WooKong Multi-Rotor

User Manual

V 3.6

2013.01.30 Revision

www.dji-innovations.com

Warning & Disclaimer

WKM is an excellent autopilot system offering excellent flight features for low altitude multi rotor, working in restricted space compared to a conventional RC helicopter. It is not a toy when installed in multi rotors of any size. Despite our efforts in making the operation of the controller as safe as possible when the main power battery is connected, such as: disabling MC signal to ESCs when USB is connected; disabling throttle input and stick command when throttle stick is not at the lowest position on power up, we strongly recommend users to remove all propellers, use power supply from R/C system or flight pack battery, and keep children and animals away during firmware upgrade, system calibration and parameter setup.

As DJI Innovations has no control over use, setup, final assembly, modification (including use of non-specified DJI parts i.e. motors, ESCs, propellers, etc.) or misuse, no liability shall be assumed nor accepted for any resulting damage or injury. By the act of use, setup or assembly, the user accepts all resulting liability.

DJI Innovations accepts no liability for damage(s) or injuries incurred directly or indirectly from the use of this product. Please read this manual carefully and strictly follow the steps to mount and connect the WooKong for Multi Rotor (WKM) system on your multi rotor, as well as to install the Assistant software on your computer.

Please observe all local laws and regulations of the country you are operating the equipment in.

For example:

AMA's (Academy of Model Aeronautics) National Model Aircraft Safety Code, USA

BMFA (British Model Flying Association) Model Aircraft Safety Code.

CAA (Civil Aviation Authority) Model Aircraft and UAV Codes of practice.

DMFV (German Model Flying Association) Model Aircraft Safety Code.

These are only a few examples; please investigate the laws and regulations for your particular location.

Never fly over others or near crowds.

WKM Profile

DJI WooKong for multi-motors (WKM) is an autopilot system designed for serious multi-rotor enthusiasts providing excellent self-leveling and position holding, which completely takes the stress out of flying RC multi-rotors for both professional and hobby applications. WKM can be installed in a variety of models from quad-rotor to octo-rotor.

WKM Control Modes			
	GPS Atti. Mode	**Atti. Mode**	**Manual Mode**
Command Stick Meaning	Multi attitude control; Stick center position for 0˚ angle, stick endpoint is 35˚ angle.		Maximum angular velocity is 150 ?/s. No attitude angle limitation and vertical velocity locking.
Command Linearity	YES		
Stick Released	Locks multi-rotor position when GPS signal is adequate.	Only attitude stabilization.	NOT Recommend
Altitude Lock	Maintains the altitude, best above 1 meter from the ground.		NO
GPS Lost	When the GPS signal is lost for more than 10seconds, the system enters **Atti. Mode** automatically.	Only attitude stabilization, GPS / position lock not used in this mode.	GPS not used
Safety	Mixture of Attitude & speed control ensures stability; Enhanced fail-safe		Depends on experience.
Applications	AP work	Sports flying.	Extreme flying

In Box

Main Controller (MC) ×1

The Main Controller (MC) is the brain of the system, it communicates with the IMU, GPS/Compass，ESC's and RC transmitter to carry out autopilot functionality. The Main Controller has a USB interface for configuration and firmware updates via a PC.

IMU ×1

The Inertial Measurement Unit (IMU) consists of one 3-axis accelerometer, one 3-axis gyroscope and a barometer. It is used for sensing the attitude.

GPS & Compass ×1

The GPS/Compass module is for sensing the position and direction.

LED Indicator ×1

The LED indicates different states of system.

Power Management Unit (PMU) ×1

Specially designed for the WKM to convert the higher voltage of the power circuit to the lower voltage required for the receiver etc. It contains two regulated power outputs for the entire WKM control system and receiver separately, a battery voltage monitor, and two CAN-Bus interfaces.

GPS Bracket ×1

Because the GPS & Compass are sensitive to magnetic interference, you should use this bracket to mount the GPS module.

PMU Connecter ×1

For connections between battery, ESCs and PMU.

USB Cable ×1

This cable is used to configure the MC and to update the firmware.

3-PIN Servo Cable ×10

Cables used to connect the Main Controller to the RC receiver.

Mounting Pads ×4

For fixing WKM components on the multi-rotor's frame.

Warranty Information Card ×1

It lists the necessary steps for using the WKM system and related safety advice. Please fill out the customer & multi rotor information card and return to DJI Innovations to register your product warranty.

Index

Important Information

For safety reasons, please pay serious attention to all following items:

1. **Please disconnect the ESCs from the power battery or remove all propellers during firmware upgrade, configuration and system setup.**
2. **Pay attention to the IMU mounting direction; Do not mount the IMU upside-down.**
3. **You have to reboot the MC and redo the TX calibration after you change the RC system.**
4. **In the TX Calibration menu of assistant software:**
   - **Throttle: Screen slider left is craft down, slider right is craft up**
   - **Rudder: Screen slider left is nose left, slider right is nose right**
   - **Elevator: Screen slider left is craft back, slider right is craft front**
   - **Aileron: Screen slider left is craft left, slider right is craft right**
5. **GPS/Compass is sensitive to magnetic interference; it should be mounted far away from any electronic devices and motors.**
6. **Make sure you switch on the transmitter first, then power on the multi-rotor. Power off the multi-rotor first, then switch off the transmitter after landing**
7. **Do not fly in GPS Mode when the signal is not good (red light blinks)**
8. **If you enable the gimbal control in the assistant software during the configuration, please note that there will be an output from the F1 and F2 ports. With the gimbal enabled you must not connect these ports to ESCs which are connected to motors/propellers.**
9. **Do NOT set the fail-safe position of the throttle below 10%.**
10. **Throttle stick position should always be higher than 10% from cut-throttle during the flight**
11. **You must set up the Low voltage protection properly in the assistant software. You should land your multi-rotor ASAP after any indication of low voltage, to prevent your multi-rotor from crashing or other harmful consequences**
12. **Using Immediately mode to stop motors: To start the motors you execute Combination Stick Command (CSC) and push the throttle above 10% within 3 seconds, if the throttle is not above 10% within 3 seconds then the motors will stop. In any control mode, once motors start and throttle stick is above 10%, motors will stop immediately when throttle stick is lowered below 10% again. At this point, if you raise the throttle stick above 10%, within 5 seconds after motors stop, motors will re-start with no need for Combination Stick Command (CSC). After 5 seconds you will need to execute Combination Stick Command (CSC) to restart the motors.**
13. **Using Intelligent mode to stop the motors: The motors will start or stop immediately when you execute Combination Stick Command (CSC). During normal flight, lowering the throttle stick below 10% will not stop the motors in any control mode. If you execute CSC during flight then**

the motors will stop, you will have to execute CSC again to re-start the motors if they stop during the flight.

14 **When you set Mixer Type from Octo-rotor to Quad-rotor / Hexa rotor, the gimbal setting will automatically switch to off for safety, which may lead the gimbal to tilt to one side, please turn to the Gimbal section for reconfiguration.**

15 **It is strongly recommended to install the receiver under the bottom board of the center frame, with the antennas pointing downwards without any obstacle. Control of the aircraft could be lost if the radio signal is lost due to an obstacle (such as the base plate).**

16 **Make sure all connections are correct, secure and in good condition before flight.**

17 **Keep wireless video transmission equipment a distance away from the main controller (>25cm), to prevent interference to the main controller.**

Assembly

GPS/COMPASS

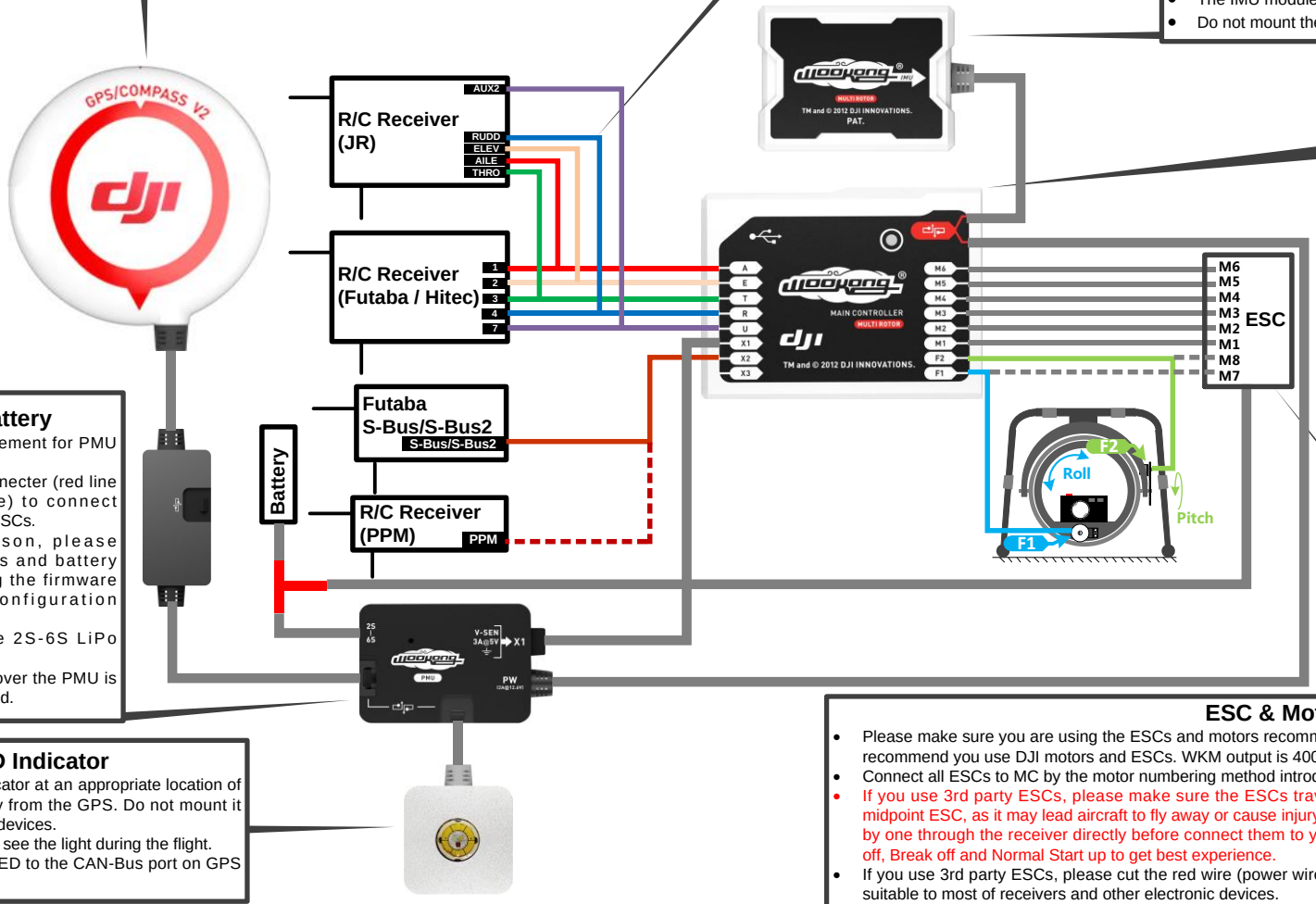
- GPS/Compass is sensitive to magnetic interference, should be far away from any electronic devices.
- You should use epoxy resin AB glue to assemble the GPS bracket first as the figure showed in previous page.
- Mount the bracket on the center plate of craft first, then fix the GPS on the plate of the bracket (by 3M glue provided). The GPS is sensitive to vibration interference, so position the bracket at least 10 cm from any rotor.
- The DJI logo marked on the GPS should face the sky, with the orientation arrow pointing directly forward. The GPS/Compass is packaged with a special indication line for mounting for the first time.
- If you are uncertain whether materials near the GPS/Compass module are magnetic or not, you can use a compass or magnet to check it. If you use your own mounting rod, make sure it is NOT magnetic!

R/C System

- These are example connections. Please setup Aileron, Elevator, Throttle, Rudder channels on your Tx first, and choose one 2 or 3 positions switch/ channel as control mode switch, then connect your receiver to the right ports on MC.

IMU

- The IMU is best positioned near the multi rotor's center of gravity, where vibration is relatively low.
- Orient the IMU such that the arrow marked on the printed surface of the IMU faces the sky and points directly forward, backward, left or right.
- The sides of the IMU should be precisely parallel to the multi rotor body. Use double-sided foam tape for secured installation.
- Check the double faced adhesive tape regularly to ensure that the IMU is securely positioned.
- DO NOT cover the ventilation holes, keep them unobstructed.
- The IMU module is NOT water-proof or oil-proof.
- Do not mount the IMU upside-down.



Main Controller

- There is no orientation requirement for the Main Controller. Choose a mounting location where as shorter ESC extension wires are needed as possible. Please make sure all ports are accessible when installing the MC so as to facilitate wiring and software configuration.
- In three-pin ports, pins near the nicks are signal pins.

- After choosing a location to mount the MC, it is recommended that you DO NOT mount the MC until all wirings and software configurations are completed.

PMU & Battery

- There is no requirement for PMU mounting.
- Use our PMU Connecter (red line depicts in figure) to connect battery, PMU and ESCs.
- For safety reason, please disconnect ESCs and battery connecter during the firmware upgrade and configuration procedure.
- You can choose 2S-6S LiPo battery.
- Sufficient air flow over the PMU is highly recommended.

LED Indicator

- Place the LED indicator at an appropriate location of craft body far away from the GPS. Do not mount it on other electronic devices.
- Make sure You can see the light during the flight.
- You can connect LED to the CAN-Bus port on GPS connection wire.

ESC & Motor

- Please make sure you are using the ESCs and motors recommended by the manufacturer of your multi rotor first. We recommend you use DJI motors and ESCs. WKM output is 400Hz refresh frequency.
- Connect all ESCs to MC by the motor numbering method introduced in ***Multi-Rotors Supported*** of ***Appendix***.
- If you use 3rd party ESCs, please make sure the ESCs travel midpoint is at 1520us. DO NOT use 700us travel midpoint ESC, as it may lead aircraft to fly away or cause injury and damage. After connect ESCs, calibrate ESCs one by one through the receiver directly before connect them to your MC, Make sure program all of them into Governor off, Break off and Normal Start up to get best experience.
- If you use 3rd party ESCs, please cut the red wire (power wire) of your ESCs , as the power from V-SEN on PMU is suitable to most of receivers and other electronic devices.
- If you use extra BEC, please use a servo cable without power wire to connect V-SEN to X1. (Not recommend)

Assistant Software

Software and Driver Installation

STEP1: Please download assistant software and driver from our website. If your operating system is 32bit, download 32bit driver; if your operating system is 64bit, download 64bit driver. Then decompress;

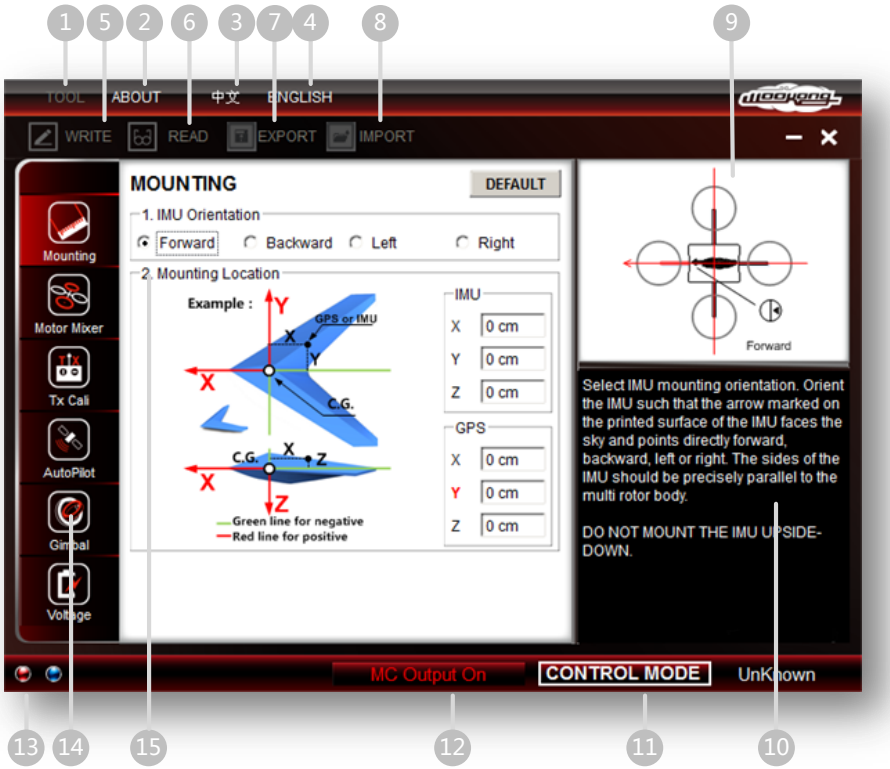
STEP2: Connect MC (Main Controller) and PC via USB cable, power on MC;

STEP3: If operating system tries to install driver automatically, cancel it.

STEP4: Open folder DJI_Wookong_M_Driver_32bit or DJI_Wookong_Multi_Rotor_Driver_64bit, double click Driver Setup.bat file and follow the steps to finish installation.

STEP5: Open the assistant software folder, double click Setup.exe file and follow the steps to finish installation.

GUI (graphical user interface)



1 TOOL

- ➔ Flight Limits: Set the height limit or distance limit if necessary, please refer to the section of “Flight Limits” for details.
- ➔ Firmware upgrade: Update your firmware from DJI server, keep your WKM system up-to-date.
- ➔ Disable All Knob: Set remote gains in “Autopilot” menu to INH
- ➔ Check for Updates: Check for latest versions of assistant software and firmware. If necessary, you can follow the links displayed to find the download page.

2 ABOUT

- ➔ Info: Information regarding your WKM.
- ➔ Error Code : Error code list

3 中文: Chinese interface.

4 ENGLISH: English interface.

5 WRITE: Write data of the current page to your MC. The parameter or the title of which will turn red and bold when modified, make sure you click the Write button or press Enter to update your system. Optional parameters will be written to MC directly after modification.

6 READ: Read parameters from MC for current page.

7 EXPORT: Export configuration data.

8 IMPORT: Import version compatible configuration data.

9 Graphical guidance

10 Text guidance

11 CONTROL MODE: Control mode indication.

12 MC Output On: Indicates the outputs of the ESCs are enabled; when communication is established between MC and assistant software via the USB cable, MC Output Off appears, it indicates no output to the motors, and then you can safely configure your multi rotor with the assistant software.

13 Red light: WKM↔PC has been disconnected.

Green light: WKM↔PC is connected.

Blue light: WKM↔PC communication.

14 Configuration sub menus.

15 Configuration step.

Note:

- Please power the MC first, then connect your MC to a internet enabled computer by the USB cable before you open the assistant software. You have to register at the first time you use the assistant software. It will auto detect the software version when you open the assistant software and will give you a prompt message if your version is not the latest one.
- Do not disconnect MC and PC when you are importing or exporting data. You can only import version compatible configuration data.

Firmware Upgrade

Please strictly follow the operation procedure for firmware upgrade, otherwise WKM might not work properly. For safety reasons, use the PMU to supply power for the main controller, and do not use power battery to motors during firmware upgrade.

1. Make sure your computer is connected to the Internet.
2. Please close all other applications during the firmware upgrade, including anti-virus software and firewall.
3. Make sure the power supply is securely connected. DO NOT un-plug the power supply until firmware upgrade has finished.
4. Connect MC to PC with the Micro-USB cable; DO NOT break the connection until firmware upgrade is finished.
5. Run Software and wait for connection.
6. Select TOOL→Firmware Upgrade.
7. DJI server will check your current firmware version, and get the latest firmware prepared for the unit.
8. If there is a firmware version more up-to-date than your current version, you will be able to click the Upgrade button.
9. Wait until Assistant software reads Finished.
10. Click OK and power cycle the unit after at least 5 seconds.

Your unit is now up-to-date.

Note:

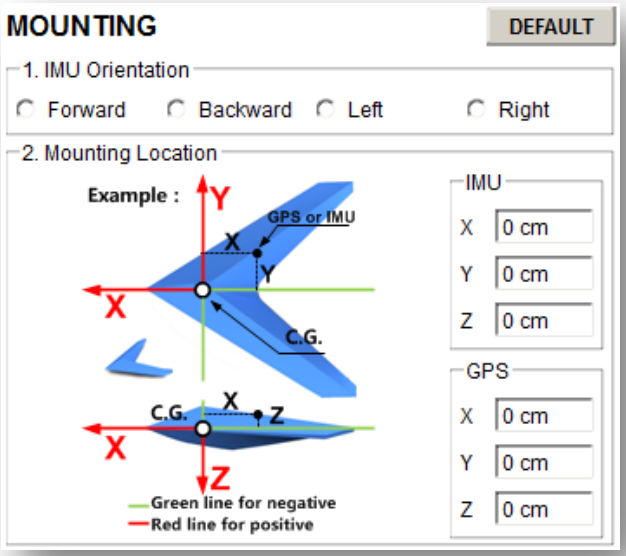
- After firmware upgrade, please re-configure WKM using Assistant software. Default all values before re-entering your settings.
- If it is notified that the network or DJI server is busy, please try again later with above procedures.
- If firmware upgrade failed, WKM will enter waiting for firmware upgrade status automatically, please try again with the above procedures.

Product Info

You can check the MC product version via ABOUT → Info. This includes software version, firmware version, IMU version, hardware ID and loader version. S/N is a 32 digit authorization code for unit function activations. We have already filled in the authorization code for your unit after manufacture. You might be asked to fill in the new S/N in the future if you brought new function upgrades. Fill-in the S/N and then click Write button. If you filled in an invalid S/N over 30 times, your MC will be locked and you have to contact our customer support.

Configuration

1. Mounting



STEP1: IMU Orientation

Select IMU mounting orientation. Orientate the IMU such that the arrow marked on the printed surface of the IMU faces the sky and points directly forward, backward, left or right. The sides of the IMU should be precisely parallel to the multi rotor body.

Note:

Do not mount the IMU upside-down.

STEP2: Mounting Location

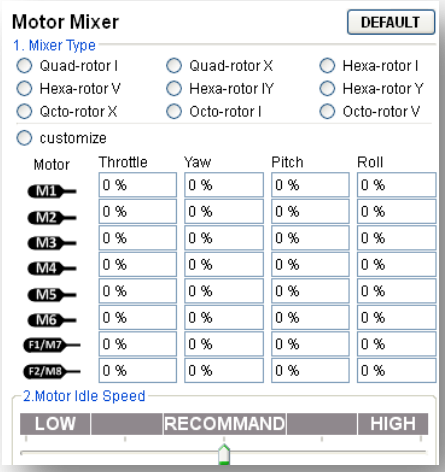
Install all payloads that will be used during the flight, including batteries, camera mount and camera. Balance the multi rotor as you would normally, with the center of gravity (C.G.) directly on the center plate. Fill in the distance between the center of the IMU / GPS case and the C.G. of the multi rotor in X, Y & Z axis as showed in the figure.

Notices:

Note:

1. You must re-measure and re-configure if the ALL-UP-WEIGHT of the multi rotor has changed.
2. If measured locations are not accurate enough or the signs (+/-) are wrong, then the error on the X, Y，Z axis will lead to an oscillation of your multi rotor.
3. Make sure you follow the diagram in our assistant software: red is positive, green is negative; unit of measurement is CM, NOT INCH…i.e. centimeters.

2. Motor Mixer



STEP1: Mixer Type

Set your transmitter into AEROPLANE mode. Then select the right mixer type according to your multi-rotor.

Tips:

- We support nine types of multi-rotors. Please refer to "***Multi-Rotors Supported***" in "***Appendix***":
- If you want to use a camera gimbal with an Octo-rotor, you have to use an S-Bus, S-Bus2 or PPM receiver, and then you can use port T and R for gimbal control. Otherwise, there will be no ports available on the MC for gimbal control.

Note:

- Do NOT follow the instructions from your multi-rotor manufacturer! Make sure the rotation direction of each motor is the same as the assistant software figure shows. If the rotation is wrong, switch any of two wire connections of the incorrect motor to change its rotation direction.
- Make sure the type of propeller matches the rotation direction of the motor.
- When you set Mixer Type from Octo-rotor to Quad-rotor / Hexa rotor, the gimbal setting will automatically switch to off for safety, which may lead the gimbal to tilt to one side, please turn to the Gimbal section for reconfiguration.

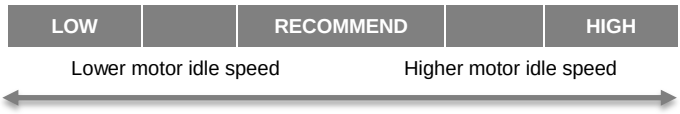
Customize: This section is reserved only for very special cases, such as customized airframes in non-conventional rotor arrangements. In the event, an airworthy multi-rotor craft with such rotor arrangement will require customized settings to meet the WKM controller algorithm. Please write to our support department or dealer together with photos of the multi-rotor for assistance.

Tips:

- Please refer to "***Customize Motor Mixer***" section in "***Appendix***" for how to customize a central symmetry multi rotor.
- If you customize the motor mixer of a quad-rotor or hexa-rotor, F1 and F2 ports can still be used for gimbal servo control.

STEP2: Motor Idle Speed

Motor Idle Speed: is the lowest speed after motor start. Set Motor Idle Speed will affect the motor lowest speed after motor start. There are five levels from LOW speed to HIGH speed, and the default is RECOMMEND. You can click and drag the cursor to the corresponding level, to change Motor Idle Speed.



Set Motor Idle Speed as LOW, the motor idle speed will be lowest.

Set Motor Idle Speed as HIGH, the motor idle speed will be highest.

RECOMMEND is the advised level.

You can reset the Motor Idle Speed according to the real situation.

Note:

- For users whose aircraft takes off at a low throttle position, please set the idle speed at a low level.
- For common users, please set Motor Idle Speed to RECOMMEND or above, since setting idle speed too low may affect the motor(s) spool up.

Tips:

- The output pulse width for every point of Motor Idle Speed is as follows

	LOW		RECOMMEND		HIGH
output pulse width	1144 us	1160 us	1176 us	1192 us	1208 us

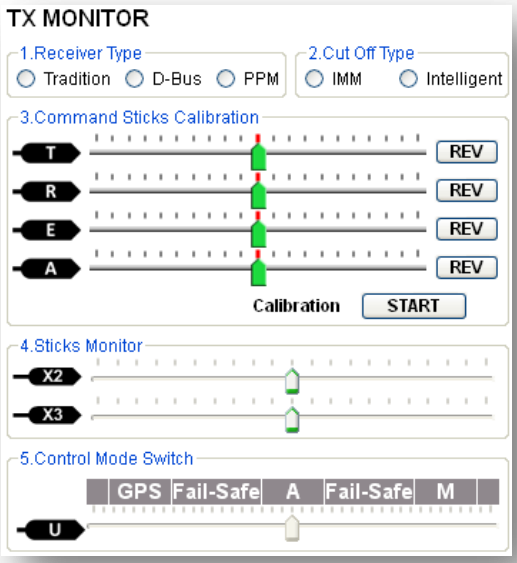
- There is a relationship between the output pulse width and the max/min pulse width when the TX End Point is 100%.

  output pulse width = (max pulse - min pulse) x proportion + min pulse

- You can get the proportion value by calculating according to the above formula for a special TX. Use Futaba TX for example. Notice that Futaba TX End Point is 100%.

	LOW		RECOMMEND		HIGH
proportion value	3%	5	7%	9%	11%

3. Tx Monitor



Note:

Make sure you have removed all propellers before this step!

STEP1: Receiver Type

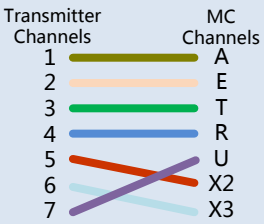
Choose the type of your receiver. If you use an S-Bus or S-Bus2 receiver, please choose S-Bus/S-Bus2 compatible option: D-Bus. If a PPM receiver is used, please choose PPM. Otherwise choose Tradition.

Note:

Please reboot the MC and redo the calibration after you change the setup of your transmitter or change your receiver!

Tips:

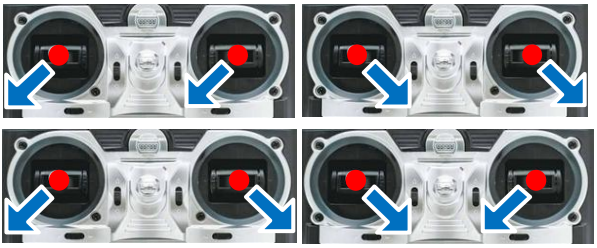
- If you use S-Bus/S-Bus2/PPM receiver, the communication of A, E, T, R, U, X2 and X3 channels are all through the D-Bus/PPM channel. Right figure shows the connection of default transmitter channels and MC channels in S-Bus/ S-Bus2/ PPM receivers (Only the first 8 channels of S-Bus/S-Bus2/ PPM receivers are used at the moment). Then the original T and R channels are for Gimbal servo control.



STEP2: Cut Off Type

Please read the introductions of start and stop motor in this step first, and then choose a cut off type.

1 **Start Motor**: When using WKM, pushing the throttle stick before takeoff will not start the motors. You have to execute any one of following four Combination Stick Commands (CSC) to start the motors:



2 **Stop Motor**: We provide two options to stop motors: Immediately, or Intelligent.

- Immediately Mode: By using this mode, in any control mode, once the motors start and the throttle stick is above 10%, the motors will stop immediately when the throttle stick is back below 10% again. In this case, if you push the throttle stick above 10% within 5 seconds after the motors stop, then the motors will re-start, CSC is not needed. If you don't increase the throttle stick within 3 seconds of the motors starting, then the motors will stop automatically.
- Intelligent Mode: By using this mode, different control modes have a different way of stopping the motors. In Manual Mode, only executing CSC can stop the motors. In Atti. or GPS Atti. Mode, any one of the following four cases will stop the motors:
  - **a)** If you don't increase the throttle stick within 3 seconds of the motors starting
  - **b)** Executing CSC
  - **c)** Throttle stick under 10%, and after landing for 3 seconds.
  - **d)** The angle of the multi-rotor is over 70°, and throttle stick under 10%.

Tips (Intelligent Mode):

1 You have to execute CSC to start the motors. "Only" raising the throttle stick will not start the motors.

2 In Atti. / GPS Atti. Mode, it has landing judgment, which will stop the motors.

3 Start motors in Atti. / GPS Atti. Mode, you have to execute CSC and then push throttle stick over 10% within 3 seconds, otherwise motors will stop after 3 seconds.

4 During normal flight, only lowering the throttle stick under 10% will not stop the motors in any control mode.

5 For safety reasons, when the slope angle of the multi-rotor is over 70° during the flight in Atti. / GPS Atti. Mode (may be caused by collision/crash, motor and ESC error or propeller broken), and throttle stick is under 10%, the motors will stop automatically.

6 You can stop the motors by executing CSC in any control mode.

Note:

1. The two cut off types will only work correctly if the Tx calibration is correct.
2. When Tx commands are valid under any control modes, the motors will start or stop immediately when you execute CSC. It has nothing to do with the current throttle stick position. Please DO NOT executes CSC during flight without a good reason.
3. If you choose Immediately mode, you should not lower the throttle stick under 10% during flight, because this will stop the motors. If you do it accidentally, you should push the throttle stick above 10% within 5 seconds to re-start the motors.
4. If you choose Intelligent mode, throttle stick below 10% will trigger landing judgment in any control mode. In this judgment, pitch, roll and yaw controls are disabled except throttle, but the multi-rotor will still auto level.
5. In any control mode, DO NOT lower the throttle stick below 10% during normal flight without a good reason.
6. In any auto action caused by fail-safe or low voltage protection （e.g. auto Go Home）, any commands applied to start or stop the motors are denied by the MC, motors will auto control.

STEP3: Command Sticks Calibration

On screen Slider Definition：

T : Slider left is craft down, slider right is craft up

R : Slider left is nose left, slider right is nose right

E : Slider left is craft back, slider right is craft front

A : Slider left is craft left, slider right is craft right

STEP1: Set endpoints of all channels to default values (100%) and set all trims and sub-trims of sticks to 0 on your transmitter first. Keep all curves' settings as default since the end-point of transmitter sticks will be recorded here.

STEP2: Click START button, and move all of the sticks throughout their complete range several times.

STEP3: After that, click FINISH button when you finished above procedures.

STEP4: If the moving direction of the slide is opposite to the *Slides Moving Definition*, click the reverse button REV/NORM at the right side of the screen.

Note:

1. All sliders should become when all the Tx sticks are in the middle positions. If the sliders cannot go back to center points (become), just click FINISH, then the sliders will be at center automatically. If still not centered, please reboot the MC, and do not apply any Tx command during

the reboot.

2. CSC may not start motors If trims and sub-trims of Tx sticks are not 0!

STEP4: Sticks Monitor

This step is optional. X2 and X3 is for remote gain tuning; X3 is also for gimbal pitch control. Setup the channel on your RC correctly.

STEP5: Control Mode Switch

Whichever 2 or 3 position switch on your transmitter you have selected to use as control mode switch, connect the correct channel of the receiver to the U port of the MC. At each switch position, use end-point fine tuning on your transmitter. Move the Transmitter slider/switch of the channel U to GPS (GPS Atti Mode), A (Atti. Mode), M (Manual Mode) and adjust the Tx end-points and mid-point to turn the corresponding area on the assistant software blue shown at the bottom of the TX MONITOR screen.

Tips:

- To move the slider is to adjust end-points of the channel selected.
- For 3-position switch, you should assign: Position-1 to Manual Mode; Position-2 to Atti. Mode; Position-3 to GPS Atti. Mode; or reverse the assignment for Position-1 and Position-3.

- For 2-position switch, you can assign any two of the three control modes as you like.

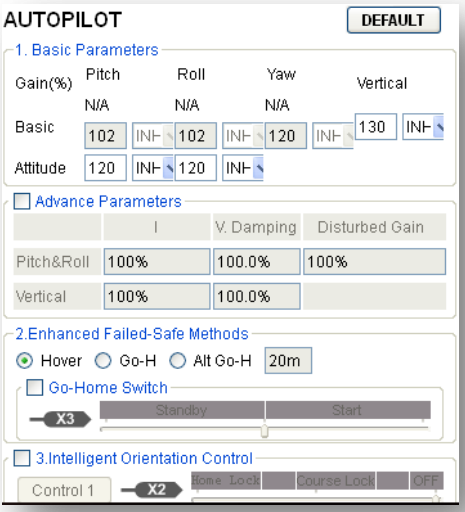
Important: You must setup the fail-safe of your Transmitter so during a fail-safe situation the area which reads Fail-Safe Mode turns blue. Once fail-safe is setup, if you switch off your transmitter, the U channel slider should move to Fail-Safe Mode and turn the corresponding area to blue. Otherwise please reset the fail-safe. Please refer to your RC manual for the details of fail-safe setup.

Note:

- Do NOT set the fail-safe position of the throttle below 10% endpoint.
- MC will not execute the Fail-Safe protection if you don't set it properly. You can verify the Fail-Safe settings by switching off your transmitter, and then you can use the following methods to check whether the MC is in Fail-Safe mode.
- Check the Assistant Software status bar at the bottom of the software interface. Control mode will change to Fail-Safe.

- Check the LED indicator. Read the appendix in this manual for details. LED will give blue blinking if in fail-safe mode.

4. Autopilot



STEP1: Basic Parameters

Usually, the default parameters are ready to go. However, different multi rotors have different gains because of different size, ESC, motor and propeller. If the gain is too large, you will find the multi rotor oscillating in the corresponding direction (About 5~10Hz). If too small, the multi rotor maybe hard to control. So you can setup the basic Gain of Pitch, Roll, Yaw and Vertical manually according to your multi rotor to have a pleasing flight experience. We suggest you change the values by 10% to 15% at a time and test fly.

For the gains of Pitch and Roll, if you release the Pitch or Roll stick after a command stick input, the multi-rotor will revert back to the hovering state. If the reaction of the multi-rotor in this procedure is too soft (large delay), please increase the basic gain slowly (10%-15% each time) until oscillation is noticed after you release the stick. Then decrease the gain a little until the oscillation just disappears. Now the gain is perfect. If the Tx stick reaction of the attitude is slow, you should follow the section a little down the page to tune the attitude gains.

The way of tuning the Yaw gain is the same as the way of adjusting the Tail Gyro of a helicopter. If you want quicker stopping reaction speed, increase the gain, otherwise decrease the gain. However, the rotation speed of the multi-rotor is produced by the counter torque reaction force, and the magnitude of which is limited. Therefore, a large gain value will not produce tail oscillation like on a helicopter, but severe reaction of the

start or stop of the motors, which will affect the stabilization of other axis.

You can use two methods to judge if the Vertical gain is good enough: 1) The multi-rotor can lock the altitude when the throttle stick is at the center position; 2) The change of altitude is small during the flight along a route. You can increase the gain slowly (10% each time) until an oscillation in the vertical direction appears or the reaction of the throttle stick is too sensitive, then decrease 20% of the gain. Now you should have a suitable Vertical gain.

Attitude gains determine the reaction speed of attitude from a Tx command stick input. The bigger the value the quicker the reaction from the Tx command. Also, an increased value will also give a sharper and quicker leveling action after the command stick is released. The control feeling will be stiff and rigid if the value is too high; and sluggish leveling action and slow braking if too small.

Note:

- You **MUST** click the Default button before configuring the gains for the first time, and also after a firmware upgrade, before re-entering your settings.
- The vertical gain has no effect in manual mode.

Tips:

- If you are a new user to this system, you can tune the basic parameters first as follows:

1 Increase the basic parameters 10% at a time so as to make your multi rotor hover or lightly oscillate after small angular command inputs.

2 Decrease the basic parameters until your multi rotor can just hover without oscillation, then decrease 10% more.

- If the basic parameters are far away from the required values, the advanced parameters will not work.
- You can use the remote gain-tuning channels to tune the gains during the flight:

1 Follow the instructions in “Assembly” R/C System section to connect and setup correctly;

2 Choose the X2 or X3 channels in Remote Adjust for the gain you want to tune. One channel to one gain.

3 The range of the remote tuning is from half of the current entered value to twice current value.

- Usually the Pitch, Roll, Attitude Pitch and Attitude Roll Gains of a hexa-rotor are higher than a quad-rotor.
- You will find example settings at the end of this manual

STEP2: Advanced Parameters

Usually you can ignore this section. The default values are suitable for most conditions, so we do NOT recommend you to change the parameters here. For some special multi rotor, experienced users can adjust the advanced parameters to have a better flight experience.

STEP3: Enhanced Fail-Safe Methods

Fail-Safe methods include Hover, Go-home, and Altitude Go-home. Choose one as your fail-safe method, which will be triggered when the MC loses the control signal in one of the following situations:

1) Signal lost between transmitter and receiver, e.g. multi-rotor is out of the communication range, or transmitter has failed, etc.
2) One or more connections of A, E, T, R, U channels between the MC and receiver is lost. If this happens before take-off, the motors will not start if you raise the throttle stick. If this happens during the flight, the LED will flash blue to warn you, in addition to the fail-safe method. If Hovering fail-safe method is configured and U channel is disconnected, multi-rotor will auto land.

Also, you can select the Go-Home Switch item to start go-home (Go-home, and Altitude Go-home) by using a TX switch during the flight, when selected during flight the LED will flash purple instead of blue.

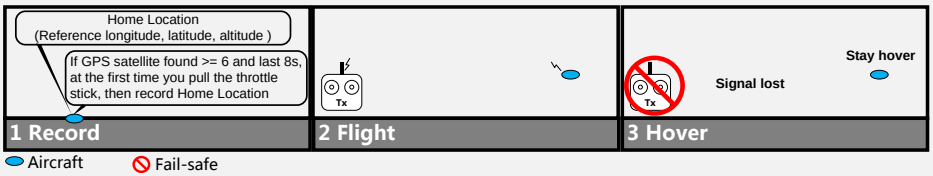
The Multi-rotor position before takeoff, including reference longitude, reference latitude and **reference altitude**, is saved as home point by the MC automatically when you raise the throttle stick for the first time AND it has 6 or more GPS satellites acquired for more than 8 seconds (blinks once or no blinking >8secs) After taking off, every time the aircraft recorded a home-point successfully the LED will blink Cyan quickly for indicating.

THEREFORE: *to use any form of Go-home (including fail-safe return home), you must make sure 6 or more GPS satellites are acquired for more than 8 seconds (blinks once or no blinking >8secs) before take-off, this will assure correct recording of the Home position.*

Go-Home Altitude: Determined by the **reference altitude** and the Fail-Safe method chosen. That is, the go-home altitude may be different due to fail-safe method chosen.

- **Hover**

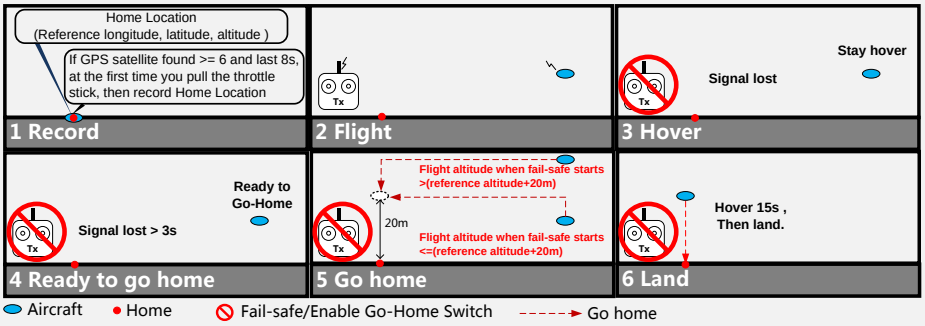
The aircraft will remain hovering when the fail-safe starts.



- **Go-H (Go-home)**

Flight altitude when fail-safe starts > (reference altitude+20m) , then go-home altitude = flight altitude when fail-safe starts

Flight altitude when fail-safe starts <= (reference altitude+20m) , then go-home altitude = reference altitude +20m

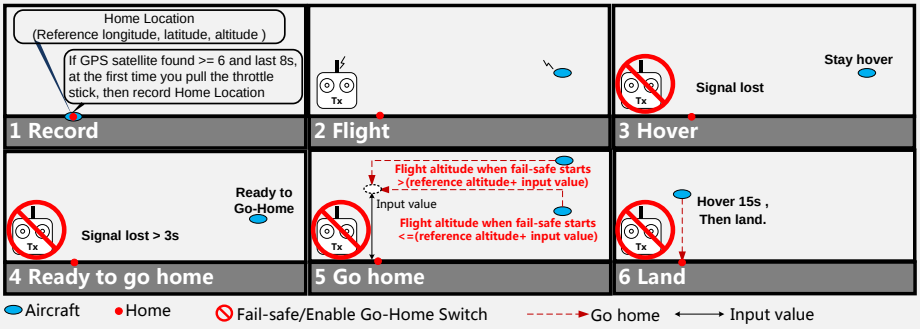


- **Altitude Go-H (Altitude Go-home)**

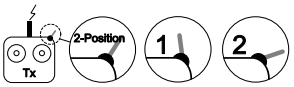
Flight altitude when fail-safe starts > (reference altitude + entered value) , then go-home altitude = flight altitude when fail-safe starts.

Flight altitude when fail-safe starts <= (reference altitude + entered value) , then go-home altitude = reference altitude + entered value.

Entered value: 20m~300m, the default value is 20m, and has an accuracy of 1m.



Go-Home Switch : Before using this function, you have to choose a 2-position switch on your transmitter as the Go-Home switch. Then connect the correct channel of the receiver to the X3 port of the MC.



You should assign: Position-1 to Start; Position-2 to Standby; or reverse the assignment for Position-1 and Position-2. Move the Tx switch of the channel X3 and check that the corresponding area Start and Standby turns blue on the assistant software screen. If required adjust the Tx channel end points.

Note:

- Switching from Standby to Start will enable go-home during flight and you will no longer have flight control of the Multi rotor. If the Multi rotor is already in a fail-safe condition, then the go-home switch will not work.
- If you switch to Manual Mode or Atti. Mode, (and the multi rotor is not in a fail-safe condition), then the go-home is cancelled and you regain control of the multi copter. Once GPS. Mode is re-selected you can once again use the go-home function.

Tips:

- Use end-point fine tuning on your transmitter to adjust the X3 channel, to give the correct switch indication in the assistant software.
- The following example shows how to enable Go-home by the Tx Switch. Use position-1 to Start and Position-2 to Standby for example.
  Position -1→ Position -2→ Position -1, if the initial switch position is at Start (Position -1).
  Position -2→ Position -1, if the initial switch position is at Standby (Position -2).
- The home point of the ground station one key go-home is the same as the point set by user in the ground station software.
- ***If*** the home point is not set by the ground station, the home point of the ground station one key go-home function is the point recorded by the MC.
- If the Go-Home Switch cannot be selected in the assistant software, that may be due to the X3 channel been set for remote gain tuning, you should change this if required.
- The multi rotor will climb at a speed of 1.5m/s if needed during go-home.
- The multi rotor will change its vertical speed during go-home, as shown below:

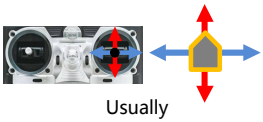
>100m height	50~100m	20~50m	10~20m	<10 m
4m/s	3m/s	2m/s	1m/s	0.3m/s

STEP4: Intelligent Orientation Control (IOC)

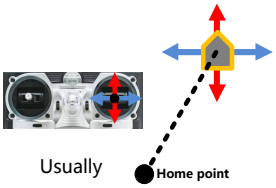
Forward Direction: The Multi-rotor will fly along this direction when you push the elevator stick.

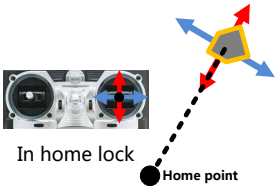
Usually, the forward direction of a flying multi-rotor is the same as the nose direction. By using Intelligent Orientation Control (IOC), wherever the nose points, *the forward direction has nothing to do with the nose direction:*

- In course lock flying, the forward direction is the same as a recorded nose direction. See the following figures (TX Mode 2):

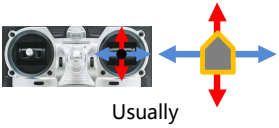


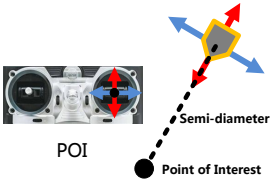
- In home lock flying, the forward direction is the same as the direction from home point to multi-rotor. See the following figures (TX Mode 2):





- In POI (**POI, Point Of Interest**) flying, the roll channel controls the multi rotor circular flight speed around a fixed point, the pitch channel is used for controlling the diameter around the fixed point, the throttle is used to control the height around the fixed point. See the following chart (Tx Mode 2):





Step1: Before using the IOC function, you have to choose a 2 or 3 positions switch on your transmitter as the IOC switch, which is also used for recording the multi rotor orientation, home position or point of interest in corresponding modes.

Step2: Connect the correct channel of the receiver to the X2 port of the MC. You can select Control 1 to change the IOC control mode options. Three IOC control options are available; they are Control 1, Control 2 and Control 3, and every option contains two IOC functions.

Control 1: Home Lock, Course Lock, OFF

Control 2: POI, Course Lock, OFF

Control 3: Home Lock, POI, OFF

Step3: Toggle the Tx switch and observe the slider position of channel X2 on the assistant software screen, the corresponding area should turn blue.

Tips:

- For 3-position switch (or exchange Position-1 and Position-3):

Control 1: Position-1 is OFF; Position-2 is Course Lock; Position-3 is Home Lock.

Control 2: Position-1 is OFF; Position-2 is Course Lock; Position-3 is POI.

Control 3: Position-1 is OFF; Position-2 is POI; Position-3 is Home Lock.

- For 2-position switch:

  Control 1: Position -1 is OFF; Position-2 is Course Lock. Or Position -1 is OFF; Position-2 is Home Lock.

  Control 2: Position -1 is OFF; Position-2 is Course Lock. Or Position -1 is OFF; Position-2 is POI.

  Control 3: Position -1 is OFF; Position-2 is POI. Or Position -1 is OFF; Position-2 is Home Lock.

  The course, home point and point of interest can be recorded manually by toggling the 3-position switch 3 to 5 times between two switch positions, the recorded point is different for different switch combinations. The following shows how the MC will record the different points.

  Position-1 ⟷ Position-2: Position-2 is recorded.

  Position-2 ⟷ Position-3: Position-3 is recorded.

  Position-1 ⟷ Position-3: Position-3 is recorded, but Position-2 may also be recorded at the same time. Danger may occur if users are not aware of the change, so it is not recommended to record Position-3 by this way.

- If you use an S-Bus /S-Bus2 /PPM receiver, the default channel connection is shown in the *Tx Monitor – Receiver Type* section. Then you only need to assign a 2 or 3-position switch of your transmitter to channel 5.
- If the assistant software does not give the correct response, Use end-point fine tuning on your transmitter to adjust the X2 channel, to give the correct switch indication in the assistant software, the corresponding area should turn blue.

NotE:

When a 2-position switch is used, do NOT set a 2-position switch as:

Control 1: Course Lock and Home Lock at the same time.

Control 2: Course Lock and POI at the same time.

Control 3: POI and Home Lock at the same time.

Course Lock Usage:

During the same flight:

STEP1: Record	STEP2: ON	STEP3: OFF	STEP4: ON again
			

STEP1: **Record forward direction:** There are two ways: Manually and Automatically. The LED will blink quickly if recording is successful.

a) Automatically: The MC will record the current nose direction as forward direction, 30 seconds after you power on the multi-rotor. ****PLEASE BE AWARE OF THE FORWARD DIRECTION WHEN YOU SWITCH ON THE MULTI ROTOR IF YOU USE COURSE LOCK*****

b) Manually: You can switch the X2 channel between OFF and Course Lock position quickly 3 to 5 times to record the current nose direction as the new forward flight direction at any time after you power on the multi-rotor for longer than 30 seconds.

STEP2: **Switch on course lock:** Switch the X2 channel from OFF to Course Lock position, when all the following requirements are met the LED will blink slowly to indicate the IOC mode.

a) The forward direction is recorded successfully

b) The MC is in Atti. or GPS Atti. Mode

STEP3: **Switch off course lock:** Switch the X2 channel to OFF position to quit course lock.

STEP4: **Switch on course lock *again*:** When all requirements in step 2 are met, Switch the X2 channel from OFF to Course Lock position.

Note:

Pay attention to the following statement, which may also lead the MC to cancel the course lock:

- Switch U channel to Manual Mode position, or switch off transmitter, or fly in waypoint mode.

Home Lock Usage:

During the same flight:

STEP1: Record	STEP2: ON	STEP3: OFF	STEP4: ON again
			

Nose direction; Forward direction; ●Home point; -------Over 10m distance

STEP 1: **Record home point:** The home point mentioned here is the same home point as the enhanced Fail-Safe. There are two ways to record this point: Manually and Automatically. The LED will blink quickly if recording is successful.

a) Automatically: Before takeoff, the current position of the multi-rotor will be saved as the home point by the MC automatically when you raise the throttle stick for the first time AND it has 6 or more GPS satellites acquired for more than 8 seconds (blinks once or no blinking >8secs)

b) Manually: When 6 or more GPS satellites are found (blinks once or no blinking), you can

switch the X2 channel between two positions quickly 3 to 5 times to record the current position of the multi-rotor as the new home point.

(1) 3-position switch:

Control 1: switch the X2 channel between Course Lock and Home Lock position,

or OFF and Home Lock (NOT Recommended);

Control 3: POI and Home Lock, or OFF and Home Lock (NOT Recommended).

(2) 2-position switch: switch the X2 channel between OFF and Home Lock position.

STEP 2: Switch on home lock: Switch the X2 channel from OFF to Home Lock position when all the following requirements are met. The LED will blink slowly to indicate the IOC mode.

a) Home point is recorded successfully

b) 6 or more GPS satellites are found

c) In GPS Atti. Mode;

d) Multi-rotor is further than 10m away from the home point.

STEP 3: Switch off home lock: Switch the X2 channel to OFF position to cancel home lock.

STEP1: Step 4: Switch on home lock *again*: When all requirements in the second step are met, switch X2 channel from OFF to Home Lock position to enter home lock mode again.

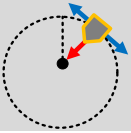
Note:

Pay attention to the following statement, which may also lead the MC to cancel home lock:

- Switch U channel to Manual Mode or Atti. Mode position, or turn off transmitter, or fly in waypoint mode.
- If you select Atti. Mode during home lock flight, then course lock is set using the current (not recorded) forward flight direction.

POI (Point Of Interest) Usage:

During the same flight:

STEP1: Record	STEP2: ON	STEP3: OFF	STEP4: ON again
			

 Nose direction; Forward direction ; ● Point of interest ; ------Semi-diameter

STEP1: Record point of interest:

a) Manually: When 6 or more GPS satellites are found (blinks once or no blinking), you can switch the X2 channel between two positions quickly 3 to 5 times to record the current

position of the multi-rotor as the new point of interest. The LED will blink quickly if recording is successful.

(1) 3-position switch:

Control 2: switch the X2 channel between Course Lock and POI position,

or between OFF and POI position (NOT Recommended);

Control 3: switch the X2 channel between OFF and POI position.

(2) 2-position switch: switch the X2 channel between OFF and POI position.

STEP2: **Switch on POI:** Switch X2 channel from OFF to POI position when all the following requirements are met. After switching on POI, the multi rotor will rotate slowly until the multi rotor nose points to the point of interest. The LED will blink slowly to indicate the IOC mode.

a) Point of interest is recorded successfully

b) 6 or more GPS satellites are found

c) In GPS Atti. Mode

d) Multi-rotor is further than 5m (and less than 500m) away from the Point of Interest.

Once in POI mode you can use the left/right roll control to control the speed of the circle around the POI, you can use the pitch to control the diameter of the circle, and the throttle to control the height while circling.

STEP3: **Switch off POI:** Switch the X2 channel to OFF position to cancel POI mode.

STEP4: **Switch on POI *again*** : Switch the X2 channel from OFF to POI position when all requirements in step 2 are met, then the multi rotor will once again turn towards the POI.

Note:

- Pay attention to the following statement, which may also lead the MC to cancel POI:

  (1)Switch U channel to Manual Mode or Atti. Mode position, or turn off transmitter, or fly in waypoint mode.

  (2)GPS status is bad, with three blinking.

  (3)Multi-rotor flies back within 5m (or further than 500m) from the POI.

Tips:

1 LED will blink slowly to indicate the IOC mode only when the MC is really flying in course lock or home lock or POI.

2 We suggest that you should know clearly which flight lock method you are going to fly, and make sure the locked forward direction, home point or point of interest is recorded correctly before you switch on IOC mode during the flight.

3 There is only one home point recorded at any time. This point is the same one used by Go-Home

and Landing fail-safe.

4 In Control 1, when flying using home lock, if the GPS signal becomes weak, the MC will automatically switch to course lock using the current (not recorded) forward flight direction.

5 It is recommended that the pilot should be near the home point to use home lock, or near to the point of interest to use POI flight.

6 It is recommended to use a 3-position switch for X2 channel.

Note:

1 Before home lock flight, you'd better fly the multi-rotor out of the 10m range around home point, then slide X2 channel switch to Home Lock position to fly in home lock when all the requirements are met. If you have already slide X2 channel switch to Home Lock position when the multi-rotor is still in 10m range around home point, and this is the first time you are going to fly in home lock during the current flight, then if all the requirements are met, MC will change into home lock automatically when multi-rotor flies out the 10m range around home point.

2 When the multi-rotor is flying in home lock at a distance away from you and the home point, please do not switch the X2 channel many times quickly, as this will change the recorded home point to the current location.

3 Avoid using POI in areas where the GPS signal might be lost or the TX / RX signal might be lost (such as built up urban areas)

4 By using a 3-position switch, if you want to record a new home point and point of interest manually, it is recommended to record them separately so as to make sure the recording is successful. Please pay attention to the following contents for correct recording.

- Control 1: do NOT switch X2 channel between OFF and Home Lock position, but only between OFF and Course Lock, or Course Lock and Home Lock position.
- Control 2: do NOT switch X2 channel between OFF and POI position, but only between OFF and Course Lock, or Course Lock and POI position.
- Control 3: do NOT switch X2 channel between OFF and Home Lock position, but only between OFF and POI, or Home Lock and POI position.

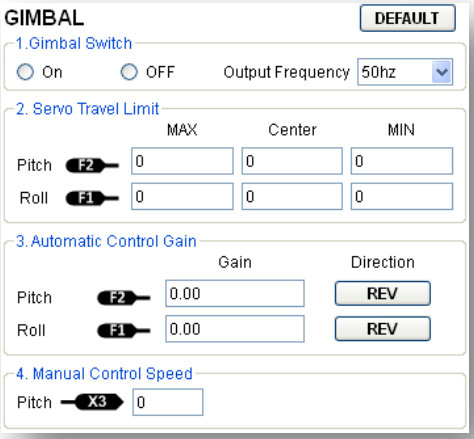
5 When you are flying in home lock, if the multi-rotor fly's within 10m range of the home point, or you switch into Atti. Mode, the MC will automatically select course lock using the current (not recorded) forward flight direction automatically. This forward flight direction is NOT the recorded forward direction. However, if you now select course lock, the MC will now fly in course lock using the recorded (not current) forward flight direction.

6 We suggest you use home lock in a limited area which is greater than 10m away from the home point; and use POI in a limited area greater than 5m (and less than 500m) away from the Point of Interest

7 If there is poor GPS quality during the flight, then the M.C. may not give an accurate flight path for the radius around the point of interest.

8 Continuously spinning the multi rotor will accumulate yaw errors. The LED will blink ○ to indicate huge cumulative yaw errors caused by spinning the craft continuously in IOC. In this case, you can stop or slow down the spinning, and continue flying after the ○ blinking has stopped, so as to have better flight performance.

5. Gimbal



STEP1: Gimbal Switch

If you use a gimbal, please select On here, and select an Output Frequency (50Hz/100Hz/200Hz/400Hz).

The chosen output frequency should not exceed the maximum servo supported frequency.

Note:

If you enable the gimbal control in the assistant software during the configuration, please note that there will be an output from the F1 and F2 ports. In this case you should not connect these ports to ESCs which are wired with propeller equipped motors.

Tips:

- If you want to use a gimbal with an Octo-rotor, you have to use an S-Bus/S-Bus2 or PPM receiver, then you can use port T and R for gimbal control. Otherwise, there will be no ports on the MC for gimbal control.
- WKM supports servo center of 1520us.

STEP2: Servo Travel Limit

Range: -1000 to+1000.

MAX/MIN are servo travel limits; adjust them to avoid mechanical binding; Place your multi rotor on level ground, adjust Center value of Pitch and Roll direction to set the camera to your desired angle-to-ground.

Notices:

- If servo expansion is used, which may enlarge the servo travel limit, make sure to reset your servo travel limit.

STEP3: Automatic Control Gain

Range: 0 to 100.

Adjust the reaction angle of automatic control. The initial value 100 is full angle. The bigger the gain, the bigger the reaction angle. Click REV/NORM, and then you can reverse the feedback control directions.

STEP4: Manual Control Speed

Range: 0 to 100.

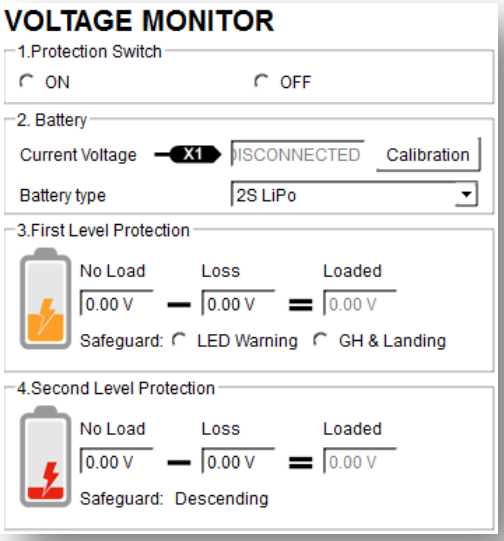
You should assign one of the knobs on your transmitter to the X3 channel for controlling the Pitch direction (angle) of the camera gimbal during flight. Then adjust the reaction speed of the pitch direction manual control; the initial value 100 is full speed.

When X3 is set as remote gain or for switch “go-home”, users can not adjust the gimbal pitch using the X3 channel, while WKM still provides enhanced stability for the gimbal; the gimbal pitch and roll will return to the center position.

Note:

- If the X3 channel is used for controlling the Pitch of the gimbal, then the X3 cannot be used for remote gain tuning or Go-Home switch.

6. Voltage Monitor



STEP1: Protection Switch

In order to prevent your multi-rotor from crashing or other harmful consequences caused by low battery voltage, we have designed two levels of low voltage protection. You can choose to not to use them, however we strongly recommend to enable the protection here!

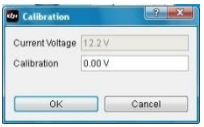
Note:

- Make sure the two connections between the PMU and the MC (PW to CAN interface, V-SEN to X1) are correct; otherwise the low voltage protection will not work correctly.
- Both protections have LED warning as default. First level will blink yellow light continuously; second level will blink red light continuously.
- Both protections will only have LED warning under Manual Mode, NO AUTOMATIC functions.
- Low voltage conditions are NOT fun! You should land your multi-rotor ASAP on seeing any low voltage warning indication, to prevent your multi-rotor from crashing or other harmful consequences!

STEP2: Battery

Power the MC using your normal flight battery and connect the MC with a PC, the current battery voltage will be displayed in this column.

If the battery voltage displayed here is different from the voltage you measure using a voltmeter, you have to calibrate. Click the Calibration, enter the voltage you have just measured in the Calibration column of the dialogue box, and then click OK.



Meanwhile you need to select the battery type you are using, so that the MC can provide default warning voltages and ranges of warning voltages for you.

STEP3: First Level Protection

No Load (No Load Voltage): No load warning voltage. You need to enter this value.

Loss (Line Loss Voltage): The battery voltage drop during the flight. You need to enter this value.

Loaded (Loaded Voltage): The real-time battery voltage during the flight. This is the actual warning voltage monitored by the MC. Does not require your input, calculated by No Load and Loss.

Tips:

Voltage Magnitude Relation:

- No Load: First level > Second level.
- Loss: First level = Second level.
- Loaded: Calculated, First level > Second level.

Method of Acquiring Line Loss Voltage:

1 Make sure you can fly your multi-rotor normally with a fully charged battery.

2 Use a fully charged battery, switch on the low voltage protections in assistant software, and observe the current voltage. Enter a reasonable warning voltage in the No Load of first protection (We recommend to enter a voltage 1V lower than the current voltage and higher than the minimum battery voltage rating). Enter 0V for the Loss at the moment.

3 Fly the multi-rotor until the first level protection is triggered, and the LED is flashing yellow. Now land your multi-rotor ASAP.

4 Connect the MC to PC, open the assistant software and read the current voltage. The Loss (Line loss voltage) is the difference between the new current voltage and the first level No Load voltage you filled in.

Note:

- If the line loss voltage of a battery is over 0.3V per cell (e.g. 3S battery over 0.9V), it's because the internal resistance of the battery is high or the battery is old, we suggest you replace it!
- Generally the line loss voltage of different batteries is different. For the consideration of safety, we recommend that you acquire all the line loss voltages of all the batteries you intend to use, and enter the lowest value for the Loss.
- When you change the payload or multi-rotor, you have to obtain the new line loss voltage.
- The line loss voltage will be higher after many flights; you should obtain a new value after charging 30 times.
- Make sure your ESCs protection voltage is lower than 3.1V (1S), otherwise the WKM low voltage protection will not work.

1 Acquire the line loss voltage by the method above, and enter the value.

2 Enter a reasonable warning voltage in the No Load.

3 Choose a safeguard method: 1) LED warning: This is the default safeguard when you switch on the low voltage protection; 2) Go Home and Landing: This safeguard will NOT be triggered if any of the following conditions are true:

a) Manual or Atti. Mode;

b) GPS signal is not good;

c) The distance between the Home Location and multi-rotor is less than 25m, and the altitude is lower than 20m relative to the Home Location. Here the recorded Home Location is the same as the one used for Enhanced Fail-safe. Please refer to Enhanced Fail-safe in "Autopilot".

Note:

- There will be a 4 second LED warning before Go Home.
- If you switch to Manual or Atti. Mode during Go Home, you will regain the control. LED warning will be still on, please land ASAP.
- If you switch back into the GPS Mode when you are in first level protection, you will have 15s time to control your multi-rotor, you should land ASAP in this 15s to prevent your multi-rotor from crashing or other harmful consequences! After this time if the Go Home and landing requirements are satisfied, the multi-rotor will Go Home and Land automatically.
- If you choose LED warning, please land ASAP after you see the LED warning to prevent your multi-rotor from crashing or other harmful consequences!
- Compare the Go Home and Landing of low voltage protection and the Go Home and Landing in Enhanced Failed-safe, the recording of the Home Location are the same; the Go Home routes are the same; the difference is that there is no hovering before landing in low voltage protection.

STEP4: Second Level Protection

1 Fill the warning voltage and line loss voltage in No Load and Loss, using the method introduced in previous steps.

2 When the second level protection is triggered, the LED warning will be on. Meanwhile the center point of the throttle stick will move up slowly to 90% of endpoint, you should land ASAP to prevent your multi-rotor from crashing or other harmful consequences!

3 When the throttle center point is at 90% of endpoint, the multi-rotor will still ascend slowly if you continue to raise the throttle stick, and the control of Pitch, Roll and Yaw are the same as before. Please land ASAP to prevent your multi-rotor from crashing or other harmful consequences!

Note:

If your multi-rotor goes into the second level protection during Go Home in the first level protection, it will land immediately. If you switch into Manual or Atti. Mode, you will regain the control, and the center point of the throttle stick will move up slowly to 90% of endpoint. Please land ASAP to prevent your multi-rotor from crashing or other harmful consequences!

Flight

Digital Compass Calibration

Why calibrate the compass?

Ferromagnetic substances placed on the multi rotor or around its working environment will affect the reading of magnetic earth for the digital compass, it also reduces the accuracy of the multi rotor control, or even reads an incorrect heading. Calibration will eliminate such influences, and ensure the MC system performs well in a non-ideal magnetic environment.

When to do it?

- The first time you install WKM on your multi rotor.
- When the multi rotor mechanical setup is changed:
  a) If the GPS/Compass module is re-positioned.
  b) If electronic devices are added/removed/ re-positioned (Main Controller, servos, batteries, etc).
  c) When the mechanical structure of the multi rotor is changed.
- If the flight direction appears to be shifting (meaning the multi rotor doesn't "fly straight").
- The LED indicator often indicates abnormality blinking when the multi rotor yaws. (It is normal for this to happen occasionally.)

Note:

- Don't calibrate your compass where there is strong magnetic interference, such as magnetite, car park, and steel reinforcement under the ground.
- DO NOT carry ferromagnetic materials with you during calibration, such as keys or cell phones.
- You don't need to rotate your multi rotor on a precise horizontal or vertical surface, but keep at least 45° difference between horizontal and vertical calibration.
- The MC cannot work in the polar circle.

Calibration procedure

STEP1: Enter calibration mode: quickly switch the control mode switch from ***Manual Mode*** to ***GPS Atti. Mode*** for 6 to 10 times, The LED indicator will turn on constantly blue;

STEP2: Calibration in horizontal: rotate your multi rotor along the horizontal axis until the LED changes to constant green, then go to the next step;

STEP3: Calibration in vertical: while the LED is green, hold your multi rotor vertically and rotate it along with its vertical axis, keep rotating until the LED turns off, meaning the calibration is finished.

STEP4: After you finished the calibration, The LED indicator will show whether the calibration was successful or not:

- If the LED turns on white for 3 seconds, then the calibration was successful, calibration mode will exit automatically.
- If the LED quickly flashes red, the calibration has failed. Switch the control mode switch one time to cancel the current calibration, and then re-start from step 1 for re-calibration.

Tips:

If you keep having calibration failure, it might suggest that there is very strong magnetic interference around the GPS & Compass module, please avoid flying in this area.

Test Flying

Before First Flight

Note:

- Make sure you have assembled your multi rotor correctly.
- Make sure you have done the configuration procedure correctly.
- Any of the following may lead to a possible dangerous accident if incorrect, double check all these items:
  - Rotation direction of all motors is correct
  - Propellers are installed correctly and on the correct motors
  - IMU installation is correct
  - All Connections are correct, including between the MC and ESC
- In Atti and GPS Atti mode, throttle stick center position is for 0m/s in the vertical direction. If you lower the throttle stick to the bottom during the flight, the multi-rotor will descend; If you lower the stick to the bottom on the ground, it will stop the motors after 3 seconds. However, slow spinning motors will affect the flight performance; we advise to keep the throttle stick position higher than 10% during the flight! In Manual Mode it will stop the motors when the throttle stick is below 10%.
- Make sure you switch on the transmitter first, then power on the multi-rotor! (Power off the multi-rotor first then switch off the transmitter, after landing!)
- Please carry out the test flights and gain adjustment with Atti. Mode in an open area without a heavy wind! Please read the first step of *Autopilot* in *Configuration* to learn how to adjust the gains.

Flying

STEP1: Make sure your batteries are fully charged for your transmitter, the MC and all the devices on your multi rotor;

STEP2: Check all connections and wiring, and make sure they are in good condition and secure

STEP3: Switch on the transmitter first, then power on your multi-rotor!

STEP4: Switch the control mode switch on your transmitter, and make sure it is working properly. Check using the LED indicator to specify the current working mode for the MC. See Appendix for details about LED indicator;

STEP5: Switch the controller to ***Atti.*** Mode. **Use any safe method to do the following test:** Increase the throttle to 20% slowly within 3 seconds after executing CSC and make sure all the motors are working, and then try to move the transmitter sticks lightly in Roll, Pitch and Yaw to feel if your multi rotor moves in the corresponding direction. If not, go back to the **Configuration Procedure** and correct your settings.

STEP6:

Tips:

After a successful test flight, the preparation before taking off can be simplified: Put your multi rotor on level ground, turn on the transmitter first, power on the multi rotor, when the LED light starts to blink normally, you can take off in Atti. Mode.

Flying with GPS

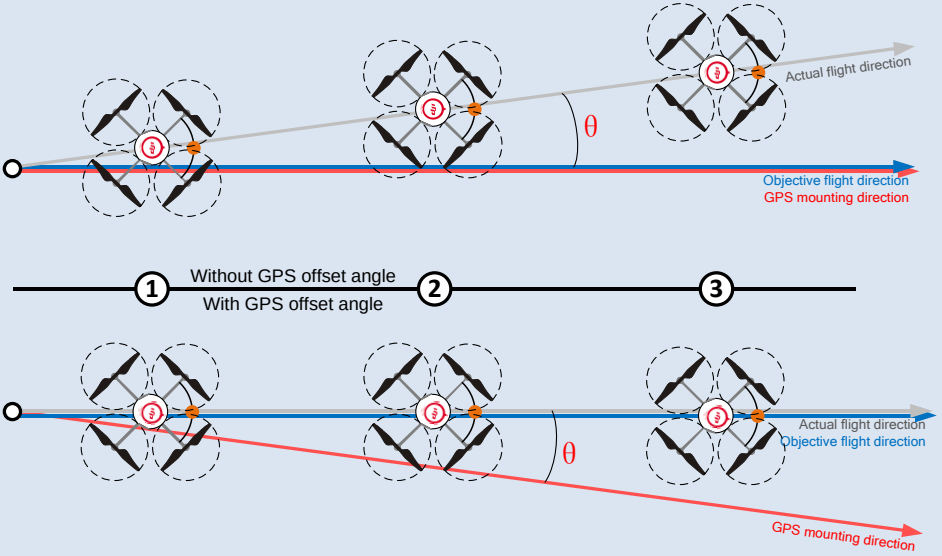
Before Flying with GPS

Note:

- When the system is powered on, you must not move your multi rotor or sticks on the transmitter until the system initialization is finished (about 5 second).
- Make sure the GPS signal is good, without red blinking LED. Otherwise the multi rotor will drift without stick commands.
- Please avoid using the MC system in the following areas, where the GPS signal is most likely weak or totally obstructed:
  - Built-up Urban area with many buildings
  - Tunnels
  - Under bridges

Tips:

Should you find the multi-rotor does not fly straight in forward flight, you might need to re-mount the GPS module in an offset angle as shown in the diagram below. Θ in the diagram is the offset angle.



Enhanced Features

Attitude Control When One Motor Output Has Failed

This feature is for Hexa-rotor, including Hexa-rotor I, Hexa-rotor V, Hexa-rotor IY and Hexa-rotor Y.

The WKM can still control the attitude of the Hexa-rotor for a safe landing when one motor output of the Hexa-rotor has failed, for example, one motor is stopped or one propeller is broken, etc.

The control mode of WKM should be in Atti. Mode or GPS Atti. Mode. The aircraft will rotate, due to an imbalance of torque; however, it can still be controlled by the TX.

Select Course lock or home lock mode for flying the aircraft into a safe area to land when the aircraft is far away or the attitude can't be recognized. Even when the multi rotor is rotating, using Course lock or home lock mode will allow you to move the multi rotor in the corresponding Tx stick direction.

Flight Limits Setting

Height Limit

If height restriction is needed, please turn to the "Tool" tab of the assistant software. Click ON and write a value (Range: 20~300m) to the Max Height box, so that the aircraft flight height will not higher than the max-height in any control mode (Manual/ATTI./GPS ATTI. Mode). However, the fail-safe and the Ground Station operation are not restricted to this height limit. If no height limit is needed, please click OFF.

Distance Limit

If distance restriction is needed, please turn to the "Tool" tab of the assistant software. Click ON and write a value (Range: 30~500m) in the Max Radius box, so that the distance from the aircraft to the Home-point will not be longer than the max-radius you set. The Distance Restriction function ONLY works in GPS ATTI. Mode. The aircraft may fly out of the restriction when emergency brake is carried out at the border (the buffer zone is about 10m), if it flies out of the restricted distance the Control Mode LED will blink Cyan. However, the fail-safe and the Ground Station operation are not restricted to this distance limit. If no distance limit is needed, please click OFF.

However, the fail-safe and the Ground Station operation are not restricted to this distance limit. If no distance limit is needed, please click OFF.

Appendix

Customize Motor Mixer

For a multi rotor, the roll, pitch, yaw and vertical axes are contributed by the combination of rotors' outputs. This procedure is called Mix Control. The proportion of rotors' outputs is decided by the mechanical structure. Customers can setup the motor output coefficients C in Motor Mixer → Customize so as to realize the Mix Control.

Before customization, you should following knowledge:

1. Motor output = C × Stick position (A or E or T or R).

   Torque produced by motor = Motor output × Force arm of motor (L) = C × Stick position (A or E or T or R) × L
2. The range of C is from -100% to 100%. Maximum C in the same column is 100%. The bigger absolute value of C, The great effect of stick position on motor output. Stick position will not affect motor output when C is 0, which means the motor output is fixed.
3. Each motor has four different output coefficients: C_T, C_Y, C_P, C_R. E.g. C_{Y2} represents coefficient of M2 in yaw control; C_{R5} represents coefficient of M5 in roll control.
4. Motor output is relative to its rotation speed. The bigger output, the faster rotation speed. Negative output does not represent counter rotation, but slower rotation speed. Motor is still spinning if its output is 0.
5. Throttle stick position (T): Pull stick T<0, multi-rotor moves down; Push stuck T>0 multi-rotor moves up;

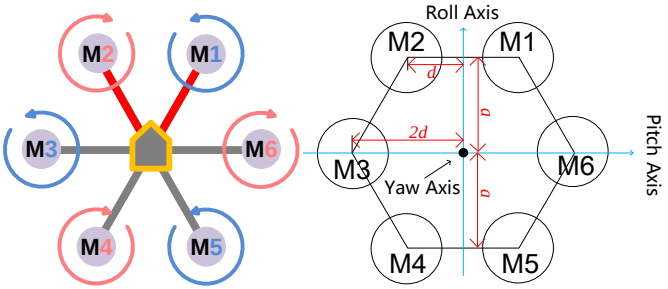
   Rudder stick position (R): Stick left R<0, multi-rotor nose left; Stick right R>0, multi-rotor nose right;

   Elevator stick position (E): Pull stick E<0 multi-rotor moves backward; Push stuck E>0, multi-rotor moves forward;

   Aileron stick position (A): Stick left A<0, multi-rotor moves left; Stick right A>0, multi-rotor moves right.
6. Multi-rotor should keep balance along all the other axes when moves along one axis:
   - To keep throttle direction balance, sum of all motors' output should be 0 when apply rudder or pitch or roll stick command;
   - To keep yaw direction balance, sum of counter clockwise motors' output should be equal to sum of clockwise motors' output when apply throttle or pitch or roll stick command;
   - To keep pitch direction balance, total torques produced by motors at each side of pitch axis should be the same when apply throttle or rudder or roll stick command;
   - To keep roll direction balance, total torques produced by motors at each side of roll axis

should be the same when apply throttle or rudder or pitch stick command。

7. To pitch or roll control, proportion of coefficients of the motors at the same side of pitch or roll axis should be equal to the proportion of force arms of those motors: $C_m/C_n = L_m/L_n$; Coefficient is 0% if the force arm of that motor is 0.



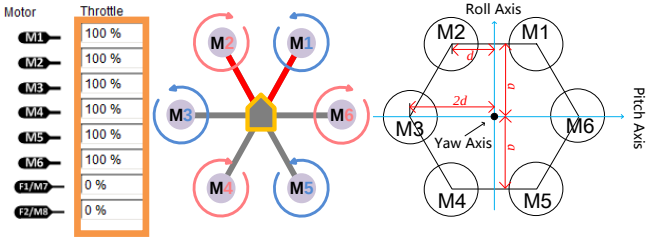
Now we take the Hexa-rotor V as an illustration to introduce how to customize motor mixer.

Throttle

Usually, we want push the throttle stick to ascend the multi-rotor; pull the throttle stick to descend the multi-rotor; put the throttle stick at center point to hover the multi-rotor. We also want multi-rotor to keep balance along all the other axes when apply the throttle stick command:

$$\begin{cases} (C_{T1} + C_{T3} + C_{T5}) \times T = (C_{T2} + C_{T4} + C_{T6}) \times T & \text{(To keep yaw direction balance)} \\ (C_{T1} + C_{T2}) \times T \times a = (C_{T4} + C_{T5}) \times T \times a & \text{(To keep pitch direction balance)} \\ (C_{T2} + C_{T4} + 2C_{T3}) \times T \times d = (C_{T1} + C_{T5} + 2C_{T6}) \times T \times d & \text{(To keep roll direction balance)} \end{cases} \quad 1$$

As we defined before: Pull stick T<0, multi-rotor moves down; Push stuck T>0 multi-rotor moves up, we can choose the following setup:



Now if push the throttle stick, the sum of all motors output ($C_{T1} + C_{T2} + C_{T3} + C_{T4} + C_{T5} + C_{T6}$)×T is positive, then multi-rotor moves up; pull the throttle stick, the sum of all motors output ($C_{T1} + C_{T2} + C_{T3} + C_{T4} + C_{T5} + C_{T6}$)×T is negative, then multi-rotor moves down. And the balance along all the other axes can be derived by substituting the throttle stick command into equations set 1.

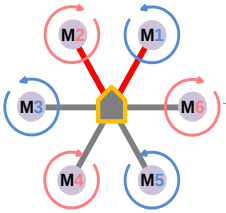
Yaw

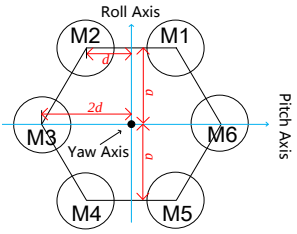
The movement about yaw axis is produced by the counter torque force from the rotation of propeller. In our example, M1 M3 M5 produce clockwise torque force; M2 M4 M6 produce counter clockwise torque force. When the hexa-rotor is hovering, all the rotors are spinning at the same angular velocity, which means the clockwise torque force equals to counter clockwise torque force, and this produces exactly 0 angular acceleration about yaw axis. Therefore, when the rotate speed of M1 M3 M5 is larger than M2 M4 M6, hexa-rotor spins clockwise; when the rotate speed of M1 M3 M5 is smaller than M2 M4 M6, hexa-rotor spins counter clockwise. We also want multi-rotor to keep balance along all the other axes when apply the yaw stick command:

$$\begin{cases} \left(C_{R1} + C_{R2} + C_{R3} + C_{R4} + C_{R5} + C_{R6}\right) \times R = 0 \ \text{(To keep throttle direction balance)} \\ \left(C_{R1} + C_{R2}\right) \times R \times a = \left(C_{R4} + C_{R5}\right) \times R \times a \ \text{(To keep pitch direction balance)} \\ \left(C_{R2} + C_{R4} + 2C_{R3}\right) \times R \times d = \left(C_{R1} + C_{R5} + 2C_{R6}\right) \times R \times d \ \text{(To keep roll direction balance)} \end{cases} \quad 2$$

As we defined before: Stick left R<0, multi-rotor nose left; Stick right R>0, multi-rotor nose right, we can choose the following setup:

Motor	Throttle	Yaw
M1	100 %	100 %
M2	100 %	-100 %
M3	100 %	100 %
M4	100 %	-100 %
M5	100 %	100 %
M6	100 %	-100 %
F1/M7	0 %	0 %
F2/M8	0 %	0 %





Now if move the yaw stick right, the sum of M1, M3, M5 output ($C_{R1} + C_{R3} + C_{R5}$) ×R is positive, the sum of M2, M4, M6 output ($C_{R2} + C_{R4} + C_{R6}$) ×R is negative, then the clockwise torque force is larger than counter clockwise torque force, multi-rotor nose right; if move the yaw stick left, the sum of M1, M3, M5 output ($C_{R1} + C_{R3} + C_{R5}$) ×R is negative, the sum of M2, M4, M6 output ($C_{R2} + C_{R4} + C_{R6}$) ×R is positive, then the clockwise torque force is smaller than counter clockwise torque force, multi-rotor nose left. And the balance along all the other axes can be derived by substituting the yaw stick command into equations set 2.

Pitch

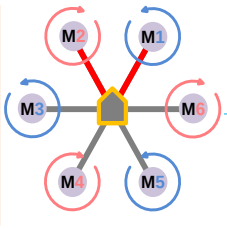
The movement about the pitch axis is produced by the differential output of M1+M2 and M4+M5. Since M3 and M6 are on the pitch axis, they do not contribute and torque. You can just keep the rotation speed of M3 and M6 the same as hovering, so C_{P3} and C_{P6} are 0. Increase output of M4, M5 and decrease output of M1, M2, multi-rotor moves forward; decrease output of M4, M5 and increase output of M1, M2, multi-rotor moves backward. We also want multi-rotor to keep balance along all the other axes when apply the pitch stick

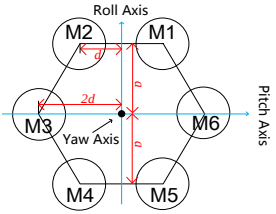
command:

$$\begin{cases} \left(C_{E1} + C_{E2} + C_{E3} + C_{E4} + C_{E5} + C_{E6}\right) \times E = 0 \ (\text{To keep throttle direction balance}) \\ \left(C_{E1} + C_{E3} + C_{E5}\right) \times E = \left(C_{E2} + C_{E4} + C_{E6}\right) \times E \ (\text{To keep yaw direction balance}) \\ \left(C_{E2} + C_{E4} + 2C_{E3}\right) \times E \times d = \left(C_{E1} + C_{E5} + 2C_{E6}\right) \times E \times d \ (\text{To keep roll direction balance}) \end{cases} \quad 3$$

Also proportion of coefficients of the motors at the same side of pitch axis should be equal to the proportion of force arms of those motors: $C_{E1} : C_{E2} = C_{E4} : C_{E5} = a : a = 1:1$. As we defined before: Pull stick E<0 multi-rotor moves backward; Push stuck E>0, multi-rotor moves forward, we can choose the following setup:

Motor	Throttle	Yaw	Pitch
M1	100 %	100 %	-100 %
M2	100 %	-100 %	-100 %
M3	100 %	100 %	0 %
M4	100 %	-100 %	100 %
M5	100 %	100 %	100 %
M6	100 %	-100 %	0 %
F1/M7	0 %	0 %	0 %
F2/M8	0 %	0 %	0 %





Now if push the pitch stick, the sum of M1, M2 output ($C_{E1} + C_{E2}$) ×E is negative, the sum of M4, M5 output ($C_{E4} + C_{E5}$) ×E is positive, then multi-rotor moves forward; if pull the pitch stick, the sum of M1, M2 output ($C_{E1} + C_{E2}$) ×E is positive, the sum of M4, M5 output ($C_{E4} + C_{E5}$) ×E is negative, then multi-rotor moves backward. And the balance along all the other axes can be derived by substituting the pitch stick command into equations set 3.

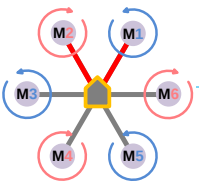
Roll

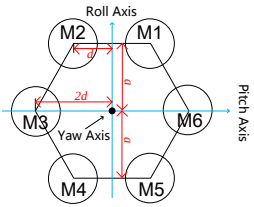
The theory of movement about the roll axis is the same with pitch axis. However there is no motor on the axis in this case, no coefficient is 0%. We also want multi-rotor to keep balance along all the other axes when apply the roll stick command:

$$\begin{cases} \left(C_{A1} + C_{A2} + C_{A3} + C_{A4} + C_{A5} + C_{A6}\right) \times A = 0 \ (\text{To keep throttle direction balance}) \\ \left(C_{A1} + C_{A3} + C_{A5}\right) \times A = \left(C_{A2} + C_{A4} + C_{A6}\right) \times A \ (\text{To keep yaw direction balance}) \\ \left(C_{A1} + C_{A2}\right) \times A \times a = \left(C_{A4} + C_{A5}\right) \times A \times a \ (\text{To keep pitch direction balance}) \end{cases} \quad 4$$

Also proportion of coefficients of the motors at the same side of roll axis should be equal to the proportion of force arms of those motors: $C_{E2} : C_{E3} : C_{E4} = C_{E1} : C_{E6} : C_{E5} = d : 2d : d = 1:2:1$. As we defined before: Stick left A<0, multi-rotor moves left; Stick right A>0 multi-rotor moves right, we can choose the following setup:

Motor	Throttle	Yaw	Pitch	Roll
M1	100 %	100 %	-100 %	-50 %
M2	100 %	-100 %	-100 %	50 %
M3	100 %	100 %	0 %	100 %
M4	100 %	-100 %	100 %	50 %
M5	100 %	100 %	100 %	-50 %
M6	100 %	-100 %	0 %	-100 %
F1/M7	0 %	0 %	0 %	0 %
F2/M8	0 %	0 %	0 %	0 %





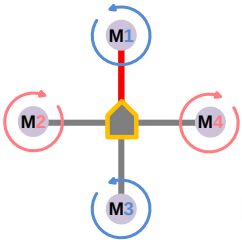
Now if move the roll stick right, the sum of M2, M3, M4 output ($C_{A2} + C_{A4} + 2C_{A3}$) ×A is positive, the sum of M1, M5, M6 output ($C_{A1} + C_{A5} + 2C_{A6}$) ×A is negative, then multi-rotor moves right; if move the roll stick left, the sum of M2, M3, M4 output ($C_{A2} + C_{A4} + 2C_{A3}$) ×A is negative, the sum of M1, M5, M6 output ($C_{A1} + C_{A5} + 2C_{A6}$) ×A is positive, then multi-rotor moves left. And the balance along all the other axes can be derived by substituting the roll stick command into equations set 4.

Summary

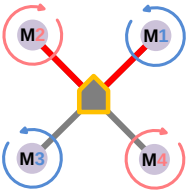
1. Once you choose to customize, all coefficients are configurable. However, you only have to setup as many as you need. Leave the rest 0%.
2. Make sure you are clear about the definition of the positive and negative. Make sure you are also clear about the relationship between the output quantity and motor rotation speed.
3. Usually, the coefficients of throttle and yaw are 100% or -100%. The rest of the coefficients should be decided by the proportion of force arms of the motors.
4. The method introduced in this section is only suitable for central symmetry multi rotor.

Multi-Rotors Supported

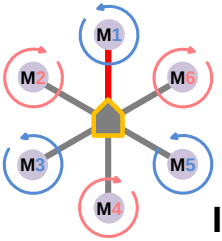
For coaxial propellers: Blue propeller is at Top; Red propeller is at Bottom. Otherwise all propellers are at top.



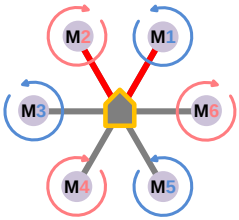
I4



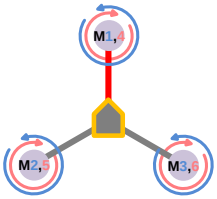
X4



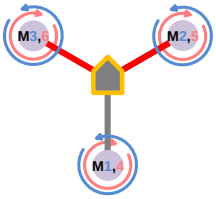
I6



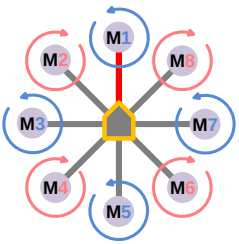
X6



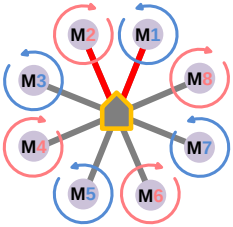
IY6



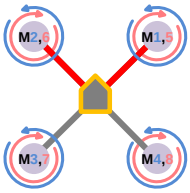
Y6



I8



V8



X8

Port Description

Main Controller

A	For roll control (left/right)		
E	For pitch control (front/back)		
T	For throttle control	Or to gimbal roll servo	
R	For rudder control	Or to gimbal pitch servo	
U	For Control Mode Switch		
X1	For voltage monitor (Connect with PMU V-SEN port)		
X2	For D-Bus (S-Bus/S-Bus2 compatible)	Or for gain tuning	Or for IOC switch
X3	For gimbal pitch control	Or for gain tuning	Or for switch go-home
M6	To #6 rotor		
M5	To #5 rotor		
M4	To #4 rotor		
M3	To #3 rotor		
M2	To #2 rotor		
M1	To #1 rotor		
F2	To gimbal pitch servo	Or to #8 rotor	
F1	To gimbal roll servo	Or to #7 rotor	
	Micro-B USB port: PC connection for configuration and firmware upgrades.		
	CAN-Bus port: MC uses CAN-Bus to power and communicate with other WKM modules.		

(In three-pin ports, pins near the nicks are signal pins.)

Power Management Unit

V-SEN	For monitoring battery voltage and supplying power to receiver and other electronic devices. (Connect with MC X1 port) ● White wire (signal wire) output: ±3.3V ● Red wire (power wire) output: 3A@5V
PW	For supplying power to WKM system. ● Output: Max 2A@12.6V

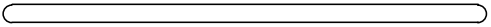
LED Description

Flight States

	Manual Mode	Atti. Mode	GPS Atti. Mode	IOC	Tx Signal Lost
GPS satellites < 5					
GPS satellites < 6					
GPS satellites < 7					
Attitude & GPS good					
Attitude status fair					
Attitude status bad					
IMU data Lost					

- Flashing indications of  are: **Single flash**, all the Tx sticks are at center position, multi rotor hovering; **Double flash**, Tx stick(s) not at center position, speed command is not zero.
-  Fast flashing: Recorded forward direction, home point, or POI is successful.

Compass Calibration

Begin horizontal calibration	
Begin vertical calibration	
Calibration finished	3 seconds 
Calibration or others error	

Low Voltage Warning

First level protection	
Second level protection	

Main Controller LED

MC is functioning correctly.	
Boot loader mode, MC is waiting for firmware upgrade.	
Firmware upgrade has finished. MC is waiting for reboot.	
Error occurred during firmware upgrade, MC reboot is required.	

PMU LED

PMU connection is correct.	
Connection between PMU and battery is wrong (polarity error).	

Recommended Setting

No.	Aircraft	Configuration Information					Basic Gain				Attitude Gain	
		Motor	ESC	Propeller	Battery	Weight	Pitch	Roll	Yaw	Vertical	Pitch	Roll
1	**F450**	DJI-2212	DJI-30A	DJI-8 Inch	3S-2200	1070 g	155	155	125	150	165	165
2	**F550**	DJI-2212	DJI-30A	DJI-8 Inch	4S-3300	1640 g	170	170	150	140	170	170
3	**S800**	DJI-4114	DJI-40A	DJI-15 Inch Carbon	6S-15000	4770 g	200	200	195	175	190	190
4	**S800&Z15 &Camera**	DJI-4114	DJI-40A	DJI-15 Inch Carbon	6S-10000	6100 g	240	240	200	200	220	220

Specifications

General

Built-In Functions	● Three Modes Autopilot	● S-Bus/S-Bus2 Receiver Supported
	● PPM Receiver Supported	● Intelligent Orientation Control
	● 2-axle Gimbal Support	● Multi Output Frequency Supported
	● Enhanced Fail Safe	● Low Voltage Protection

Peripheral

Supported Multi-rotor	● Quad-rotor: I4, X4; ● Hexa-rotor: I6, X6, Y6, IY6; ● Octo-rotor: X8, I8, V8.
Supported ESC output	400Hz refresh frequency.
Recommended Transmitter	Only PCM or 2.4GHz with minimum 7 channels and fail-safe function available on all channels.
Recommended Battery	2S ~ 6S LiPo
Assistant Software System Requirement	Windows XP SP3 / 7

Electrical & Mechanical

Power Consumption	MAX 5W (0.9A@5V, 0.7A@5.8V, 0.5A@7.4V, 0.4A@8V)
Operating Temperature	-5°C to +60°C
Total Weight	<= 118g (overall)
Dimensions	● MC: 51.2mm x 38.0mm x 15.3mm ● IMU: 41.4mm x 31.1mm x 27.8mm ● GPS & Compass: 50mm (diameter) x 9mm ● LED Indicator: 25mm x 25mm x 7mm ● PMU: 39.5mm×27.5mm×9.7mm

Flight Performance (can be effected by mechanical performance and payloads)

Hovering Accuracy (GPS Mode)	● Vertical: ± 0.5m ● Horizontal: ± 2m
Maximum Wind Resistance	<8m/s (17.9mph / 28.8km/h)
Max Yaw Angular Velocity	150deg/s
Max Tilt Angle	35 °
Ascent / Descent	±6m/s