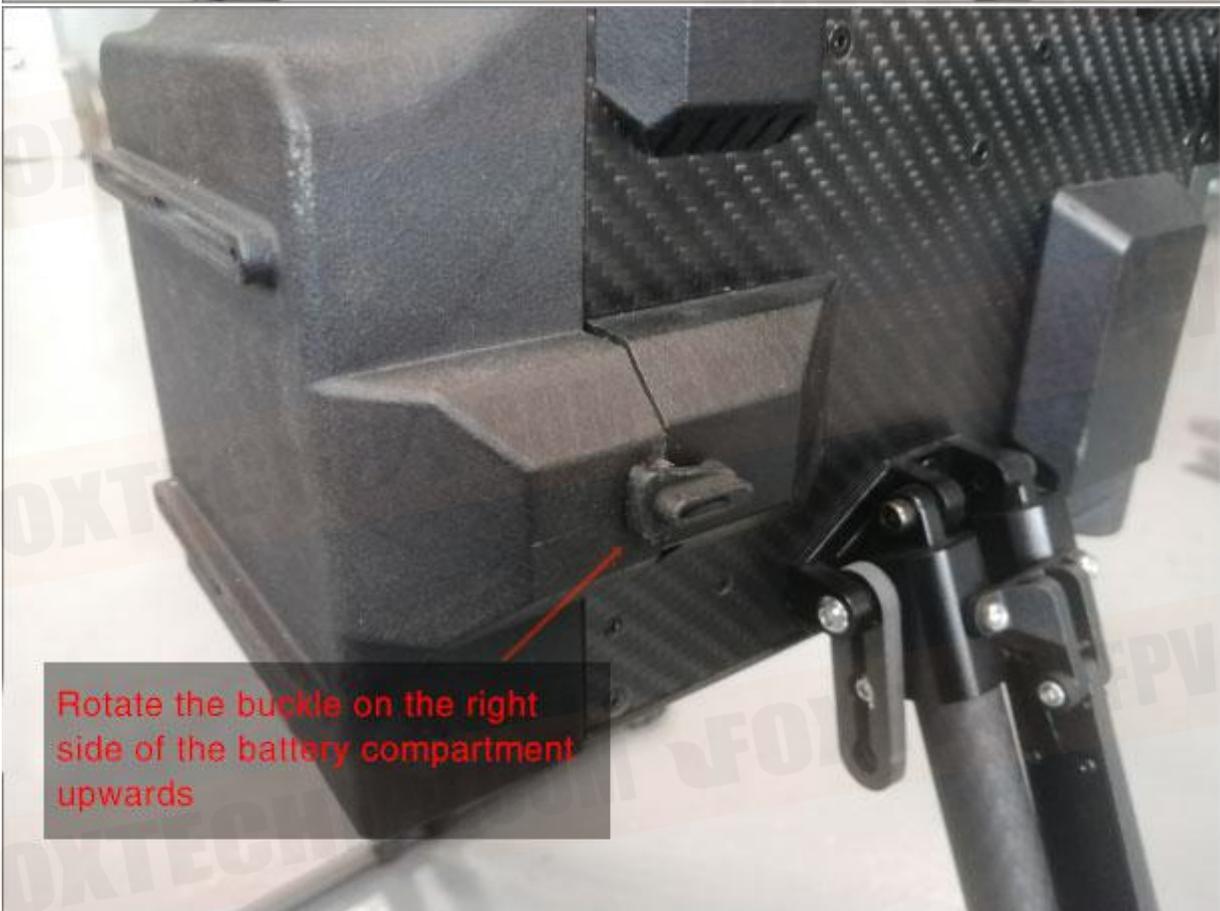


3. Install Battery





Rotate the battery compartment buckle to the right to a horizontal position



Rotate the buckle on the right side of the battery compartment upwards



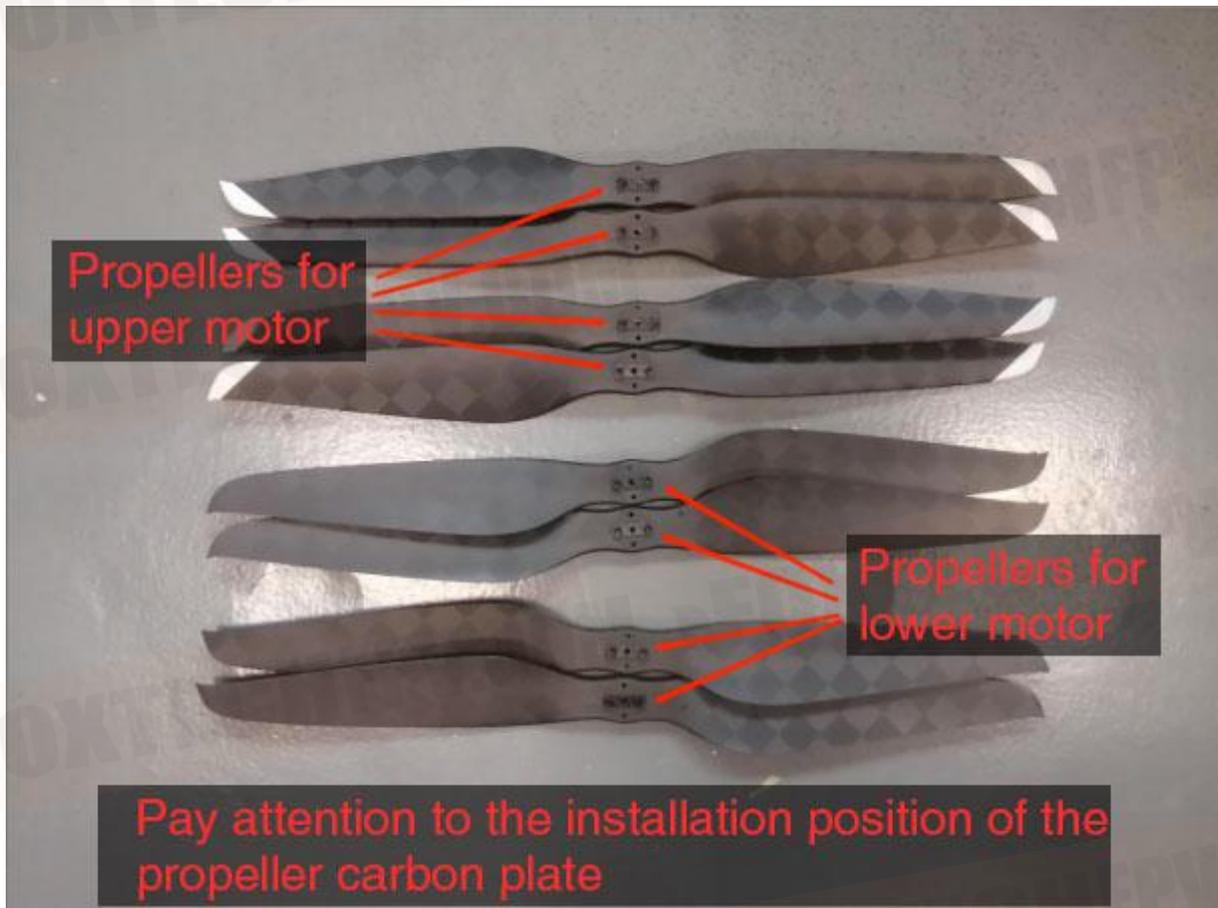


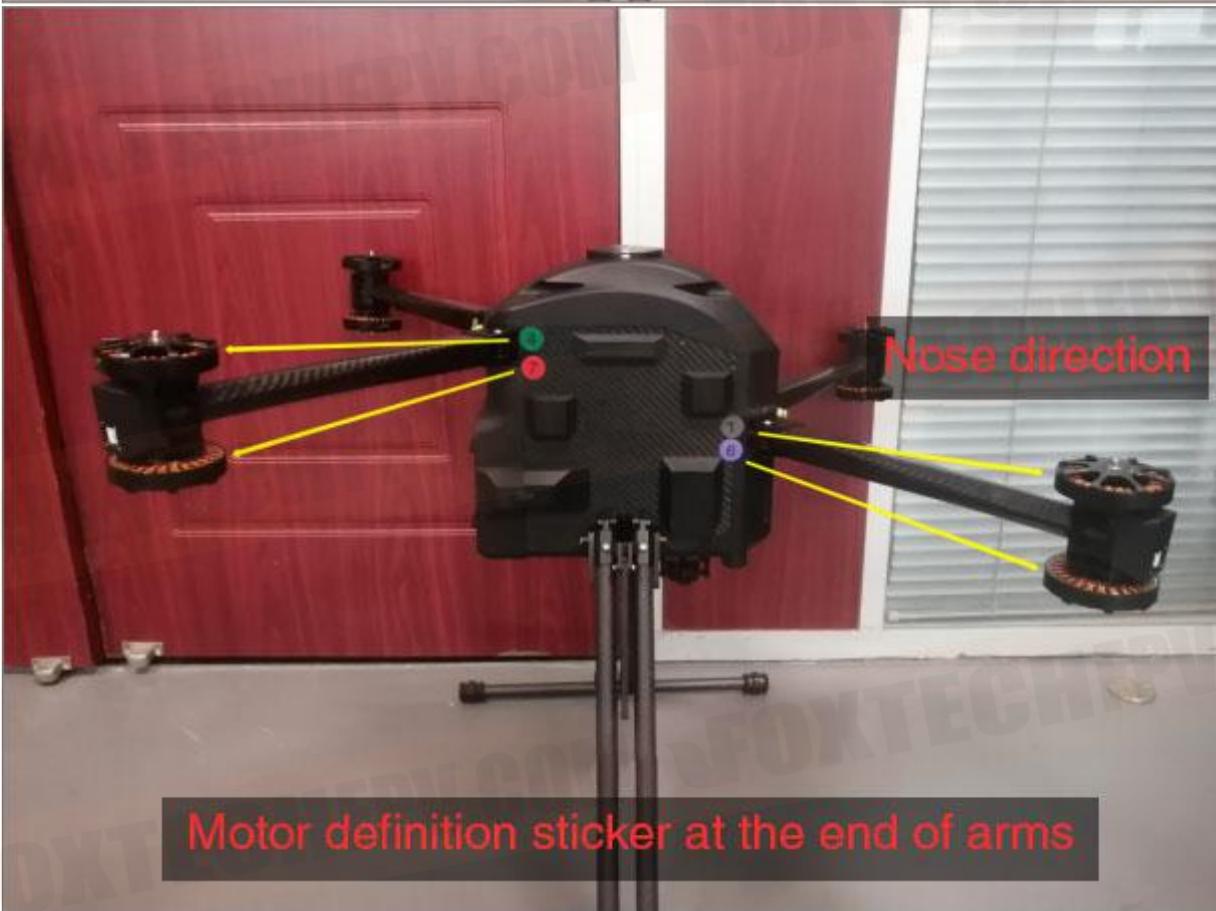
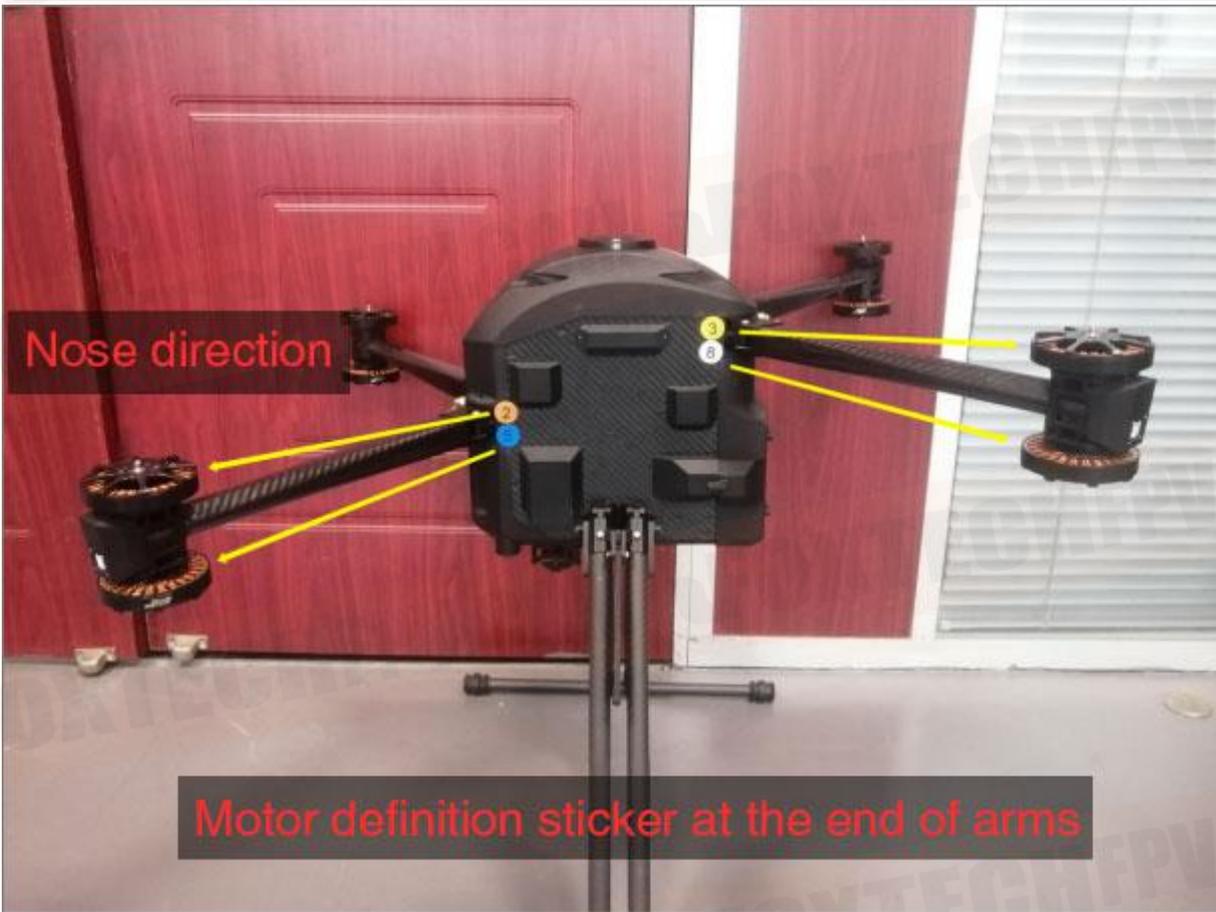


4. Install Propeller

The motors are divided into upper and lower parts. The upper motors are defined as No. 1, No. 2, No. 3, and No. 4. The lower motors are defined as No.5, No. 6, No. 7, No. 8.

The stickers for motor are attached to the end of arms, and propellers also have stickers corresponding to the motors. Please install the propeller according to the number on sticker.



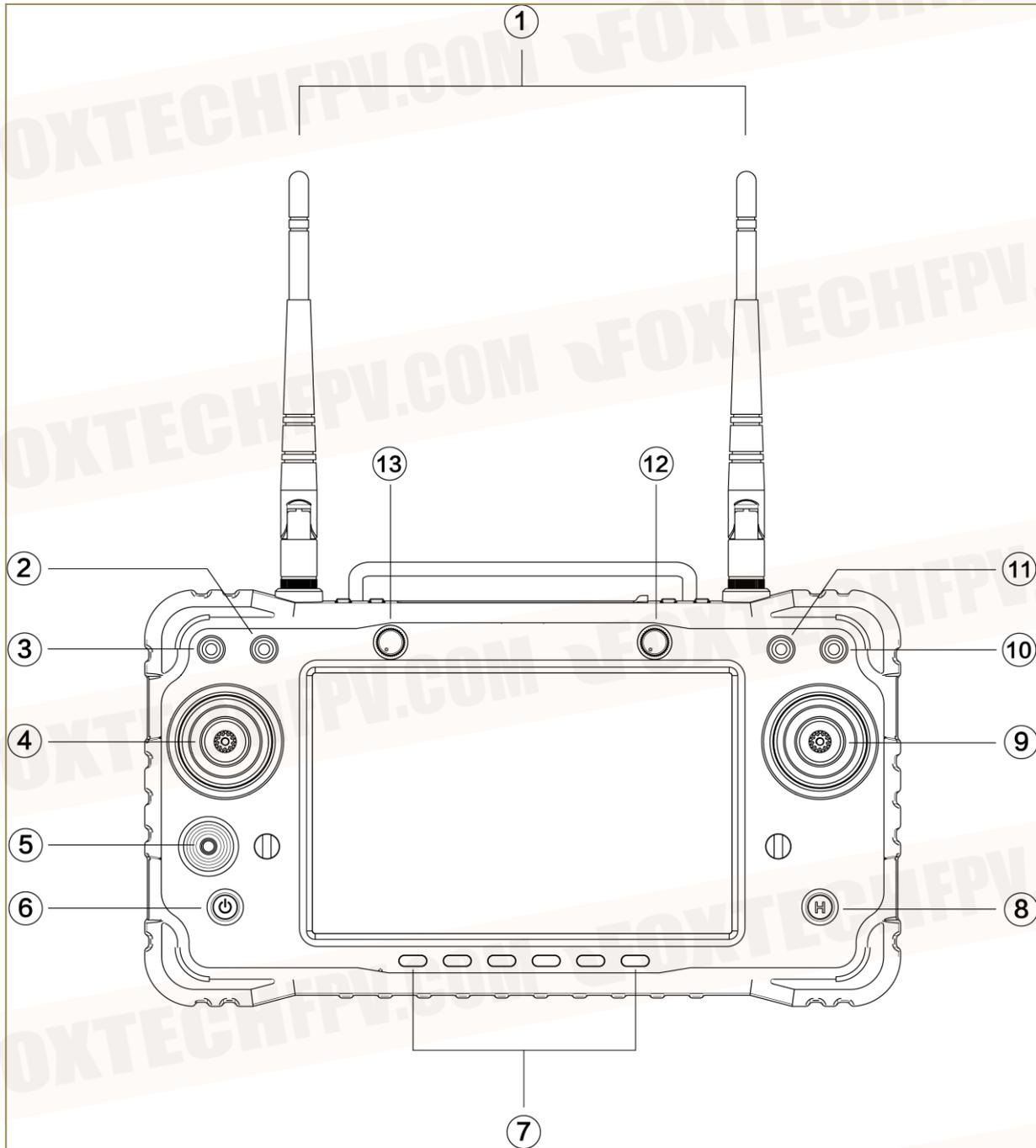




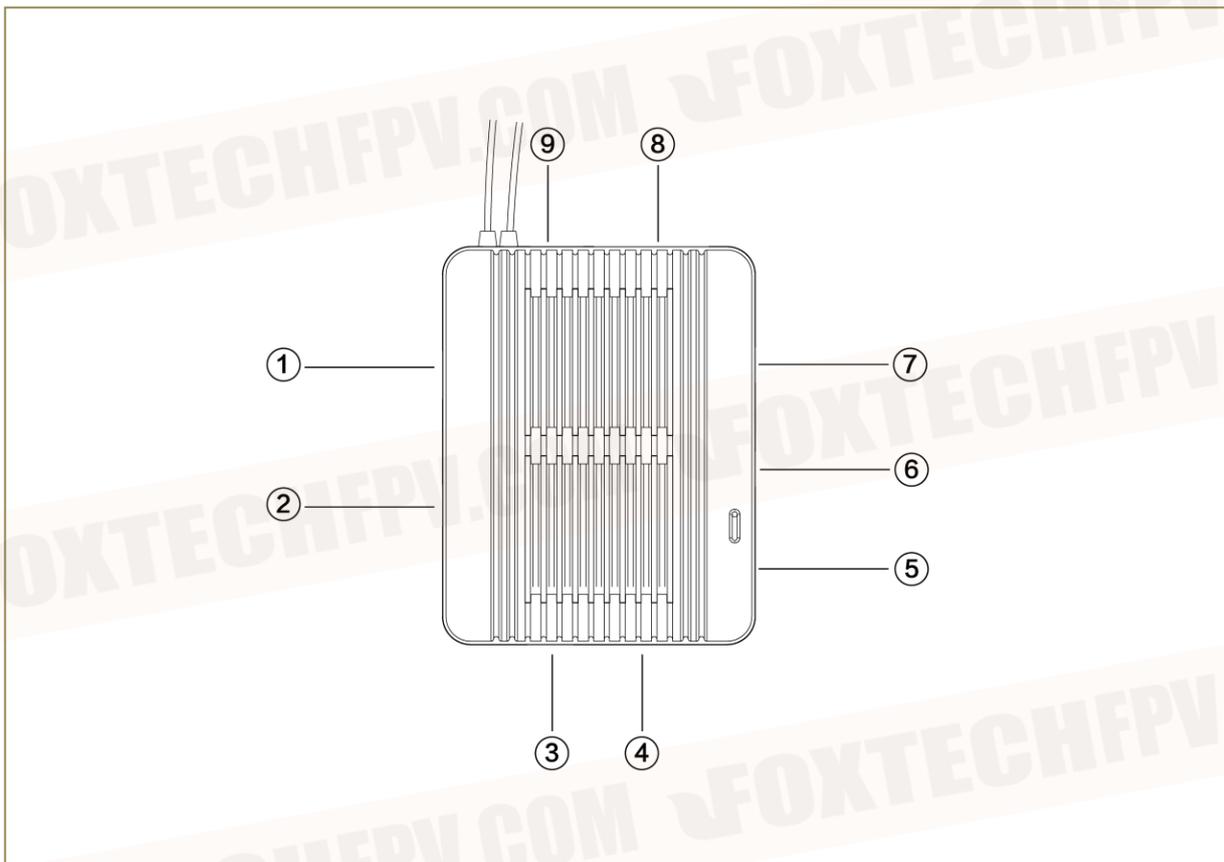
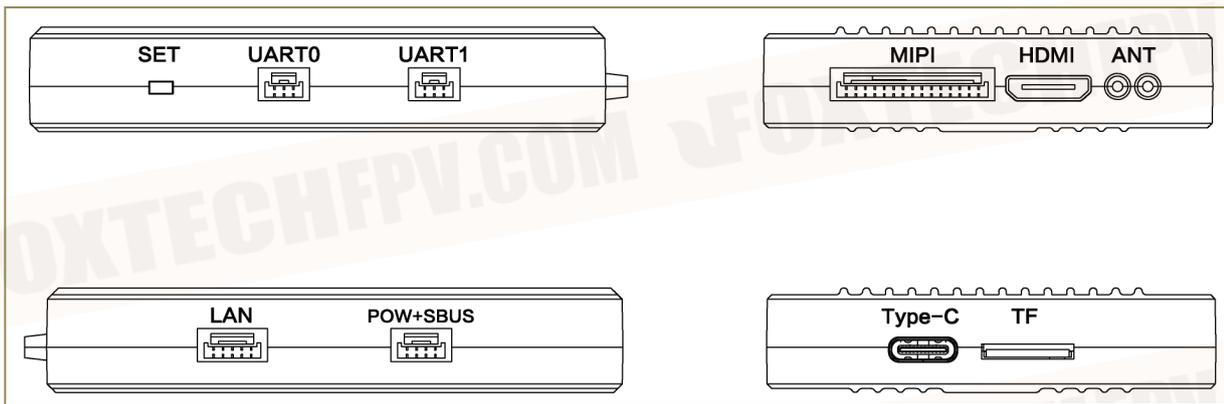


二. MX16 Introduction

1. MX16 GCS Diagram

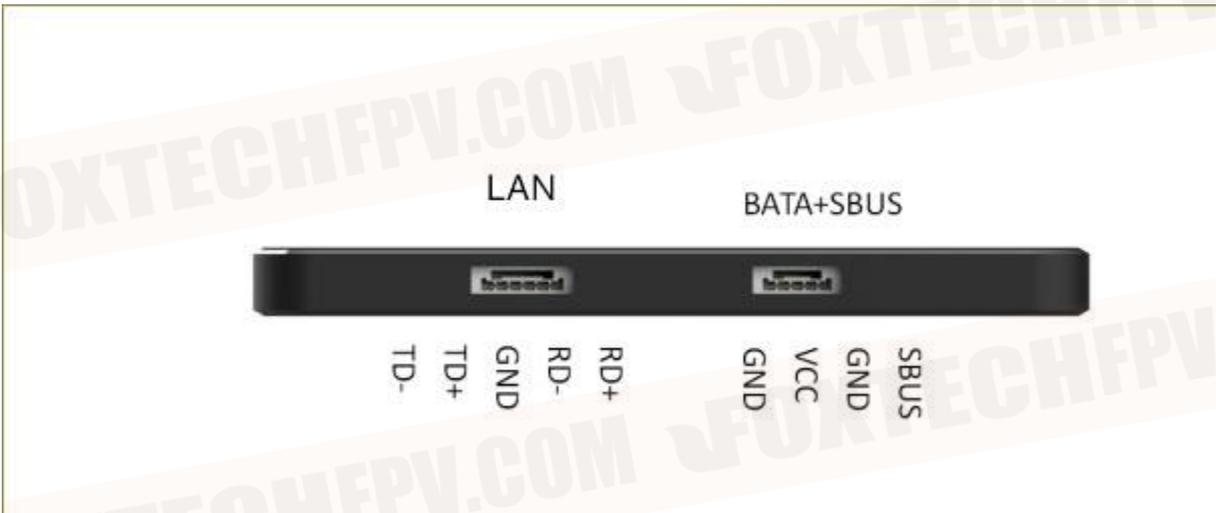
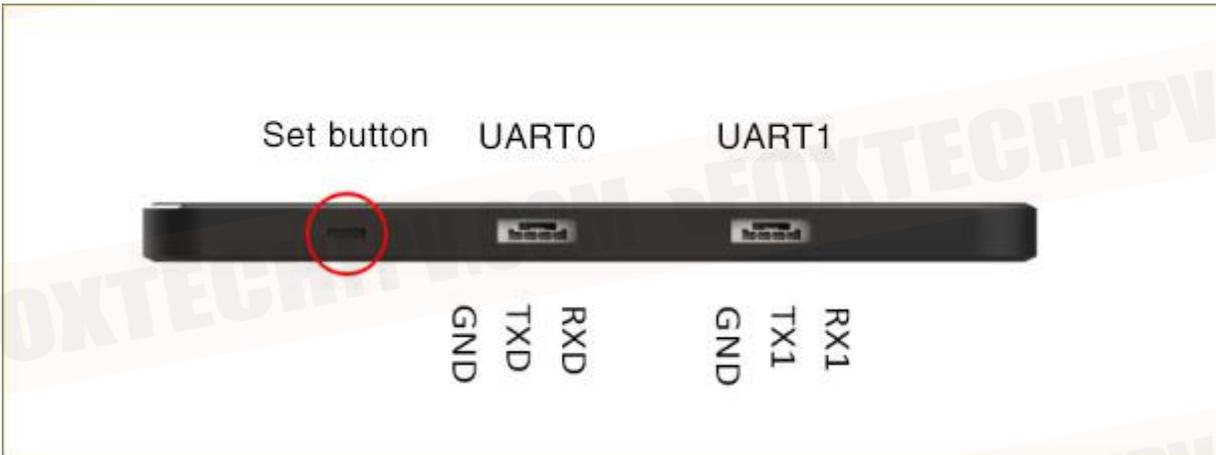


No.	Note	No.	Note
1	2.4G 3dB antenna	8	Set Button
2	3-position switch SW2	9	Right joystick X2. Y2
3	3-position switch SW1	10	3-position SW4
4	Left joystick X1. Y1	11	3-position SW3
5	Small joystick X3. Y3	12	Knob AUX2
6	Power button	13	Knob AUX1
7	6-segment switch		



No.	Note	No.	Note
1	LAN	6	UART 0
2	Power and SBUS input	7	UART 1
3	Type-C port	8	MIPI camera port
4	TF card port	9	HDMI input
5	Frequency pairing button		

2. Air Unit Interface



3. Status Prompt Bar



1. Access to internet successfully through Ethernet port or USB
2. Remote controller and receiver signal strength (the receiver is not connected in the picture)
3. Power

4. Time
5. Return
6. Back to the main surface
7. Background task management/split screen button

4. MX16 Assistant



1. Switch the joystick control method of the remote controller.
2. Check the channel value of the remote control.
3. Check MIPI HDMI UART VIDEO and other RTSP Video
4. Frequency pairing between remote controller and other receiver.
5. Can adjust the channel, upgrade the joystick firmware, modify the receiver serial port baud rate. Ask the technician for the password

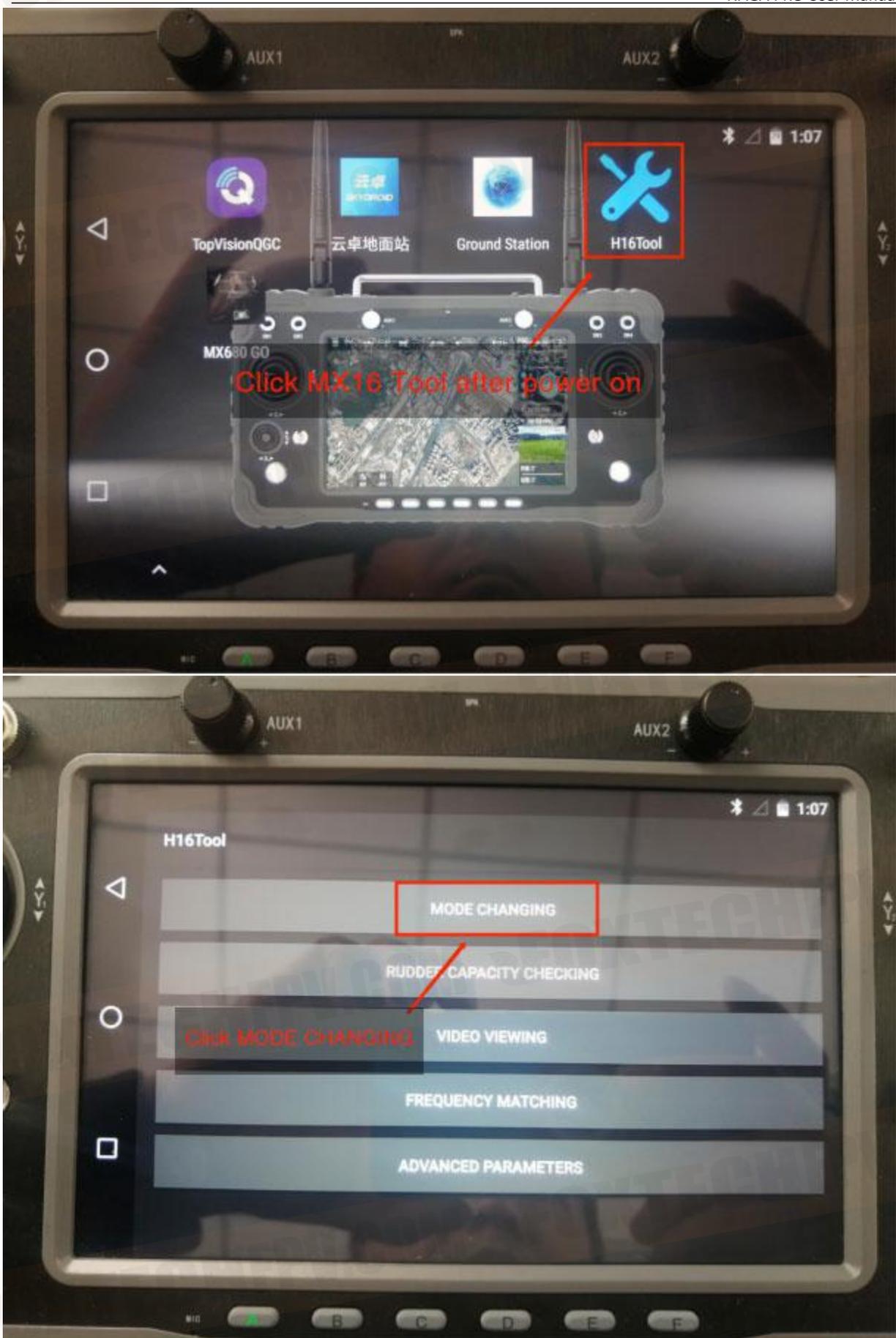
5. Frequency Matching



- ① Wait for 3s-5s after the receiver is powered on, and then long press the SET button until the white light flashes.
- ② Enter MX16 assistant and click frequency matching. (it will display 'connected' after the frequency successfully matched)

6. Mode Changing

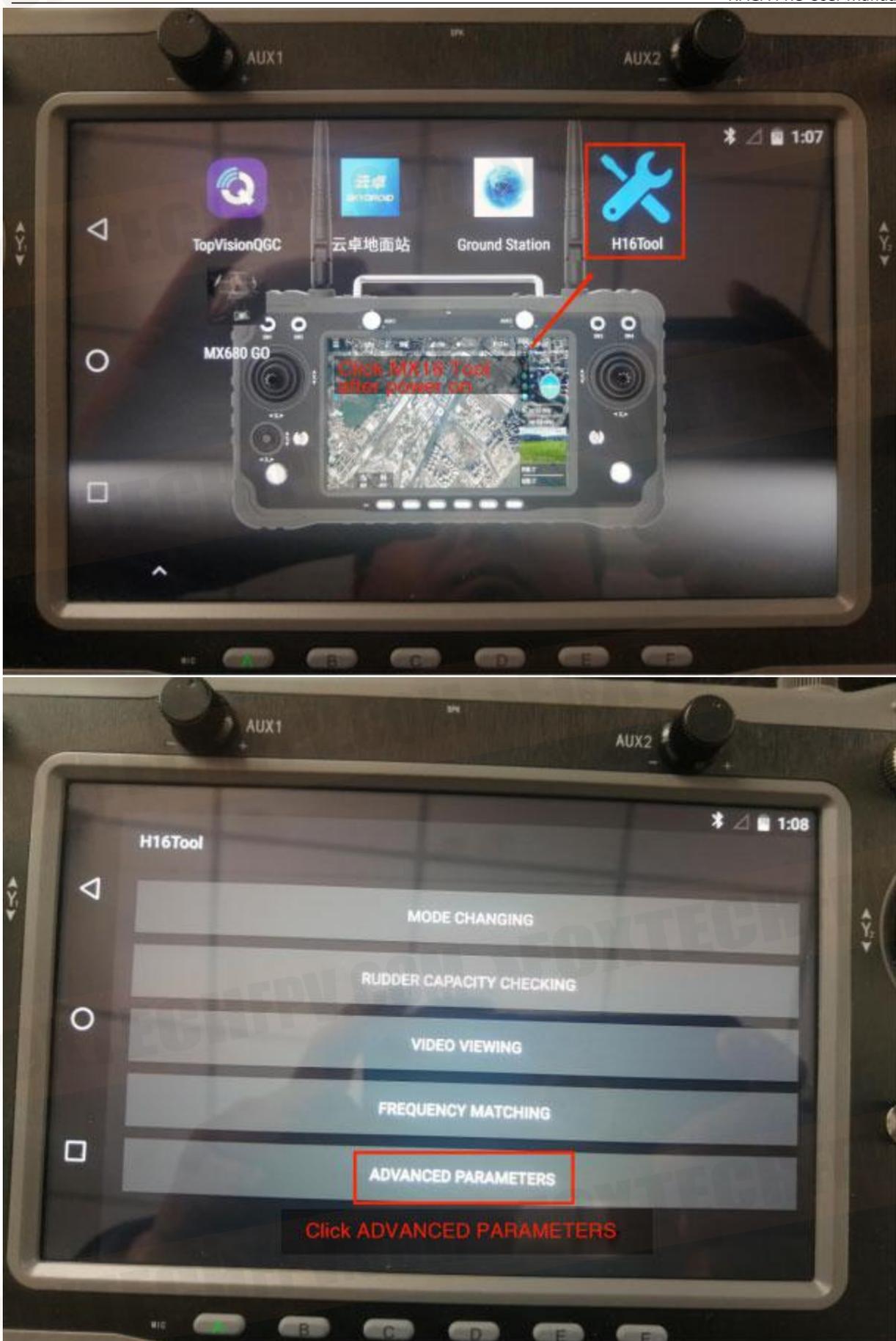
The operation mode can be set according to customer requirements. If the customer needs to change the mode, please follow the steps below:

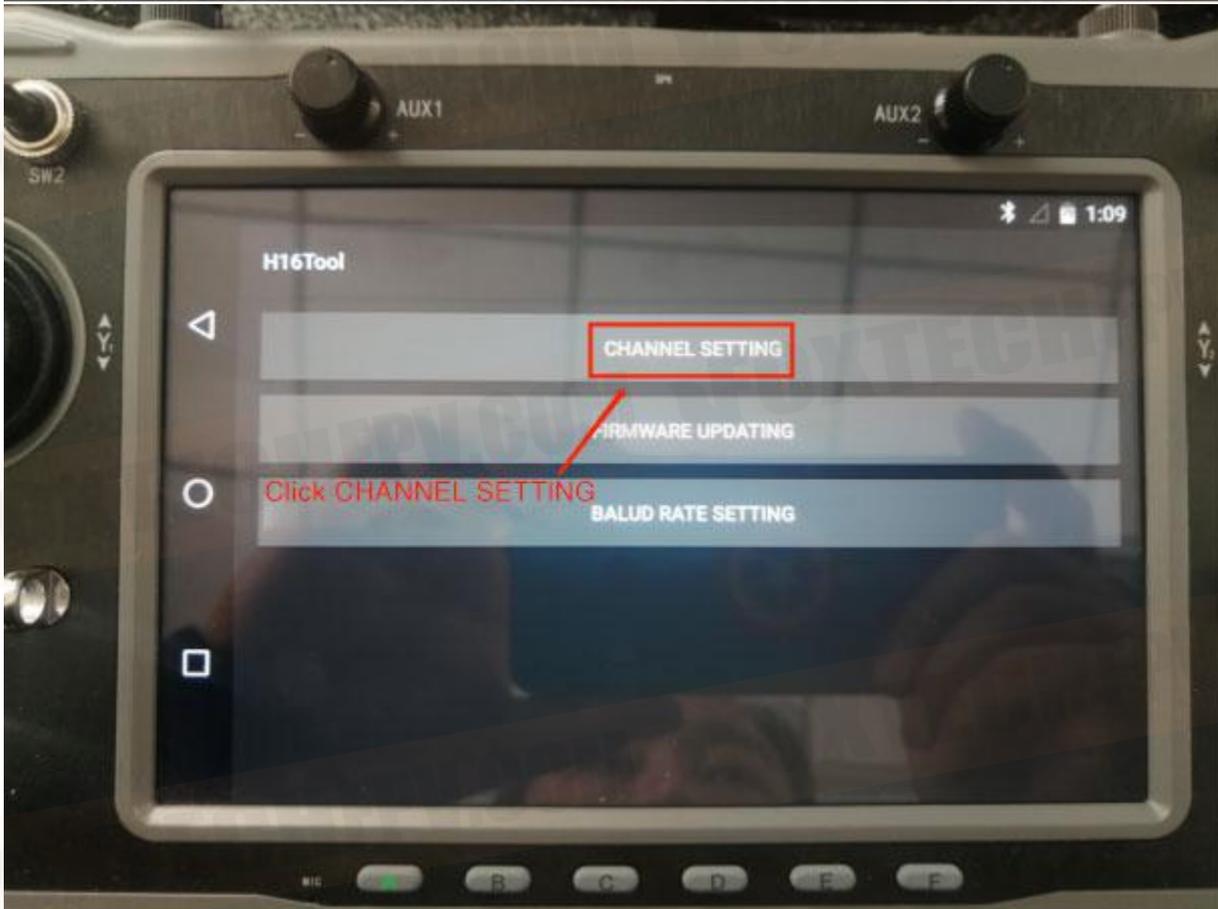
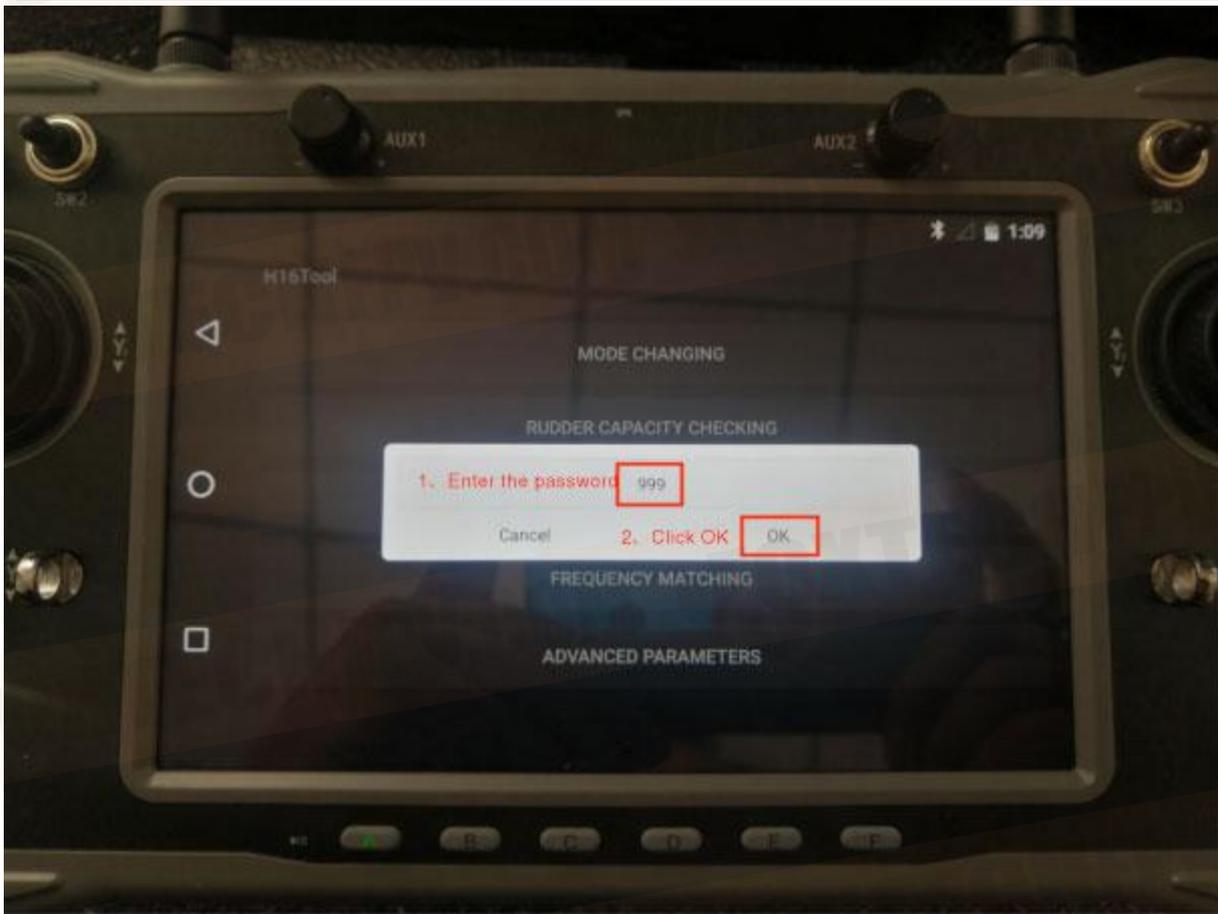


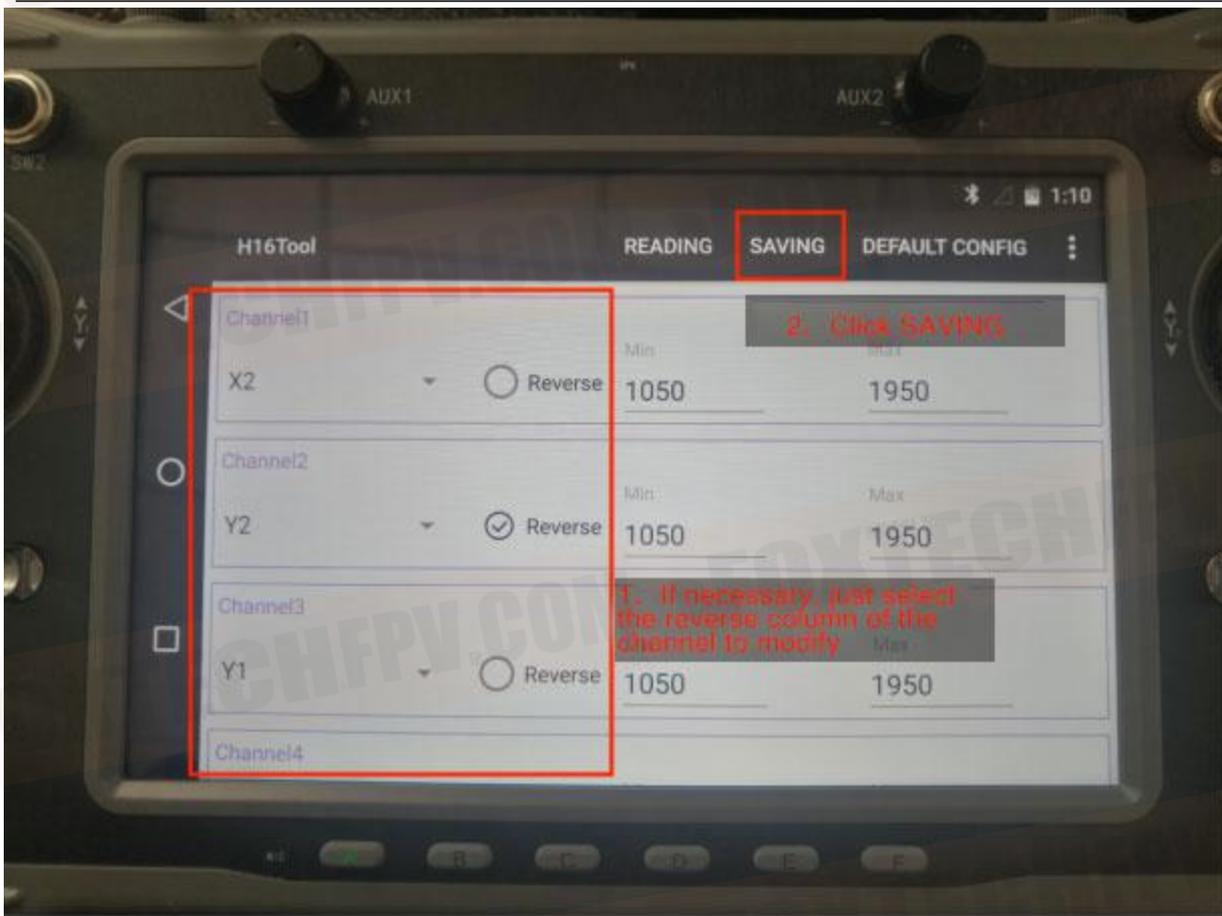


7. Channel Reverse

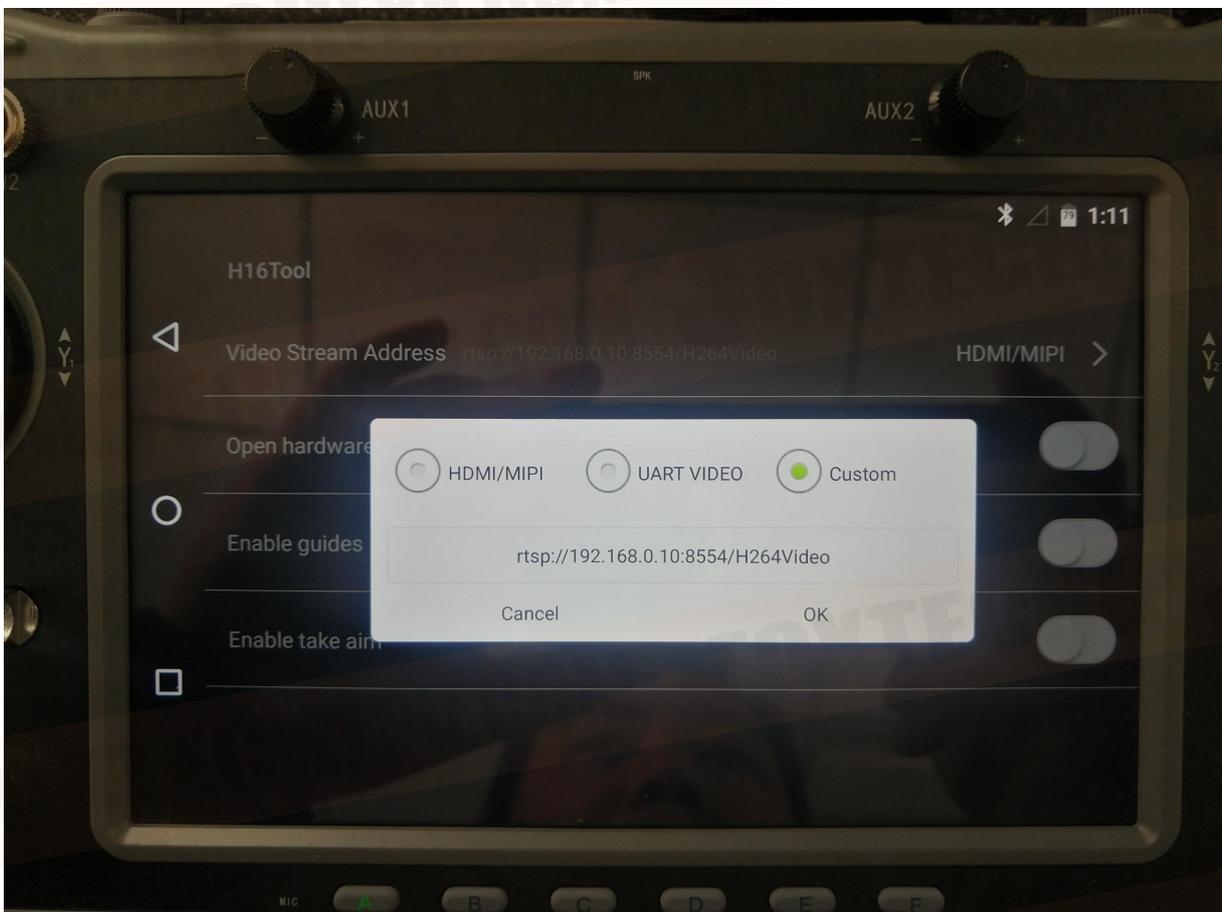
If the channel is found to be reversed during use, you can change it according to the following steps:







8. Image Connection and Setting



- ①The factory default mode is HDMI/MIPI, used to display image transmitted via receiver MIPI/HDMI
- ②UART VIDEO Mode to display single-axis gimbal camera and MINI camera images(only applicable to 680 device)
- ③Custom mode, display the image transmitted through the air unit Ethernet port.

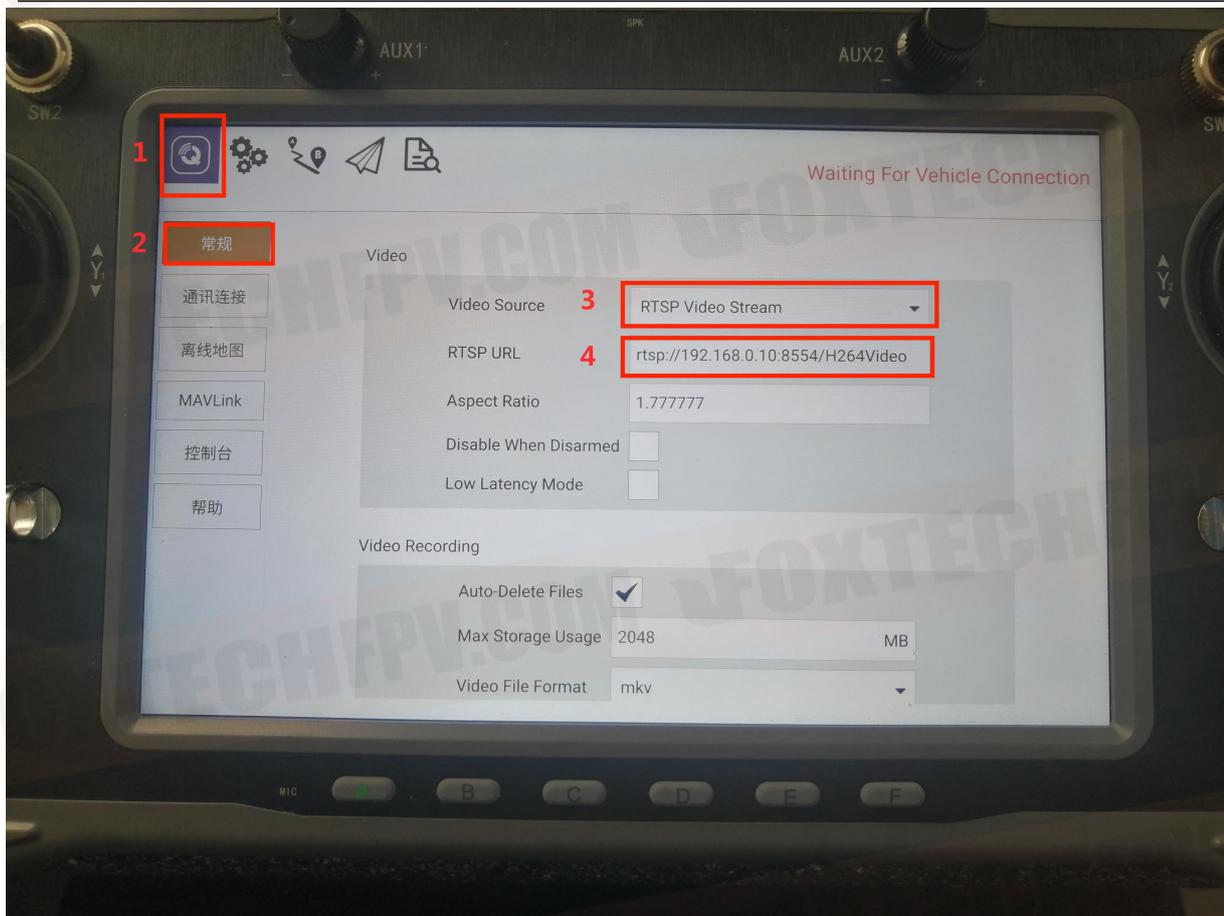
9. Joystick Calibration



Click the rudder quantity checking in MX16 tool, and calibrate according to reference value.

- ①When the screen of the remote controller is completely turned off, center the knob. Long press the C and D button in the six-segment switch, then wake up the screen and slide the screen upward.
- ②Release C and D button, and long press D. Start the calibration when the remote controller makes a sound.
- ③Press D button to exit the calibration mode after reaching the max and minimum values of the left, right, small joystick and knob of the remote controller.

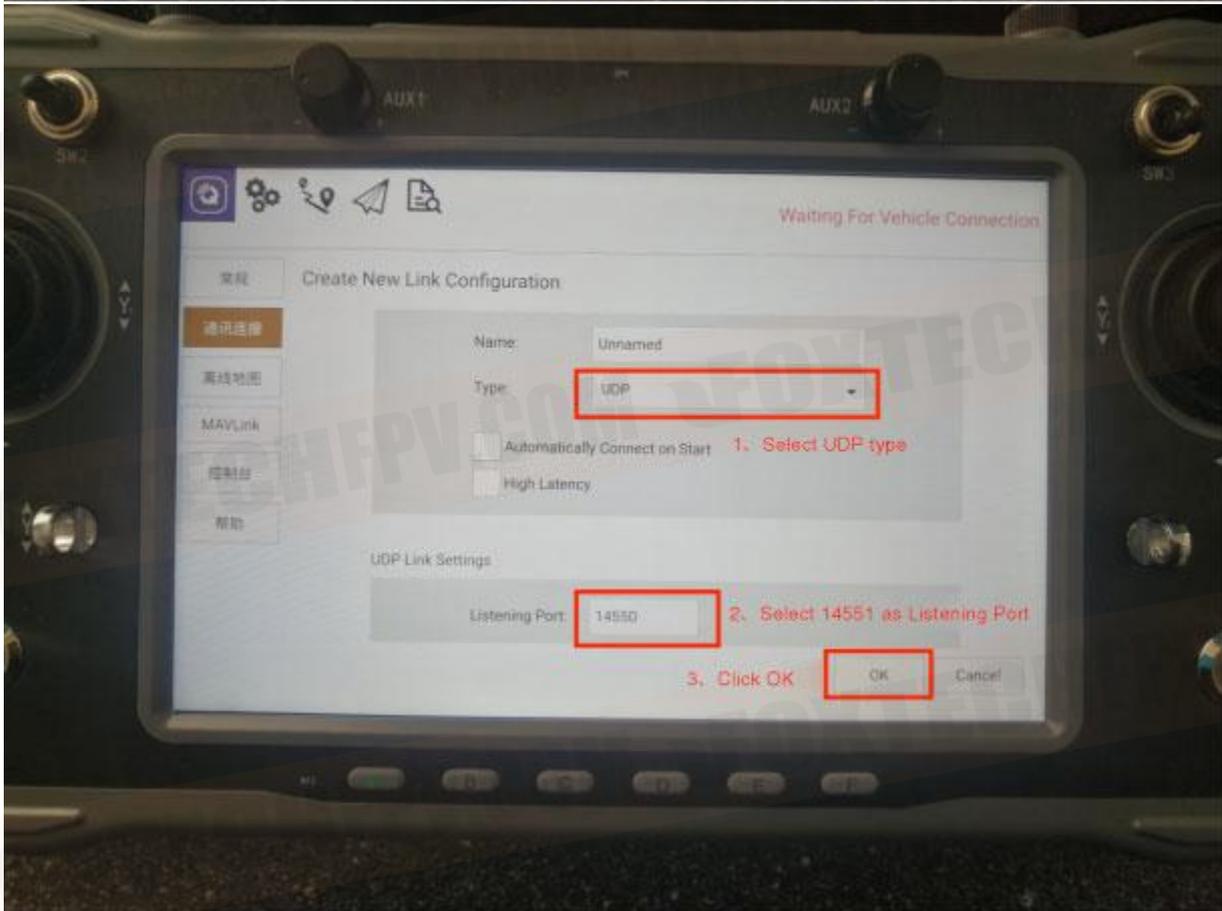
10. Video Transmission Information Displayed on Ground Station



- ①Click System Setting icon in QGC
- ②Click 'General'
- ③Change the video source to RTSP Video Stream
- ④Input the video RTSP address in RTSP URL

To display MIPI and HDMI image, input [rtsp://192.168.0.10:8554/H264Vide](rtsp://192.168.0.10:8554/H264Video) in RTSP URL

11. Connect FC and Datalink in QGC



12. Share Network, Video and Data information

- Share the Internet

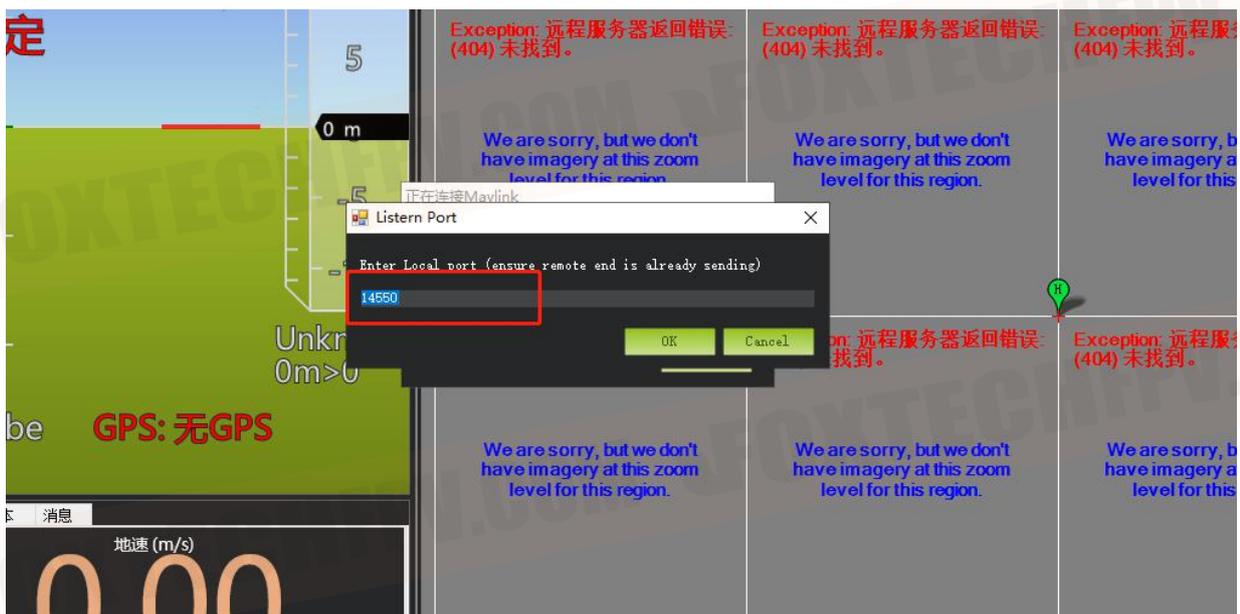
When the remote controller is connected to the Internet via the USB wireless card, the hot spot of the remote controller can be turned on for network sharing.

- Share the Datalink

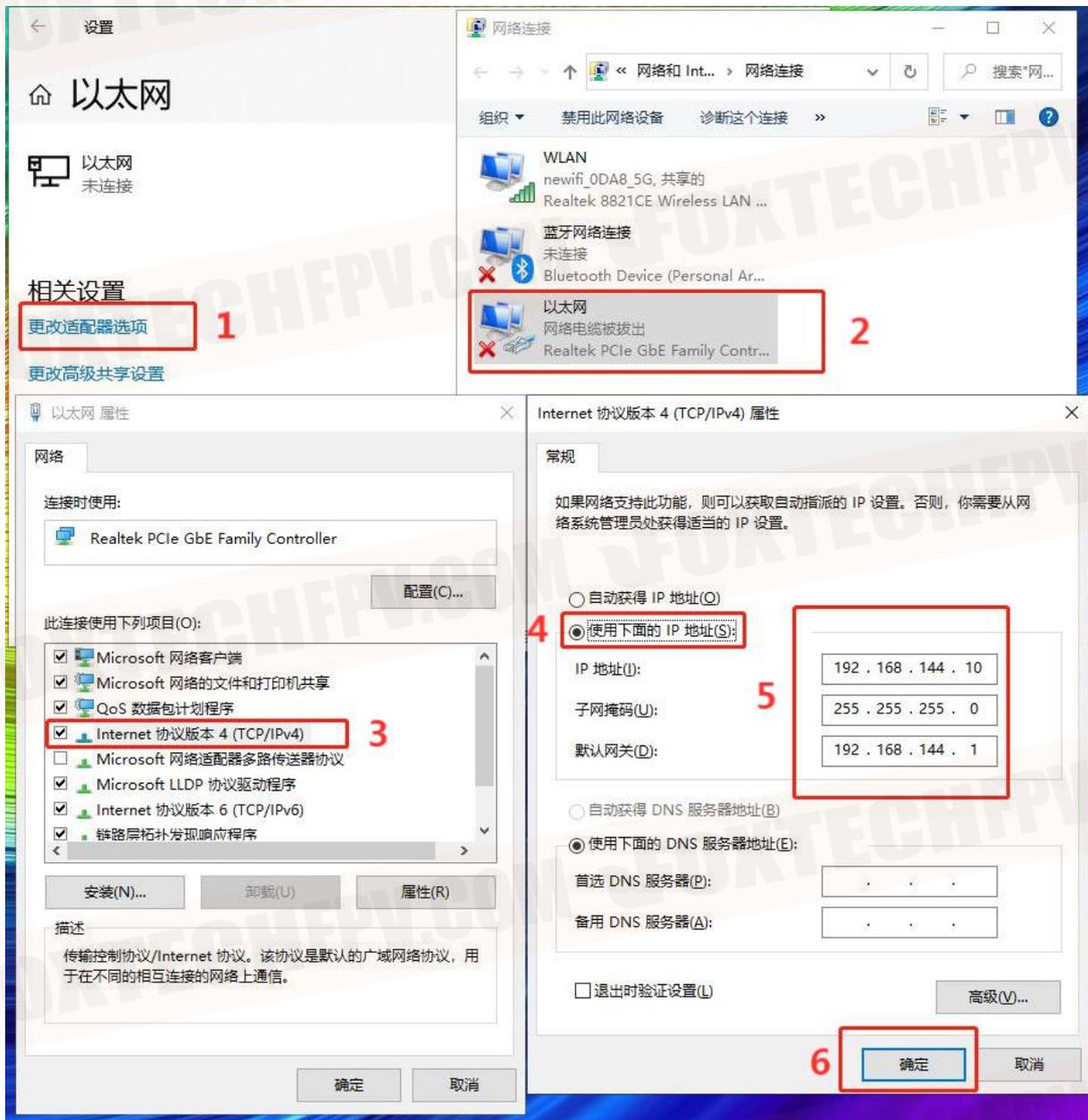
- (1) Open the hot spot of the remote controller.
- (2) Connect the computer to the remote controller's hot spot.
- (3) Open Mission Planner, choose the TCP connection method.



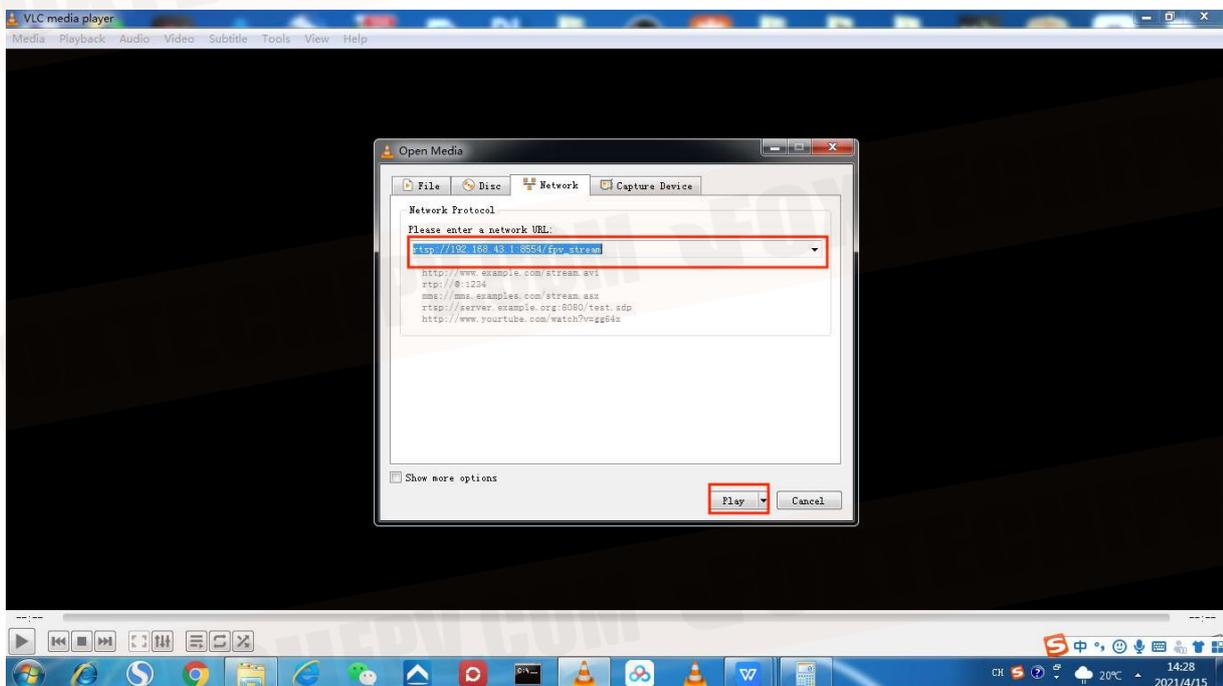
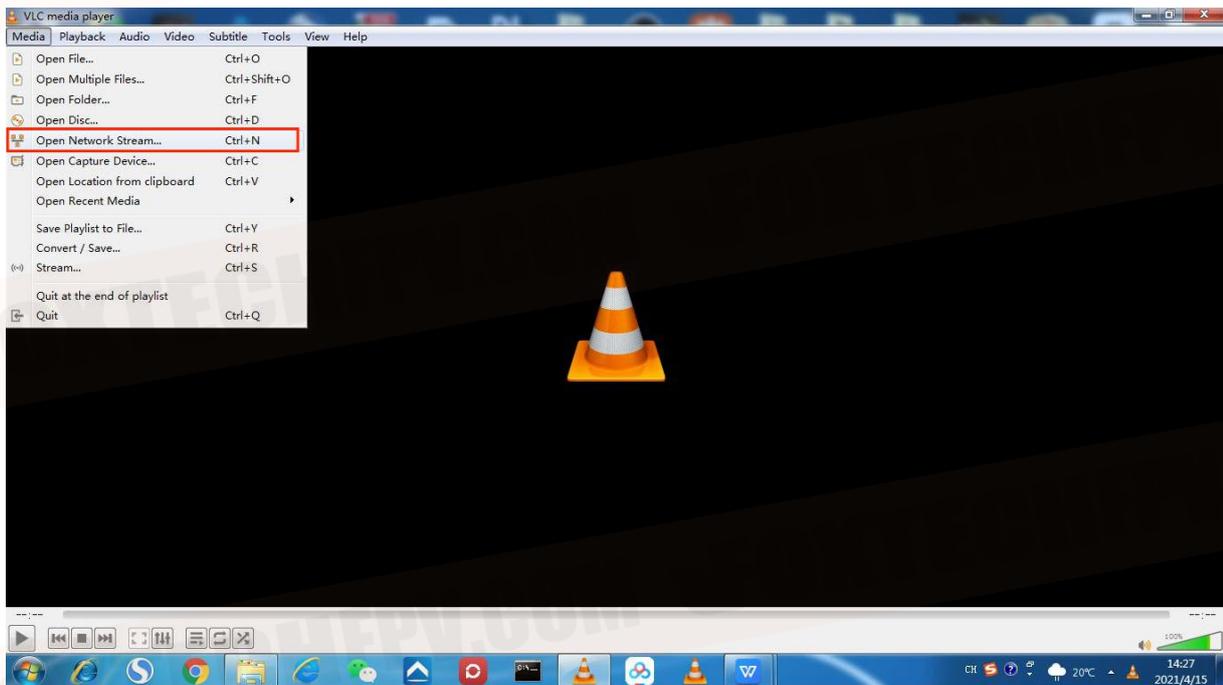
- (4) After clicking connect, select 14550 for the port number, then click OK.



- Share the Video link
 - (1) Open the hot spot of the remote controller.
 - (2) Connect the computer to the remote controller's hot spot.
 - (3) Open the computer's settings, click on the adapter, select Ethernet, select the IPV4 protocol, select a custom IP address, enter as shown in the figure, then click on "confirm".



- (4) Download VCL software  to display the video.
- (5) Open the VLC software, and select Network Streaming in the media.
- (6) In the input field of the network URL, enter `rtsp://192.168.43.1:8554/fpv_stream` and click play



三. Mission Planner Operation Guide

1. Download Mission Planner

Before installing firmware for The Cube, please download stable version of Mission Planner from ArduPilot website. Mission Planner currently supports Windows, just download the corresponding version according to your need.

Using Windows 10 as example, download the .msi installation file and run it as administrator.

During the installation process, device drivers will be installed together. Click "yes" if any

dialog box pop up.

Software download URL.: <http://firmware.ardupilot.org/Tools/MissionPlanner/>

2. Connect Mission Planner to The Cube

Connecting The Cube usually has two connection methods: wireless data transmission and USB. Mission Planner also supports Bluetooth and IP address connections. No matter what kind of connection you use, your data transmission driver or serial port driver must be installed correctly to ensure the normal operation of the data link, then the Cube can be connected to the ground station.

- Using USB Cable: insert the USB into the USB port on the left side of The Cube, and try not to use a USB hub when connecting to the computer. Select the corresponding COM port from the drop-down list at the top-right corner in Mission Planner. Then select the baud rate as 115200.



- Data Transmission Connection Method: usually use USB to connect the data link of the ground station you need to select the corresponding COM port, and set the baud rate on the right side to 57600. For WIFI or Bluetooth to connect the data link of the ground station, select the corresponding device from the device list and input the IP address in the device list. For specific parameters, please refer to your data link instructions first.

3. Loading Firmware to The Cube

Before installing the firmware, select the corresponding device and baud rate (the same configuration as when connecting the device). Don't hit Connect just yet.

On the Mission Planner's "Initial Setup > Install Firmware" screen select the appropriate icon that matches your frame (i.e. Quad, Hexa). Follow the instruction and messages to install firmware.

Go to "Initial Setup > Install Firmware" and select your aircraft type



赫星（厦门）电子有限公司

Hex Technology Limited

hex.aero



After connecting, follow the instruction and messages to install firmware. When it shows "Download Completed", unplug and replug the USB cable.

Firmware installation is successful if a music tone is played. If a music tone with 3 tones is played sequentially, unplug and replug the USB cable while pressing the safety button. After restarting, Firmware installation is successful if a music tone with 2 tones is played.

4. Basic Hardware Calibration and Parameter Setting

4.1 Frame Type Configuration

Open the Mission Planner ground station, and connect to the flight controller, Connect to Mission Planner. On the "Initial Setup > Mandatory Hardware > Frame Type" screen select the corresponding frame type such as Plus frame or X frame.



4.2 Accelerometer and Compass Calibration

Go to "Initial Setup > Mandatory Hardware > Accel Calibration". Click Calibrate Accel to start the calibration. Pointing the nose of aircraft to LEVEL, LEFT, RIGHT, NOSEDOWN, NOSEUP, and BACK according to the message below. "Calibration successful" will be shown after calibration completed successfully.

4.2.1 Accelerometer Calibration

Place the aircraft LEVEL and press any button to continue.

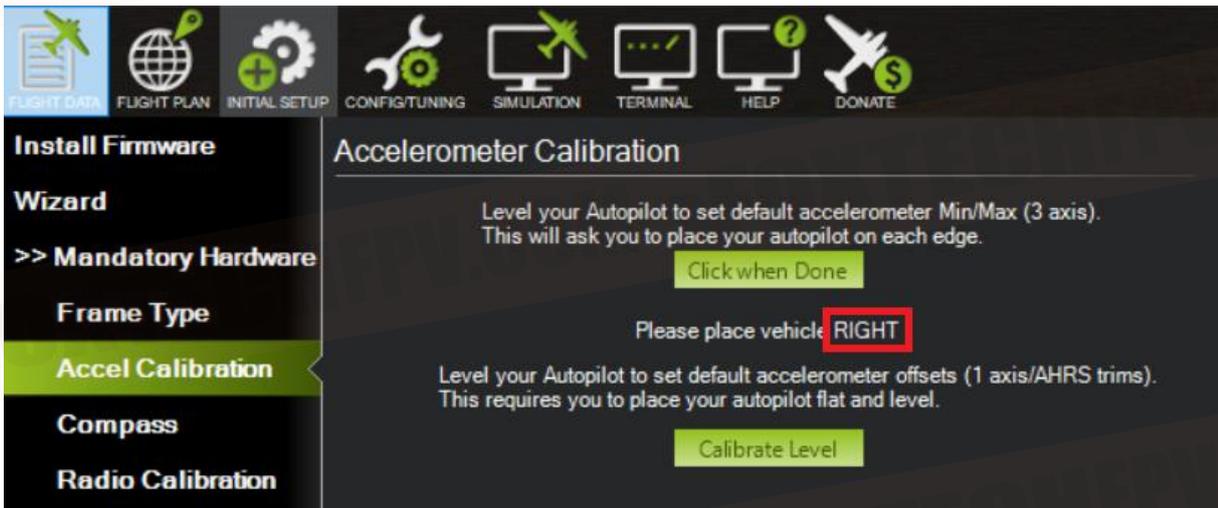




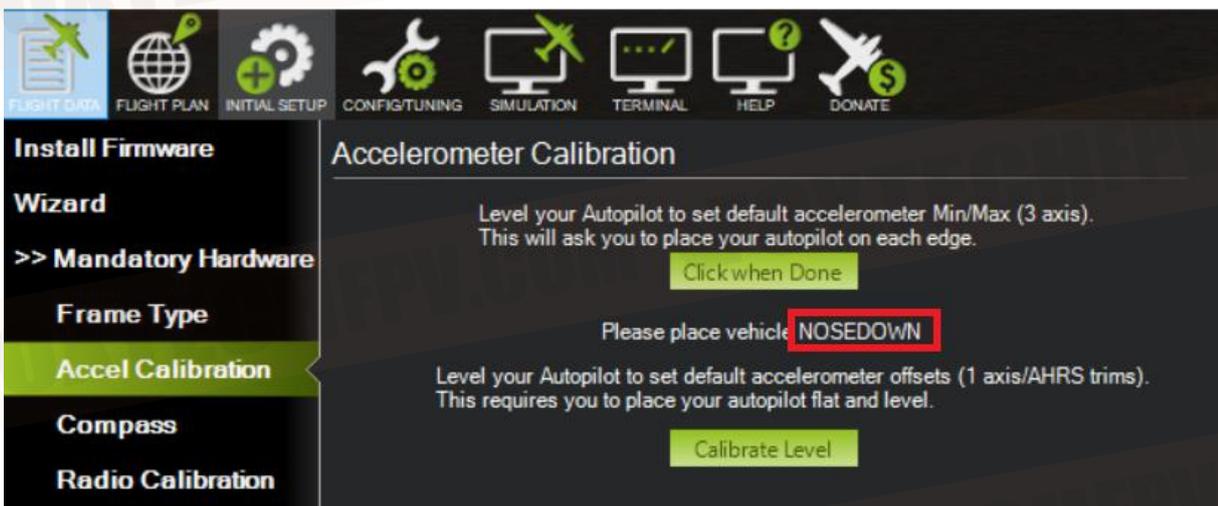
Place the aircraft nose to front and left-hand-side to the ground then press any button to continue.



Place the aircraft nose to front and right-hand-side to the ground then press any button to continue.



Place the aircraft nose to the ground then press any button to continue.

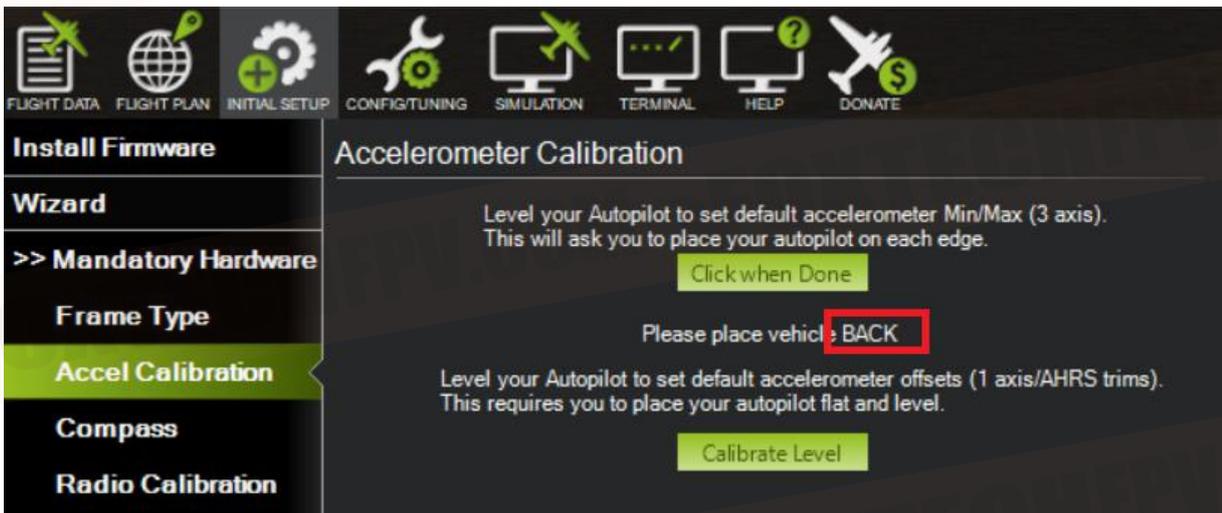




Place the aircraft nose to upward then press any button to continue.



Place the aircraft upside-down then press any button to continue.



"Calibration successful" will be shown after calibration completed successfully.



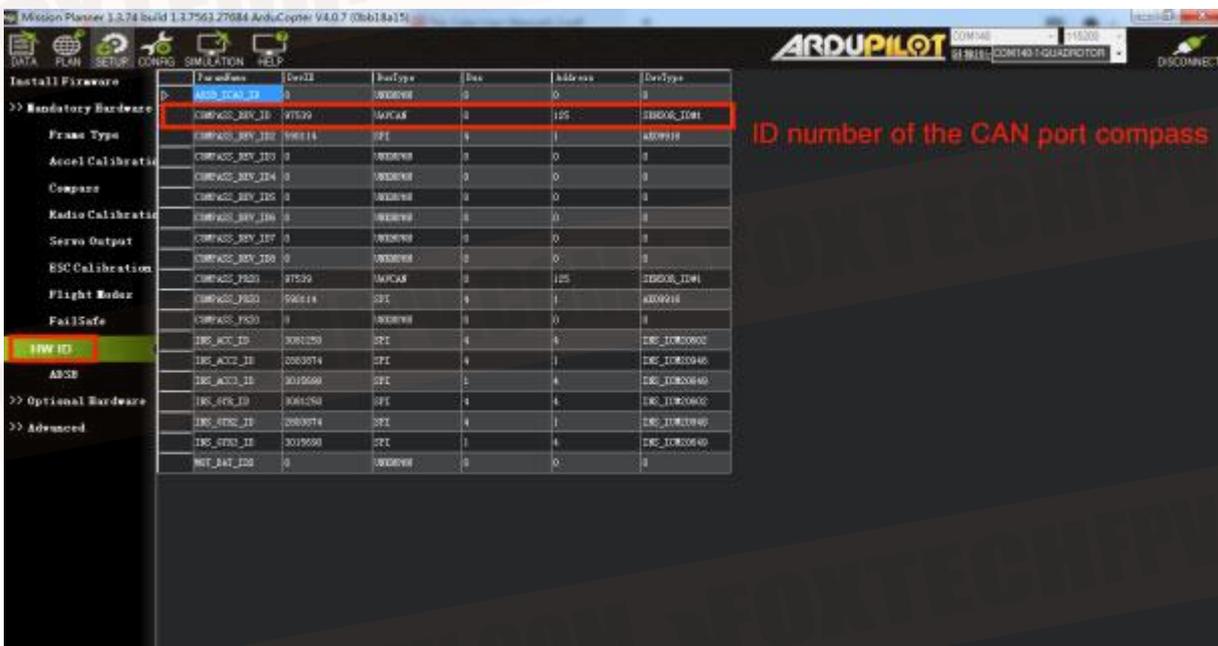
4.2.2 Level Calibration

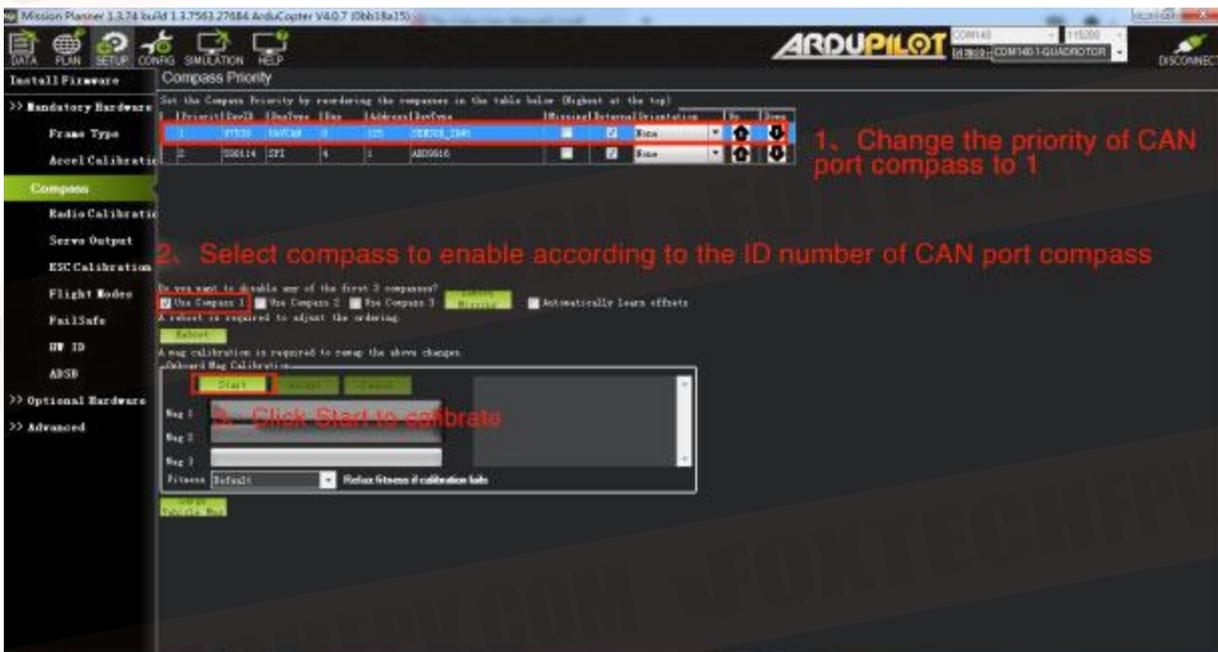
Place the aircraft horizontally and click "Calibrate Level". The text in button will become "Completed" after calibration successful.



4.2.3 Compass Calibration

Go to "Initial Setup > Mandatory Hardware > HWID", check the ID number of the CAN port compass, and then select the compass. Select to enable the Use compass ID number according to the ID number of the CAN port compass, and adjust the use priority of the CAN port compass to the best. Click to start calibration. Please rotate the flight controller within 60 seconds. Each axis should rotate at least once: pitch 360 degrees once, roll 360 degrees once, horizontally and in situ rotation 360 degrees once, and each face rotates 360 degrees at least once.

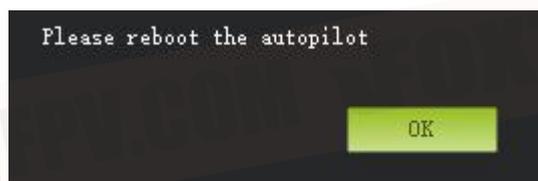




If calibration is successful, the window below will show "success". "success" will also be shown on compass.



Upon successful completion, a “Please reboot the autopilot” window will appear. Click OK, unplug and replug the USB.



If, after multiple attempts, you are unable to calibrate the compass, Press the “Cancel” button and change the “Fitness” drop-down to a more relaxed setting and try again. Normally, select Default.



4.2.4 Remote Controller Calibration

Connect the RC receiver to The Cube via RCIN and turn on your RC transmitter. Then click the remote control calibration button in the lower right corner of the window, and toggle the remote control switch to move the red prompt bar of each channel to the upper and lower limit positions. After the red line calibration of all channels is completed, click the Finish button. If the indicator bar above does not change when you move the joystick, please check whether the receiver is connected correctly, and also check whether each channel corresponds to it at the same time.



4.2.5 ESC Calibration

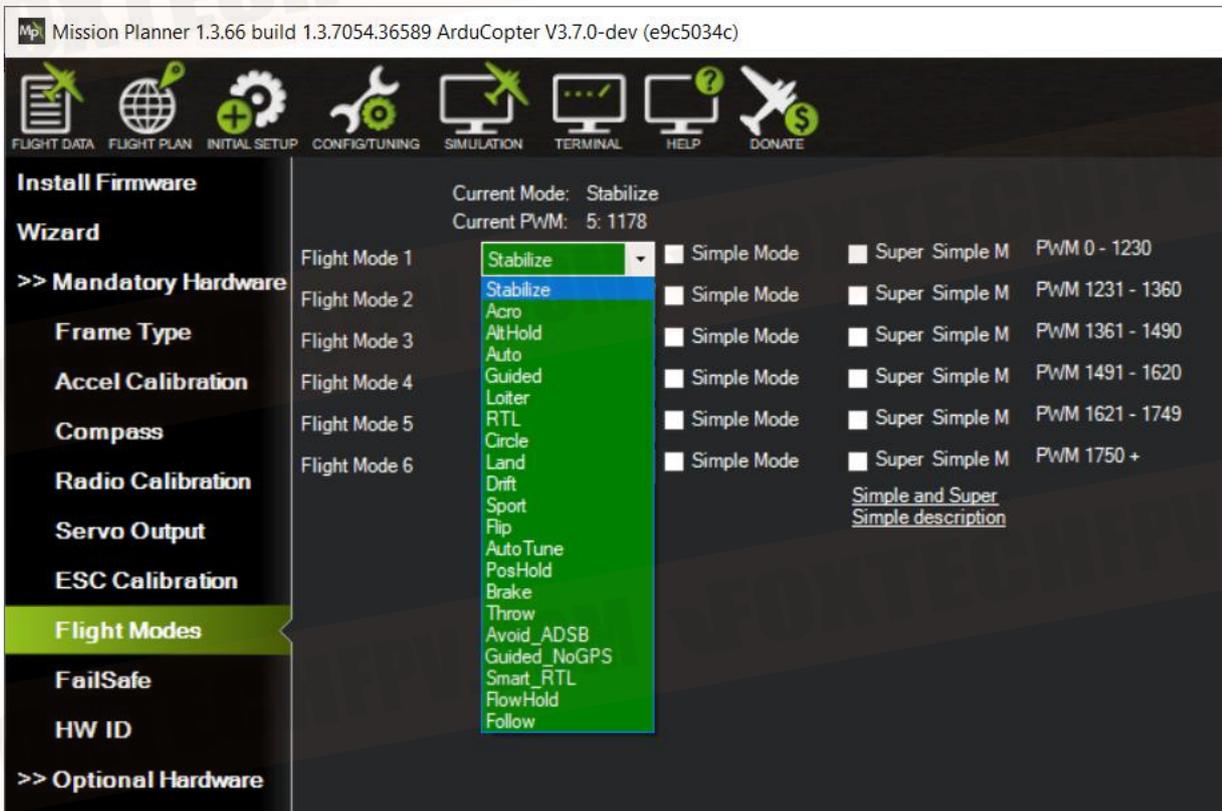
Safety Checking: Before calibrating the ESC, please make sure that there is no propeller mounted on the aircraft.

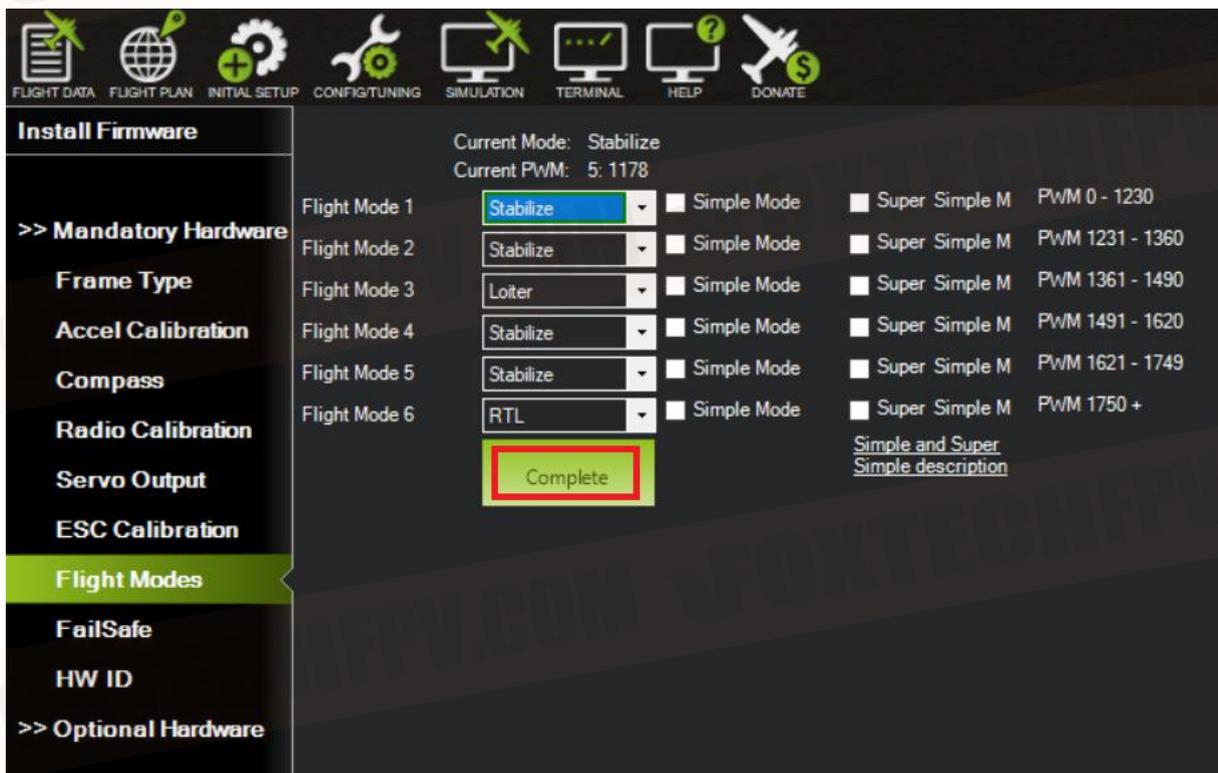
Connect NAGA Pro to MP ground control station via data link. Select the "Configuration > Full Parameter List > Search for the "esc" keyword, change the ESC-CALIBRATION parameter value to 3, then power off the aircraft. Wait for the flight controller to automatically complete the ESC calibration procedure. After the calibration is completed, power off the aircraft and restart it.



4.2.6 Select Flight Modes

Set the 5 channel or the other channel on the remote controller (which can be set by all parameters FLTMODE-CH) to the appropriate position. Mission Planner will display the current position in green, select a mode for each switch and click the save mode button. The remote controller can set up to 6 flight modes, and you can set up 6 single-channel mixing according to your own remote controller instructions.





Four commonly used flight modes:

- ALT HOLD

After the first test flight, you can try the altitude hold mode. This mode does not require GPS support. The autopilot will maintain the current altitude based on the data from the air pressure sensor. If the point is not fixed during altitude hold process, the aircraft will still drift. The aircraft can be remotely controlled to move or maintain the position. When setting the altitude, the autopilot controls the throttle to maintain the altitude. But you can still use the remote controller to control throttle to adjust the height, not for landing because the throttle will not drop to zero.

When switching between stabilized mode and altitude hold mode, keep the throttle of the remote control transmitter at the same position to avoid sudden rise or fall of the aircraft due to mode switching and changes in throttle control mode.

- Loiter Mode

The loiter mode is the GPS fixed-point mode. You should let GPS fix the point before taking off to avoid sudden positioning problems in the air. Other aspects are basically the same as the altitude hold mode.

- Auto Mode

In this mode, the aircraft will automatically perform tasks set by the Mission Planner on the ground station, such as taking off and flying to multiple waypoints in sequence, rotating, and taking pictures.

- RTL

GPS positioning is required for the return home mode. The GPS positioning point before ARM is the current "home" position; if GPS is not positioned before takeoff, the first positioning point in the air will become "home". After entering the return home mode, the aircraft will rise to 15 meters, or if it is already higher than 15 meters, it will maintain the current altitude and then fly back to "home".

You can also set advanced parameters to choose whether to land autonomously after returning "home", and how many seconds after hovering to land automatically.

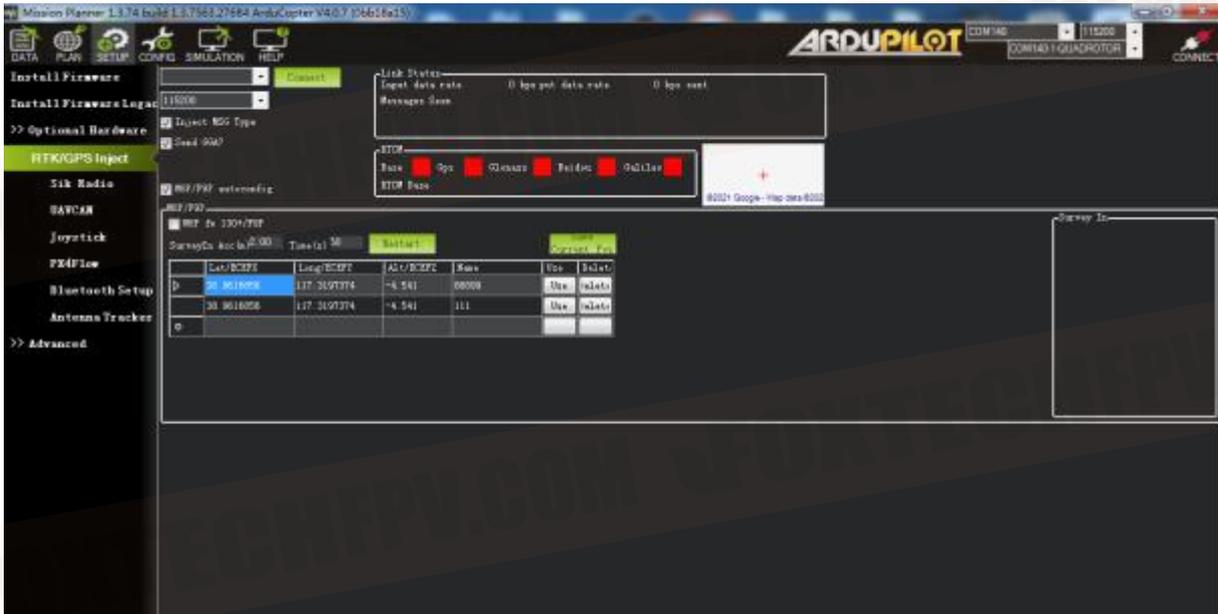


四. Mission Planner RTK Setting

1. Basic Setting

First, set up the base station. During the base station setup process, the mobile station and UAV flight controller do not need to be turned on.

Open the Mission Planner ground station software on your computer and enter the initial setup→Optional Hardware→RTK/GPS Inject, you will see the following page:



Select the correct base station port in the upper left corner and click connect. In the SurveyIn Acc column, enter the absolute geographic accuracy you expect your HERE+ base station to achieve. In the Time field, enter the shortest search time you expect. Click Restart, the ground station will transmit the data you input to the HERE+ base station, and the base station will start a new round of satellite search and positioning. You will see the following page:



During the satellite search process, the box on the right side of the Mission Planner page will display the current position of the satellite searching:

- Position is invalid: the base station has not yet achieved effective positioning;
- In Progress: satellite searching is still in progress;
- Duration: the number of seconds that the current search task has been operated;
- Observation: the number of observations obtained;
- Current Acc: the absolute geographic accuracy that the current base station can achieve;

The green vertical bar under Mission Planner shows the satellites and the signal strength of the satellites searched by the current base station.

It takes a certain time for the base station to search for satellites to meet the accuracy requirements you input. After testing, in an open and unobstructed area, it takes several minutes to reach an absolute accuracy of 2m. An absolute accuracy within 30cm takes about an hour. And an accuracy within 10cm takes several hours.

It should be noted that the absolute geographic accuracy of the base station here will affect the absolute geographic accuracy of the mobile station, but will not affect the relative accuracy of the base station and the mobile station. If your application does not require drones to have high absolute geographic accuracy, you do not need to set the accuracy of the base station too high, resulting in a longer search time.

Even if the accuracy of the base station is 1.5~2m, the position accuracy of the mobile station relative to the base station can still reach the centimeter level. After HERE+ base station search is completed, Mission Planner will display the following page:



In the figure, the indicator light showing the status of the base station is shown in green, and the two satellite systems, GPS and Glonass, are shown in green (if you want to change the satellite system, please refer to the instructions in the following chapters). The box on the right is displayed as Position is valid.

Store the current position in Mission Planner: Click Save Current Pos, Enter a name in the dialog box and click OK. As shown in the figure below, you can see your storage location in the list. Click the Use button corresponding to the location you saved, the base station will enter the fixed-point mode, and the status is displayed as Using FixedLLA in the right box. In the future, when you set up the same location in base station, you don't need to search for satellites again, just click the Use button corresponding to your saved location.



2. How to Use Base Station

Open the Mission Planner ground station software on your computer, enter the initial setup→Optional Hardware→RTK/GPS Inject page, select the correct base station port in the upper left corner, and then click connect. You will see the following page:



Enter the latitude and longitude of the known fixed station and the measured height of the RTK antenna relative to the ground at the position in the figure below, and then click the use button.



Note: The RTK antenna placement position should coincide with the fixed point position as much as possible. The higher the accuracy, the better.

五. First Take-off

1. Self-checking

The autopilot will do some self-checks when it starts. If any problems are found before takeoff, including calibration failure, configuration errors or poor sensor data, it will be blocked from unlocking. These checks will help prevent the aircraft from taking off under abnormal conditions.

The LED will flash blue or green under normal circumstances. If a problem is found during the self-check, the LED will flash yellow.

- If the yellow light flashes, please try to unlock. An error message will be displayed in the HUD window. Follow the error prompt to solve the problem. Detailed error information and solutions please refer to the Ardupilot website:

http://ardupilot.org/copter/docs/prearm_safety_check.html.

- If the blue light or green light flashes, the buzzer will emit a low-pitched sound after unlocking, and the motor will start idling and can take off.

2. Meaning of LED Indicator Light:

- Flashing red and blue: Initializing sensors and auto-check the autopilot. Please lay down the flight controller.
- Flashing blue: Passed self-check and is in unlock state, but GPS positioning has not been obtained.
- Solid blue: Armed with no GPS lock
- Flashing green: Locked state, unlocked state is reached, GPS has acquired location lock.
- Fast Flashing green: High-precision positioning such as RTK mode is found. The flight controller is locked and can be unlocked.
- Solid green: The buzzer emits a long beep: the aircraft has been unlocked and is ready to take off.
- Double flashing yellow: Unlock failed, flight refused (check Pre-Arm error message).
- Single flashing yellow: Remote controller fail-safe protection has been activated.
- Flashing yellow: rapid buzzer sound: battery fail-safe protection activated.
- Flashing yellow and blue- with high-high-high-low tone sequence (dah-dah-dah-doh): GPS glitch or GPS fail-safe activated.
- Flashing red and yellow: EKF or Inertial Nav failure.
- Flashing purple and yellow: Barometer glitch
- Solid Red: Hardware error, usually the SD card cannot be detected (re-inserted or replaced), MTD device or IMU sensor, you can check the SD card and the directory BOOT.txt to see the boot information analysis.
- Solid red with SOS tone sequence: SD card missing or SD card bad format. No light when power on: No firmware, firmware lost, SD card missing or bad format (ac3.4 or higher version)

3. First Flight

3.1 Arm the Drone

Before the drone takes off, it must be unlocked. This will power all motors and actuators.

Before unlocking, please make sure to test in an empty environment to avoid accidents. Check

in detail whether the hardware installation is correct (especially whether the arm is locked in place, the battery compartment cover is tightly locked, whether the landing gear is locked, whether the external load is installed firmly, the direction of the propeller, etc.). After confirming that there is no problem, perform the following steps :

- Turn on your rc transmitter
- Insert the battery into the aircraft. The flight controller status light should flash red and blue alternately (self-check process). Do not move the aircraft during the self-check.
- Pre-Arm will run automatically. After a normal self-check, the blue light or green light will flash, indicating that the Pre-arm has no error and can be unlocked. If the yellow light is flashing, please refer to the FAQ summary to eliminate the error.
- Set the correct mode: Set the mode to Stabilize, ATHold or Loiter (outdoor GPS lock is required). Novices are recommended to use Stabilization or Altitude hold mode.(For this product, press the A button on the bottom of the remote controller to enter Alt hold mode)
- Unlock the safety switch: Press and hold the unlock safety switch until the safety LED is always on (flashing means lock and does not output pwm signal, and always on means unlocking and output pwm signal) (the safety switch of this product is disabled, so the user can omit this step)
- Arm the aircraft: There are two ways to unlock the autopilot, which can be unlocked through the ground control station or the remote controller.
 - ❖ Unlock through the remote controller. lower the RC throttle to the lowest position, and the YAW channel to the far right for 2 seconds to unlock it, and then return the YAW channel to the center.



❖ Unlock through the ground control station. Under the premise that the autopilot has a link to the ground, there is an action tab at the bottom of the HUD window of the ground control station. Click the unlock button inside to unlock.



- ARM Successfully : The propeller will spin up at idle speed to remind that it has been successfully unlocked.

- Take off: raise the throttle to take off, and control the direction according to the attitude. (if the novice is not familiar with the control, you can practice the flight simulator first, so as to avoid the explosion of the aircraft and the loss of personnel and property)

If there is no operation within 15 seconds after unlocking, it will be automatically locked. After unlocking, the ideal attitude is too different from the actual attitude it will be automatically locked.(Such as hitting the roll bar sharply or shaking the aircraft with your hands)

3.2 Disarm the drone

Perform the following operations to disarm the drone:

- Check your flight mode switch, set to Stabilize, Alt Hold or Loiter.
- Keep the throttle at the lowest and the direction YAW to the left.
- Unplug the aircraft battery.
- Turn off the remote control transmitter.

4. Take-off Precautions

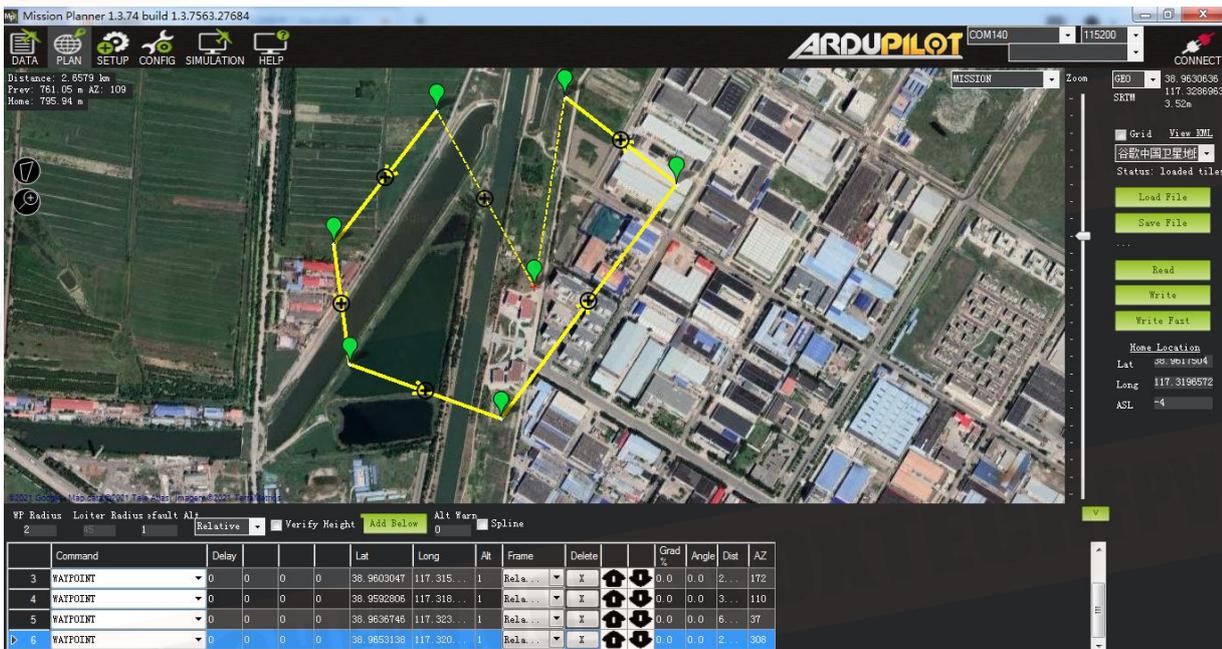
It is best to use the Stabilize mode to take off for the first time. Make sure that the aircraft is flying normally before switching to another mode. The throttle control mode of the stabilize mode is linear, so the range of throttle control needs to be relatively small.

After flying in the stabilize mode for a period of time, if the altitude stays above 1 m, you can switch to other functional modes such as altitude hold, fixed point, etc. The throttle control logic of altitude hold and fixed point modes is different. There is a dead zone in the neutral position of the throttle to maintain altitude. Push up, the plane goes up, push down, the plane goes down.

Note: Before switching to another function mode, you must first understand the characteristics of the flight mode.

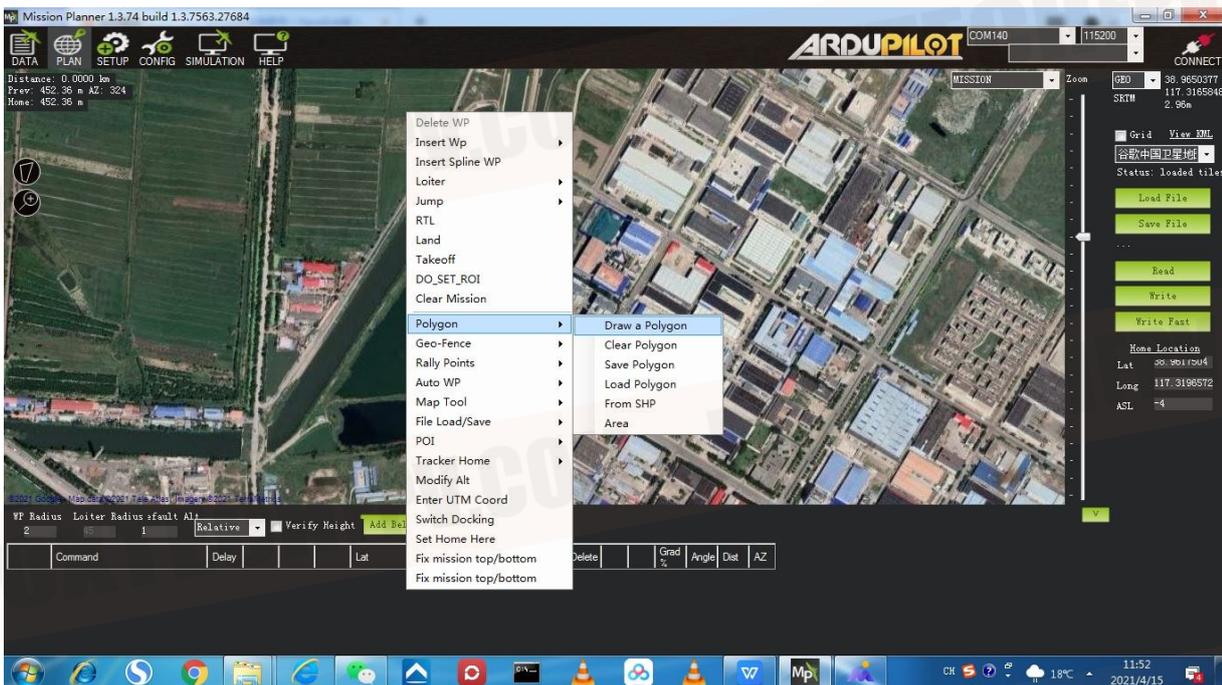
六. Automatic Mission Planning

Flight planning is one of the most important functions in MP: the average player can use it to plan the simplest flight missions, including height control of each waypoint, stay time, camera trigger, various condition triggers, channel triggers, and even automatic take-off and landing planning, etc. Industry users can also do surveying and mapping planning and so on.

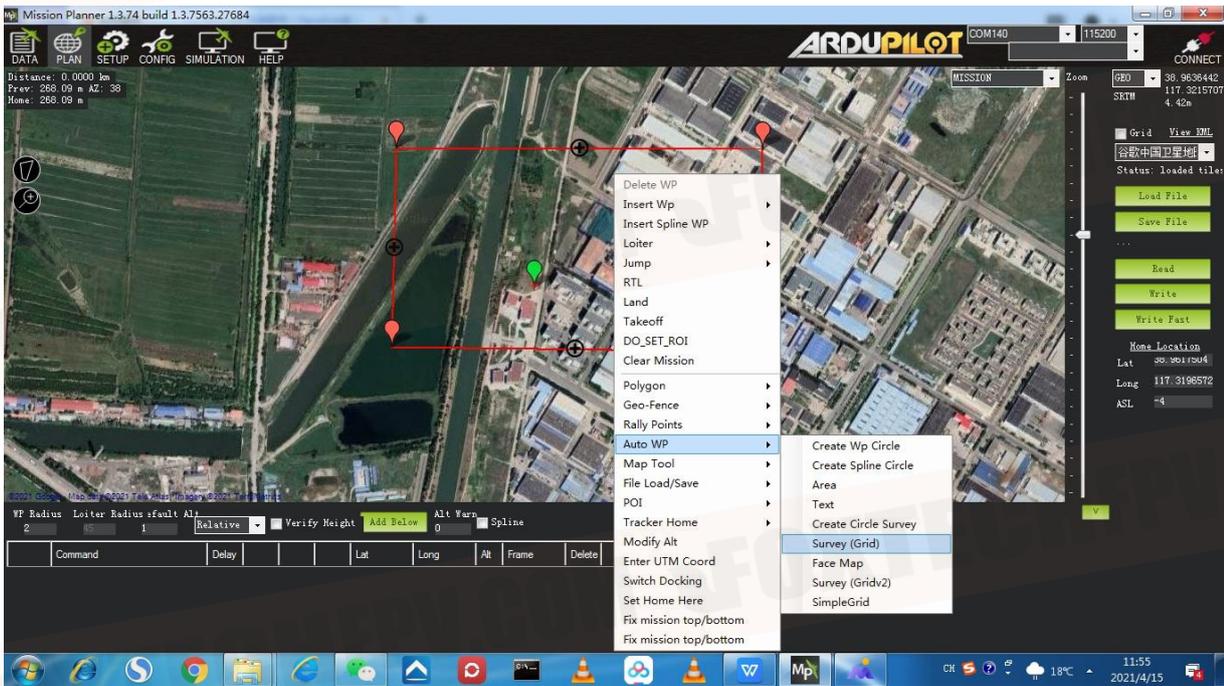


The main explanation here is the mission planning function of the MP ground control station, but the waypoint planning concepts of other ground control stations are actually very similar.

- Create a multi-waypoint area in the MP mission planning interface



- In the area, click the right mouse button to open the menu and select Automatic Waypoint→Survey(Grid)



- The mission planner will display the configuration interface. This interface defines the camera parameters and automatically calculates the shooting distance DO_SET_CAM_TRIGG_DIST command parameters, you can also set the parameters according to the actual situation.

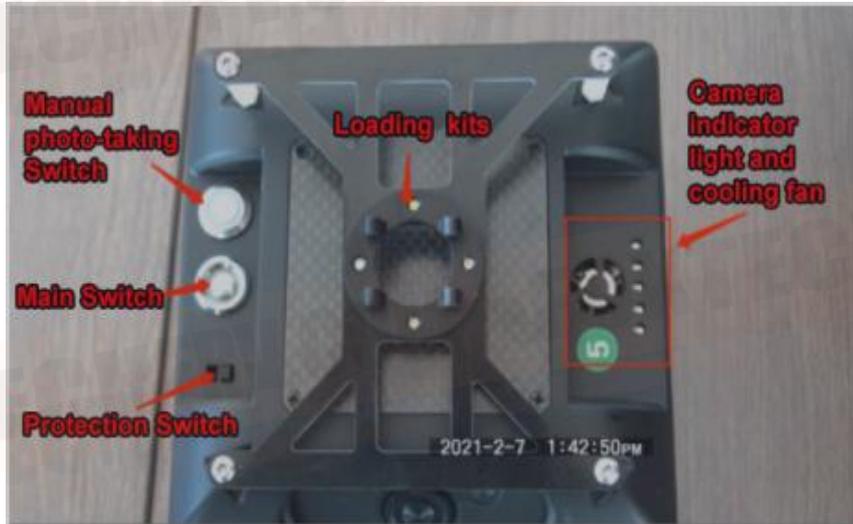


If you accept these parameters, please click accept. The mission planner will generate a series of waypoints covering the designated area, including the take-off point and the landing point. Call DO_SET_CAM_TRIGG_DIST command to set the distance of the camera shutter

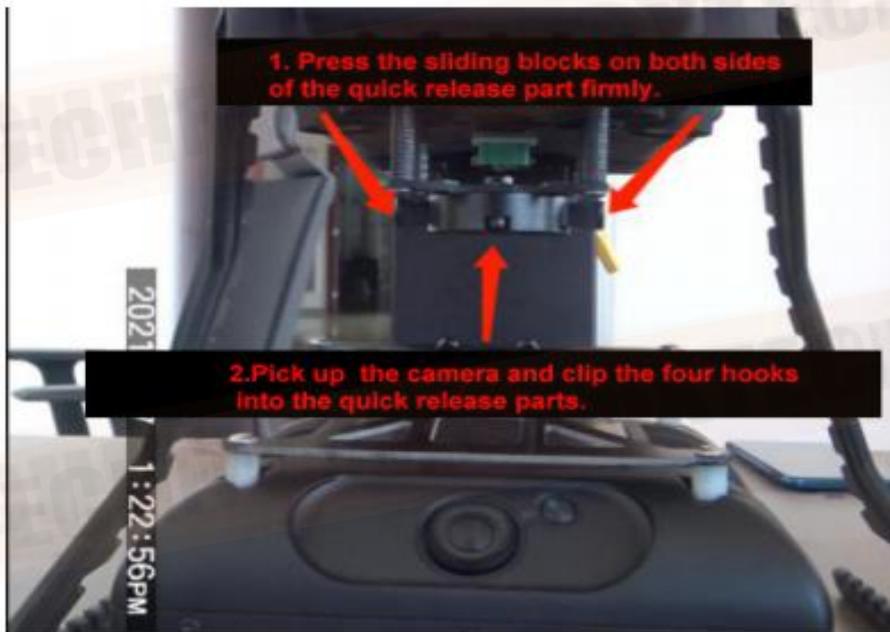
command, and finally call DO_SET_CAM_TRIGG_DIST again to set the parameter back to 0 and stop taking pictures; Note that the parameters of two call are different.

七. How to Use Oblique Camera

1. Camera Function Buttons

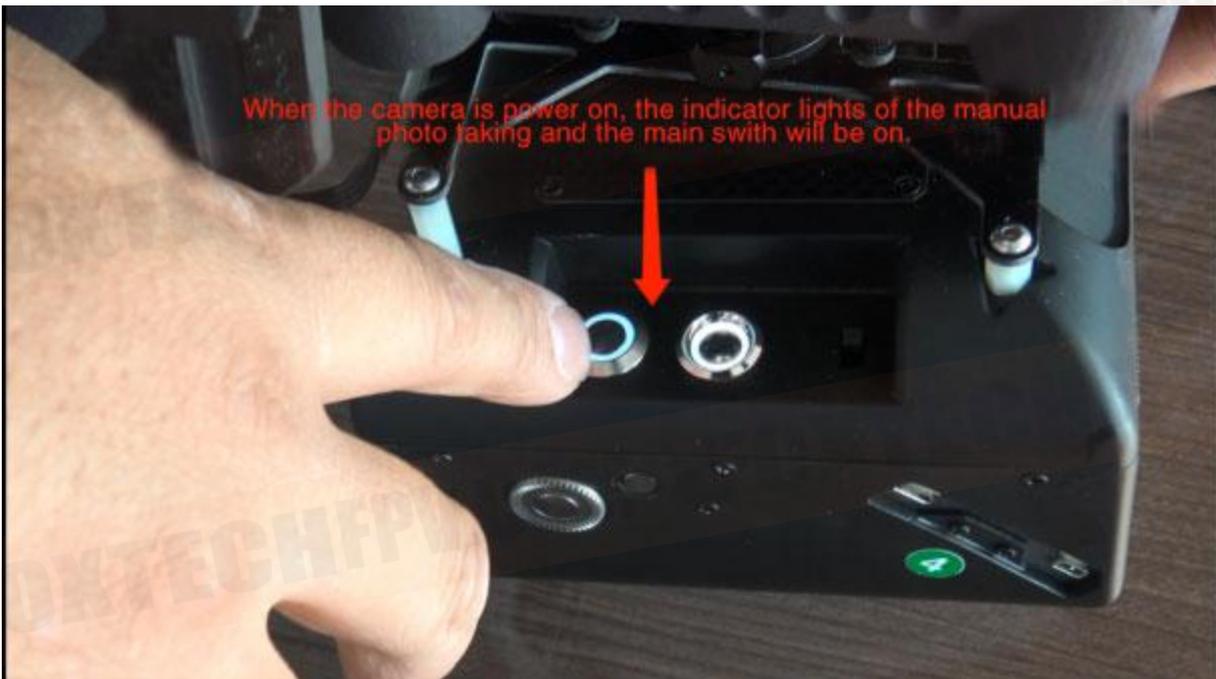


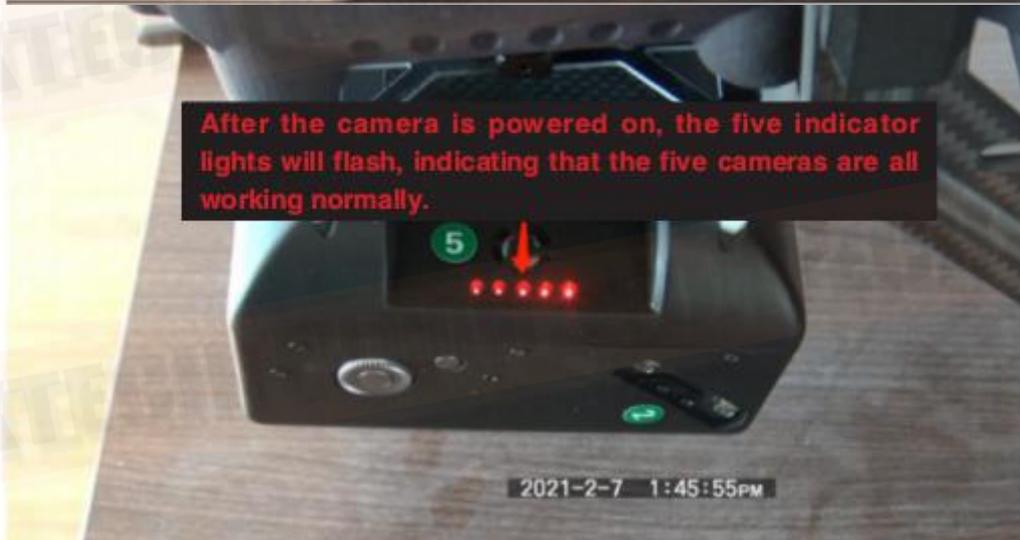
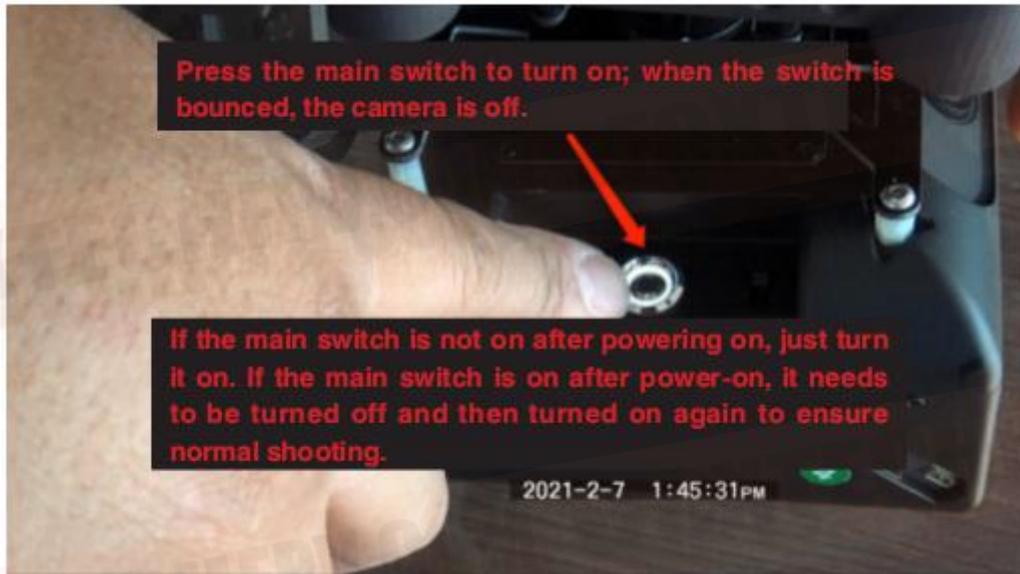
2. Camera and Aircraft Connection

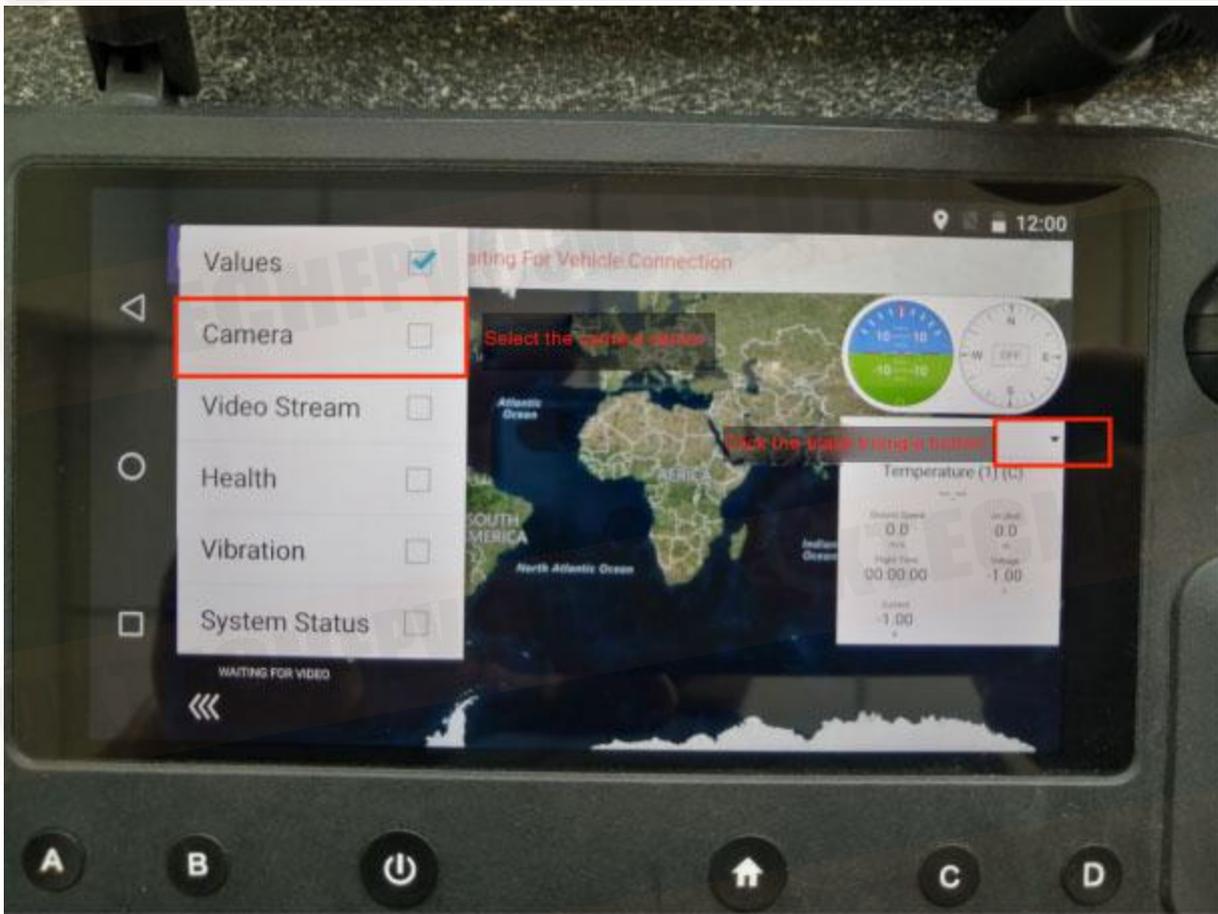




3. Photo Taking Test







八. FAQ

1. Bad AHRS

The cause of the problem: the acceleration and level are not calibrated, or the calibration is wrong. Added GPS, but the GPS is not fixed, or the GPS arrow is not consistent with the flight controller.

Solution: Correctly calibrate the acceleration, power off the flight controller after calibration, reconnect, and calibrate the level, this step is very important. Assemble the GPS correctly, make sure the GPS is fixed, and the arrow of the GPS and the arrow of the flight controller should be the same. If the flight controller and GPS are integrated, that is to say, when moving, GPS and flight controller are together, and you cannot move one of them. Correctly calibrate the compass. If GPS is added, pay attention to calibrate the dual compass correctly.

2. Compass variance

The cause of the problem: If the firmware is updated to version 3.3.3 or above and GPS is added, the above problems will be encountered during debugging. Compass variance means: compass movement deviation. It means that the direction of the built-in compass of the flight controller and the GPS external compass are deviated and inconsistent.

Solution: The GPS arrow is the same as the flight controller arrow. Fix it. Do not move the GPS or flight controller alone. The flight controller and GPS must be regarded as one. Do not move one of them alone. Re-calibrate the magnetic compass.

3. Bad Accel Health solution

The cause of the problem: the design of the IMU2 power supply of the flight controller is defective, and the low temperature failure occurs in the environment below 5°C. Too low temperature will cause IMU2 to report an error and cause unhealthy acceleration.

Solution: The solution is to disable IMU2, which is to set "INS_USE2" to 0 in "Configuration debugging/All parameter list". If you open the "Configuration debugging/all parameter list", there is no such parameter, please find the "INS_SPIC" parameter, and change it to 5. If the acceleration error is still reported after this method is operated, please re-calibrate the magnetic compass.

4. Check board voltage solution

The cause of the problem: If you update the firmware of multirotor or fixed-wing version 3.5 or higher, and plug USB into the computer for debugging, you may encounter this error. It is caused by insufficient USB power supply.

Solution: power by battery (Of course, the battery can not directly supply power to the flight controller, use an ESC or BEC or ammeter to stabilize it to 5V to supply power to the flight controller). In the debugging stage, if you must use USB, you can first ignore the function of voltage detection (found ARM_CHECK in

configuration debugging\standard parameters, don't check the board voltage, and others can be checked or unchecked. Remove the check, then remember to click the "Write Parameters" button above, then power off the flight controller and reconnect it).

5. Compasses inconsistent solution

The cause of the problem: Compasses inconsistent means that the compass is out of sync. When we use the dual compass, if the GPS arrow and the flight controller arrow are not consistent, this error will be reported.

Solution: When using dual compass: fix the GPS, the GPS arrow and the flight controller arrow are consistent. The simplest solution is to only use an external compass (that is, GPS compass)

6. NO RC receiver

The cause of the problem: The signal input of the receiver is abnormal.

Solution: If you are using the PPM encoder board, check whether the blue status light of the PPM encoder is still flashing (you can judge whether the PPM encoder is still working). If using SBUS and PPM receivers, check whether the receiver settings are correct.

7. RC not calibrated

The cause of the problem: the remote controller has not been calibrated, or the range is not within the recorded value of the flight controller. it is usually caused by setting the remote controller or changing the remote control.

Solution: Re-calibrate the remote controller.

8. Compass not healthy

The cause of the problem: The electronic compass is unhealthy. It may also be that there is no value or the hardware is damaged. It may also be that the ambient temperature is lower than 0, which may cause the compass sensor to have no value.

Solution: Power on again. If the temperature is too low, please take heat preservation measures. Power on again, and check whether the compass values of MX1 MY1 MZ1 \MX2 MY2 MZ2 are correct at the ground station-Status.

9. Compass not calibrated

The cause of the problem: the compass is not calibrated, or the compass is removed and added, it will prompt that the compass is not calibrated.

Solution: After installing the compass, do the calibration again.

10. Compass offsets too high

The cause of the problem: The offset value of the main compass (i.e. $\sqrt{x^2+y^2+z^2}$) is greater than 500, and this will be prompted. Generally, there are magnetic objects (motors, screws, battery) near the flight controller or GPS, or the environment has strong magnetic interference.

Solution: Please remove the interference and power on again, install the flight controller or GPS in another location, and re-calibrate.

11. Check mag field

The cause of the problem: If you are indoors, or change to a different environment, or there is magnetic interference nearby, this error may be prompted.

Solution: If you change the environment, just do the calibration again. If you are indoors or there is an interference source, just leave the interference source.

12. GPS Glitch/ Need 3D Fix

The cause of the problem: If the GPS is not positioned successfully or there is no GPS. And the flight mode that requires GPS is used or the electronic fence is activated, these two error messages will be prompted.

Solution: If GPS is not installed or flying indoors, please switch to the flight mode that does not require GPS and wait for GPS to be positioned by 3D FIX.

13. Bad velocity

Cause of the problem: The problem may be that the moving speed is too fast, or the accelerometer is not properly calibrated, or the GPS refresh rate is lower than 5HZ.

Solution: Wait for the GPS satellites to lock more. HDOP is less than 1.5.

14. High GPS HDOP

The cause of the problem: The satellite positioning accuracy HDOP is too high, which is generally caused by insufficient satellites.

Solution: Put it in an outdoor unobstructed environment. Wait for more satellites to lock on before flying.

15. INS not calibrated

The cause of the problem: the accelerometer is not calibrated, or the calibration is incorrect.

Solution: Re-calibrate the accelerometer.

16. Accels not healthy

Cause of the problem: This may be a hardware problem, or it may be that flight controller is started immediately after flashing the firmware.

Solution: Re-power on the flight controller and reconnect it.

17. Gyros not healthy

The cause of the problem: the data of the gyroscope fluctuates badly, the value is out of range, and there is no data. This may also be a hardware problem, or it is not static when it is powered on, resulting in an error.

Solution: lay it flat and turn on the power again.

18. Gyro cal failed

The cause of the problem: usually when the power is turned on (when the red and blue lights are flashing, the power is cut off. Or the value exceeds the peak value will also cause this error message.)

Solution: Re-level and power on.

19. Gyros inconsistent

The cause of the problem: The rotation rate of the two gyroscopes differs by more than 20 degrees/sec. This may be a hardware failure or the gyroscope is calibrated incorrectly.

Solution: Power on again

20. Check FS_THR_VALUE

The cause of the problem: The current throttle value is too low and the failsafe protection has been triggered.

Solution: Check the throttle channel setting of the remote controller. The normal value should not be lower than 1000. The most suitable value is around 1100. Check the ground station-Failsafe setting-whether the throttle value is set too high.

21. Fail to ARM and Solution

- **Flight controller failure or non-calibration:** Check the error report in the flight data menu in the ground control station. Resolve according to the error message. If you want to unlock successfully, the flight controller cannot report any errors. If the accelerometer and geomagnetism are not calibrated, the flight data will show a response failure.

- **Incorrect forward or reverse phase:** the flight controller will check the throttle and rudder when unlocked. The direction of lifting in the ground control station is opposite to the direction of your remote controller (for example, the remote controller lifting channel is down,

the ground control station sees it is upward), and the other channels are the same as the ground control station. If not, it means the channel direction is wrong, reverse setting and then re-calibrate.

- **When the indoor flight is unlocked, the correct flight mode is not selected:** there is no GPS signal indoors, and the fixed-point or loiter flight mode needs to be positioned in flight mode, that is, the flight controller can only be unlocked after finding the GPS signal positioning. Therefore, when the indoor flight is unlocked, you need to switch the flight mode to self-stabilization or fixed altitude flight mode without positioning to unlock. If you select fixed point or loiter mode, you cannot unlock.

- **Failure to press the safety switch on the airplane:** You can set whether a safety switch is required. If the safety switch is effective, you must press the safety switch before unlocking the remote controller. The safety switch indicator changes from flashing red to solid red.

- **The remote controller joystick is not calibrated:** the throttle joystick is the lowest, and the direction joystick is the rightmost to unlock. Taking the direction channel as an example, the default direction channel of the remote controller has the maximum rudder to the right is 1900. If the maximum rudder value to the right of the direction channel of the remote control is 1800, it cannot be unlocked. You need to calibrate the remote controller in the ground station to let the flight controller know that the maximum rudder value of the remote control stick to the right is 1800. When the rudder amount reaches 1800, the flight controller knows that the joystick is in the rightmost position, and it can be unlocked.

- **The ESC has not been calibrated:** After unlocking, if you can hear the motor beeping quickly, the ESC has not been calibrated properly. Please re-calibrate the ESC. Refer to the ESC manual for ESC calibration.

22. The reason why the camera does not take pictures:

- The 5V output failure caused the optocoupler module to fail to work normally.
- Shooting channel PWM output value reverse.

23. **Motor does not work:** ESC stroke calibration error, re-calibrate.

九. Troubleshooting Guide

1. The aircraft tilts severely or turns over when taking off:

This means that it is usually caused by installation or settings. You can check the following

points:

- Check if the frame setting X or + is correct
- Check if the ESC serial number is correct
- Check if the motor rotation is correct
- Whether the propeller direction is correct and whether the wind is blowing downwards
- Whether the accelerometer calibrates correctly
- Whether the ESC throttle is synchronized

2. The aircraft cannot take off when the motor rotates or the motor will not rotate when unlocked:

- Check whether the wind is blowing downwards (propeller installed incorrectly, motor turning incorrectly)
- Insufficient power? Check whether the propeller size matches the battery voltage in the motor parameters
- The motor does not respond and keeps screaming: the throttle range of the remote controller is not calibrated.

3. Controlling the aircraft to fly forward but actually flying backward or controlling to left but actually to right:

- The control channel of the remote controller is reversed, just adjust the corresponding channel of the remote controller menu to reverse it.

4. The flight controller cannot detect the remote controller signal:

- If it is the first time to use: first check whether the receiver is paired successfully. Whether the receiver output is PPM or SBUS protocol. If not, please use a PPM encoder.
- If it was normal before, it suddenly fails: Maybe the receiver is faulty or the IO of the flight controller is faulty
- After flashing the PX4 native firmware, it is abnormal: it may be that the IO firmware or BootLoader has been broken.

†. How to Use QGC

For the use of QGC ground station, please refer to QGC official website:

<https://docs.qgroundcontrol.com/master/en/>