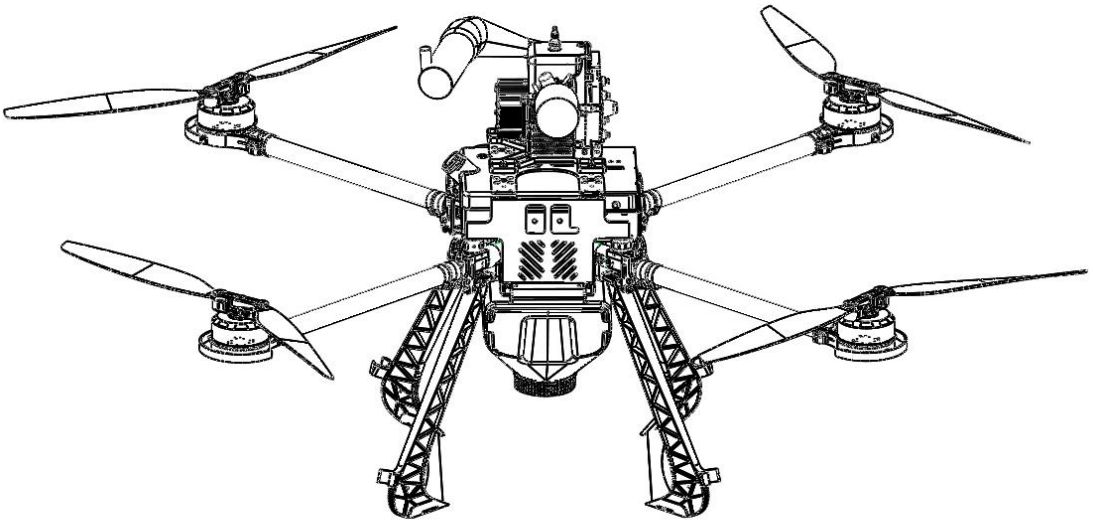
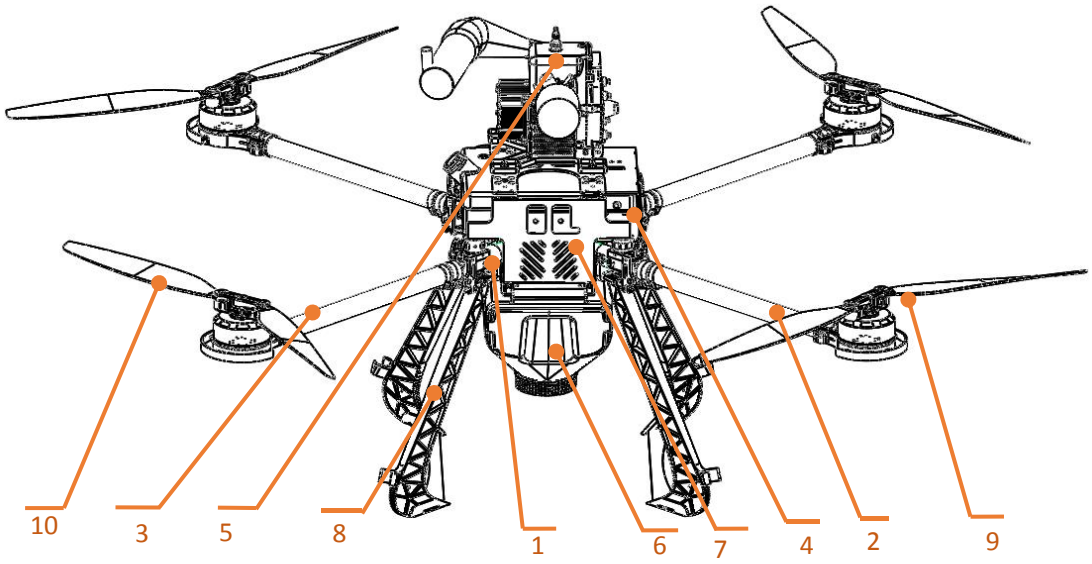
M4H Hybrid Drone Manual



Beijing TT Aviation Technology Co.,Ltd.

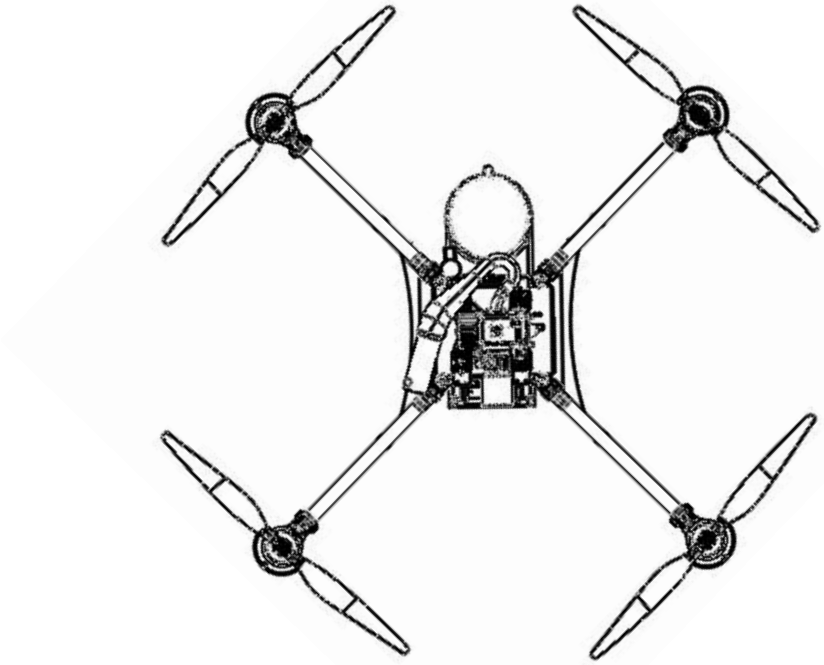
Make sure the pilot is well-trainned in operating UAVs before going on mission.

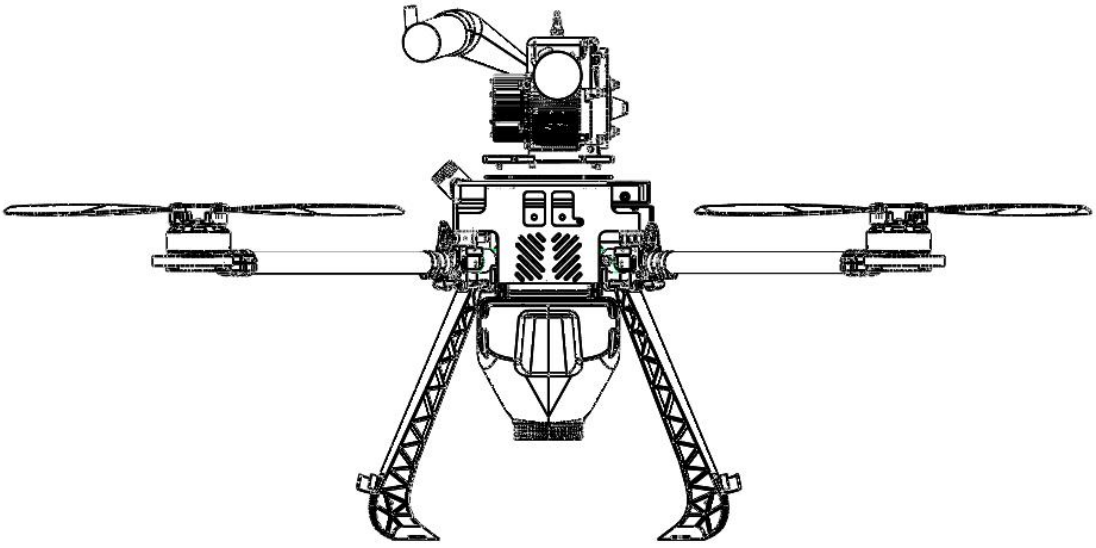


TIANNONG M4H Structure Picture

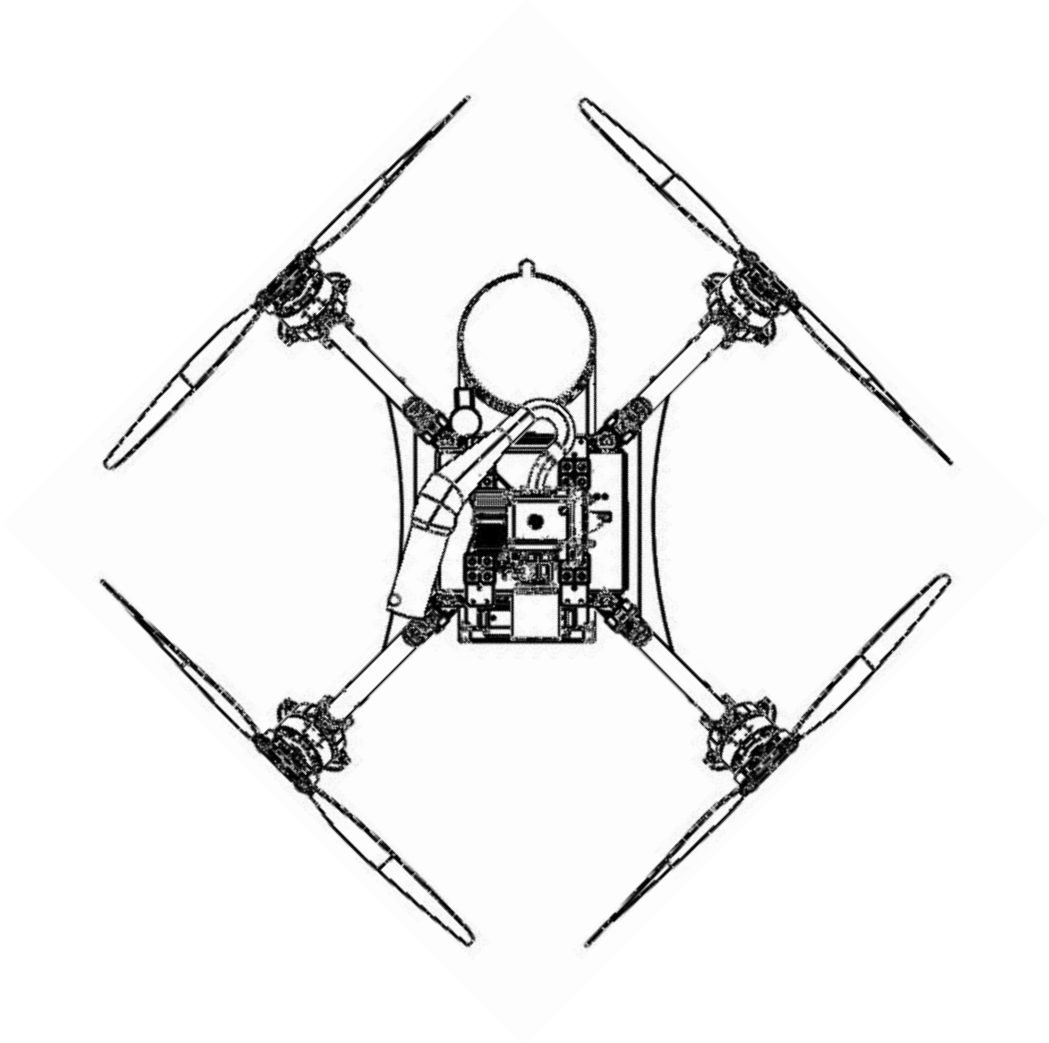
Item	Component	Item	Component
1	Fuselage	6	Tank Component
2	Clockwise Arm with LED	7	Bearing Component of Tank
3	Counter Clockwise Arm with LED	8	Landing Gear
4	Flight Controller Component	9	Propeller（clockwise）
5	Engine Component	10	Propeller（Counter clockwise）

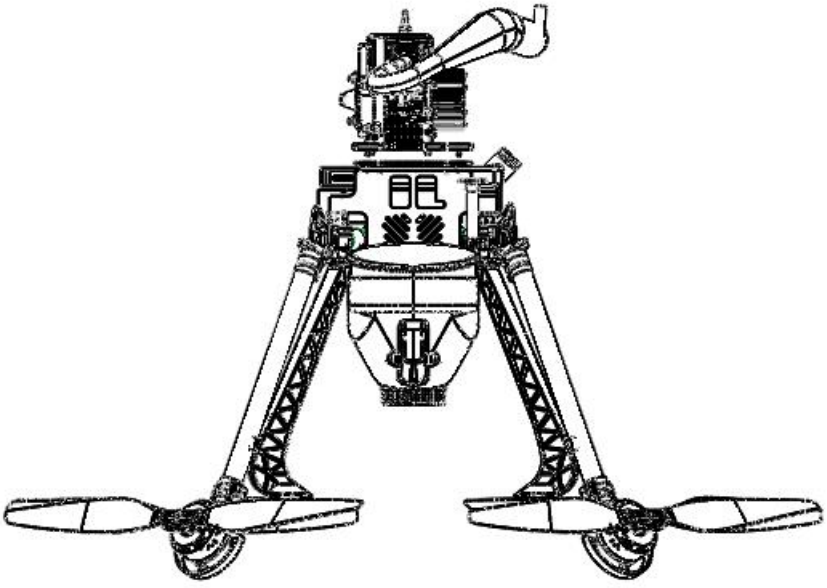
Unfolded View





Folded View





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1.Use Instruction

1.1 Safety Instruction

	◆ The product is not suitable for the ones who are less than eighteen or who do not have full capacity for civil conduct.
	◆ The product have bigger fuselage size, high speed rotary and strong flight dynamics. At runtime have a certain dangerousness . Not in accordance with the requirement operation and usage will cause to potential danger and hurt.
	◆ When using this product, please keep away from airport, railroad, high speed road, high buildings ,electric wire and other dangerous environments.
	◆ When using this product, please keep away from mobile phone base stations, high power transmitting equipment, and other high electromagnetic interference environments.
	◆ When using this product，please keep away from army and kinds of manned craft flight area.
	◆ Don’t use this product in rain, thunder, sandstorm, fog snow ,high wind ,and low temperature and other bad environments.
	◆ When flying in more than three kilometers. Environmental factors can lead to flight performance degradation, please care of using it.
	◆ When operating this product fly in low sky .Please always keep UAV and people & animals in a safe distance of ten meters
	◆ When using this product in desert area, please keep UAV within the range of operator’s vision.
	◆ Don’t hover or fly over the crowd, Don’t be delight in scaring others.
	◆ When it is close to the crowd ,please land this UAV as soon as possible and guide people to keep and avoid potential accident.
	◆ Don’t operate it in the area of children playing.
	◆ If not in the extreme necessary condition, please do not power off when flying in the air.

	◆ You can not fly it you are in drinking , tied, drugs, physical ,discomfort, etc. .
	◆ Please inspect it before using very time, including but not limited to parts of fastness, organism and propeller of cracks, and abrasion ,battery ,the effectiveness of light. When error happens, please stop using immediately and replace the corresponding parts.
	◆ Abnormal working state of the UAV maybe happen accidentally, don't open the propellers and forcibly fly with wrong.
	◆ Do not try to prevent any moving parts while working.

1.2 Pesticide Usage

	◆ All pesticides are poisonous. Please be careful and work strictly according to the safety instructions of pesticides. ◆ When dispensing, please use clear water. If not, will cause jams mesh of impurities. If it is blocked, please clear it before reuse ◆ When dispensing , please note that liquid sparks and the pesticide residue in fuselage will be harmful to human body. ◆ When dispensing, please pay more attention and use protective tools, and do not let body directly touch with the pesticides; After pesticide spraying, please clear your skin, copter and remote control. ◆ When using pesticide, there will be interaction between different pesticides , user should clear cartridge or keep a certain interval time。 ◆ Spraying shall be carried out in windless sunny day, don't spray under high temperature at noon. While breezing, the operator should be standing above the wind and spraying; do not work when wind is four. ◆ When spaying ,if you feel uncomfortable ,headache or dizzy, please leave the site at once and rest. If once severe symptoms occur, immediately be sent to hospital. ◆ Pesticide effect and the solution concentration, spray rate ,copter high from crops ,wind direction, wind speed and so on are close related. When using pesticide should consider the above factors, to achieve the best effect. Please

	make sure that do not damage the human beings and animals and surroundings during the process of sprayings. ◆ When using pesticide , do not pollute river and drinking water

1.3 Inspection

	◆ Before flying, ensure the battery is enough ◆ Ensure all the parts are installed firmly, and all the screws are tight as required. ◆ Ensure all the wires are correctly linked. ◆ Ensure all parts goes well. If it is broken or aging, please replace timely. ◆ Before flying, carefully check the propellers installation direction、 rotation direction, control and others. ◆ Ensure all the propellers are fine, no any scratch and tightly installed. ◆ Ensure the sprayer is fluent without any clogging.

1.4 Environment

	◆ While flying, please ensure the drone away from the crowds, dangerous goods, high buildings, high-voltage wires and others. Please fly the drone in a dedicated space. ◆ Please ensure the drone fly within the operator's eyesight. ◆ The drone working temperature is between 0℃-40℃. ◆ Ensure the drone fly within the permit of local law and regulations. ◆ To fly the drone safely as required, please fly it within in the height of 50 meters. If it has local flying height limit within 5ometers, please make sure obey the related regulations.

1.5 Operation

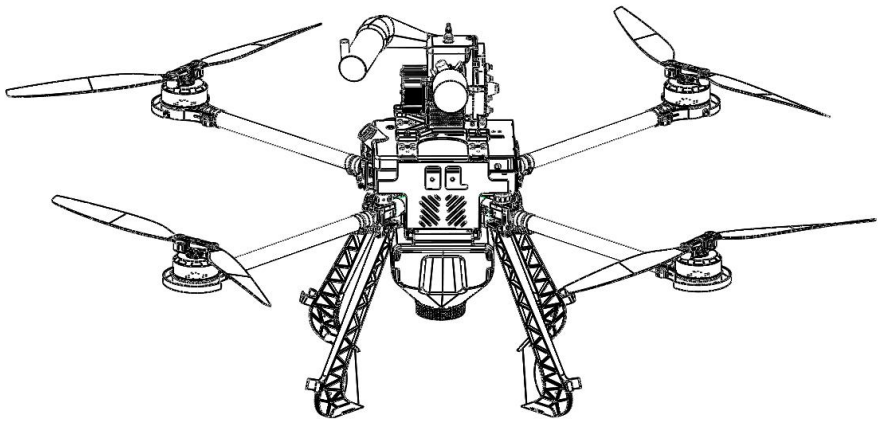
- Please ensure the multi-rotor drone flying height is within 8 meters, except the special requirements.
- Before remote control calibration、 hardware update, parameter setup, please remove the propellers and avoid the potential moving suddenly.
- Remove the battery if it does not fly, to avoid flying it when touching the remote control once.
- Please remove the batteries once landing. Do not move the drone when it is in power.
- Do not touch the joy stick mistakenly, and prevent start the drone.
- When it is powered, please stand in the safe distance of above 10 meters.
- Ensure the propellers completely stop and power off.
- Please switch it to the manual operation mode when errors happen. When the manual operation mode does not work, please press the emergency bottom. Please keep away from the crowd.
- When the battery is damaged, please ensure it is stored in the disposal area and avoid spontaneous combustion. In order to protect environment, please don't throw batteries randomly. And consult the maker about the proper disposal method.
- During the flight, don't fly overload and do not cause any potential dangers.
- When low battery is warning, please return as soon as possible.
- Ensure that the remote control and battery is enough, to ensure that firmware has been updated to the latest version.
- Ensure flying sites outside of the restricted areas and is proper for flight . .
- Please make sure do not fly or operate the drone when you are drunk or with medicine limitation.
- Be familiar with the remote control operation & each flight mode, and ensure you know how to operate the control condition.
- User shall know and obey all the law and regulations in flying location.

1.6 Compass Calibration Requirements

- Compass has to be calibrated before using the first time. If else, it cannot work and will affect flying safety. Calibration tips:
- Please do not calibrate it in the place close to the high-magnetic field or big metal materials, such as high-voltage, magnet, parking lot, concrete iron building, etc.
- When calibrating, please do not bring the magnetic materials, such keys and cellphone.
- If it is calibrated indoor, please do not re-calibrate it outdoor. It prevents that the two magnet differences cause the potential flying data errors.
- Magnetic field location is different, please make sure re-calibrate when it changes to the place far away from the previous one.

2. Product Introduction

TIANNONG M4H, the multi-rotor UAV, is the most economic integrated solution for all the agriculture spraying services. This UAV is waterproof and easy to repair, long-time flight with high-strength & light fuselage material. The big power brushless motor guarantees the sensitiveness and flexibility. The Lipo batteries guarantee the power supply and easy to repair and maintain. Various spraying tests proves the best performances of this UAV.



2.1 TIANNONG M4H Parameter

Weight (without battery)	11.5KG	Max Pitch Angle	≤35°
Standard Takeoff Weight	23KG	Best Spraying Speed	4--6m/s
Max Takeoff Weight	24KG	Max Spaying Speed	10m/s
Max Thrust-weight Ratio	2.25(Flying weight23Kg)	Working Time	6--12min/ flight
Battery	12S, 1800aAh	Max Climbing Speed	5m/s
Max Power	3200W	Max Landing speed	3m/s
Hovering Power	2400W	Max Flying Speed	15m/s
Hovering Time	Empty flight ≥30min Full flight ≥15min	Recommended Working Temperature	-30~60C°
Hovering Accuracy	Horizontal ±0.2m Vertical ±0.5m	Max Anti-wind Strength	12m/s
Spraying Height	2--4m	Max Flying Altitude	2000m
Max rotation angle	360°	Best Storage Temperature	10-25C°

2.2 TIANNONG M6E-1 Agriculture UAV Specification

Frame		Diagonal Wheelbase	1400mm
		Arm Length	506mm
		Unfolded Height	745mm
		Folded Height	900mm
		Folded Width	900mm
		Sprayer Distance	1390mm
Power System	Motor	Motor Model	HobbywingX8
		Stator Size	81*20mm
		KV	180KV
		Max Thrust	15.3KG
		Max Power	3000W
		Weight	1040g
	ESC	Max Continuous Working Current	80A
		Max Peek Current(3s)	100A

		Working Voltage	12S LiPo(44--50.4v)
		Working Pulse Width	1000--1940us
		Compatible Signal Frequency	50--500Hz
		Drive PWM frequency	400Hz
	Foldable Propellers	Material	High strength engineering plastic
		Diameter /Screw pitch	3090 (L=739mm)
		Weight	180g
	Battery	Capacity	1800MAh
	Water tank	Payload	10L
Spraying System	Sprayer	Model No.	Pressure Type (Sector)
		Quantity	4 pcs
		Sprayer Diameter	0.5-1.5mm
		Spraying Speed	4--6m/s
		Spraying Volume	1.8--2.2L/min
		Spraying Width	4-6m (up to height)
		Spraying Droplet Diameter	80--200μm（adjustable）
Remote Controller	Remote Controller	Model No.	R4
		Working Frequency	2.4Ghz
		Charging time	10h
		Effective Signal Distance	1.2KM
		Battery capacity	3.7V，4000mAh
		Charging type	DC，5V 2A
		Charging time	5-10h
		Working Environment Temperature	0--40C°
		Best Storage Temperature	10--25C°
		Best Charging temperature	10--25C°

2.3 Preparation Before Takeoff

2.3.1 Installation of Fuselage

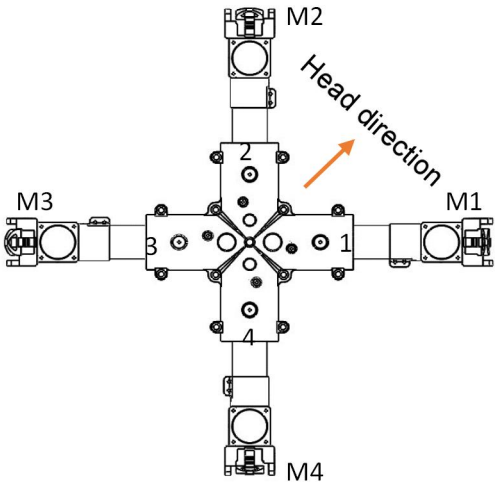


Figure 1

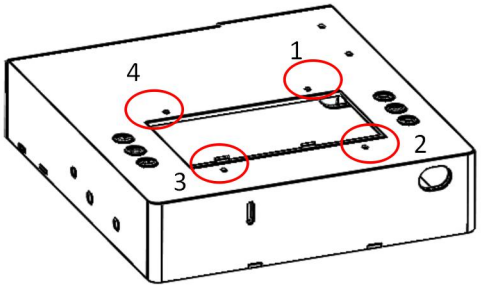


Figure 2

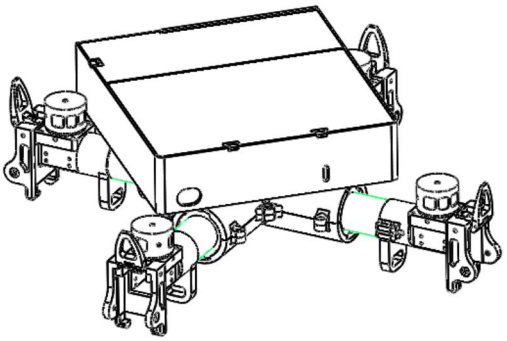


Figure 3

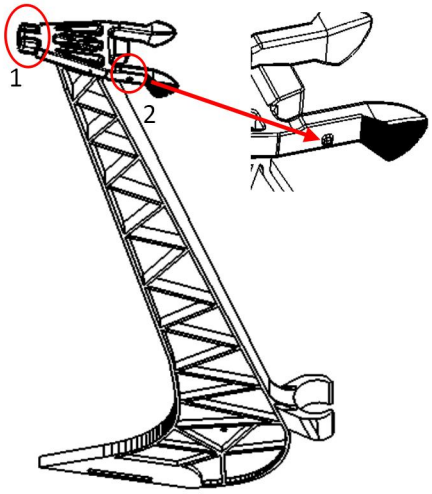


Figure 4

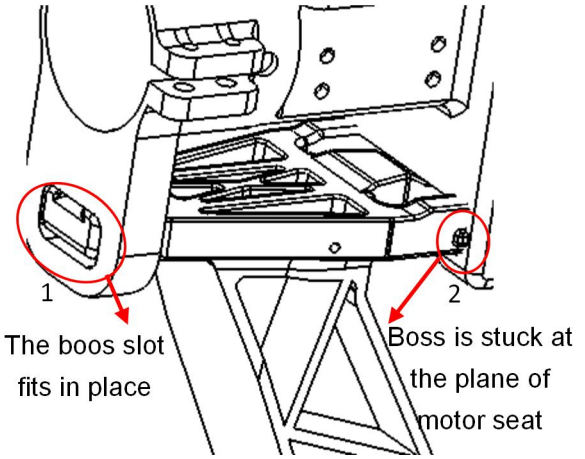


Figure 5

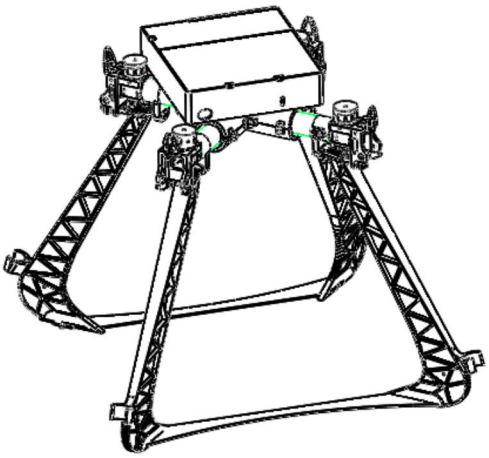


Figure 6

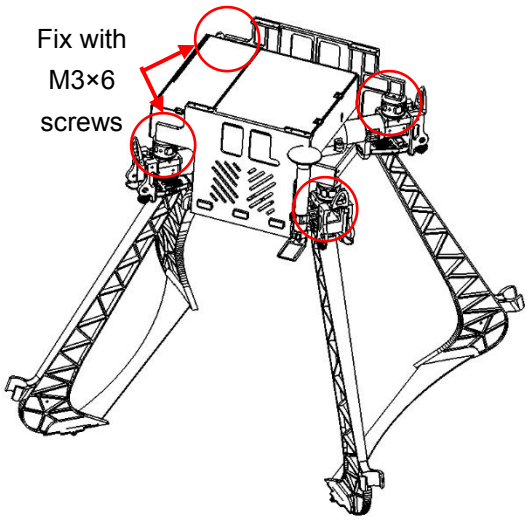


Figure 7

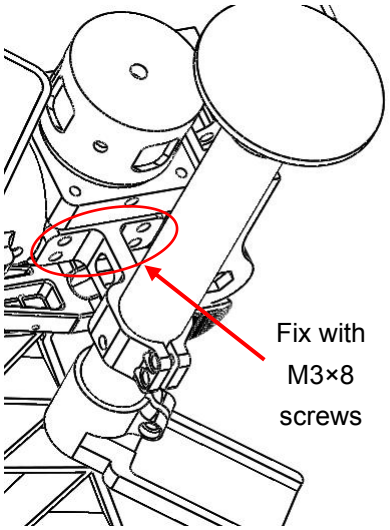


Figure 8

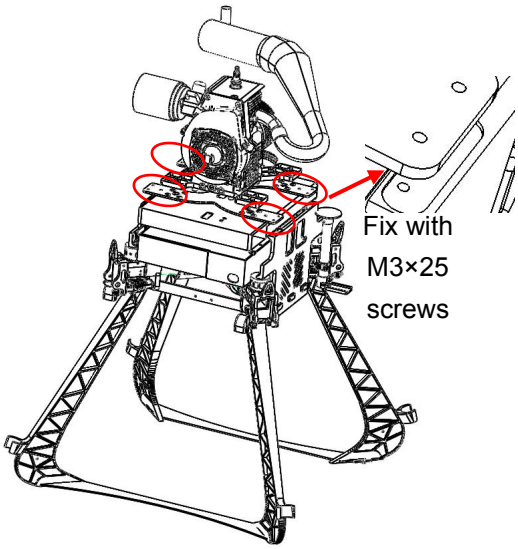


Figure 9

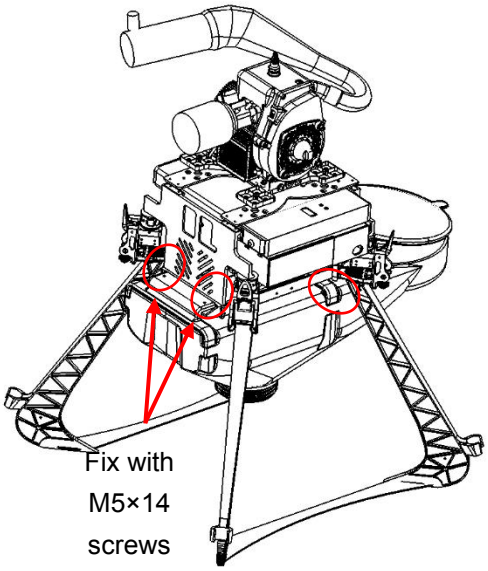


Figure 10

1) Fix the fuselage and flight controller component with M3*6 screws in 1,2,3,4 positions as the figure1 and figure 2, the results are shown in figure3.

2)The landing gears should be installed as figure 5. It should be completed as Figure 6.

3) Fix the tank component on rubber connecting column of fuselage with M3 × 6 screws as figure 7.

4) Fix the GPS module on the arm M2 as the figure 8.

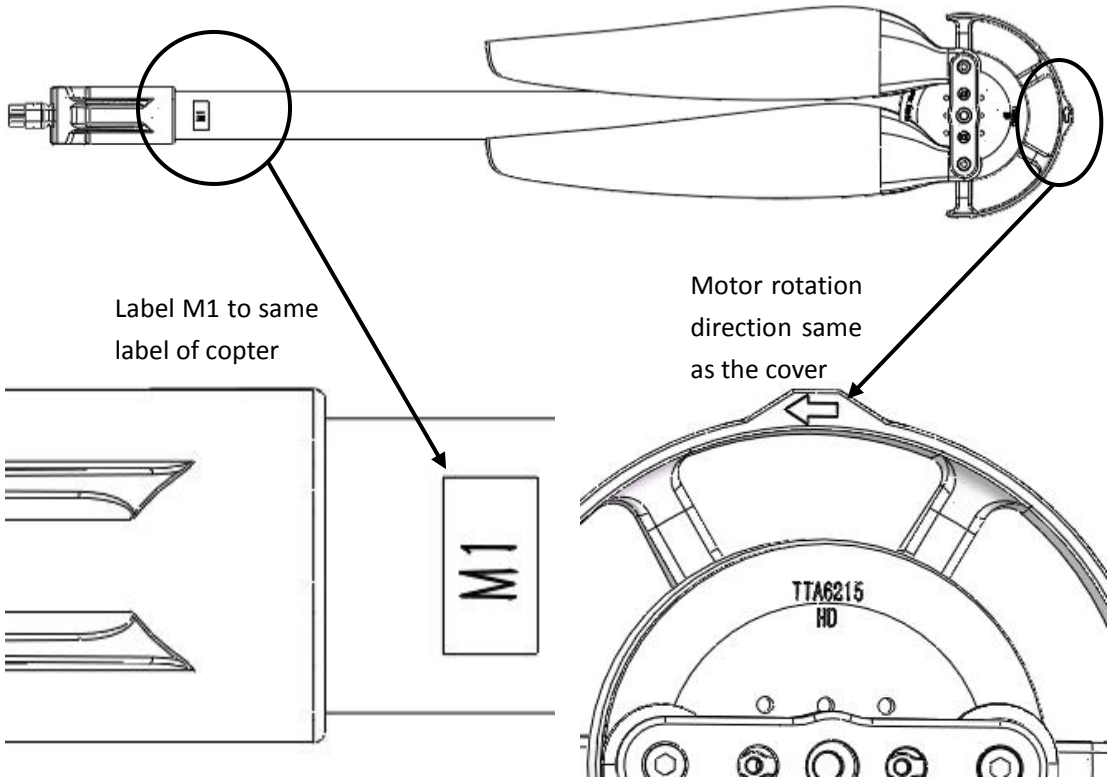
5) Fix the engine module and tank bearing module with M3×25 screws as figure 9.

6) Fix the tank module on tank bearing module with M5 × 14 limited screws as figure10.

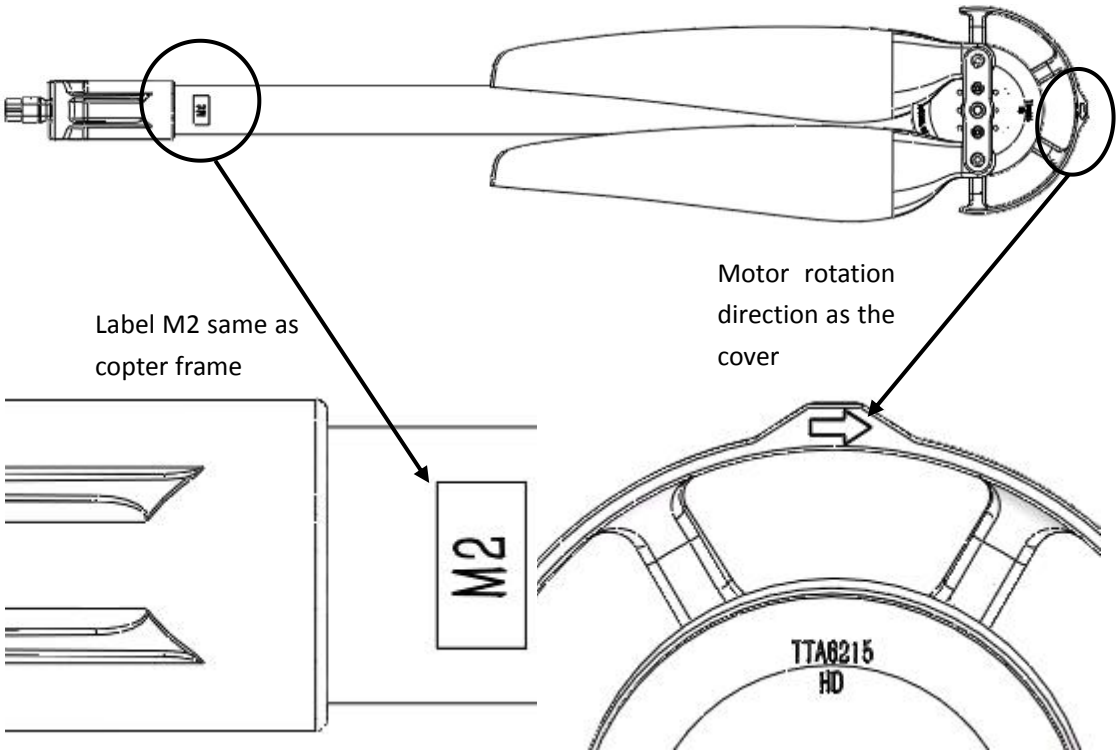
7) Connect the engine controller and flight controller.

2.3.2 Arm Installation

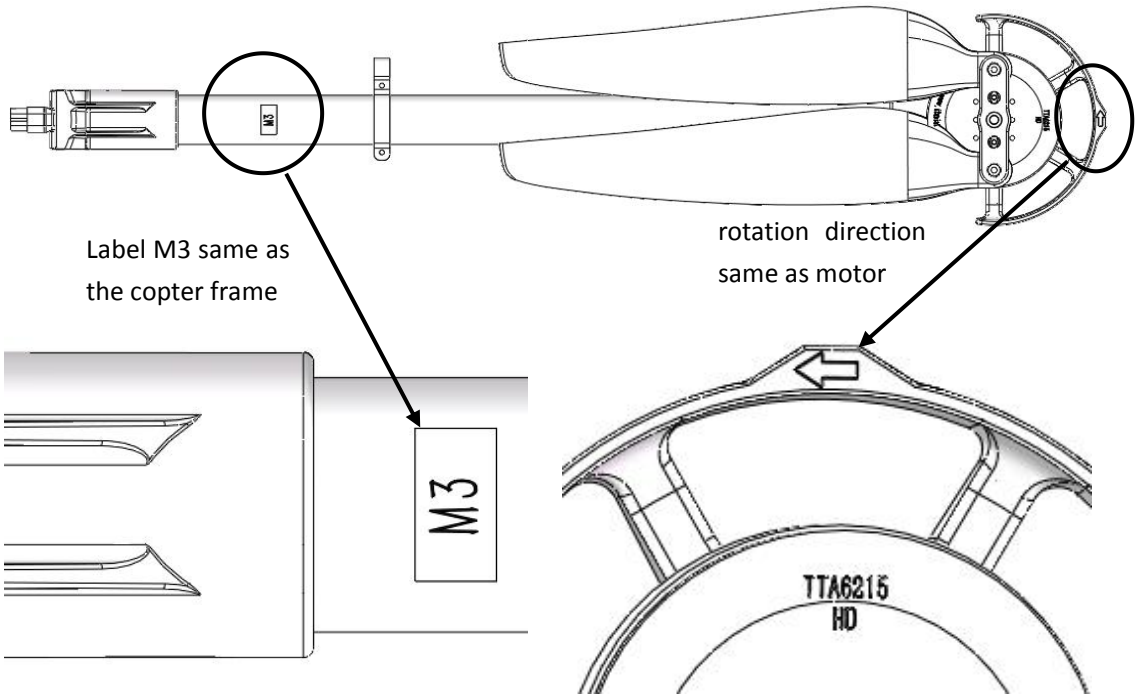
Set all the arms ready: 1 clockwise(CW) arm with LED, 1 counter clockwise(CCW) arm with LED, 1 CW arms and 1 CCW arms. Totally 4 arms.



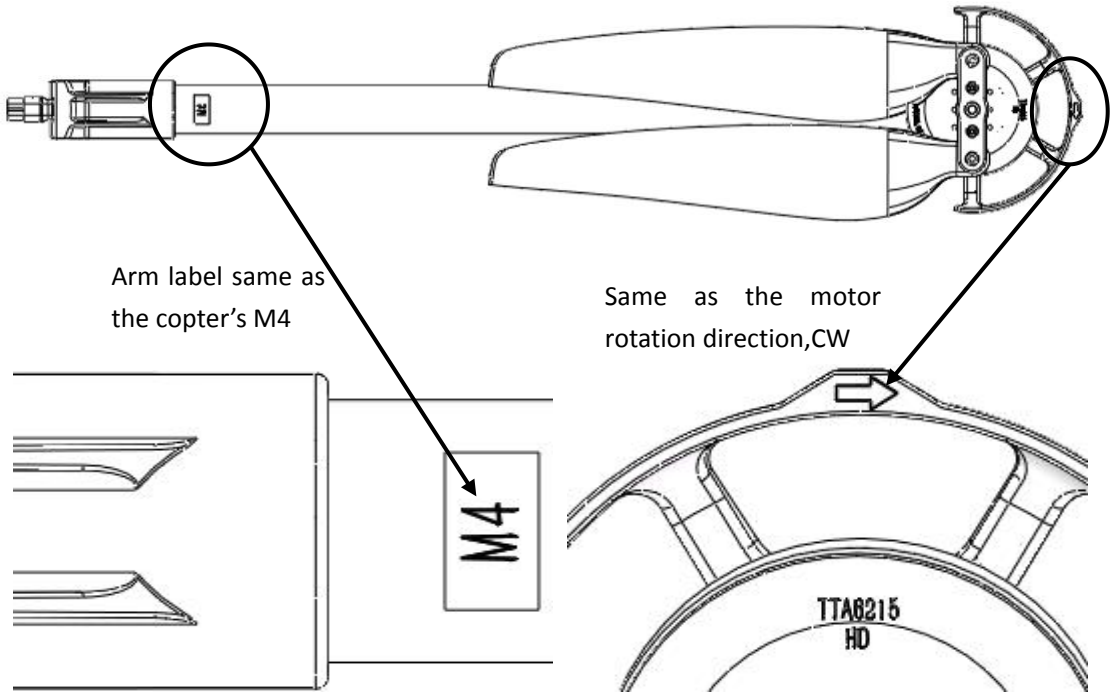
M1 CCW arm assembly



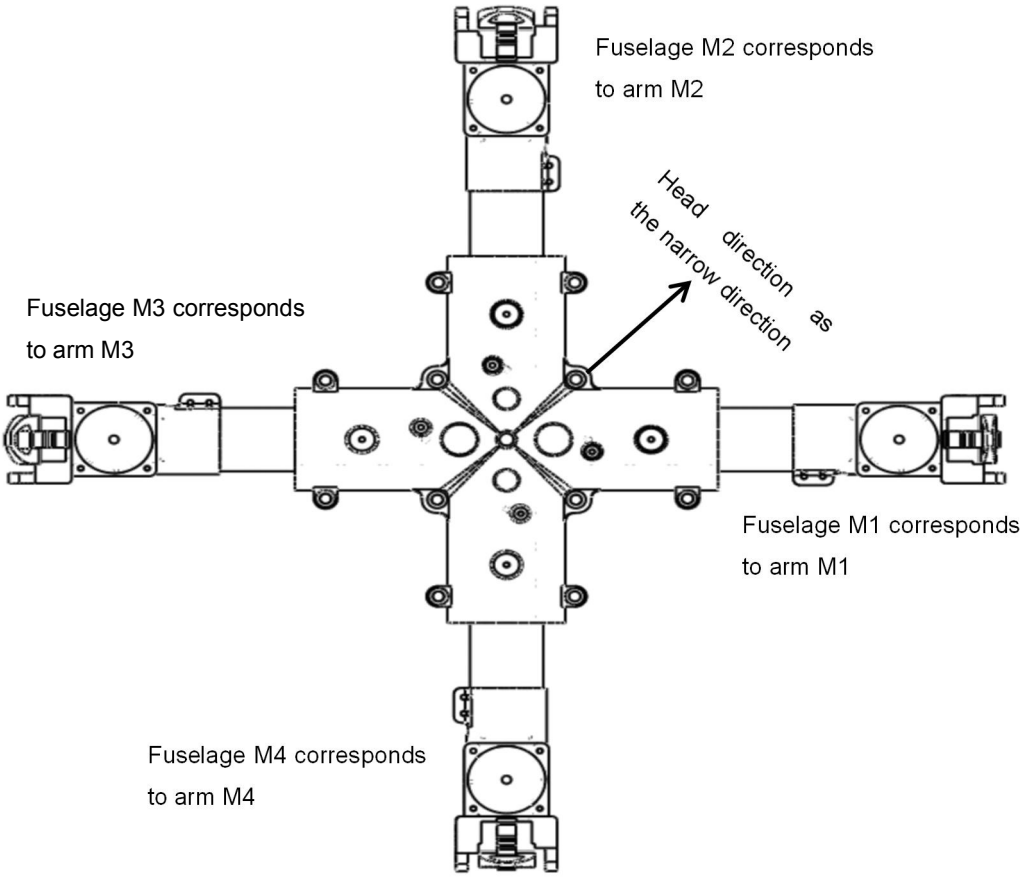
M2 CW arm assembly



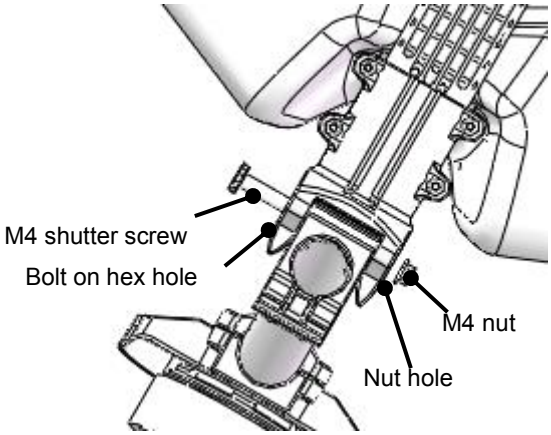
M3 CCW arm assembly

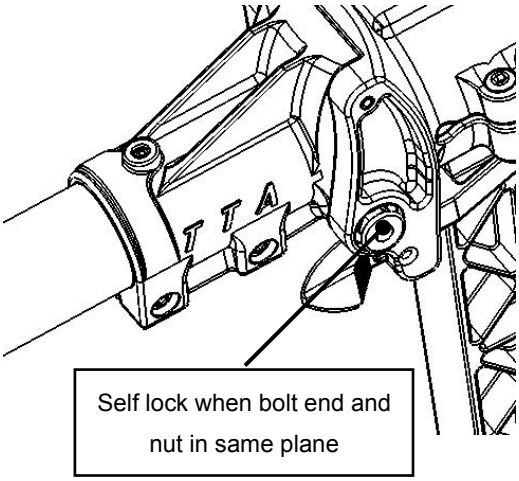


M4 CW arm assembly

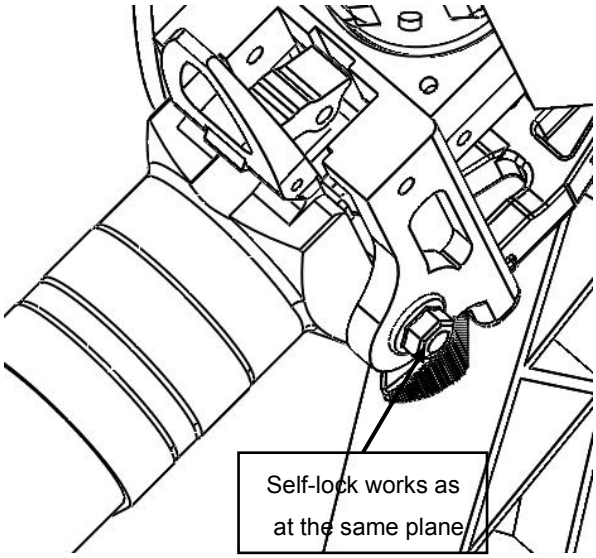


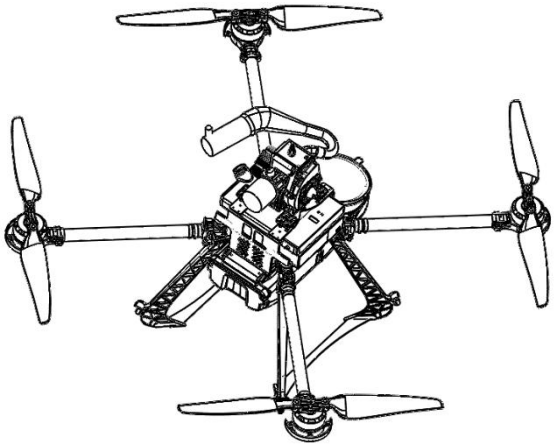
1) Arm M1-M4 should be matched with copter's.
2) Match the arm's AS150 female connector with copter's AS150 male connector.
3) Match 6mm inner hole of arm clamp with copter's main part 6mm inner hole.





4) Install the M4*50 plug screw from the hexagon side of the 6mm hole on fuselage arm joint.
5) Lock the plug screw with a M4 nut from the other side.As the bolt end and the nut at the same plane,self-lock works,
6) Install the rest 3 arms as above, completed as the figure below.





Attention:

1) The difference between CCW arm and CW arm is different rotation direction of the propellers which produce lift force. There is a mark arrow on every motor holder to help differentiate. CCW arrow means CCW arm, you need to install the CCW propeller,otherwise it will be CW arm which you need to install the CW propeller.
2) When installing, the direction perpendicular to the flight control mounting plate is the direction of the head.
3) According to the Figure 7, install CCW arm on M1 and M5, install CW arms on M2 and M4, install CCW Arm with LED on M3, install CW Arm with LED on M6.
4) During the installation of the arm, the arm cannot be folded when the stuff screw hole is adjusted. The maximum angle is only horizontal with the ESC assembly, and the arm can only be folded down.

2.3.3 Spraying Tube Installation

1) First, insert the Φ8 spraying tube into the three-way connector as Figure 14-1. Second, through the spraying tube from the tube holder as Figure 14-2. And then inset the other side of the spraying tube into the one-way connector at the nozzle place as Figure 14-4. Install the other spraying tube the same way.

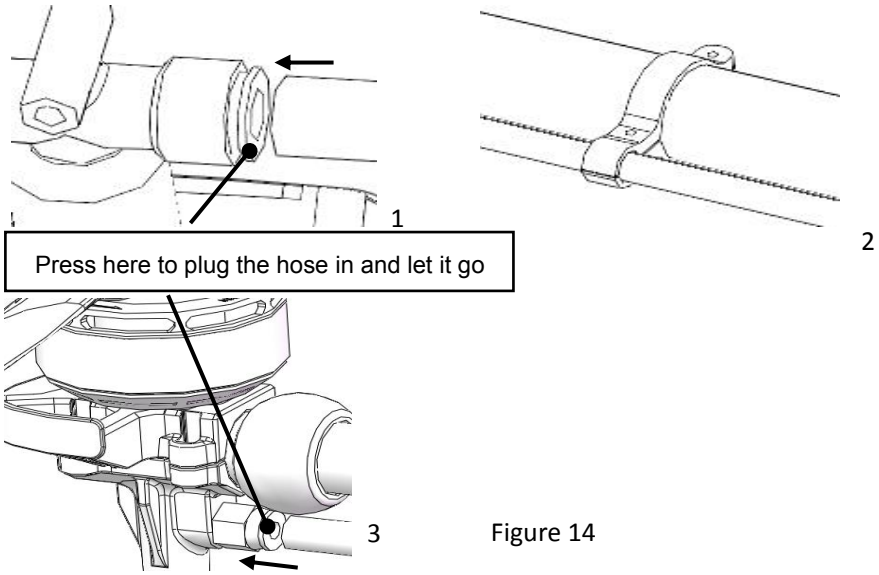
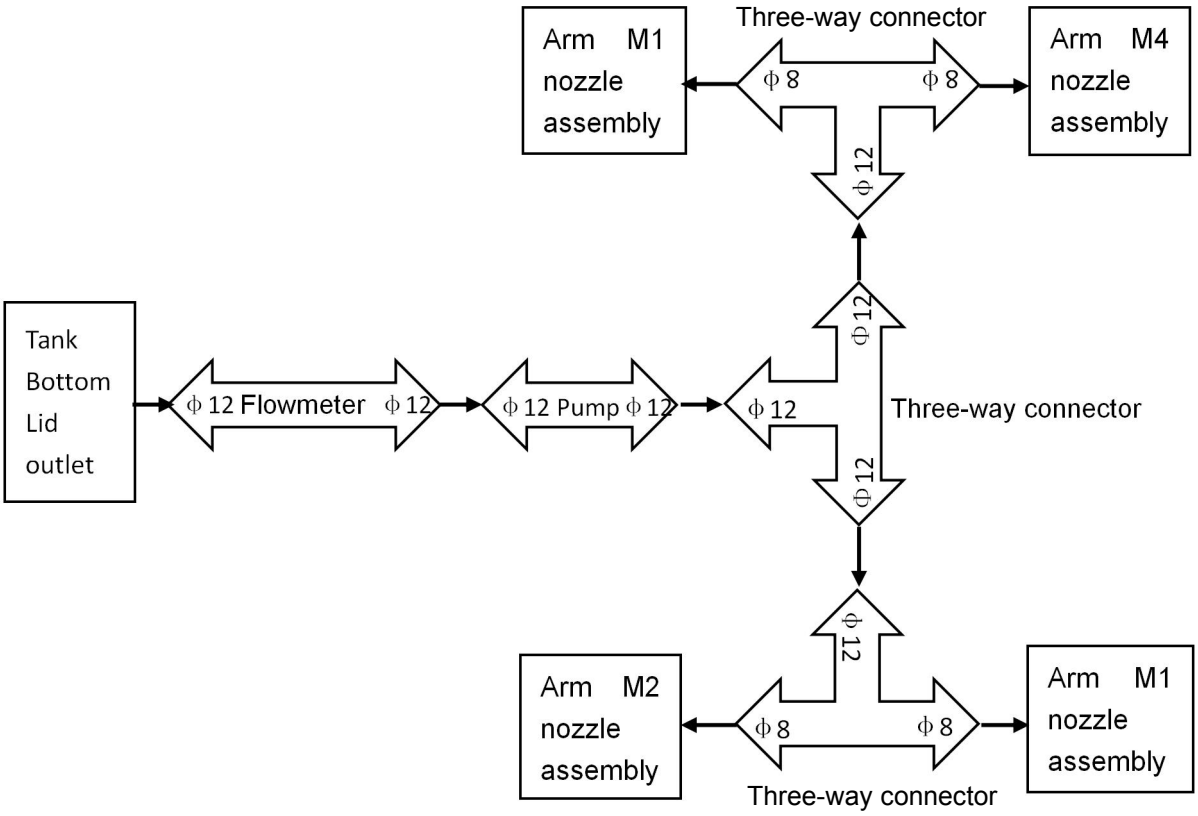


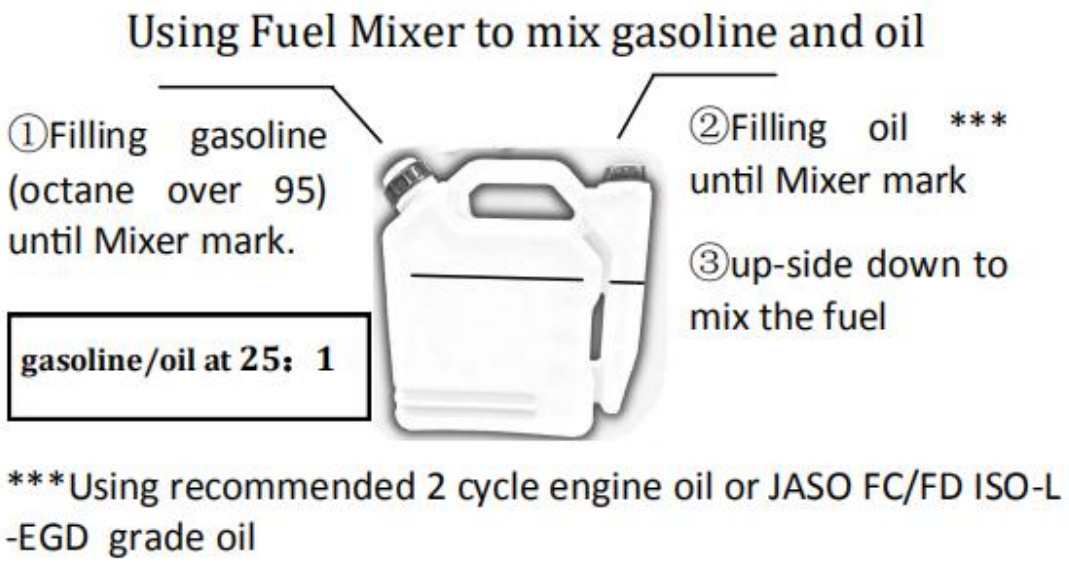
Figure 14

2） Tube installation wiring diagram



3. Generator

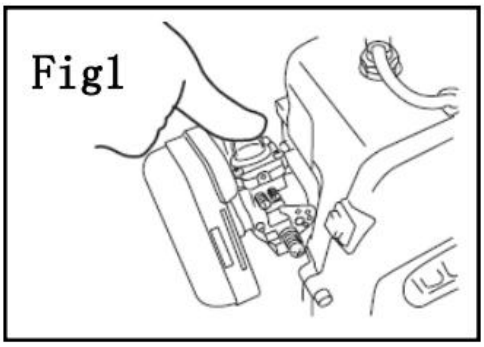
3.1 Fuel

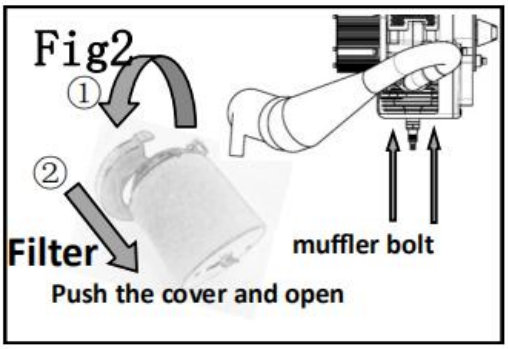


User must use Motul710-2T oil and gasoline(octane over 95). The mixed oil should be light green after mixing.

3.2 Getting Started

1) Before every started, push the primer pump several times until overflow fuel flows out from the yellow pipe.(Fig.1) Check the filter to avoid clogging. Check muffler bolt to avoid loosening .(Fig.2)

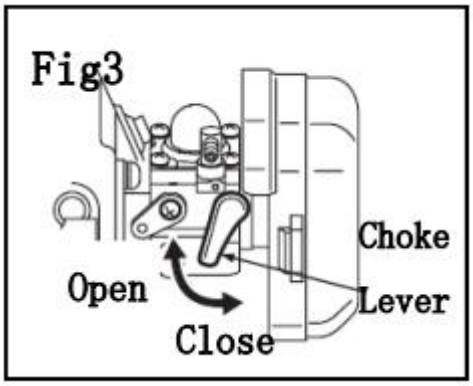


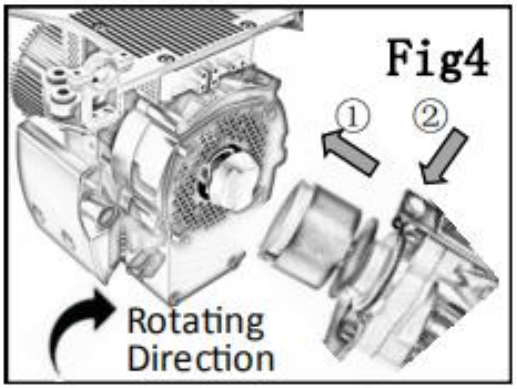


2) Power on and switch the three-position switch to “idle”. Make sure the status lamp on generator controller is “green”. If not, please see Trouble Shooting chapter.

3) Use hand puller: Close the Choke Lever(Fig.3), ① Pull hand puller. ② When hear firing noise, release the hand puller.(If engine is in warm-start condition, choking may not be necessary)

4) Open the Choke (Fig.3). Push start buttom for 2~3 seconds. Pull the starter until hearing firing noise(Fig.4)



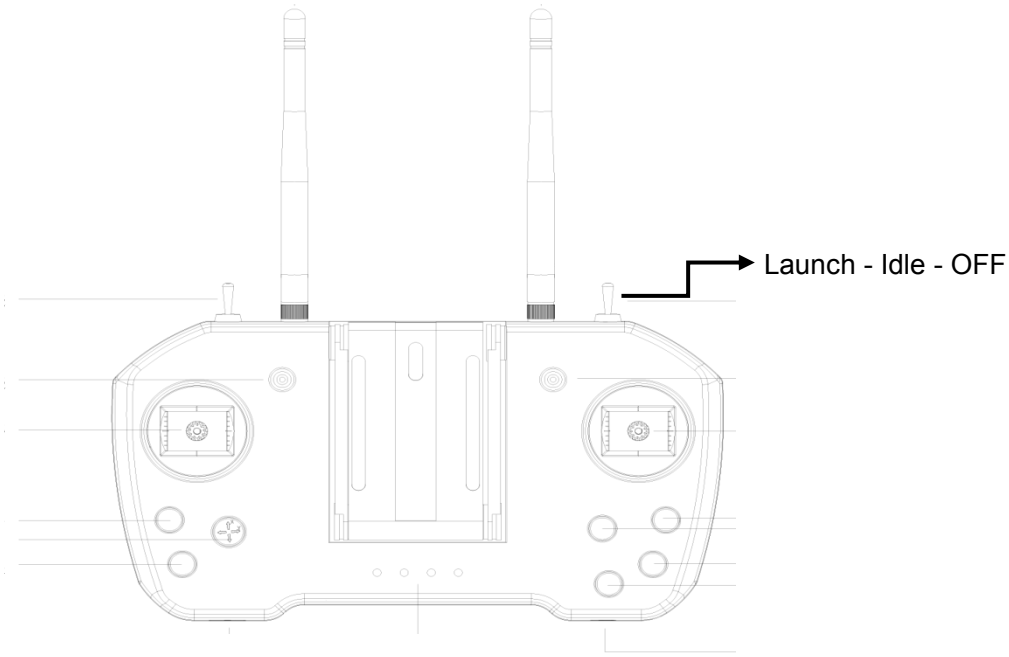


5) If can not get started, please refer to Trouble Shooting chapter.

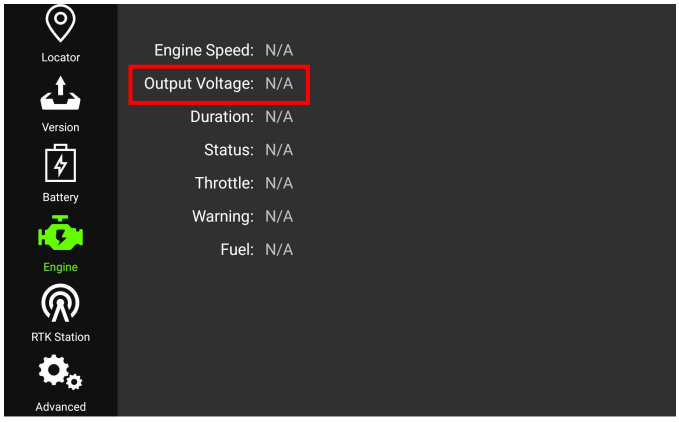
3.2 Launch

1) Before starting make sure the color of controller LED turns as the Three position switch, (refering to Trouble shooting chapter)

2) Switch the three-position switch to “run”, and monitoring the UAV input voltage.



3） Voltage should stay above 49V stably.



4）Keep the generator on for 1 minute to warm up it.

5）Take-off by operating remote controller or running Auto-pilot program.

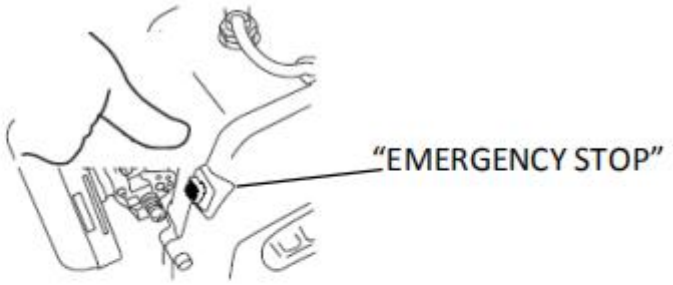
6) Voltage may drop 2~3 V when encounters air turbulence or maneuver.But if the voltage drop rapidly to 45V,or even lower. Please pay attention. Land and inspect when necessary.

7) Drone has LiPo Battery with capacity of 90-secend emergency landing.

3.3 Stop

1) After landing,switch the three-segment lever to OFF position. Engine will shut down automatically.

2) Generator has a yellow emergency stop button.



Gasoline is flammable! After finished one day's work or long-distance transport, the fuel tank should be emptied. Fuel shall be properly stored !

Caution :

1.Fuel ran out may seriously damage the generator. Be sure to set a 30% low fuel protection,and protection mode should be auto-landing.

2.Gasoline is flammable! After finished one day's work or during long-distance transport, the fuel tank should be emptied. Fuel shall be properly stored.

3.4 Maintenance

1) Generator runs in a very high speed. Maintenance is necessary for it to keep in good performance.

2) As the controller lamp start to flash “green and red” every 75 hours working, it reminds you to maintain the generator.

3) The controller lamp will flash “Green and red” for only 2 more hours after every 75 hours working. It will not blink after 2 hours blinking. If the generator is not maintained at every 75 hours working,it will lead to poor performance and damage.

4) Any consequences caused by not maintaining on time will be undertaken by users.

Caution: Lipo battery need to balance its voltage regularly.

3.5 Trouble Shooting

1) Switch the three-segment lever (E) and observe the controller lamp before every starting to check generator’s conditions.

Controller Lamp	3-segment lever	说明
OFF	OFF	/
Constant Green	Idle	Green controller lamp will flash and buzzer will ring while voltage is under 46V.
OFF	Launch（before ignition）	
Constant Green	Launch（after ignition）	
Red Flash	OFF,Idle,Launch	Buzzer rings,#6 cable is open-circuit.

2) Before ignition,ensure the controller lamp will change while switching three-segment lever。If lamp change is not correct,please check the settings of remote controller and receiver ‘s channels.

3) Trouble shooting

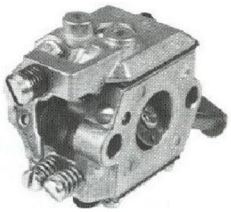
Unable to start			
	LED	Possible Reason	Solution
Three-segment Lever	Off	Switch is not on “idle”	Switch to “idle”
	Off	Power is off	Check power wiring and voltages.
	Green or green flashing	EMERGENCY STOP switch failure	Change
Filter overflow & clogged	Constant Green	Carburetor clogged	Repair carburetor or exchange
		Bad environmental air condition	Clean the filter with mixed gasoline
Fuel Supply	Constant Green	Improper Oil type	Change proper Oil
		Prime pump or no fuel	Press prime pump to suck fuel
Air inlet	Constant Green	Chock lever OFF	Open chock lever
Spark plug		Yellow spark or weak spark	Change spark plug
Wiring	OFF, idle & launch position , LED red flashing and alarming	#6 wire Three-position switch cable is not connected	Check wiring, change flight controller or RC receiver channel
Maintenance period exceeded	green and red flashing	Engine need maintenance	Maintenance
Starter		Rotating direction wrong or voltage lower than 15V	Clock wise (view from starter) or charge the 4S battery

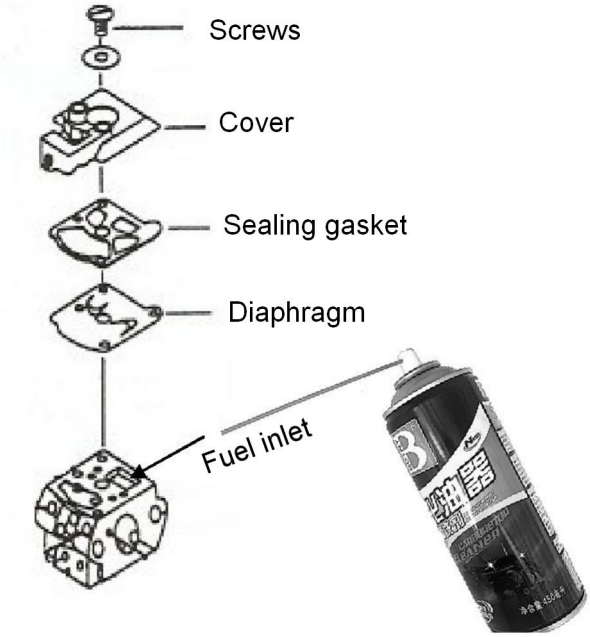
lack of power or unstable running			
	LED	**Possible Cause**	**Solution**
Unstable running, unstable voltage, dense smoke	Constant green	Water in fuel, wrong or poor fuel quality, or mixed fuel stored longer than 2 months	Change with proper fuel
		Poor oil quality	Use FD/ISO-EGD 2T oil
		Controller or sensor failure	Contact us
		Air filter clogged	Clean the filter with gasoline
	LED OFF	Carburetor clogged	Clean (as below)
Lack of power	Green & red flashing alternately	Maintenance required	Maintain
		Air filter clogged	Clean the filter with gasoline
		Carburetor clogged	Clean (as below)
Spark plug	Remove spark plug and insert red plug cap, touch spark ignition head to cylinder and pull hand puller. If spark is yellow or weak, change the spark plug.		
Voltage drops rapidly after take-off	Red flashing three times	Voltage too low	Run 1 minute until green LED is on before take-off
Others		Mechanical component damage	Contact us

3.6 Carburetor Cleaning

Dirty operating environment (dusty) or unfiltered fuel can lead to clogging of carburetor and lack of power. It can be solved by simple carburetor cleaning.

1. Remove fuel pump cover screw and pump cover
2. Clean diaphragm and fuel inlet using carburetor cleaner
3. Reassemble the carburetor cover and make sure the gasket and diaphragm's direction is correct.

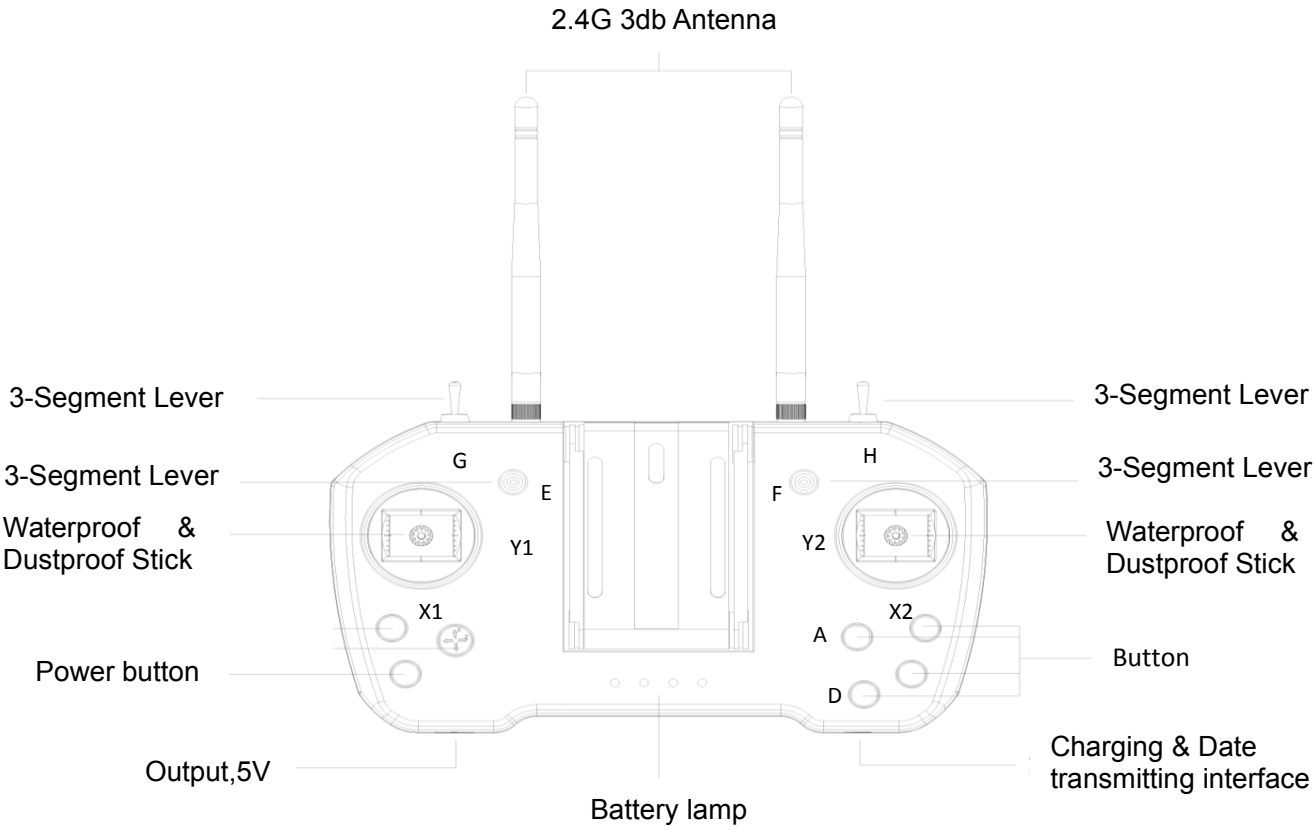




The carburetor does not need to be disassembled from the generator, just disassemble the carburetor cover to clean the "diaphragm" and "inlet".

4. Remote Controller

- Charger output more than 5V should not be used.
- Remote controller charging current should be not more than 2A.
- Any damaged,smoking or abnormal heating charger should not be used.
- Charging should not be continued in condition of smoking,smelly,weeping.
- Charging should not be in the area of baby playing.
- Charging should not at temperature more than 60℃.



4.1 Function Description

Channel	Top	Middle	Bottom
E: Flying mode	Altitude mode	GPS mode	AB mode
F: AB recording	/	Recording Point A	Recording Point B
A: Flow switch	OFF	/	ON
D: Home landing	OFF	/	ON
Channel	Left	Middle	Right
G: Pump mode	OFF	Combination	Manual
H: Ignition	Launch	Idle	OFF

4.2 Bind

- Power on the remote controller first. Power on drone for 1 second and cut off immediately, repeating this step for three times. Then power on the drone for the fourth time and keep the power connection. The done will enter into binding mode automatically. Drone will bind the remote controller successfully with a voice prompt. Remote controller need to be calibrated after binding.

Remark: Binding remote controller can not be operated for more than one pair at the same time. Only one-to-one pairing is allowed.

4.3 RC connection & Device Helper.APP Introduction

1) Turn on remoter controller (short-press + long-press). Open bluetooth, search and connect bluetooth of remote controller (T12-*** , password: 1234).

2) Device Helper introduction.

ADJUST PARAMETERS -------- Adjusting channels, rudder value, fail-safe value.

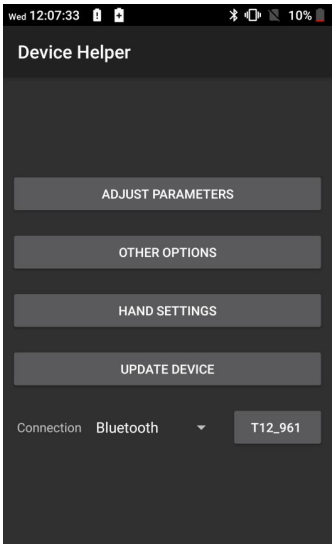
OTHER OPTIONS --------- Selecting SBUS or PPM output mode of receiver, and telemetry baud rate.

HAND SETTINGS -------- Select hand mode, USA, Japan ect.

UPDATE DEVICE -------- Update firmware online

Connection mode --------- Bluetooth mode, SBUS receiver mode.

Caution: Don’t do any adjustment, unless under professional introduction. Otherwise,any consequences caused are undertaken by its users.

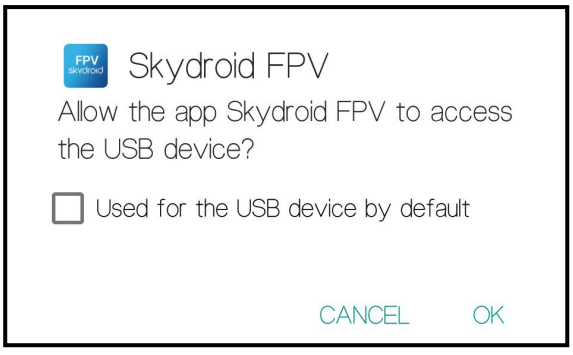


4.4 Video Transmitter Introduction

1) Install TTA APP into user's phone.

2) Open OTG function of phone. Connect the phone and remoter controller with USB cable. Power on the drone.

3) Video will be displayed on the phone after user click the ' OK ' option.

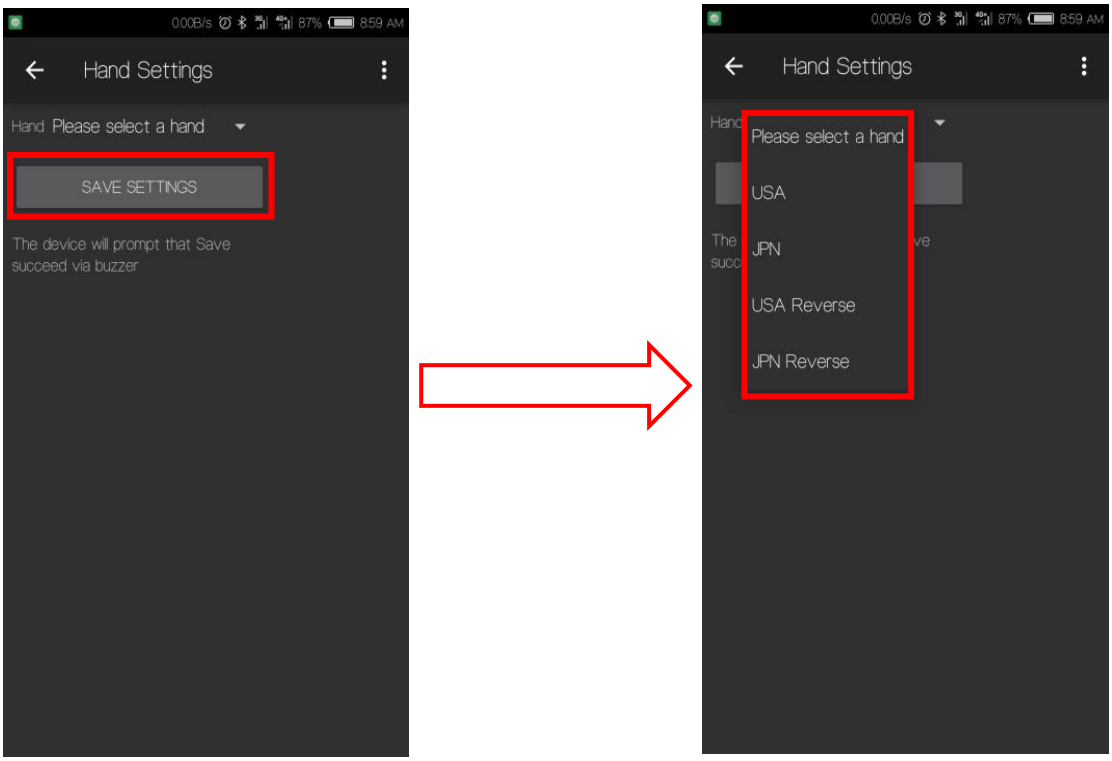


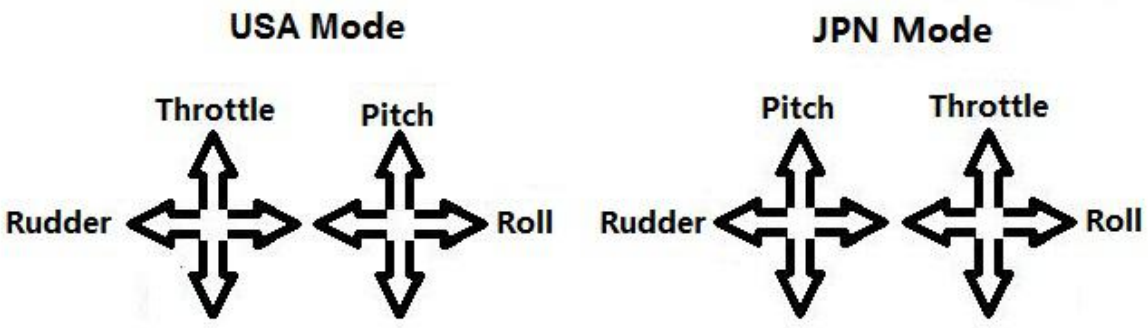
4.5 Hand Mode Settings Introduction

1) Connect user's phone, remote controller and drone

2) Open Device Helper.APP, click HAND SETTINGS and select hand mode: USA or JPN.

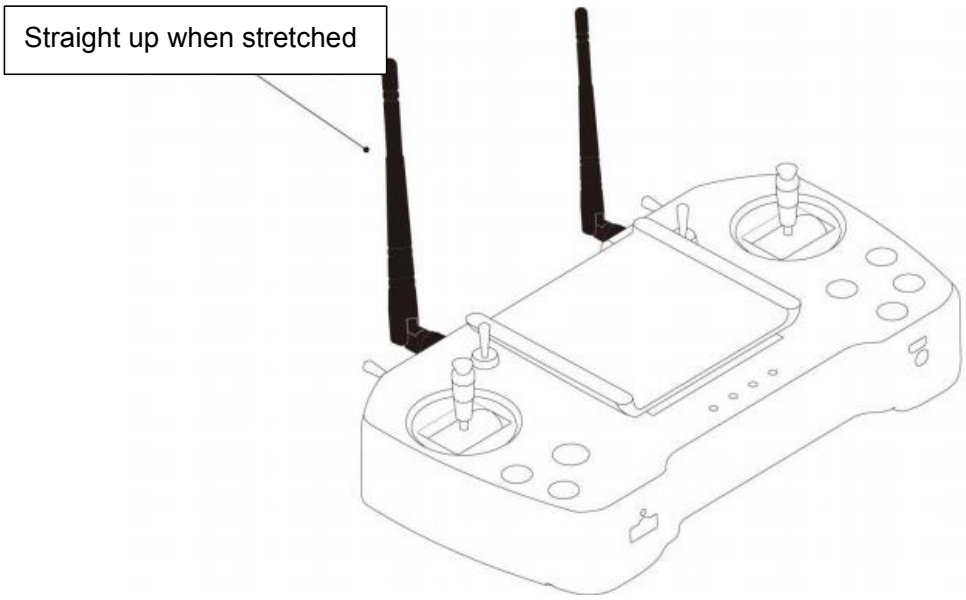
3) Click "SAVE SETTINGS" to save.



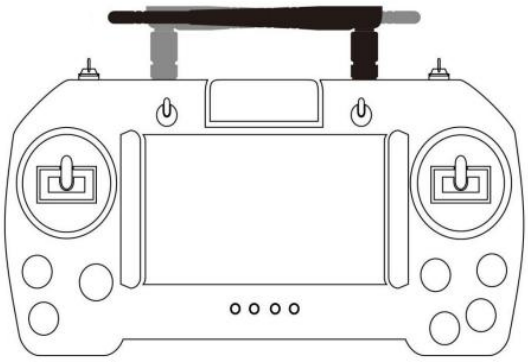


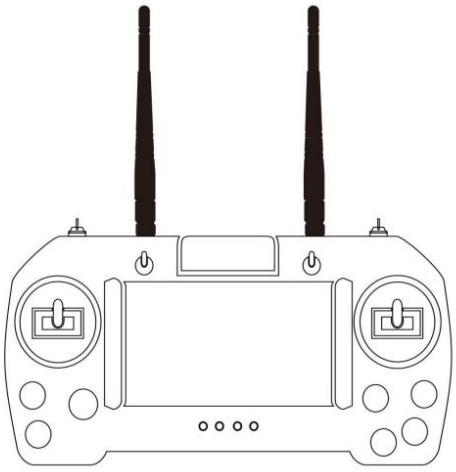
4.6 Remote Controller Antenna

Remote controller antenna should straight up when it is stretched.



Caution: Incorrect directions as the two pictures below.





5. GCS App Settings

5.1 Software Configuration

Figure 5-1

1. Please install the GCS (Ground Control Station) software.
2. After GCS installation,the label will be appeared as figure 5-1.

TTA-M4H support Android 4.0 or above

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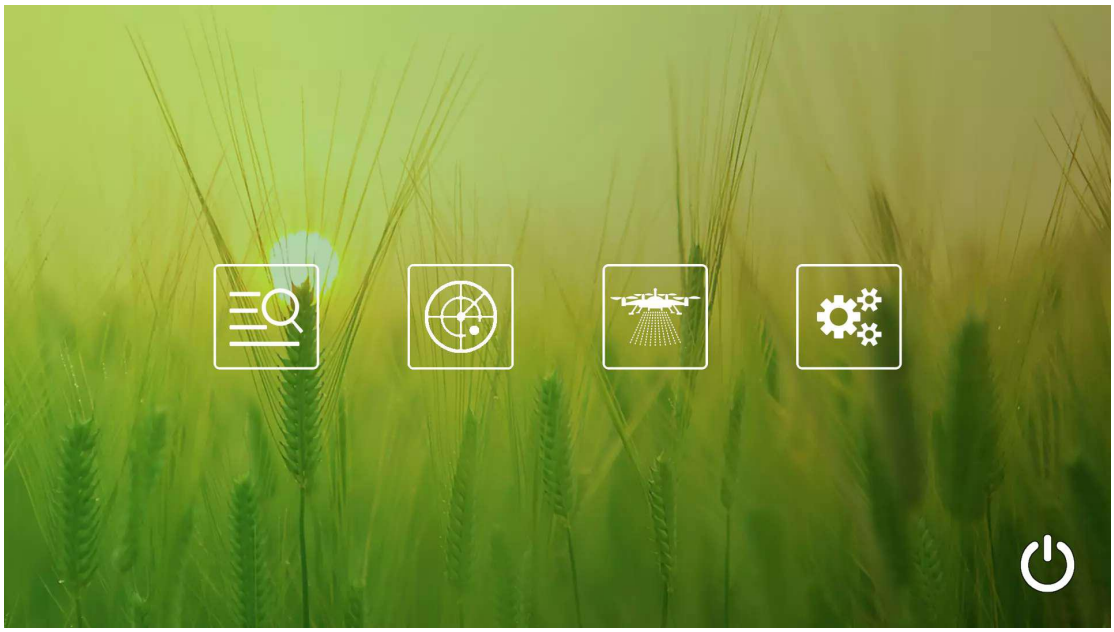
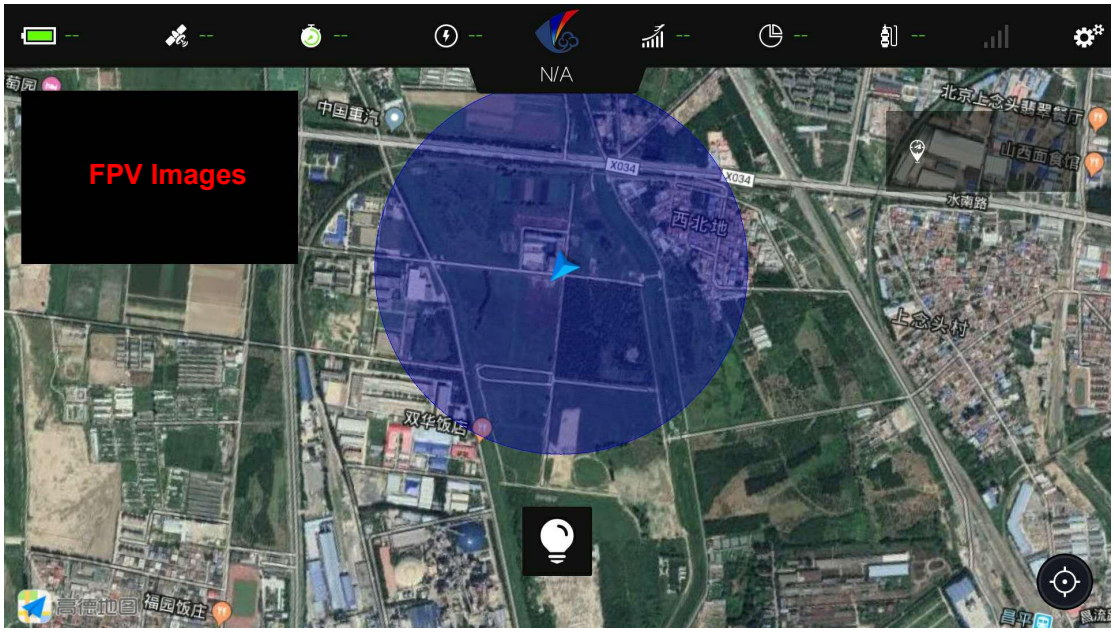
3. Open GCS,enter into the start page.
4. Enter into the main page ,see figure 5-2.



GCS main entrance has four function icons , from left to right: Statistical page, Monitor page, Mission planning and settings.

5.2 Mission Monitor Page



Icons from left to right,

Left: battery capacity, GPS satellites, flying time, horizontal speed

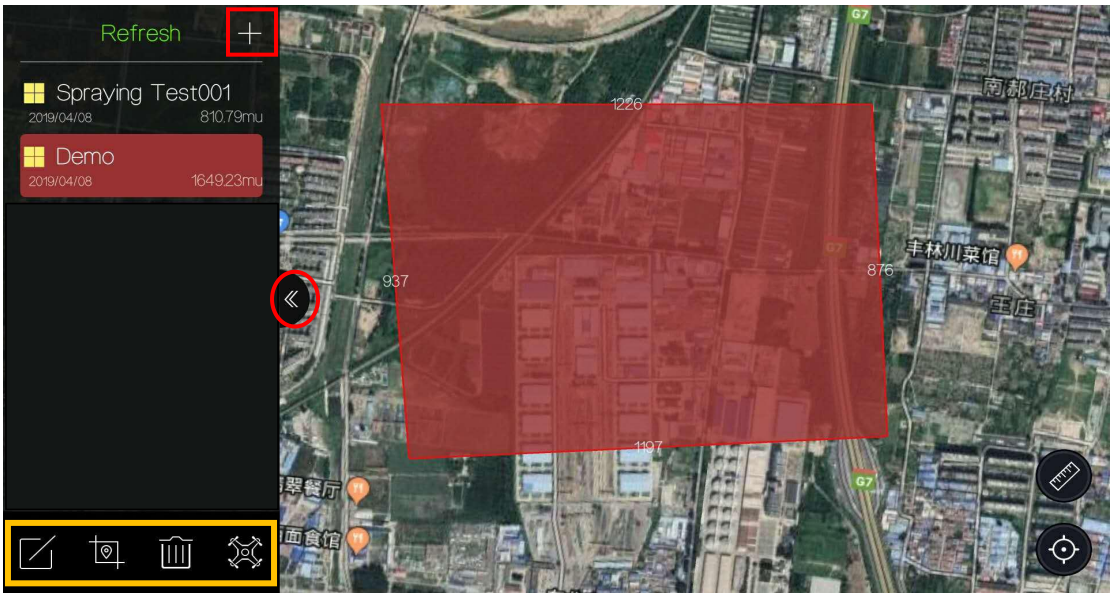
Middle: current flight mode

Right: altitude, mission area status(finished/total,unit:mu),remaining liquid(unit:liter),signal of remote controller,settings

Remark:1 hectare=15mu

5.3 Mission and Mapping

5.31 Block list

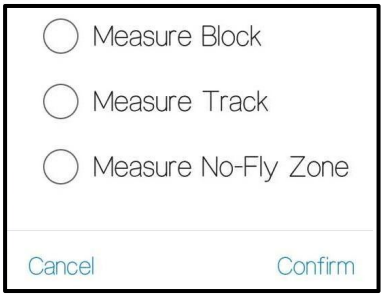


After entering the mission page of the ground control station(GCS), the GCS will locate the current user's location, and all the blocks that have been mapped will be listed on the left and displayed on the map at the same time.

1) The user can either select a block in the list or click on the map to select. The selected block will be highlighted in the list, and the map will move to the block position and display as large as possible.

2) The four icons in the yellow box below,from left to right: Rename, block division, delete, block planning.

3) Click the plus sign above circled by the red box, the dialog regular-block mapping mode and orchard mode mapping for the 'confirm' button,then jump to the mapping page.

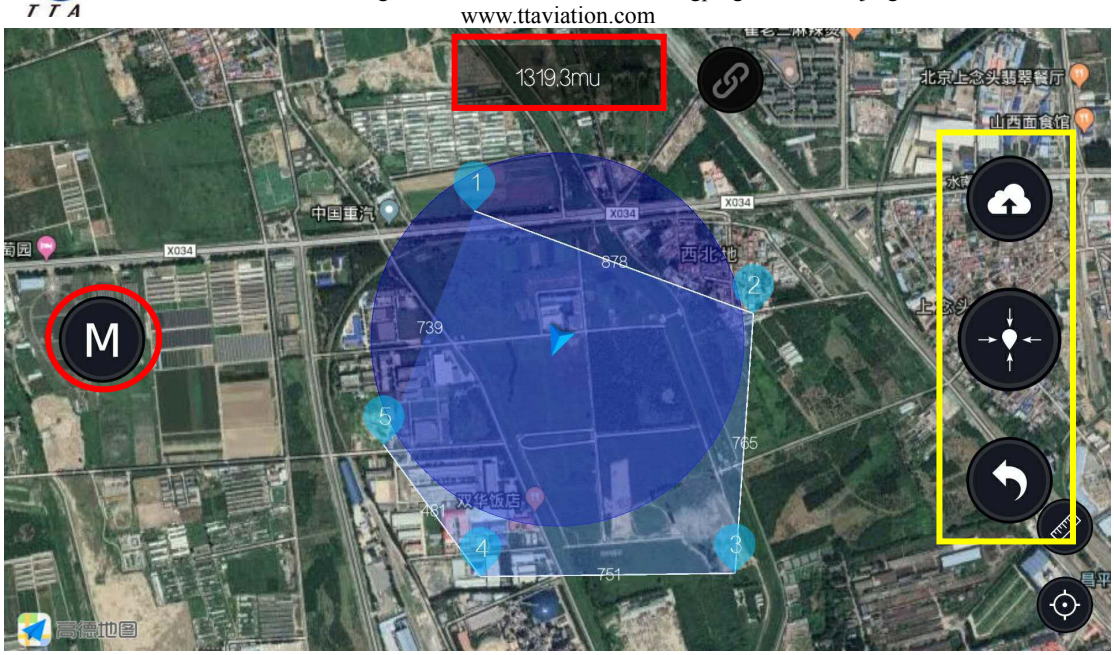


5.32 Measure Block

Measure block is used to map regular blocks.

1) Measure Block mode is used to map large areas of continuous land. Users can collect route points along the edge of the field (inflection point) to make a polygon and identify the field with it. After mapping finished, GCS can make routes according to the planning of block to start automatic mission.

2) After entering the mapping page, the GCS will automatically search for the spotting device, which can be automatically connected after the search is completed. A dot will be displayed on the map to indicate the positioning of the spotting device. Red indicates single point positioning, yellow indicates floating point positioning, and green indicates fixed positioning. When green is displayed, the positioning accuracy will reach centimeter level.



3) The left icon circled by red box indicates the kind of points. M indicates mapping point, O indicates obstacle point, C indicates calibration point.

Remarks:

The calibration point is used to calibrate the GPS coordinates of the drone. The deviation between drone's GPS positioning and GCS GPS positioning will make drone not follow the planned route. The function of the calibration point is to place the drone on it before the UAV works, so that the UAV can correct the deviation and fly on the planned route accurately.

4) The content on the top(circled by red frame) indicates the amount of mapped area (unit: mu. one hectare=fifteen mu)

5) The three icons on the right (circled by the yellow frame) are, from top to bottom: **finish**, **spotting** and **cancel**.

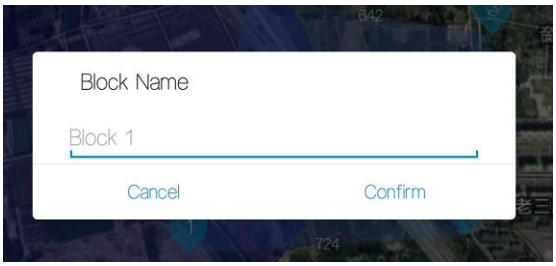
Spotting is to add the current mapping point location as the vertex point of the area. Mark points are displayed numerically when you add a block vertex point or obstacle vertex point. The calibration point will be displayed as C point.

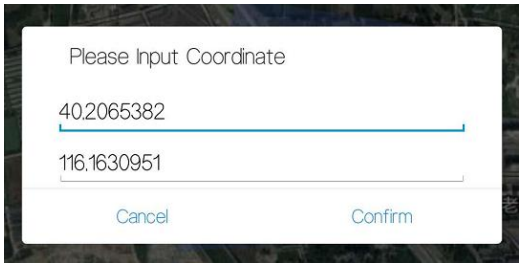
Cancel is to delete the last vertex point

Finish function has two meanings:

① In the process of obstacle mapping and calibration point mapping, Finish means that the current object mapping is over.

② In the block mapping process, Finish means the entire block is mapped completed, the name needs to be noted and then uploaded to the cloud.





Caution:

The shape of the block and the obstacle must be normal polygons, and no self-intersection is allowed.

User can click the calibration point to enter the accurate latitude and longitude coordinates as the picture above, when using a precise positioning tool,such as RTK .

5.33 Measure Track

1) The measure track is used to work in the situation where the Measure Block mode cannot be sprayed normally, such as orchard, tea gardens, etc. In these places, the distribution of crops is scattered, so the whole plot is not evenly sprayed. The Measure Track mode is the planning the track artificially ,and make the drone spray along the specified track.

2) In Measure Track mode, the GCS will also attempt to connect the spotting device.

3) The Measure Track mode does not require mapping obstacles. The left icon (in the red box) only support track mapping and calibration point mapping.

4) The three button functions on the right is the same with the Measure Block mode. After mapping completed, click the Finish icon to finish mapping, name it and upload to the cloud.

5.34 Block Division

1) The block division is proposed to divide one block into 2 or more parts.

When the measured block is too large (for example, the length of one side exceeds 1km), the liquid contained will not be sufficient to support the round-trip of single-route spraying, Therefore the work efficiency is greatly reduced. At this point, the blocks can be divided into a number of small blocks to make the single-route mission more efficient and improve work efficiency.

2) The three icons on the left (circled by a red frame) is Finish, Divide, Cancel.

3) Before the route is divided, user can freely move the map and select the location and size for easy division.When starting to divide, the map can not move any more. At this time, dragging the map can form a red line to cut the block. After the planning is completed, the block will be automatically divided along the red line, and the user can continue to adjust to make more divisions..

4) Cancel: cancel the last division action.

5) Finish: indicating that the division is completed, and all divided parts will be uploaded to the cloud.

5.4 Route Planning

1) Click block planning icon in block list to enter into route planning page.

2) For Measure Block mode, the route panning page is as below.

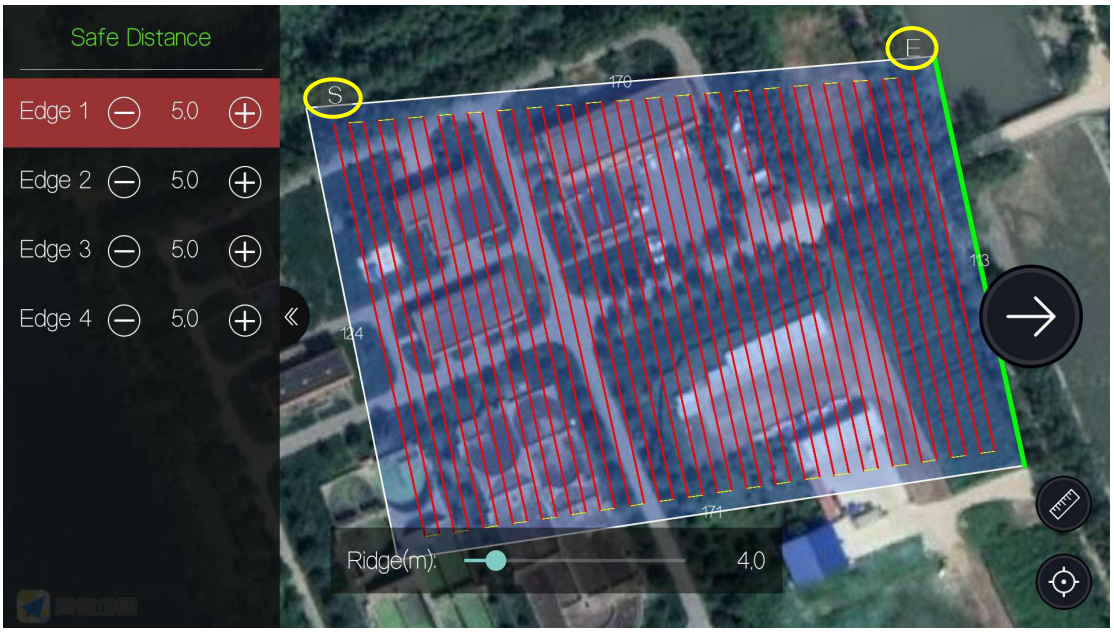
3) Safe distance is the distance between route and block boundary. User can set the distance to keep drone safe and improve work efficiency.

Ridge is the distance between 2 spraying route.

4) The direction of planned route can be adjusted by selecting boundary. The direction will be parallel to the selected boundary.

5) S and E point in planned route is the start point and end point. User can click on the corner of map to reset the S&E point,and also the route.

6) After all settings finished, user can click the arrow to enter into spraying page.



5.5 Mission Start

From left to right, the icons in the bottom red frame are: Spray rate, Points upload, Calibrate Drone (at calibration point), Take-off, Start route, Return to home point, Landing.

1） Click ‘Take-off’ icon, the GCS(ground control station) will upload the route to drone, and take off automatically.

2） After clicking the ‘Start Route’ icon, the drone automatically flies to the first point (Note: there can’t be any obstacles between the current drone position and the first

point) , then flies and sprays along the route.During the flight, the routes that have already flown will be marked in green.

3） Proper mission start process:

①Click 'Take-off' icon to make drone fly to the set altitude ② Click 'Start route' icon to start mission. ③If you want to break the route and return to home point, click "Return to home point' icon to return back.

Caution:

1. Before taking off, all operations can be returned to the previous page to modify, once taken off, it can not be modified.

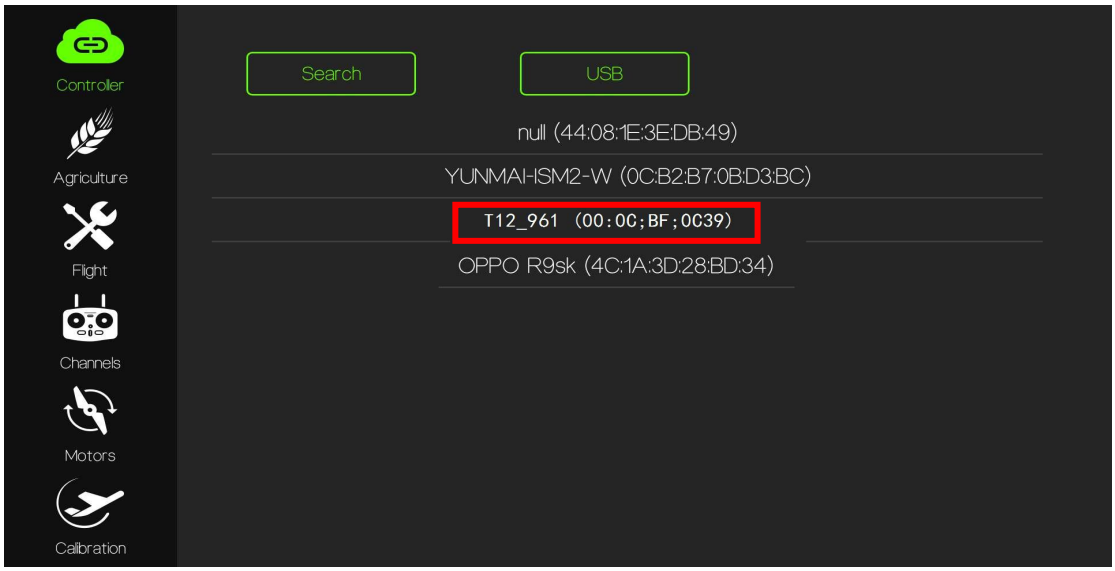
2. The top status bar will display battery voltage, current flying time, flying altitude, finished area(unit:mu), remaining liquid.

5.6 GCS Settings

GCS settings include choosing connection mode with drone, agriculture settings, flight parameter settings, remote channel inspection, motor inspection, flight calibration, reading flight logs, and setting the spotting device.

5.61 Connection Mode

GCS only supports Bluetooth connection of remote controller currently, users can connect remote controller after searching for Bluetooth and pairing.



5.62 Agriculture Settings

1) In the plant protection setting, the user can adjust the ridge distance (distance between two routes), flight height (relative to the height of the crop), flight speed (maximum speed), set the spray flow.

2) User can adjust the parameters by dragging the slider bar, or by clicking the plus or minus sign to adjust the parameters, or click on the number to directly input the parameter value.

Spraying rate settings:

Spraying rate(ml/min): Drone will spray at a certain rate as the set spray rate.

Spraying rate(ml/mu): It is used to set the amount of liquid per mu. The spraying rate will follow the flying speed. Drone will adjust the spraying rate automatically to achieve precise spraying.

5.63 Flight Settings

User can only reset the Take-off/Homing height(height above the ground), 2-levels voltage alarm and the corresponding two-level protection, Manual Direction, Manual Height, Max speed, Fence Height, Fence Radius.

Manual Direction/Manual Height: Manually controlling the direction/ height is turned on or not during flight.

Max Speed: Max speed corresponding to the top position of throttle in altitude mode

Fence Height/Fence Radius: Max flight height and radius. If beyond the height and radius, drone will return automatically.

5.64 Channels

1) In this section, user can check whether the remote controller and the drone are properly connected, and whether the remote controller is working properly. When user operate the switches or the joysticks, the corresponding channel changes in GCS.

2) Check whether the remote control value of 1-8 channels is within the allowable range for the ground station. Push the channel to the top or pull it down. If there is an over-range prompt, you will need to recalibrate.

3) Calibration Steps:

①Press and hold the C and D buttons of RC, then short-press and long-press the power button to enter into the calibration mode. RC will beep constantly after entered into successfully.

②Rotate the two sticks to maximum and minimum position 4 to 5 times.

③After calibration, long-press C button to exit calibration mode and meanwhile beep stops.

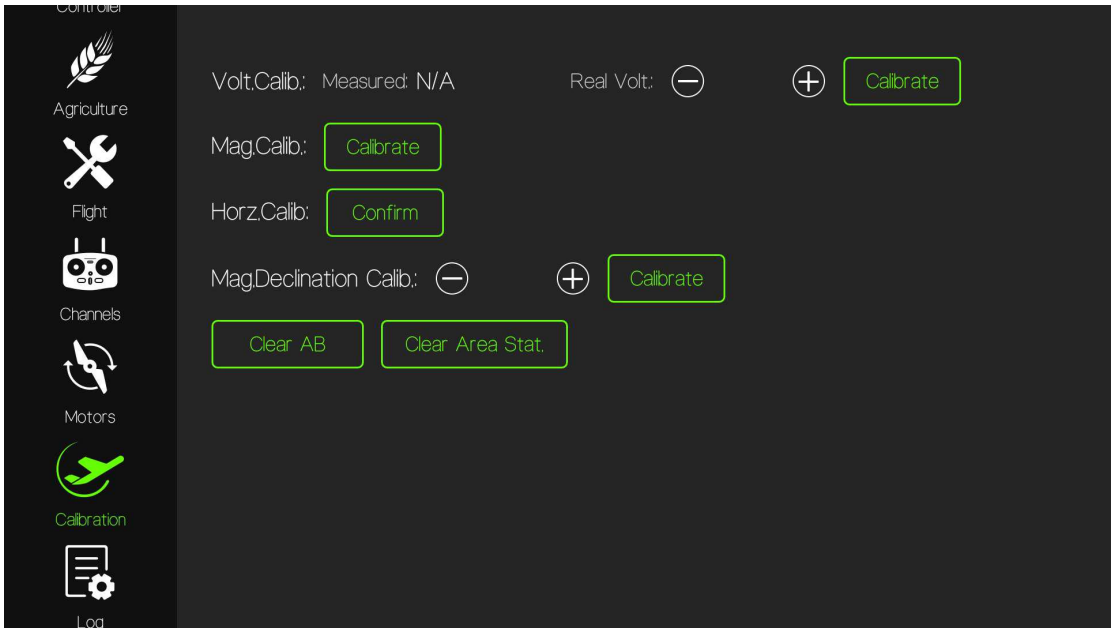
5.65 Motors Check

Motors Check section can check if the motor of the drone is working properly.

Click the check icon of motor. Click the check icon of motor, the corresponding motor will rotate, the speed will be displayed on the progress bar to judge its working condition.

5.66 Flight Calibration

Flight calibration is used to calibrate the battery voltage, compass and horizontal plane,

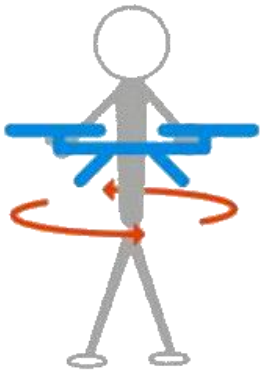


Volt.Calib(Voltage Calibration): This function can be used to calibrate to the correct value when the monitored voltage does not match the real voltage. Measure the real

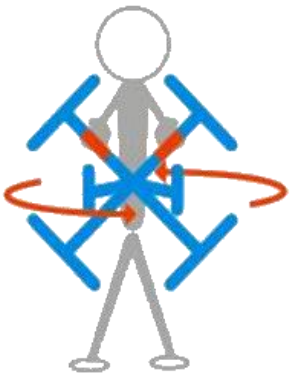
voltage, input the voltage into the blank and click “calibrate”.

Mag.Calib（Compass Calibration）: Place drone on a horizontal plane.Click “calibrate”, when green LED of drone is on, hold and keep drone rotating clockwise slowly.

When LED turns to blue, hold and place the drone vertically and keep the head up to the sky, rotate copter clockwise slowly till LED flashes,calibration succeeded. If LED turns to red , calibration failed. User need to calibrate again.



Rotate Horizontally

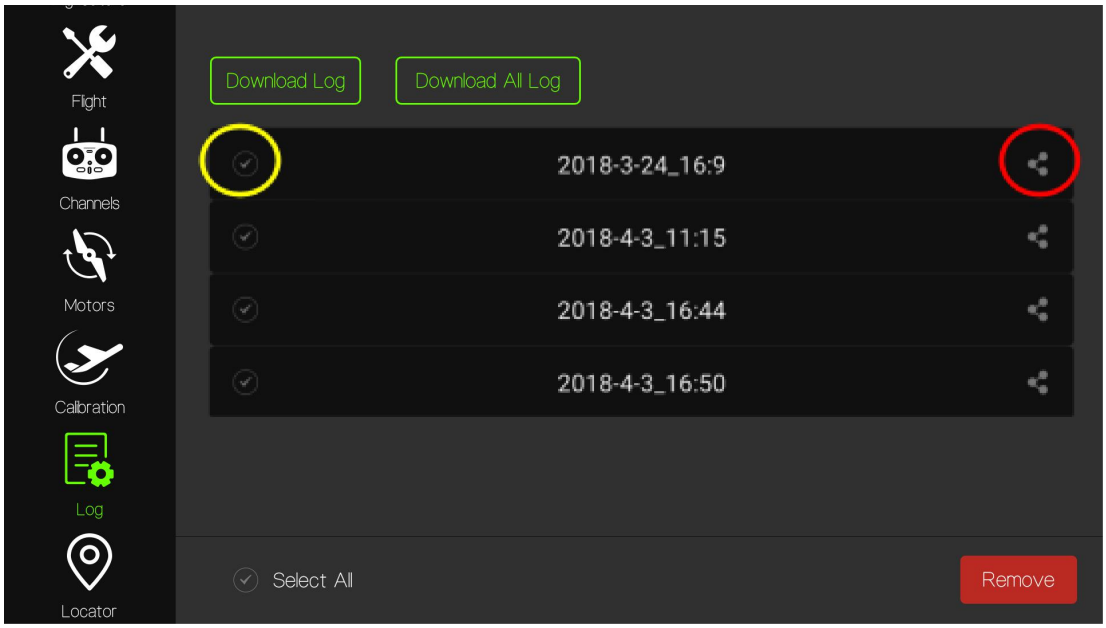


Rotate Vertically

Horz.Calib(Horizontal Calibration): Place drone on a horizontal level plane and click on the “confirm” to calibrate.

Mag.Declination Calib(Magnetic Declination Calibration): Right Declination---Increase the value of number, Left Declination---Decrease the value of number.

5.67 Logs



Click ‘Download Log’ to read the logs of drone.

Caution:

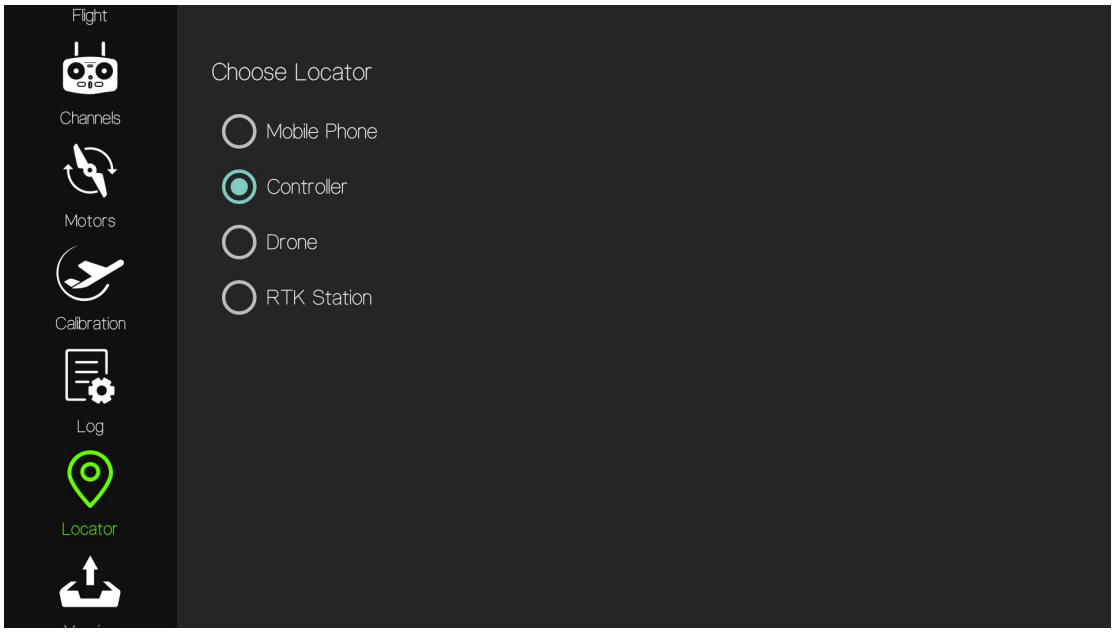
1) User can not download log unless drone is parked on the ground and the propeller is locked to avoid danger.

2) The mark in the yellow circle on the left of each log indicates whether it is selected. The button in the red circle on the right side is used to send logs to the developer via communication software,such as Wechat .

3) Click ‘Remove’ icon to delete the selected logs.

5.68 Locator

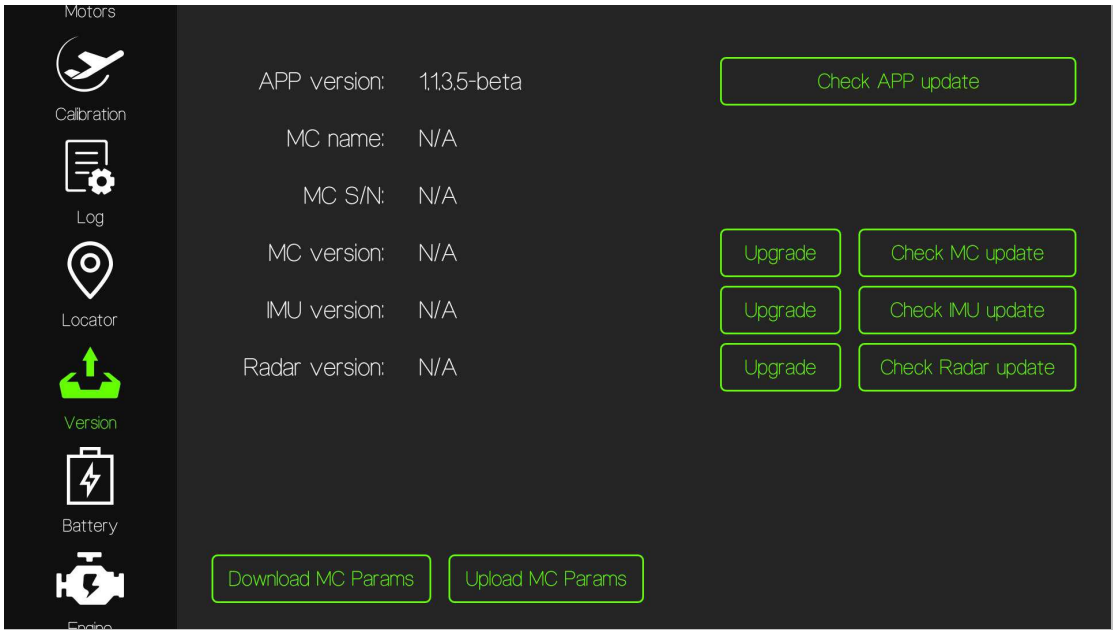
Locator section is used to chose spotting device, mobile phone,remote controller,drone and RTK station.



5.69 Version

Version information is used to display the GCS version, flight controller firmware version, serial number and flight control firmware upgrade.

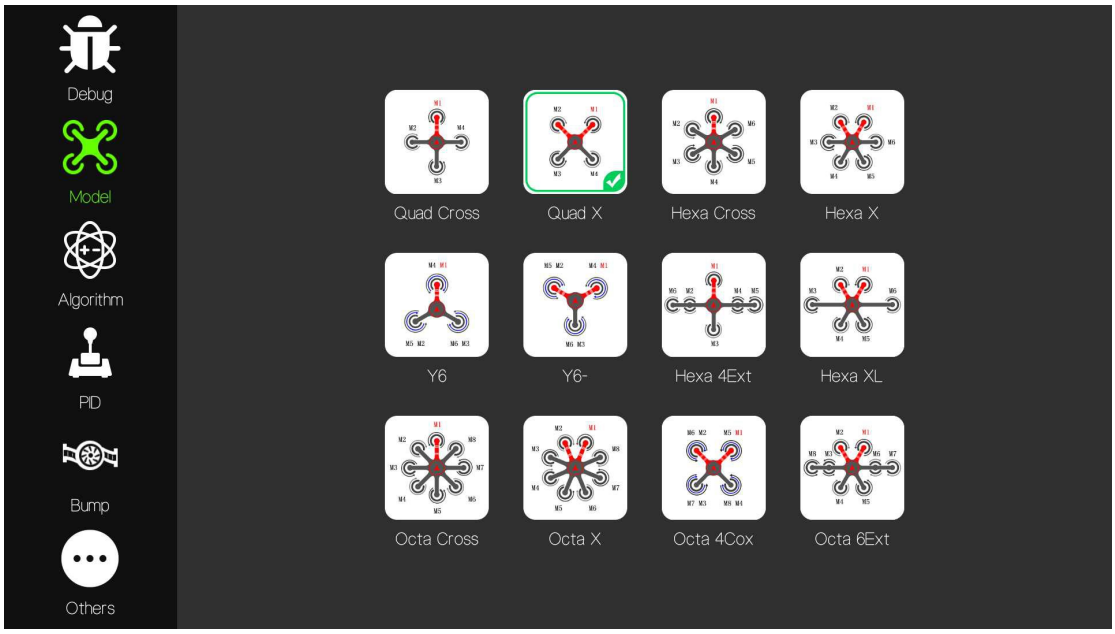
Caution: Do not upgrade the firmware unless under professional introduction. Otherwise all consequences shall be undertaken by users.



5.70 Advanced

Caution: Do not changing any settings unless under professional introduction. Otherwise all consequences shall be undertaken by users.

(1)Drone Model



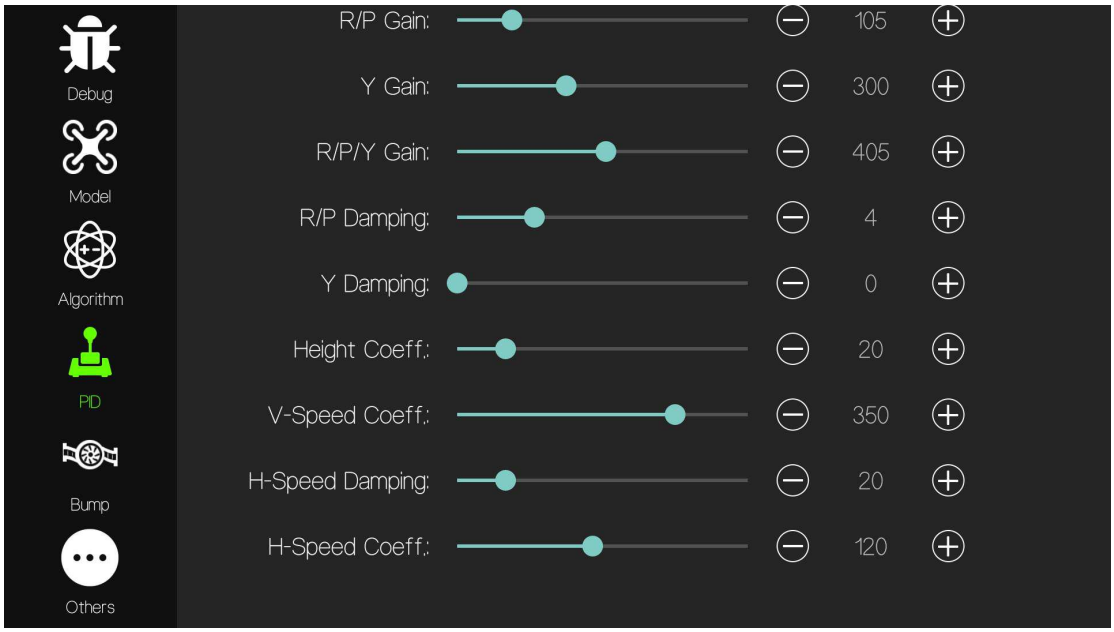
M4H drone's model chose QUAD X model.

(2)Algorithm

M4H drone settings:

MC Position: Back ; **Noise Suppression**: Strong ; **Idle Speed**: Slower

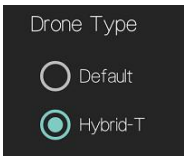
(3)PID



PID(sensitivity settings) is as the picture above.

(3)Drone Type

Ensure the drone type is set on “Hybrid-T”.



6.Flight Preparation

6.1 Check Before Takeoff

6.11 Conditions Requirement

Open field and no shelter conditions to avoid affect the GPS signal;

Wind is less than 5 level (≤8m/s);

No strong magnetic field around, such as high-voltage lines, magnetite, etc., so as not to affect the running of the magnetic compass.

6.12 Drone Status Check

1) Check all connectors and wiring to ensure all connected well.

2) Check the battery and wiring to ensure sufficient power supply

3) Power on and check the status light.

4) Switch the remote controller mode, push the sticks to check the reactions of drone.

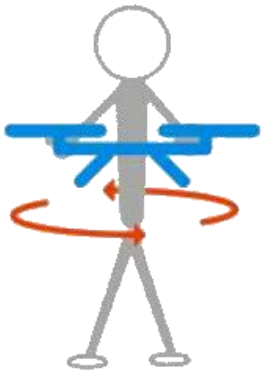
6.2 Compass Calibration

1) Place drone on a horizontal plane.

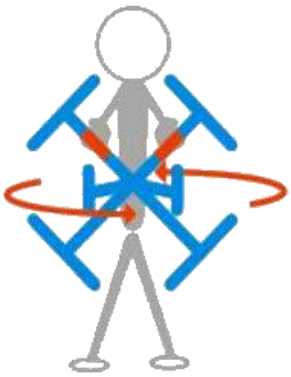
2) Push E lever of RC from top to bottom rapidly for 5 times to enter into compass calibration mode. Or Click “Mag.Calib” icon in Calibration section of GCS to enter into compass calibration.

3) when green LED of drone is on, hold and keep drone rotating clockwise slowly.

When LED turns to blue, hold and place the drone vertically and keep the head down to the ground, rotate copter clockwise slowly till LED flashes,calibration succeeded. If LED turns to red, calibration failed. User need to calibrate again.



Rotate Horizontally



Rotate Vertically

Drone need to be calibrated,when

- GPS or flight controller was moved to other positions。
- Electronic wiring of drone is changed.
- The distance between the last calibration place is over 30-50KM.
- Drone can not fly in a straight line,or it circles a fixed point.

Caution:

(1) Compass should be calibrated after changing flying area.

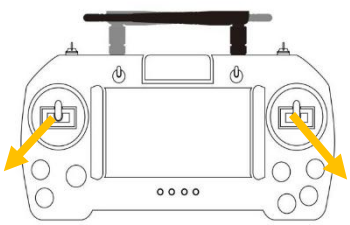
(2) Calibration should be done in outdoor, far away from high tension line tower which is easy influenced by magnetic interference.

(3) Keep horizontal and vertical during the slow calibration.

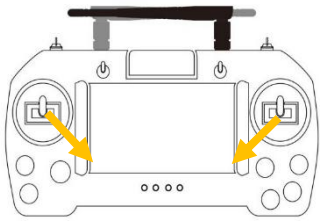
6.3 GPS

Place the aircraft in an open field, power on the power battery, and wait for drone to complete the search for satellites. When the number of satellites is not enough, the LED light will flash red 2 times. The red light will flash one time when the GPS positioning is poor. Unlocking is forbade when there has a red light. When there is no red light / blue light / blue light prompt, you can unlock normally.

6.4 Lock & Unlock



Unlock



Lock

1) Push stick as outer eight shape to unlock drone. Meanwhile,Keep away from the drone to avoid any injuries.

2) Push stick as inner eight shape to lock drone(only for emergency use.While flying,inner eight operation can also lock drone).

3) After unlocked, push the throttle above the neutral position to make the aircraft take off.

4) After unlocked, motor will be stopped and locked automatically if user do not push the throttle above the 10% position in 3 seconds.

Cautions:

1. Motor may can not be unlocked, if user didn't calibrate the sticks.
2. If the fine adjustment of the joystick is not zero, the motor may not start when the unlocking action has performed !
3. Motors can not start by unlocked action if idle speed is too high.
4. Keep away from the drone to avoid any injuries and property damage while unlocking

7. Non-Autonomous Flight Modes

7.1 Altitude Mode

GPS is not used for positioning and drone can only stay at a certain altitude. Altitude mode is the safest mode by only depending on IMU of flight controller, not affected by any other sensors.

In altitude mode, drone can not positioned,which may result in horizontal shifting. User need to control drone by RC constantly.

Working conditions:

After the flight controller is initialized, user can unlock drone when the LED light flashes green quickly. In altitude mode one green LED light flash at a time.

Operation Introduction:

1. Push the E lever to chose altitude mode and unlock drone. Motor is on idle speed mode if throttle is on on neutral position. Drone will take off by gently pushing throttle beyond neutral position. Drone will stay at a certain height during flying if throttle is back to neutral position.

2. User can take over drone and break auto-route mission by switching to altitude mode.

7.2 GPS Mode

In GPS mode, drone will use GPS module to position precisely. Therefore, drone is able to stay on a certain height and a certain point.

Working conditions:

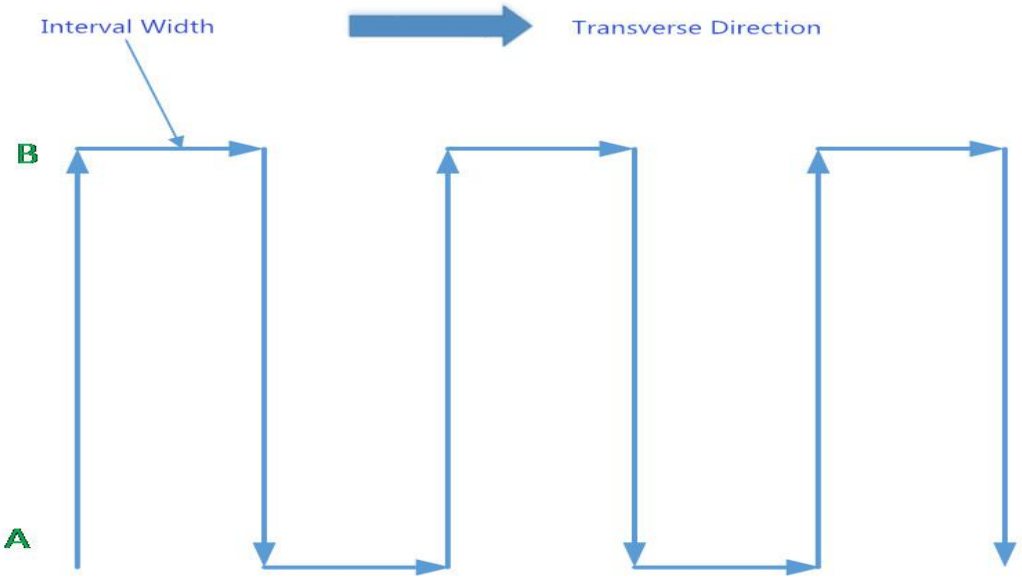
Drone can not take off unless GPS module has searched enough satellites and only green light is flashing. In GPS mode green LED light will flash two times constantly at a time.

Operation Introduction:

After researching satellites and positioning completely, switch E lever of RC to GPS mode and then unlock drone. Motor is on idle speed mode if throttle is on on neutral position.

Drone will take off by gently pushing throttle beyond neutral position. Drone will stay at a certain height and a certain point during flying if throttle is back to neutral position.

7.3 AB Mode



AB mode is a more simple efficient mode with fault tolerance to operate.The working theory is above in the picture.Record the point A and B,the UAV will plan the flight line like this.

AB mode supports terrain following function(if have), adjusting length of route manually, adjusting height and heading direction manually.

7.31 Operation Steps

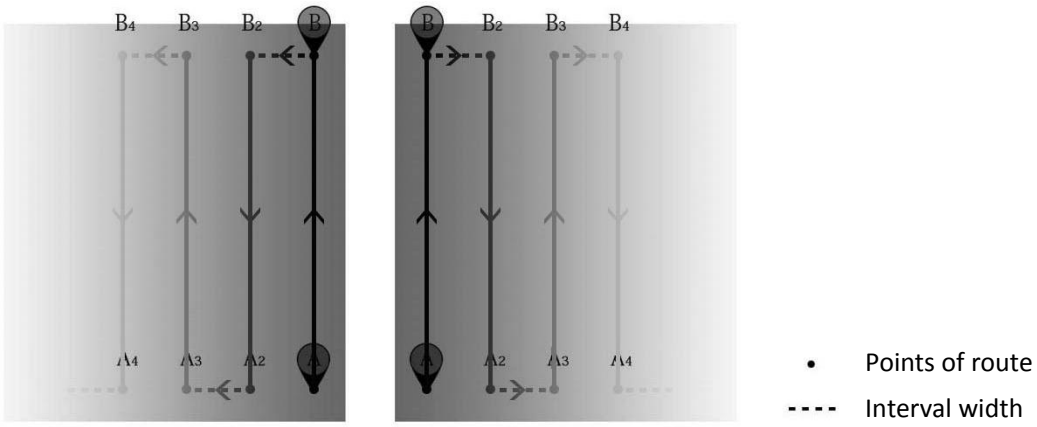
1) Delete the last AB-point dates firstly by push AB Recording Stick from top to bottom rapidly for 4~5 times. The GCS will prompt that AB dates has been removed.
2) Record the point A. Switch the flight mode to GPS mode. Take off manually, fly to the start point, A point. Until the drone self-hovering steadily at A point, switch F to middle ”Point A memorized”. After that,the LED flash purple. The GCS will have voice prompt.
3) Record the point B. Drive the drone to the position(point B) you want,**be sure it is at least 10 meters away from point A**. Until the drone self-hovering steadily,switch F to

the bottom, ”Point B memorized”.After that,the LED flash purple 2 times at a time. The GCS have voice prompt.

4) Switch G lever to select spraying mode,**auto-controlled or manual-controlled.** Press A button ‘Flow Rate’ to open spraying function.

5) Select the spraying direction. Switch E (Flight mode) to AB mode. Move the roll joystick to select the roll direction.

If move the joystick to left side, then the drone rolls to the left,and starts to fly along the route.If move the joystick to the right, the drone rolls to the right side,and starts to fly along the route.While the drone doing AB point flight mode,the user can stop controlling the joystick. **Interval width can be set in Agriculture settings of GCS.**



Roll to left Roll to right

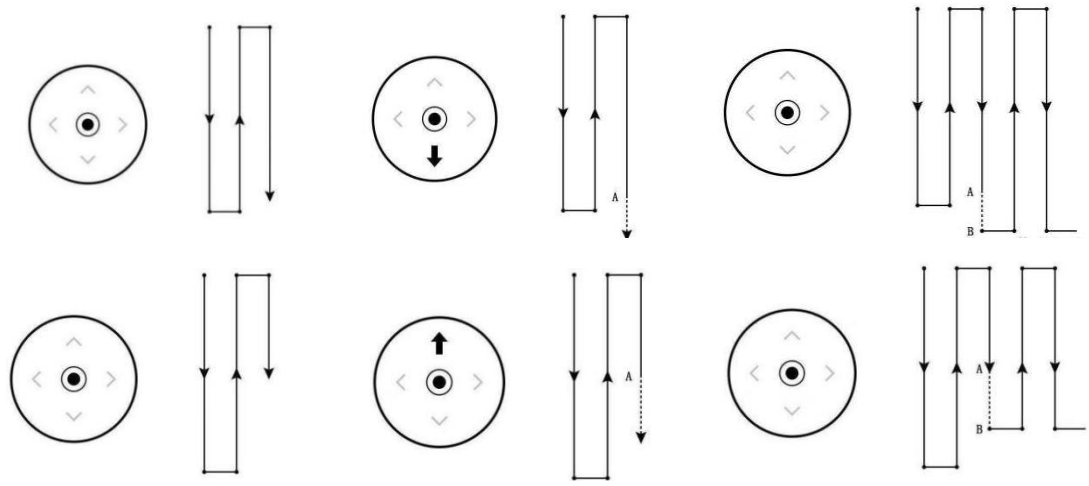
7.32 AB Mode adjustment

①Altitude correction:Control the flight altitude by the throttle joystick, “up” for the drone to rise, the “down” for the drone to set ;

②Correct the the rudder to control the direction;

③Extension the length of route: while the drone fly to a point nearby the extended position, control pitch stick to fly further. Drone will fly in a 2-meter speed. Release the pitch stick when drone almost reach at the extended position.

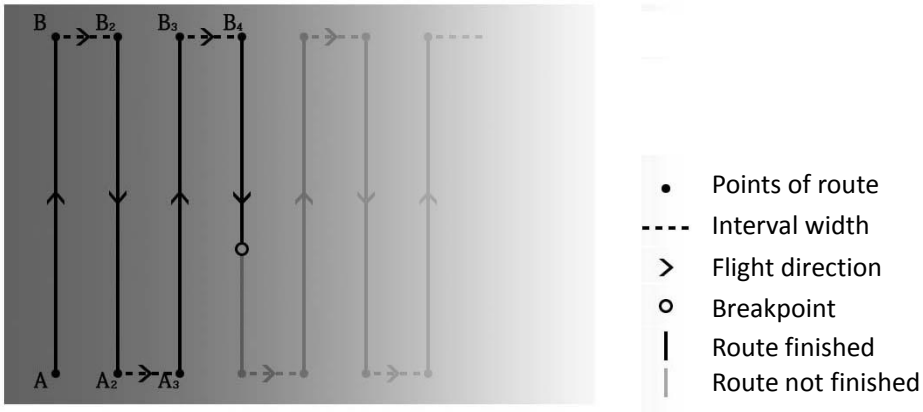
④Shorten the length of route: while the drone fly to a point nearby the shorten position, control pitch stick to fly further. Drone will fly in a 2-meter speed. Release the pitch stick when drone almost reach at the extended position.



7.33 Route Resumption

When exiting the AB route manually or automatically, the aircraft will record a breakpoint. The route resumption function allow user to pause temporarily and then resume the route at the breakpoint.

Take off and drive drone to the working height, then switch E lever (flight mode) to AB mode. Control pitch stick to fly forward, then the drone would fly to the breakpoint and resume the route.



7.34 Manual Obstacle Avoidance

In AB mode, user can control the drone forward,backward,left and right to avoid obstacles along the route or in emergency. The operation is as below.

Push roll stick, drone will stop flying forward ,then move to the direction as the roll operation. When drone reached the safe position, push pitch stick to bypass the obstacle. Then release all sticks, drone will resume the route automatically.

Appendix Implication of Indicator Light

Color	Indicator light	Specification
Red		System initialization/Compass calibration failure
		Poor positioning
		Very poor positioning
		Low voltage alarm
Green		Compass horizontal calibration
		Altitude flight mode
		GPS flight mode
		Automatic flight mode
		Positioning good,ready to take off
Blue		Compass vertical calibration
		Transmission alarm
		No IMU dates/Hovering shaking alarm
		GPS satellites lost alarm
		Speed alarm
		Position alarm of remote controller
Yellow		Accelerator alarm
		Gyroscope alarm
		Magnetometer alarm
		Temperature over 65° alarm
Purple		Recording A point
		Recording B point
		Remote controller calibration
		ESC calibration
Cyan		Poor altitude status
		Poor motor balance
White		Radar is available

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   B) the unauthorized modification, debugging, and replacement parts products.
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Tech-support:
Beijing TT Aviation Technology
Tel:+86 13581977281
Emil: tta_gobal@ttaviation.com