X4V2 Flight Controller Manual

V1.1

Zero UAV (Beijing) Intelligence Technology Co., Ltd.

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1 Warning and Disclaimer

Danger

Thank you for purchasing this ZERO UAV product. The product is an advanced and specifically dedicated control item. Any misuse may result in damage to property, injury or even death. The user must conform to the law and use the equipment responsibly. This product is not suitable for people under the age of 18. Please read this disclaimer carefully before using the product, or visit the X4V2 web page at http://www.zerouav.com to refer to relevant updates or information.

Caution

1. Please keep the product out of reach of children.
2. Make sure the aircraft is kept away from people and dangers such as buildings roads and property. We suggest you fly your aircraft at specially designated areas.
3. Please do NOT fly this product when affected by drunkenness, tiredness, drugs, dizziness fatigue, nausea or any other condition that might impair your ability to control the aircraft.
4. Please strictly follow the user manual when operating the device.
5. Please make sure all components of the device are connected and work well, otherwise your unit may be damaged, destroyed or even buried!
6. Please power off and remove propellers before making any adjustments to the unit such as calibrating, upgrading firmware or changing parameters. There is an ever present danger of the propellers starting unexpectedly and causing injury.
7. Please do NOT fly in unfavorable conditions.
8. Please do NOT open or modify the autopilot, there are no user serviceable parts inside.

Disclaimer

1. Zero UAV (Beijing) Intelligence Technology Co. Ltd. products are specially controlled devices. The user shall be responsible for any and all activities connected with the use of all their products. The manufacturer shall not be reliable for any consequences directly or indirectly caused by all their products.
2. The user is responsible for abiding with the law and not behaving contrary to public order or public safety by using this product.
3. We shall not provide technical support or security warranty for any of the following conditions:

1) Units or individuals obtaining the product from agents or channels not authorized by Zero UAV (Beijing) Intelligence Technology Co. Ltd.

2) Products after modification, debugging or replacing parts without authorization;

3) Products losing warranty card, serial number or flight data;

4) Injuries and property losses due to mis-operation or force majeure of natural disasters.

2 Terms and Abbreviations

Name	Description
GCS	Ground control station
SSID	Service Set Identifier, name of wireless network
Dual controller operation	Aircraft radio control transmitter +Gimbal radio control transmitter
Single controller operation	To control the aircraft and gimbal with a single radio control (RC) transmitter
CH	Channel, for example CH5 means channel 5 Channel switches assigned to different functions
F/S	Fail/Safe control

3 Functions

The types and related functions of the aircraft are as follows:

- Airframe type: 4-axis X-type, 4-axis cross type, 6-axis X-type, 6-axis cross type, 8-axis X-type, 8-axis cross type, 6-axis reverse Y-type, 6-axis Y-type, 4-axis X-type with 8 motors and customized types (irregular or quasi-irregular);
- Firmware upgrading: PC upgrading (standard USB serial port cable);
- Control mode: transmitter radio control/mobile control;
- Parameter adjustment mode: PC/tablet PC/mobile ground station ;
- Operation mode: manual stabilization, automatic hover, automatic navigation and return and land;
- Status indication: LED
- Security measures: auto return on loss of control, black box flight recorder;
- PTZ: servo PTZ;
- Receiver: Standard receiver, S-BUS receiver, PPM receiver

4 In the Box

Key: **■Hardware □Software (download)**

■Controller X1	■GPS+COMPASS （hereinafter referred to as GPS ）X1
	
The MC (Master Controller) combines and communicates with the other modules and external electronic devices to carry out its function as a complete autopilot system. Firmware is updated in this unit via its RS232 COM port. The YS-GCS (Ground control Station) records real time flight state via WI-FI.	The GPS/Compass modules are for sensing the orientation of the aircraft by reading its position and direction.
■External LED indicator X1	**■Power module X1**
	
The LED indicates current flight status of the craft. The light shows information such as flight mode, number of satellites in view and battery used.	Supplies regulated power for the autopilot and the Wi-Fi module.
■WIFI module X1	**■R232 serial port to USB converter cable (FTDI) X1**
	
Connects the Auto Pilot to the Ground Station via WI-FI (Wireless Network) Supports 2 work modes: Peer to Peer and Router	Connects PC and autopilot via USB to update firmware.
■GPS bracket X1	**■Warranty card X1**
The GPS + COMPASS is sensitive to magnetic interference. This bracket is used to mount the GPS module where necessary and to keep it far away from EMI sources.	This provides Product Serial No., Purchase Date. Please fill out the relevant information and return to Zero UAV Intelligence Technology Co. to register your product warranty.
□Ground station software **□Upgrade software**	

5 Installation

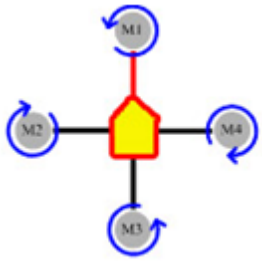
5.1 Airframe Types

The X4V2 flight controller provides support for aircraft in a cross (+), X and Y configurations of rotor arms and propellers.

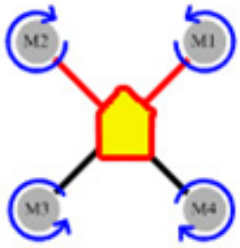
In the figures below, the yellow arrow at the position of the central plate indicates the direction of the aircraft nose; the blue curved arrow indicates the direction of rotation of the upper propeller and the purple curved arrow the direction of rotation of the lower propeller.

NB

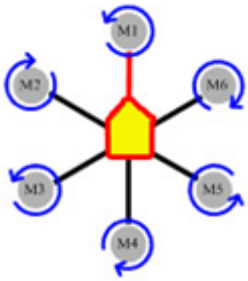
Install the motor and propellers according to the following modes.



Quad-Rotor +4

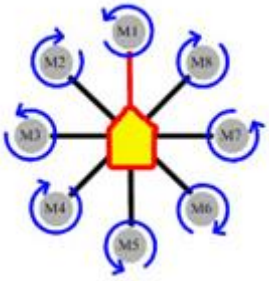


Quad-Rotor x4

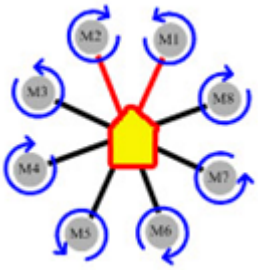


Hexa-Rotor +6

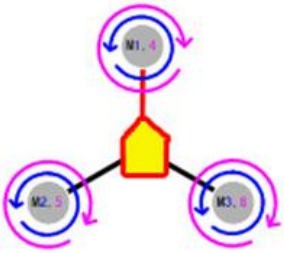
Hexa-Rotor x6



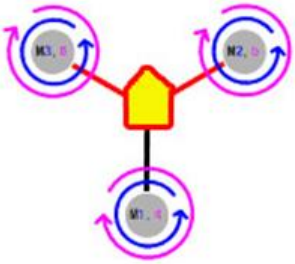
Octo-Rotor +8



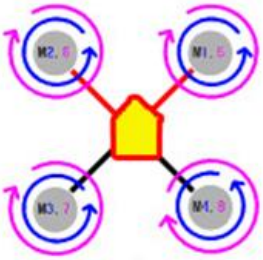
Octo-Rotor x8



Hex-Rotor reverse Y6



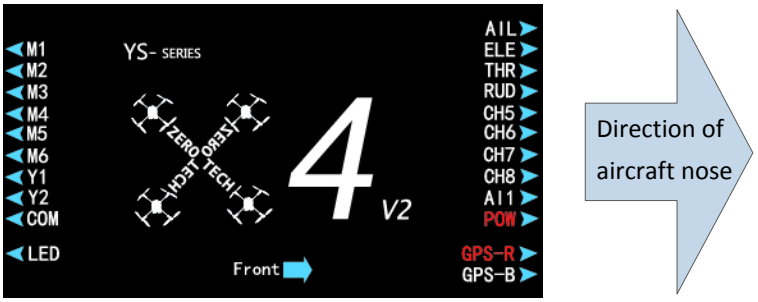
Hex-Rotor Y6



Quad-Rotor X8

5.2 Installation of Flight Controller

Install the X4V2 flight controller on the central deck of the aircraft horizontally, **with the arrow labelled "Front" pointing to the aircraft nose**, as indicated in the following diagrams:



5.3 Installation of the GPS

Install the GPS on the bracket with the GPS label facing upwards and **the small arrow pointing to the aircraft nose.**

The appearance of the bracket is as shown in Figure 1.

Figure 1

NB

- Make sure the small arrow points to the aircraft nose. If not the aircraft will circle (toilet bowl) when in auto-hover;
- Place the GPS module in an elevated and horizontal position, away from equipment which can produce magnetic fields such as cables, transmitters and cameras without screening.

6 Wiring

6.1 Port Definitions

Port Definitions: X4V2 flight controller

Port	Port function	Port	Port function
M1	ESC for Motor #1	**AIL**	Aileron
M2	ESC for Motor #2	**ELE**	Elevator
M3	ESC for Motor #3	**THR**	Throttle
M4	ESC for Motor #4	**RUD**	Rudder
M5	ESC for Motor #5	**CH5**	Switching flight mode
M6	ESC for Motor #6	**CH6**	Switching flight mode
Y1	Connect NO.7 ESC or connect roll of servo gimbal for multiplex	**CH7**	Control the gimbal pitch and roll Connect S-BUS receiver for multiplex (**NOT** support S-BUS2 port of 7008SB)
Y2	Connect NO.8 ESC or connect pitch of servo gimbal for multiplex	**CH8**	Connect PPM receiver for multiplex
COM	Wi-Fi data unit or to PC via USB for updating firmware etc.	**AI1**	Power management module (option)
LED	LED indicator	**POW**	5.7V output from power module
		GPS-R **GPS-B**	GPS-R: Red terminal from GPS module GPS-B: Black terminal from GPS module

6.2 Wiring Diagram

Notes:

a. The power supply range for the power module and Wi-Fi module should be a Lipo battery of between 3S and 6S, namely 10.8v-25.5v;

b. The RC receiver should be powered directly from the flight controller. If an external power supply is used at the same time the equipment may be destroyed.

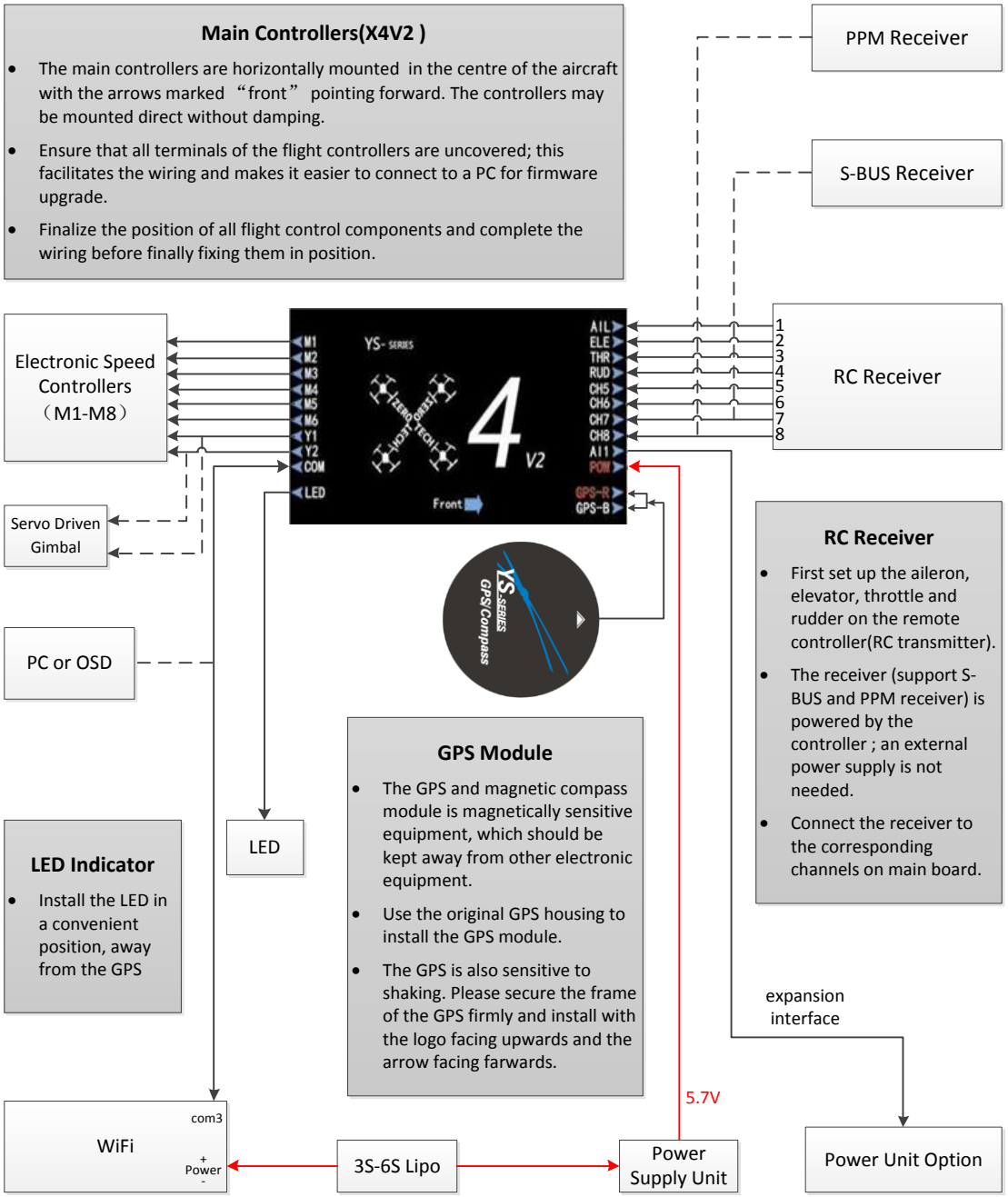
c. The ESCs and motors can cause serious magnetic interference. The GPS and magnetic sensor modules must be installed as far away as possible from motors and ESCs (particularly where there are multiple ESCs). The arrow on the GPS must be pointed at the aircraft nose. The power lead from the battery will create a large magnetic field particularly when large currents are drawn. Keep this as far away as possible from the GPS module to avoid flight artefacts such as “toilet bowling”.

d. A servo driven gimbal should not be powered from the receiver but should be powered separately.

e. The video transmitter (VTX) must be kept as far away from the aircraft electronics as possible to avoid serious interference.

f. Make sure the full system power is not connected directly to the flight controller. This will destroy the flight controller which should be powered by a 5.7 V output only. The LED indicator will flash three times after the initialization of the flight controller, indicating that correct correction has been made and the system started normally.

Wiring diagram



7 System Preparation and Debugging

The X4V2 Aircraft system links to PC or Android ground station software. As the Android is more convenient for debugging and flight monitoring at the field, this is the recommended system.

7.1 GCS Installation

7.1.1 Installation of Mobile GCS

Android mobile GCS should be installed as follows:

1. Download YS-GCS Android mobile software from the download section in the support zone of the official website (www.zerouav.com).
2. Automatically install the software by clicking on the APK file in the file manager. The ground station App will appear on the mobile device desktop after installation as shown in Figure 2. The GCS must be installed in the memory of the mobile.

Figure 2

7.1.2 Installation of PC GCS

Download the YS-GCS PC software from the download section in the support zone of the official website (www.zerouav.com). After decompressing, double-click the ZERO-GCS Rotor Ground Station.exe file to install the program.

7.2 Wi-Fi Configuration

7.2.1 Wi-Fi Communication Mode

The X4V2 Wi-Fi system can support two communication modes: point-to-point (P2P) and router. The delivery default setting is point-to-point mode with an SSID of ZERO-TECH and no password.

After the link is completed all flight data will be recorded to the ground station. The file with the extension of ".hj" can be found in the directory "YShj" in the root directory of a mobile device or in the file folder "Hj" in the PC ground station software package. This file can be replayed and analyzed in the PC GCS application.

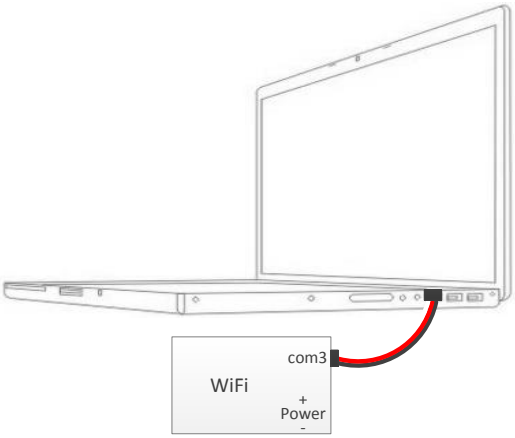
A Wi-Fi configuration tutorial can be found at:
http://v.youku.com/v_show/id_XNTE2OTY4MjQ4.html

7.2.2 Wi-Fi Configuration

7.2.2.1 Firmware Connection

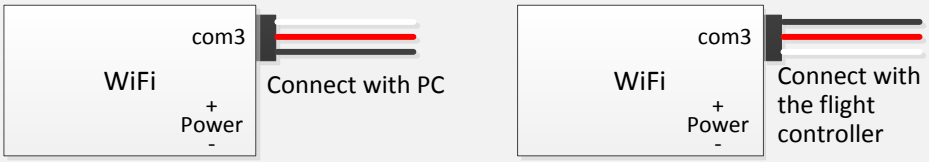
The firmware can be updated using the following procedure:

1. Download the USB driver from the ZERO official website and install it;
2. Connect the Wi-Fi module to a PC with the supplied USB serial port cable shown below. Connect the USB terminal to any USB port on the PC and the serial terminal to the *com* port of the Wi-Fi module;
3. Plug the lead reserved for the Wi-Fi module from the power supply into the *Power* port of (3S-6S input) of the Wi-Fi module.



Note:

- When connecting the Wi-Fi module to the Computer, the WHITE wire of the communication cable is located at the upper right hand corner of the Wi-Fi module.
- When connecting the Wi-Fi module to the X4V2, the BLACK wire of the communication cable is located at the upper right hand corner of the Wi-Fi module.



7.2.2.2 Software Set-up

7.2.2.2.1 Point-to-point Mode

It is possible to use the wireless router in the point-to-point mode and the password can be set up in this mode to make sure no other user can connect to the Wi-Fi. Setup procedure is as follows:

1. Download Wi-Fi configuration software from the Zero UAV site.
2. Double-click “SeanyConfig.exe” after decompression and a “SeanyConfig” window will pop up, as shown in Figure 3.
3. Click “Setting” for the main interface, as shown in Figure 4.

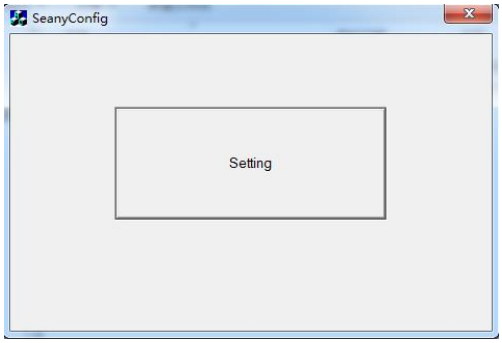


Figure 3

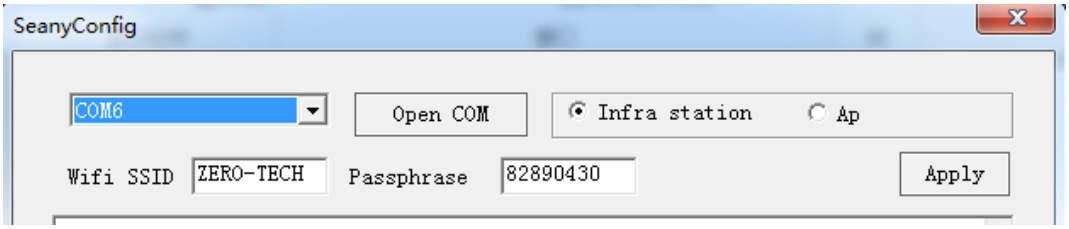


Figure 4

4. Select the correct COM port. If you are unsure which port this is you can search for the “Prolific USB-to-Serial Comm Port” in your Windows Device Manager. This will give you the port number. Check "AP" (Access Point) which is "PTP mode".

   To check your port: right-click “My computer”→“Properties”→“Device manager”→“Port (Com and LPT), as indicated in Figure 5.

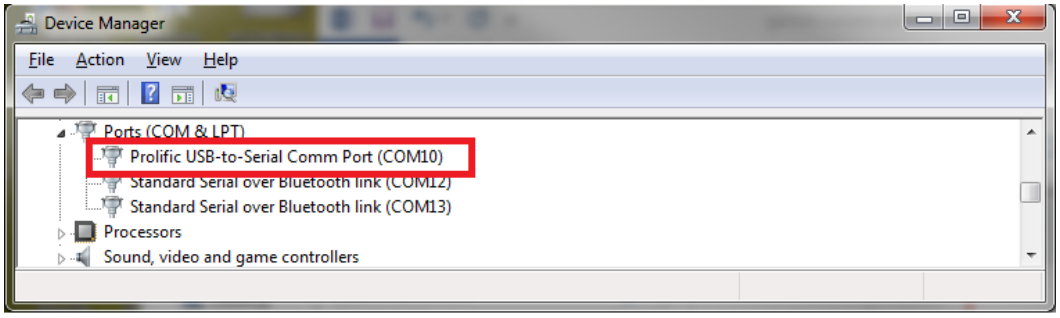


Figure 5

5. Set up the SSID of Wi-Fi module, default is “ZERO-TECH”.

6. Uncheck “No Passphrase”; the Wi-Fi password must be five digits; as shown in Figure 6.

7. Click “Apply” and wait for completion of the software configuration; click “Yes” to exit after the window “Ap mode OK” pops up, as shown in Figure 7.

8. Connect your mobile device or PC GCS to the SSID via wireless after set up.

9. The Wi-Fi blue indicator changes from solid to flashing to indicate the GCS is connected and receiving data.

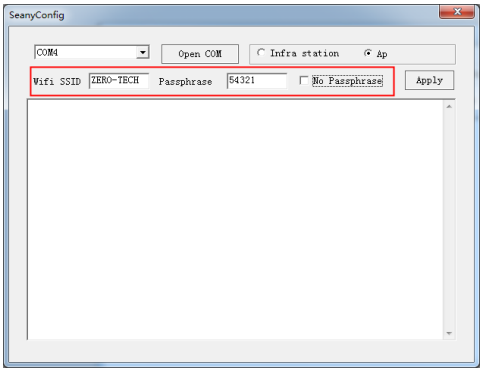


Figure 6

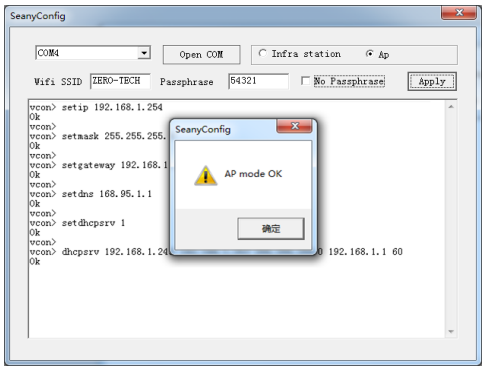


Figure 7

7.2.2.2.2 Router Mode

Set up Wi-Fi router mode if your mobile device or PC is incompatible with P2P.

Configuration of router mode is similar to that of point-to-point mode and you should proceed as follows:

1. Download Wi-Fi configuration software from the ZERO official website to your PC;
2. Double-click “SeanyConfig.exe” after decompression and a “SeanyConfig” window will pop up, as shown in Figure 8.
3. Click “Setting” and the main interface will pop up, as shown in Figure 9.
4. Select the correct port and check “Infra station”, as shown in Figure 10.
5. Set up the SSID of Wi-Fi module, default is “ZERO-TECH” it is case-sensitive and the default password is 82890430.
6. Complete the configuration modification by clicking “Apply”.
7. A video showing how to configure the route can be seen at: http://v.youku.com/v_show/id_XNTE3NzE1NDcy.html/;
8. Connect your mobile device or PC GCS to the SSID via wireless after set up.
9. The Wi-Fi blue indicator changes from flashing to solid to indicate the GCS is connected and receiving data.

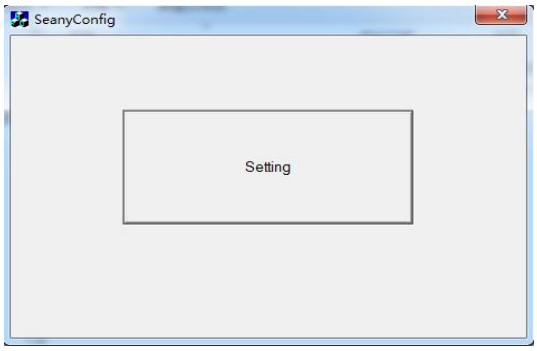


Figure 8

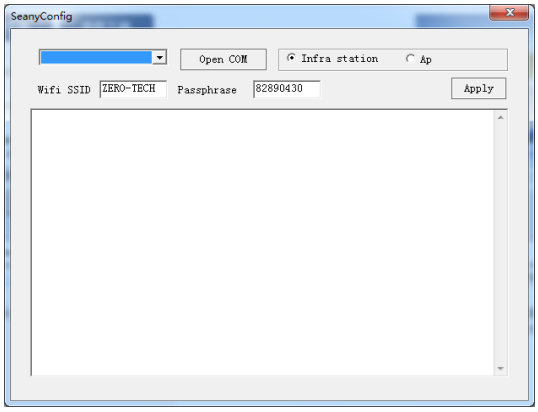


Figure 9

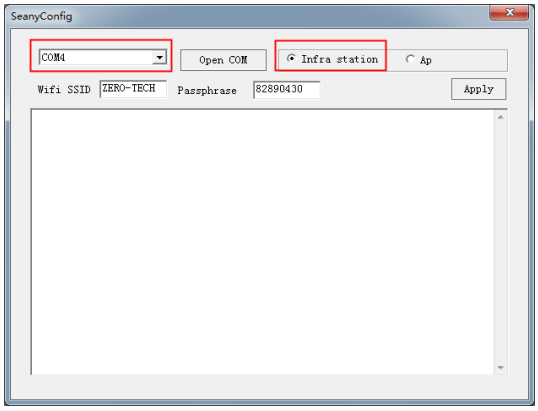


Figure 10

Note:

- The SSID and password of the router must be consistent with those of the Wi-Fi module;
- TP-LINK is taken as an example for the router configuration in the video;
- WPA2-PSK AES encryption method is used with an IP of 192.168.1.1.

7.3 Setting up the Transmitter(s)

Fixed wing mode must be used in the RC transmitter without any mixes configured. If you are using FUTABA none of the channels should be reversed. All channels should be reversed for a JR or WFLY transmitter.

The transmitter of the aircraft can be set up as follows:

1. Set three-position switches to CH5 and CH6 on the transmitter as indicated in the following diagram:

2. To set up F/S (Fail safe) protection set both CH5 and CH6 of the transmitter to Position 3 and the accelerator near central position (50%).

The relationship of four operation modes is indicated in the following table:

CH5 status	CH6 status	Operation mode
Position 1	X, (Any Position)	Manual stabilisation If Channel 5 is switched to position1 then the aircraft will be in manual stability mode whatever the position of Channel 6
Position 3	Position 1	Automatic hovering
Position 3	Position 2	Automatic navigation
Position 3	Position 3	Returning and landing
Note: Position 2 of CH5 is a functional Position in which the Carefree mode can be selected. Refer to “10.2.8 Carefree Mode” for more information.		

Refer to your transmitter manual for specific instructions to set up failsafe and take a look at this video: http://www.tudou.com/programs/view/e1ai526Mbt4/.

8 Ground Control Software setup and Debugging

The aircraft will be set up by following the GCS installation guide. We can follow your own customized setup in the GCS app. It is recommended that you follow the GCS installation guide because it is easy to miss out essential steps if you do it yourself and you may damage the equipment as a result.

You should pay attention to the following points during the installation:

- Before turning on the transmitter or powering the flight controller when you are installing or debugging, make sure the propellers are removed, and it is recommended that you are able to power the motors separately from the controller.
- Switch your transmitter to manual mode and advance the throttle before entering settings, otherwise it will not be possible to make changes.

Note:

- Carry out the following inspections if there is no data transmission during installation or debugging:

  1. Examine whether the wires are connected correctly;
  2. Examine whether there is any problem with the flight controller; connect the flight controller to the PC and see whether there is any data transmission from the flight controller; the flight controller can be considered faulty if there is no data transmission but the USB serial port lead is working okay.
  3. Check Wi-Fi configuration;

- An automatic alarm will be made by the mobile ground station if the voltage is too low.

8.1 Mobile Ground Station Debugging

8.1.1 Ground Station Software Auxiliary Setting (Installation Guideline)

The ground station software auxiliary settings are as follows:

1. Connect the ZERO-GCS app on your android mobile device or tablet to the autopilot by Wi-Fi to enter the initial interface screen, as shown in Figure 11.
2. Click “Settings ” for the settings interface, as shown in Figure 12.
3. Click “Installation Guide” to start the installation, as shown in Figure 13.

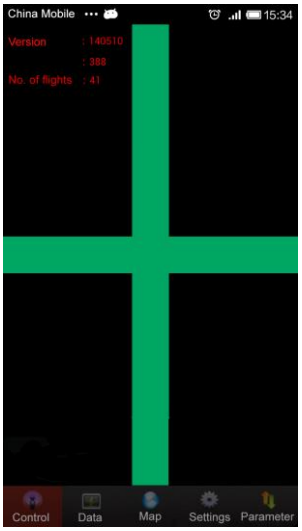


Figure 11

Figure 12

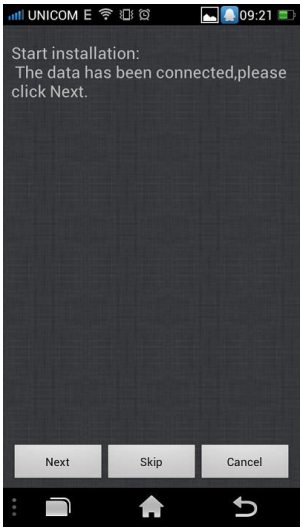
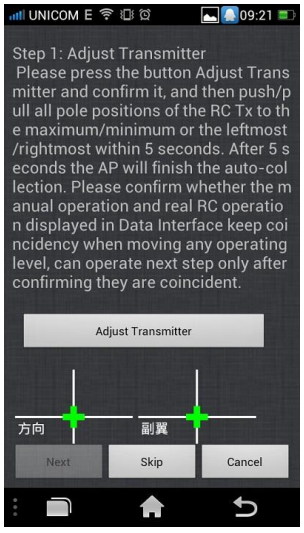
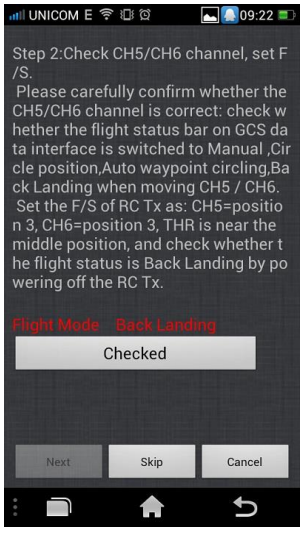


Figure 13

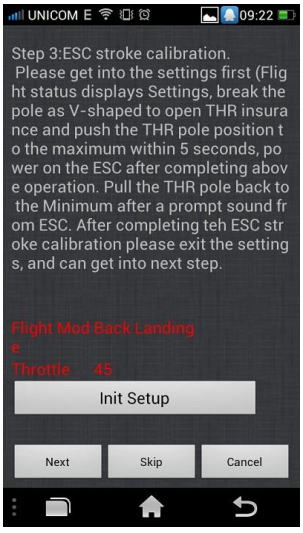
4. Click “Next” to start setting up or debugging by following the on-screen instructions:



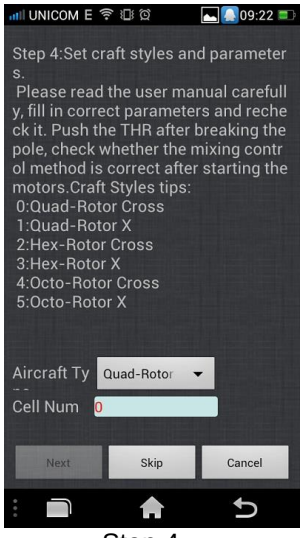
Step 1



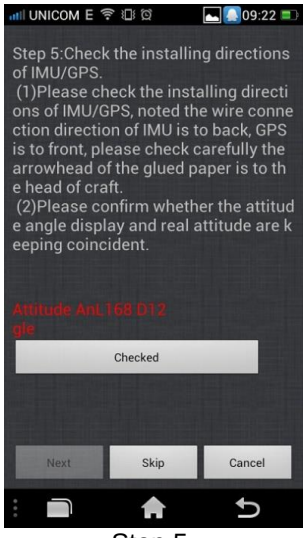
Step 2



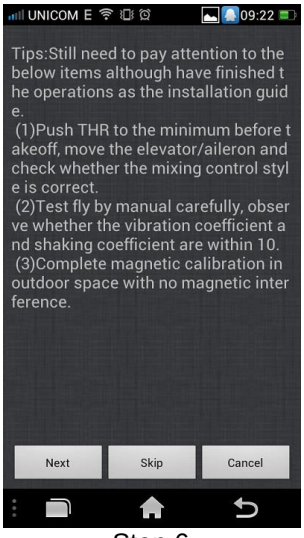
Step 3



Step 4



Step 5



Step 6

5. Click “Next” to exit the installation guidelines. An instructional video can be found here: http://www.tudou.com/programs/view/h6Umvfs1my8/.

8.1.2 Manual Settings

8.1.2.1 Transmitter Mode Set Up

Powers to the motors should be off or propellers removed to guarantee safety.

1. Select correct operational mode;
   a) Click menu on your android to open the dialogue, as shown in Figure 14.
   b) Click “Set” to open the setting window, as shown in Figure 15.
   c) Open the drop-down menu next to “Stick mode”, as shown in Figure 16.

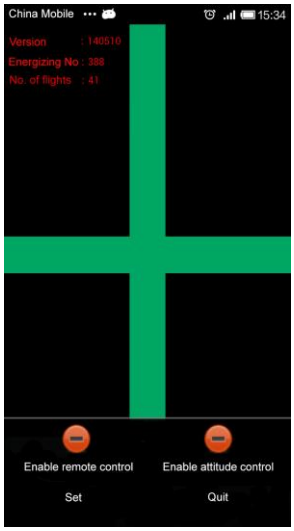


Figure 14

Figure 15

Figure 16

   d) Check next to your stick mode; for example “US” would be mode two (left-hand throttle).

2. Verify correct stick movement.
   a) Press “Adjust Transmitter” in the settings interface, and then press “OK” to confirm.
   b) Within 5 seconds rotate the left and right transmitter sticks to their extremes in all directions, as shown in Figure 17. The flight controller will automatically collect maximum, minimum and neutral values for each channel.

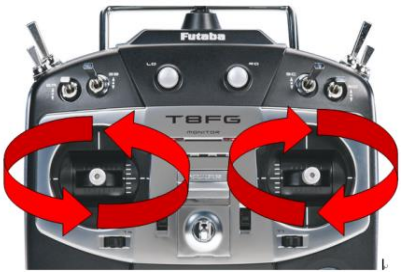


Figure 17

3. Now make sure that the direction of movement of the sticks is reflected accurately in the diagram below. You can only proceed to the next step after confirming this.
   c) How to check stick position:
      – In the diagram below showing “Manual Servo Data” in the data interface, the left stick is rotor and elevator and the right is aileron and throttle, as shown in Figure 18.

– When the sticks are in neutral position they will be shown as green. The vertical will be shown the yellow when fully extended and the sticks will be shown as red in any other position than neutral.

d) It is necessary to select “capture transmitter central point” in the settings interface to make the flight controller record the correct neutral position of the sticks if, for example, if either stick is not in the central position after fine tuning.

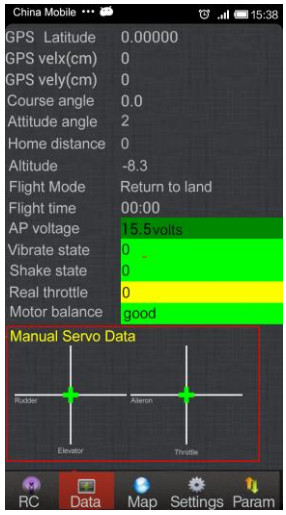


Figure 18

8.1.2.2 Check CH5 and CH6 for F/S (fail/safe protection)

❖ **Check operation mode switching is correct:**

You need to check with mode switching is normal each time you connect the GCS.

For example, looking at the data interface on the GCS, flight mode should display “Manual” when CH5 is at position 1 and CH6 is at any position, as shown in Figure 19. This is not the case you should look at the data link or the settings in your transmitter.

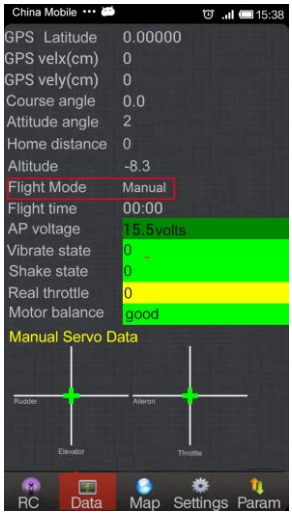


Figure 19

❖ **Check F/S protection**

Turn off your transmitter, the flight mode should display “Returning to land” and the throttle should show is neutral (green). This is not the case you should reset F/S protection.

8.1.2.3 Setting up Aircraft Parameters

The autopilot is set to 4-axis X-type mode as default before delivery and the parameters should be set up according to the following procedure:

1. Click the “Parameter” tab for the parameter interface, as shown in Figure 20.
2. Click “Get” to load the existing parameters of the aircraft;

Figure 20

3. Click “Send” after any alterations to send the modified parameters to the aircraft;

   Please refer to the following table specific parameter descriptions:

Note:

- Click Get or Send multiple times to avoid failure in obtaining or sending parameters;
- Click “Default” to recover factory setting values.

Parameter name	Setting description
Roll Sensitivity Pitch Sensitivity	This is the sensitivity of roll and pitch of the aircraft. The value will have a direct effect on the sensitivity of the controls, too small or too large settings will make the aircraft unstable. Settings represent the angle speed error and are in the range of 0 to 255. The larger the value of the sensitivity, the more rapid the response of the aircraft, but too much sensitivity will result in high frequency vibration. Sensitivity needs to be reduced for aircraft with high-speed, smaller propellers.
Sway Compensation	This sets up vibration dampening for aircraft with a lower propeller rotation speed; this will improve the stability but reduce sensitivity. The range is from 0 to 255. A value too high or too low will cause instability. If there is no sway compensation, the aircraft will rock backwards and forwards rather than snapping directly into its neutral position. – If your aircraft repeatedly rocks, then the value needs to be increased to stop the aircraft rocking. – This value should be reduced when the high-speed vibration appeared.
Photo spacing	Sets up the distance interval (in meters) between two photograph captures within the range of 5m- 255m. This parameter is only available in automatic photography mode.
PTZ Roll Sensitivity PTZ Pitch Sensitivity	The PTZ (Gimbal) roll output and PTZ pitch output sensitivity is used to adjust the compensation angle of the PTZ data for your Gimbal. You can compensate high or low for aircraft movement within a range from -127 to 127. **Note:** You can enter a negative value to reverse the direction of compensation.
Cell Num	Enter the cell number of your flight battery (4S shown) The autopilot can calculate the low voltage alert according to the Cell Number filled in by the user. If your cellphone vibrates once every 2 seconds it is a reminder that the power is getting low. When it vibrates continuously it means the power is getting very low and you should land at once.
Altitude Limit Distance Limit	This shows the highest and furthest distance which the aircraft can fly. You can enter the value 0 for unlimited distance. You can also fill in your own distance limit value. **Note**: The aircraft will automatically return to the starting position

Parameter name	Setting description
	if the height or distance limit is exceeded after taking off in manual or GPS mode. It is not possible to regain control of the aircraft until it is back within the permitted range.
Volt Alert Threshold	Enter the voltage per cell required to activate a low voltage alert, for a Lipo battery this would be normally 3.65v.
PAR+PHO Multiplex	1. If using a brushless gimbal: select parachute-opening + photograph 2. Servo Gimbal: select 2-axis PTZ
Aircraft Type	Set according to the type of aircraft in use.
Handle Mode	To select speed mode or status mode The speed mode is the speed in GPS mode while the status mode is the speed in manual mode. It's necessary to fill in maximum flight speed when selecting status mode.
Max Fly Speed	Flight speed is governed to the value selected.

4. Customized parameter setup (**Users of common standard aircraft patterns may skip this bit**) If you are using a non-standard multirotor with an irregular flight configuration you may set up the parameters according to your own requirements, customizing the speed increase and decrease ratios of the roll, pitch and yaw channels of each axis.

   The specific definitions are as follows:

Channel	Aircraft activity	Required parameter values
Throttle	Climb or descent	100 for all
Yaw	Rotate to the right	Decrease to -100 or increase to 100
Pitching	Pitch down	Decrease to -100 or increase to 100
Rolling	Roll to the right	Decrease to -100 or increase to 100

Flight parameters can be set up using 4-axis X-type quadcopter as an example, as shown in Figure 21.

Set up as follows:

a) Click "Settings" in the GCS;

b) Click "Mixing Define" for the parameter setting interface;

c) Fill in the necessary parameters and click "Send" to send your modified values to the flight controller; click "Get" to download the parameters again from the GCS to check whether parameters are uploaded successfully.

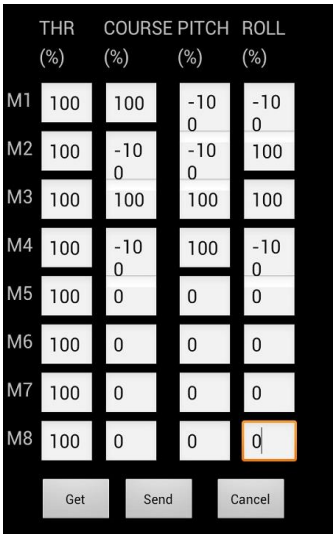


Figure 21

d) Click on the “parameter” interface and select “aircraft type” and select “user-define”;

e) After successful modification of parameters, power up the aircraft, throttle up gently and carefully note that the aircraft response is consistent with your settings; now you can confirm this with a trial flight.

NB

Because the motors might immediately rotate at high speed after the aircraft type has been modified, it is strongly recommended to remove propellers to make sure of safety.

8.1.2.4 ESC Stroke Calibration

Please remove propellers before ESC stroke calibration.

Some ESCs which have been designed specifically for multi-rotors do not need to be calibrated. Here we take the Hobbywing I did as yours ESC as example: hi DDM goodtime.

1. Connect the autopilot power only, pull the throttle to the bottom and put CH5 to position 1.
2. Click "Init Setup" in "Setting" page, as shown in Figure 22. Click "Confirm" button in the dialog box. Now the "Flight Mode" should be displaying as "Settings" in the Data screen of the GCS, as shown in Figure 23.

Figure 22

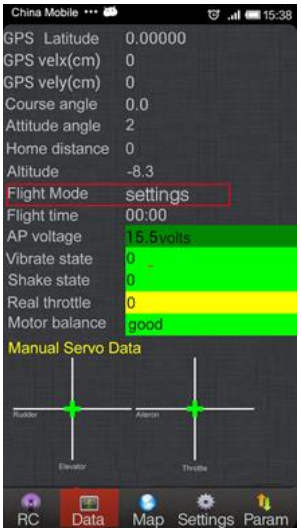


Figure 23

3. After arming the motors with CSC (Section 9.2 Unlocking and Arming the Motors), push the throttle all the way to the top and then connect power on **(No propellers!)**
4. Pull the throttle to its lowest position after two confirmatory sound signals from the ESCs and the gimbal controller will also sound a number of beeps to indicate the number of cells in the battery. This will complete ESC calibration.
5. Click “Quit Setup” and confirm in the dialog box that pops up.
6. To check whether verification is successful, push the throttle after unlocking and all my motors should work simultaneously.

8.1.2.5 Inspection of Flight Controller and GPS Installation

The flight controller and GPS installation should be inspected as follows:

1. Check that the arrows of X4V2 and GPS are all pointing to the aircraft nose.
2. Check X4V2 is installed horizontally and GPS is elevated and installed horizontally;
3. Check X4V2 and GPS are fixed firmly.

8.2 PC Ground Station Setup and Debugging

8.2.1 Ground Station Software Auxiliary Setting (Installation Guideline)

The ground station software should be set up as follows:

1. Connect the PC to the Wi-Fi module, or directly to the COM1 on the auto pilot using the USB adaptor, and run "ZERO-GCS rotor ground station.exe" to enter the initial interface, as shown in Figure 24.

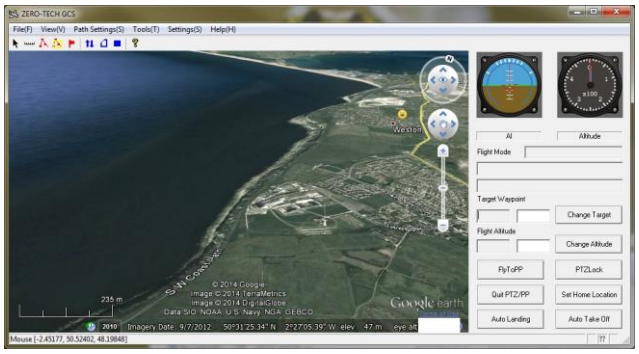


Figure 24

2. Select "File"→ "Open Wi-Fi", the flight data information bar will pop up at the bottom of the ground station window, indicating controller data, as shown in Figure 25.
3. Now select "Settings"→"Installation guide", to pop up the installation debugging window, as shown in Figure 26.

Figure 25

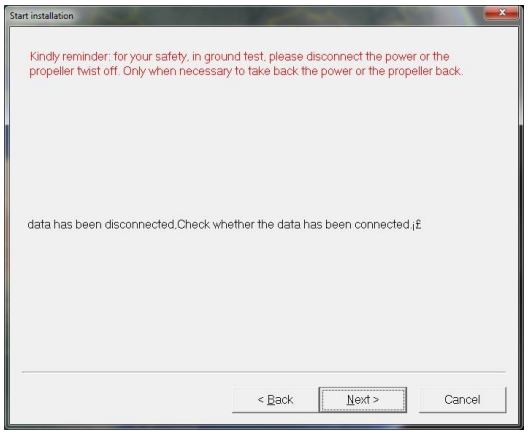
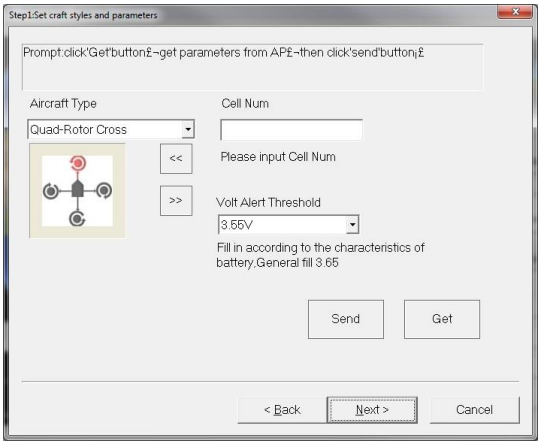
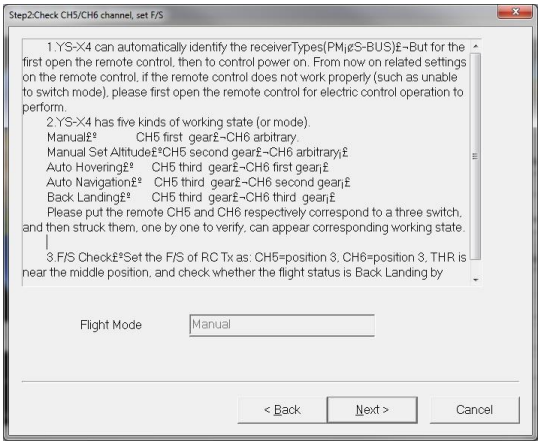


Figure 26

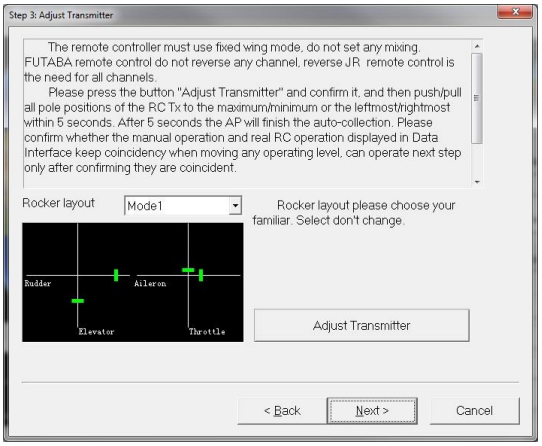
4. Click "Next" for the installation operation stage. Complete the required information as indicated below:



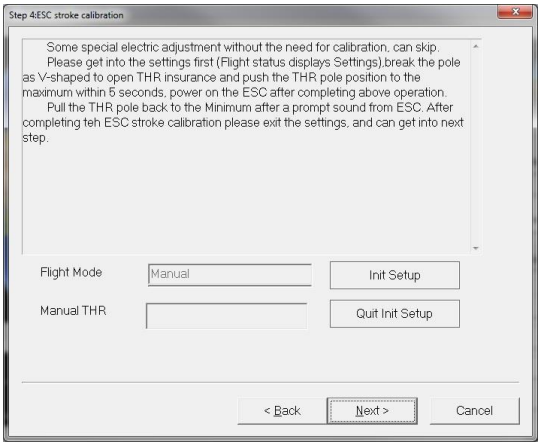
Step 1 Set the aircraft type, battery cell number and required alarm voltage from a single cell.



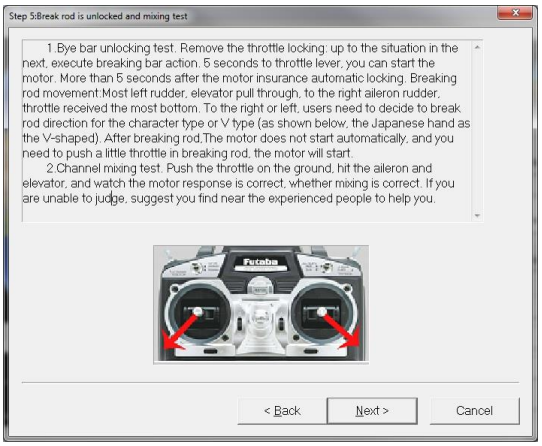
Step 2 Check channel settings, and failsafe setting (F/S)



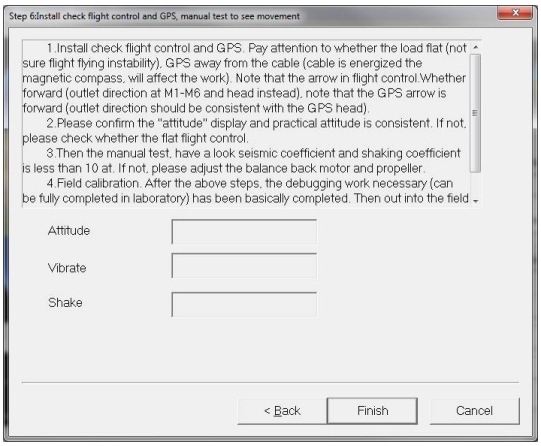
Step 3 Select transmitter Stick Mode and direction of stick movement.



Step 4 Calibrate ESCs



Step 5 Unlock (using the CSC operation) and check channel mixing.



Step 6 Examination of flight controller and GPS installation

5. Click “Finish” to exit the installation guide after software debugging.

8.2.2 Manual Settings

8.2.2.1 Calibration of Transmitter

The power supply should be disconnected from the motors or propellers removed before continuing. The transmitter is calibrated as follows:

1. Select correct stick mode;

   a) Run “ZERO-GCS rotor ground station.exe” and open Wi-Fi;

   b) Select your TX stick mode from the pull-down menu, as shown in Figure 27. (Mode 2 – American standard is shown)

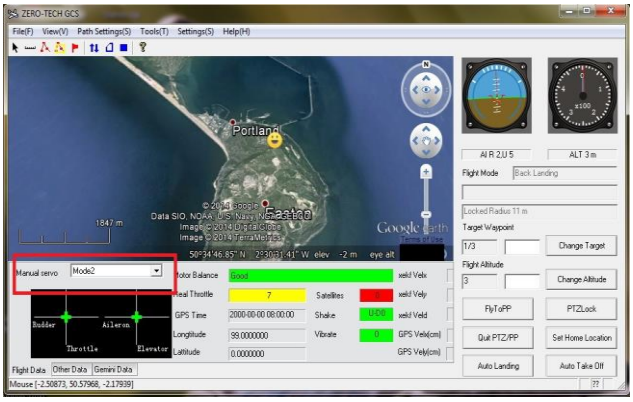


Figure 27

2. Calibrate Stick Movement

   a) Click “Setting(S)”→“Transmitter (T)”→“Adjust Transmitter (C)”, the calibration prompt dialogue will open, as shown in Figure 28

   b) Click “Yes”, within 5 seconds rotate the left and right transmitter sticks to their extremes in all directions, as shown in Figure 29. The flight controller automatically record the maximum and minimum values for each control axis and also the neutral values.

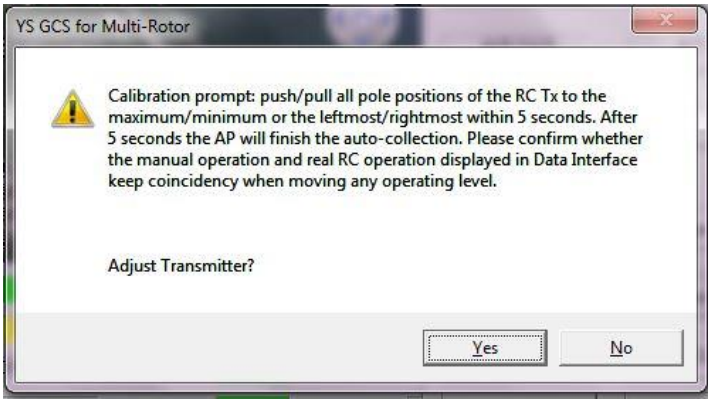


Figure 28

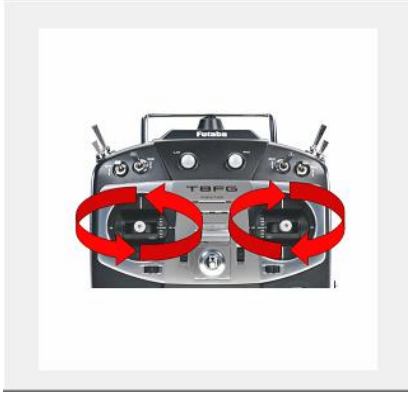


Figure 29

3. Check the stick movement is consistent with the directions indicated in the GCS;

   a) Check display positions:

      – In the flight data interface, stick positions are shown as per the diagram below. Mode 2 is indicated where the throttle and rudder are on the left stick, the aileron and elevator are on the right stick, as shown in Figure 30.

– When the sticks are in their neutral position they are shown in green. When moving they are shown in red. At their full extent they are shown in yellow.

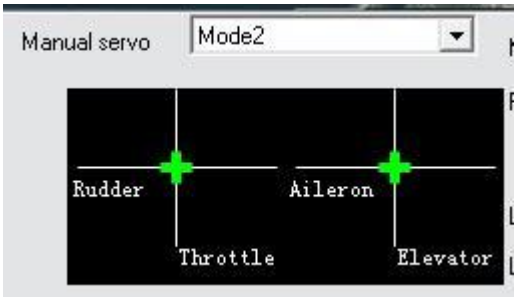


Figure 30

b) Select “Setting”→ “Transmitter”→“Capture Transmitter Centre point (N)”, to make sure the flight controller records the correct neutral position if this has not already been done in fine tuning.

8.2.2.2 Checking CH5 and CH6 Switching and F/S (failsafe)

❖ **Check operation mode switching**

Check whether the switching of operation mode is correct after connecting GCS module.

For example, the flight state on the “Flight status” interface on the right side of the GCS should display “Manual” when CH5 is at position 1 and CH6 in any position and so on, as shown in Figure 31. If not, examine the firmware connection or your transmitter settings.

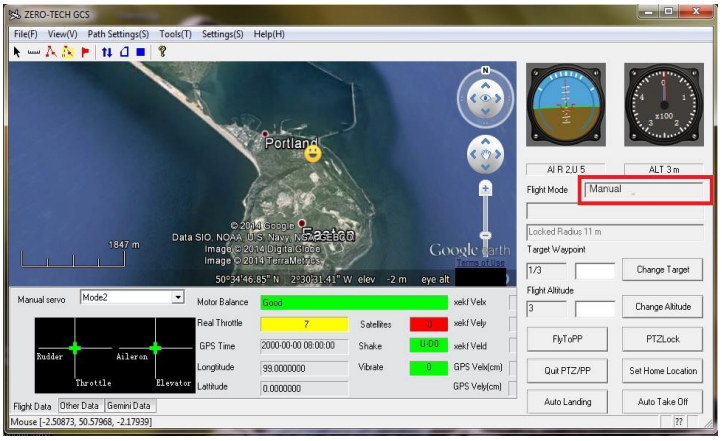


Figure 31

❖ **Check F/S protection**

Switch off your transmitter, flight state should display “Back landing” and the throttle slider should be near the neutral position in green in the “Manual servo” in the flight data interface. This is not the case recheck your failsafe setup.

8.2.2.3 Setting up Aircraft Parameters

The steps of setting up aircraft parameters are as follows:

1. Select “Setting(S)”→“ Parameters (P)”, the parameter setting window will pop up, as shown in Figure 32.

2. Click “Get” to obtain the existing parameters of the aircraft;

3. Click “Send” after parameter adjustment to send the modified parameters to the aircraft.

   An explanation of parameters can be found in “8.1.2.3 Setting up Aircraft Parameters”.

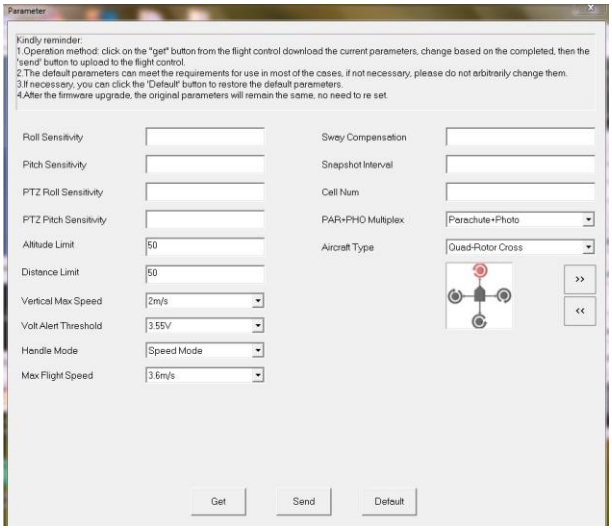


Figure 32

Note:

- Click Get or Send multiple times to avoid failure in obtaining or sending parameters;
- Click “Default” to recover factory setting values.

4. Customized parameter setup (**Users of common standard aircraft patterns may skip this bit**) If you are using a non-standard multirotor with an irregular flight configuration you may set up the parameters according to your own requirements, customizing the speed increase and decrease ratios of the roll, pitch and yaw channels of each axis.

   The specific definitions are as follows：

Channel	Aircraft activity	Required parameter values
Throttle	Climb or descent	100 for all
Yaw	Rotate to the right	Decrease to -100 or increase to 100
Pitching	Pitch down	Decrease to -100 or increase to 100
Rolling	Roll to the right	Decrease to -100 or increase to 100

An example of flight parameter set up is shown in Figure 33, using a 4-axis X-type quad copter as an example.

Setting up procedure is as follows:

a) Click “Setting ”→“Other (O) ”→“ Mixing Define (E)” in the GCS.

b) Fill in required parameters and click “Send” to send these values to the flight controller; click “Get” to download latest parameters to the GCS to check whether parameters have been uploaded successfully.

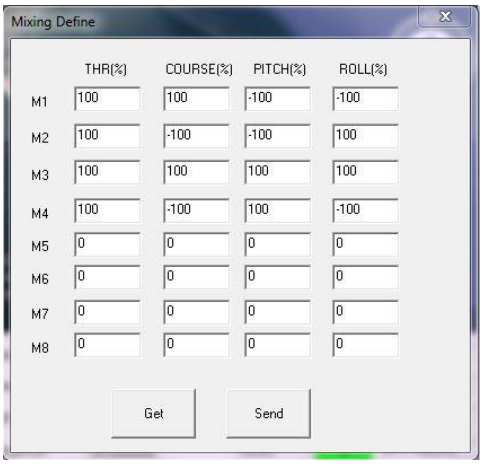


Figure 33

c) In the “Parameters(P)” dialogue enter your correct “Aircraft Type”, for example “Quad-Rotor Cross”

d) Power the flight controller after confirming successful modification of parameters and apply a small amount of throttle to check the motors are spinning in the correct directions. If this is successful you are all set to make a trial flight.

NB

Because the motors might immediately rotate at high speed after the aircraft type has been modified, it is strongly recommended to remove propellers to make sure of safety.

8.2.2.4 ESC Stroke Calibration

Please remove propellers before ESC stroke calibration.

Some ESCs which have been designed specifically for multi-rotors do not need to be calibrated. Here we take the Hobbywing ESC as an example.

1. Connect the autopilot power only, pull the throttle to the bottom and put CH5 to position 1.
2. Click "Init Setup" in "Setting" page. Click "Confirm" button in the dialog box. Now the "Flight Mode" should be displaying as "Settings" in the Data screen of the GCS, as shown in Figure 34.

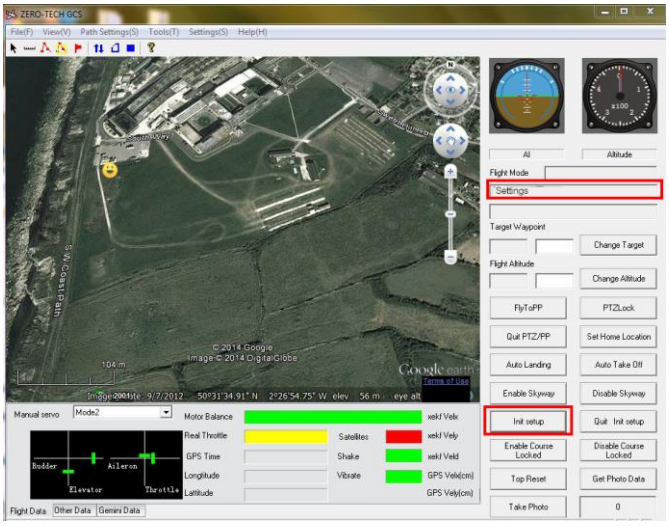


Figure 34

3. After arming the motors with CSC (Section 9.2 Unlocking and Arming the Motors), push the throttle all the way to the top and then connect power on (No propellers!)
4. Pull the throttle to its lowest position after two confirmatory sound signals from the ESCs and the gimbal controller will also sound a number of beeps to indicate the number of cells in the battery. This will complete ESC calibration.
5. Click “Quit Setup” and confirm in the dialog box that pops up.
6. To check whether verification is successful, push the throttle after unlocking and all motors should work simultaneously.

8.2.2.5 Examination of flight controller and GPS installation

The flight controller and GPS installation should be inspected as follows:

1. Check that the arrows of X4V2 and GPS are all pointing to the aircraft nose.
2. Check X4V2 is installed horizontally and GPS is elevated and installed horizontally;
3. Check X4V2 and GPS are fixed firmly.

9 Pre Flight Inspection

9.1 Calibrating the Magnetic Compass

9.1.1 Using the Android GCS

NB

- The magnetic compass must be calibrated before the first flight after installation of the X4V2 flight controller.
- Calibration should be carried out in a clear space outside; calibration should not be done indoors or in an environment with strong magnetic fields, such as in the presence of cars or shipping containers.
- You should also calibrate after re-arranging components in your aircraft or if you find it flies in circles.
- Compass calibration does not need to be done every time you fly, or if you upgrade firmware without changing hardware position. However it should be done when components are moved or if the aircraft flies in unexpected ways.

Compass calibration is carried out in three steps: horizontal calibration, vertical calibration and storage of magnetic compass data. Instructions for each stage can be found in the status bar at the top “Settings” interface, as follows:

1. Switch the transmitter to manual mode and pull the throttle to minimum.

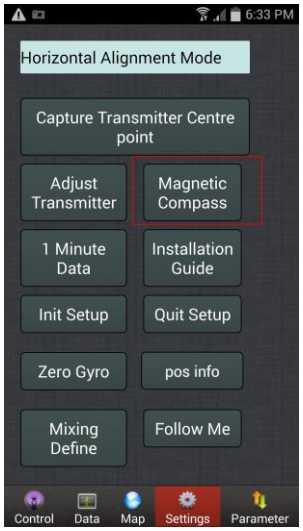


Figure 35

2. Click “Settings” to enter the settings interface, as shown in Figure 35.
3. Click “Magnetic compass” to open the calibration dialog box, as shown in Figure 36.

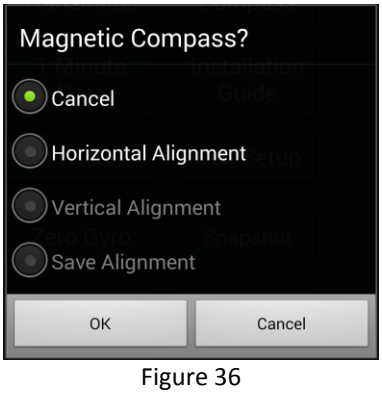


Figure 36

4. Select “Horizontal Alignment” and to click “OK” to start horizontal calibration.

5. **Hold the aircraft horizontally** (within a status error of 5° which can be maintained if you hold the aircraft with both hands, as shown in Figure 37),turn around two or three times slowly making sure that the blue LED stays lit. If the blue LED goes off, stop and adjust the aircraft, before continuing.

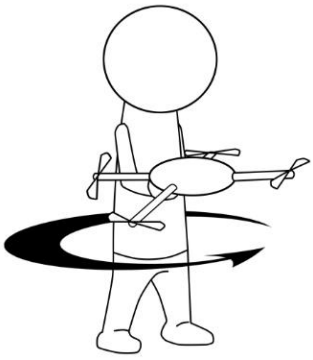


Figure 37

6. Now select “Vertical Alignment” and click “OK” for vertical calibration.

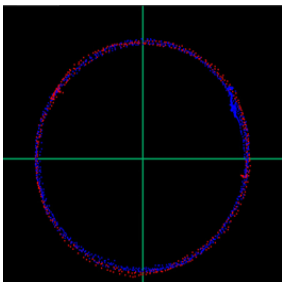
7. **Hold the aircraft with the nose vertically down**(within a status error of 5°, as shown in Figure 38) turn around two or three times slowly making sure that the blue LED stays lit. If the blue LED goes off, stop and adjust the aircraft, before continuing.

8. Select “Save Alignment” in the dialogue box and click “OK”.

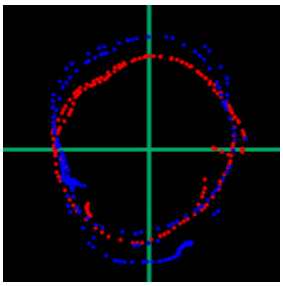
Figure 38

9. You will need to wait for the flight controller to process the recorded magnetic data. A purple LED will show during the processing. When the purple light goes out, calibration is complete.

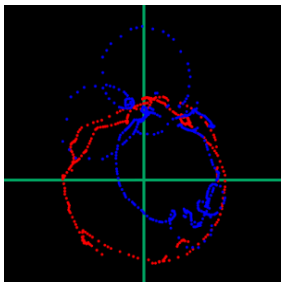
10. The ground station will switch to the remote control interface automatically and spend a few seconds calculating. Then it will display two circles, **one blue and the other red,** as indicated in the following figures: The superposition of two circles, red and blue indicates successful calibration. If this is not the case you need to start again with a new calibration operation.



Calibration excellent



Calibration okay



Calibration unsuccessful

9.1.2 Compass Calibration Using a PC Ground Station

NB

- The magnetic compass must be calibrated before the first flight after installation of the X4V2 flight controller.
- Calibration should be carried out in a clear space outside; calibration should not be done indoors or in an environment with strong magnetic fields, such as in the presence of cars or shipping containers.
- You should also calibrate after re-arranging components in your aircraft or if you find it flies in circles.
- Compass calibration does not need to be done every time you fly, or if you upgrade firmware without changing hardware position. However it should be done when components are moved or if the aircraft flies in unexpected ways.

Compass calibration is carried out in three steps: horizontal calibration, vertical calibration and storage of magnetic compass data. Instructions for each stage can be found in the status bar at the top “Settings” interface, as follows:

1. Switch the transmitter to manual mode and pull the throttle to minimum;
2. Select “Settings(S)”→“Magnetic Compass (M)”for the “Magnetic Compass Alignment” window as shown in Figure 39.
3. Click “Horizontal Alignment” for horizontal calibration, as shown in Figure 40.

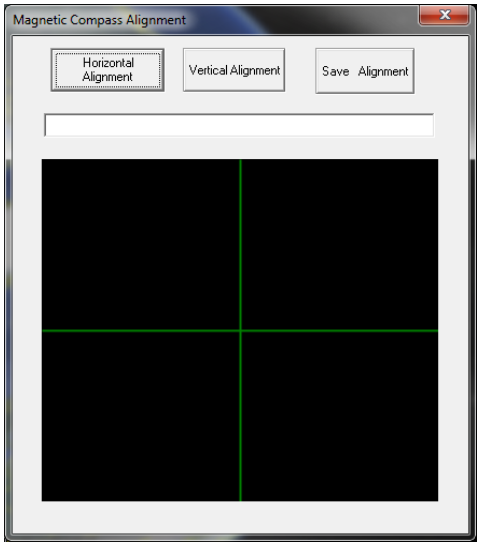


Figure 39

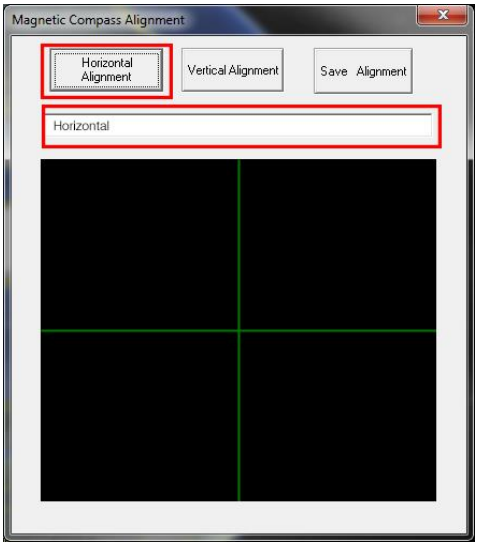


Figure 40

4. **Hold the aircraft horizontally** (within a status error of 5° which can be maintained if you hold the aircraft with both hands, as shown in Figure 41),turn around two or three times

slowly making sure that the blue LED stays lit. If the blue LED goes off, stop and adjust the aircraft, before continuing.

5. Now select “Vertical Alignment” and click “OK” for vertical calibration.

6. **Hold the aircraft with the nose vertically down**(within a status error of 5°,as shown in Figure 42) turn around two or three times slowly making sure that the blue LED stays lit. If the blue LED goes off, stop and adjust the aircraft, before continuing.

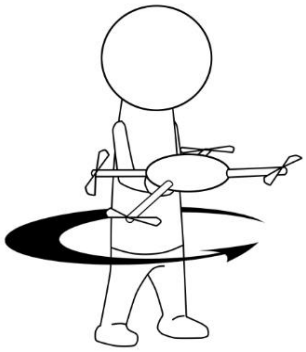


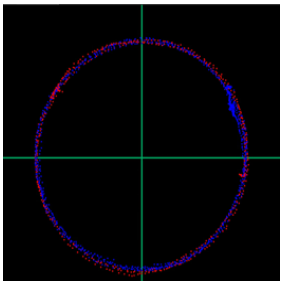
Figure 41

Figure 42

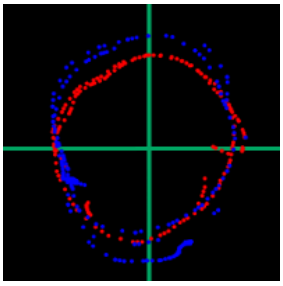
7. Select “Save Alignment” in the dialogue box and click “OK”;

8. You will need to wait for the flight controller to process the recorded magnetic data. A purple LED will show during the processing. When the purple light goes out, calibration is complete.

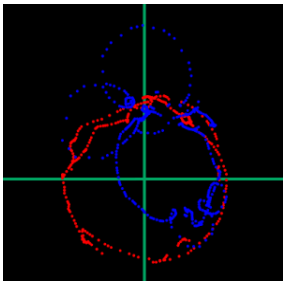
9. The ground station will switch to the remote control interface automatically and spend a few seconds calculating. Then it will display two circles, **one blue and the other red,** as indicated in the following figures: The superposition of two circles, red and blue indicates successful calibration. If this is not the case you need to start again with a new calibration operation.



Calibration Excellent



Calibration okay



Calibration unsuccessful

9.2 Unlocking and Arming the Motors

NB

- The controller cannot be unlocked and motors armed near large airports, or within Beijing 5th ring.

- The controller cannot be unlocked without GPS.
- Magnetic compass calibration must be carried out before the first time you unlock the motors.
- The flight controller will lock the motor again if no throttle has been applied within five seconds. In this instance you should perform the unlocking operation again.
- Checking F/S protection is intended to reduce the possibility of accidents in the flight. **Failsafe check should be made each time the system is powered.**
- The motor will run when applying throttle after unlocking. It′ s normal for some motors to slow down or even stop if there has been no take off. The aircraft will take off normally only by increasing the throttle.

Motors are locked by the X4V2 flight controller for the purpose of safety. Motors will run normally only after unlocking. The unlocking procedure, also known as arming or applying CSC, is as follows: using a FUTABA transmitter as an example (in Japanese stick mode, mode 1).

1. Check F/S protection by shutting off the transmitter, the flight status bar on the ground station should display “Returning and landing”, before attempting to unlock. If it does not you should reset failsafe.
2. Unlock by pushing the rudder stick to the extreme left, and pull it fully down. Now push the aileron stick to the extreme right and pull it down.

Note:

When unlocking, the reverse V-type (/\ ) is required for the left-hand pattern (Japanese and American, or Mode 1 and Mode 2) while the V-type (/\ ) is required for the right-hand pattern (Chinese and European, or Mode 3 and Mode 4).


Reverse V-type


V-type

9.3 Inspecting Motor Rotational Direction

You must inspect the direction of rotation of each motor before the aircraft takes off, in the same way that you would inspect the control surfaces of a fixed wing aircraft before takeoff.

Switch to manual mode and check F/S setting to allow unlocking;

Using a four axis cross- type multirotor as an example; rotor direction inspection is carried out as follows. The diagrams that follow give the conditions required for other types of aircraft:

1. Check motor balance by making sure that all four motors rotate at the same speed when gently applying throttle.
2. Check the aileron channel. Push the aileron stick slightly to the left and the M4 motor should run immediately (Figure 43) while the other three motors remain static. Push the aileron stick slightly to the right and the M2 motor should rotate immediately (Figure 44) while the other three motors remain static.

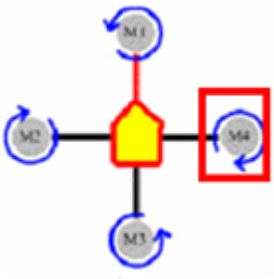


Figure 43

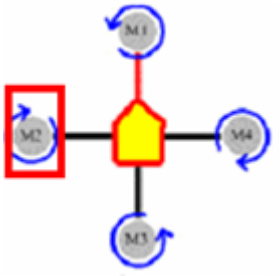


Figure 44

3. Inspect the climb and descent channel (Elevator) in the same way as the aileron channel. Push the elevator stick up and M3 should rotate (Figure 45). Pull the stick down to make M1 rotate (Figure 46).

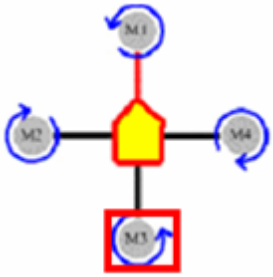


Figure 45

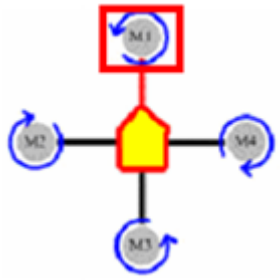
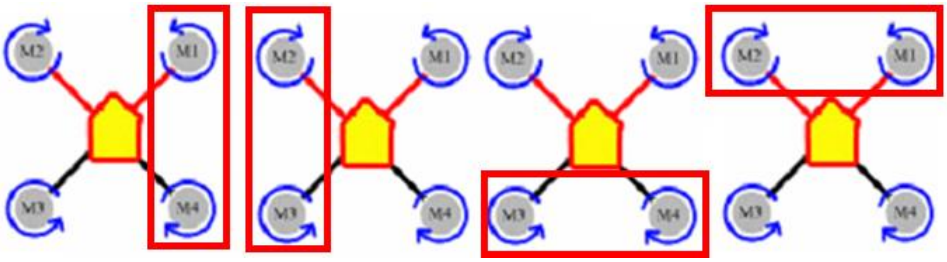


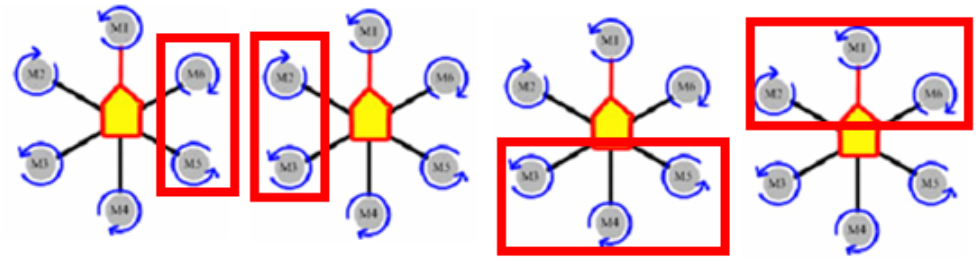
Figure 46

4-axis X-type:



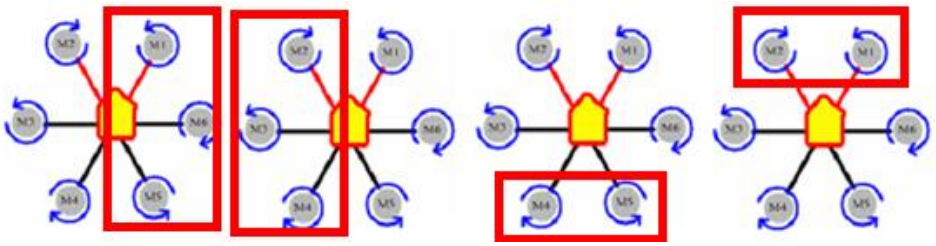
Push aileron stick to left Push aileron stick to right Push elevator stick up Push elevator stick up

6-axis cross type:



Push aileron stick to left | Push aileron stick to right | Push elevator stick up | Push elevator stick up

6-axis X- type:



Push aileron stick to left | Push aileron stick to right | Push elevator stick up | Push elevator stick up

10 Flying at the Field

10.1 Flight Status

10.1.1 LED Status Indications

❖ **GPS**

The red light, blue light and green light indicate the current operational state of the aircraft as indicated the table below:

Light colour	Light status	Operational status
Red light (for all modes)	3 flashes ● ● ●	No GPS
	2 flashes ● ●	GPS 5 satellites
	1 flash ●	GPS 6 satellites
	Red light out	GPS 7 or more satellites
Blue light (GPS mode, non-positioning)	1 flash ●	User in operation
	2 flashes ● ●	Hovering at fixed height
Green light (GPS mode, in positioning)	1 flash ●	User in operation
	2 flashes ● ●	Hovering at fixed point

Note:

- Only take off after 7 or more GPS satellites are in view.
- The flight controller will use the take-off position as the home location when the GPS first locks in to seven satellites.

❖ **White LED**

(1) The LED white light indicates a large status error or a loose connection to the GPS module.

(2) Action required when the white light comes on:

– If the light comes on when the aircraft is suffering violent movement but goes out when it retains stability than you can continue the flight normally.

– Land the aircraft as soon as possible if the white light shows continuously and check the GPS connection. Zero the gyro in the GCS if there is a status error.

❖ **Low voltage alarm**

The red light will flash quickly as a low battery voltage alarm. It shows as a solid light in an emergency situation of extreme low voltage.

❖ **Barometer initialization failure**

A continuous red light showing when the aircraft is on the ground, indicates the failure of the barometer to initialize. You must restart the flight controller.

❖ **Magnetic field verification**

When calibrating, a continuous blue light indicates a magnetic compass calibration error less than 5° and indicates a successful calibration. However, if the blue light goes off with a status error more than 5° this indicates that adjustment is needed. The **purple light** will be on continuously when storing the data after calibration of the magnetic data. The **purple light** will go out completely when data storage is complete.

10.1.2 Motor Balance and Real Throttle Position

The two parameters of motor balance and real throttle position are shown as follows in the ground station:

❖ **Mobile ground station**: open the mobile ground station and click “Data”, as shown in Figure 47.

❖ **PC ground station**: Open Wi-Fi and the “Flight data” section will open at the bottom or select “View” → “Flight data” to check. The parameters are indicated in Figure 48.

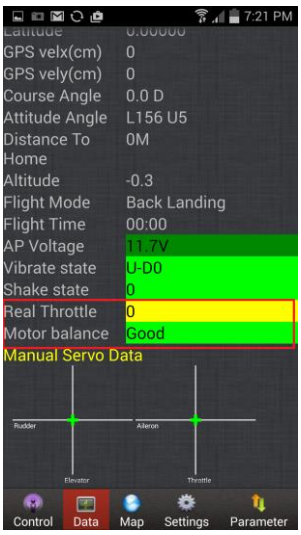


Figure 47

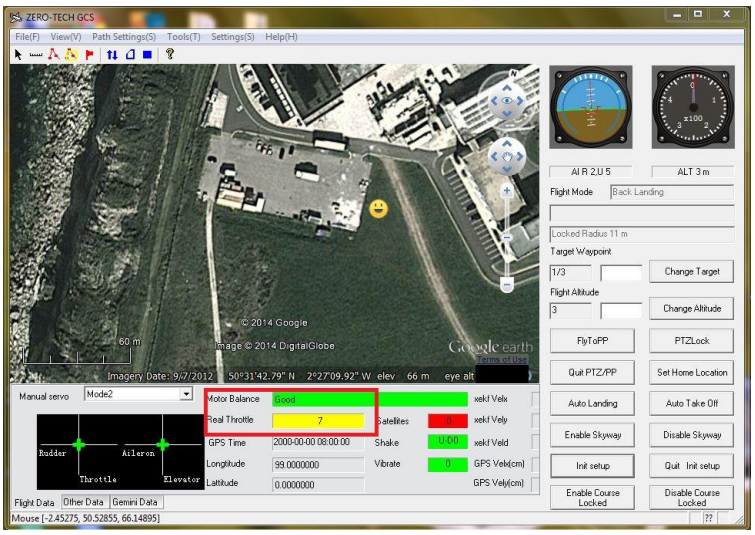


Figure 48

10.1.2.1 Motor Balance

"Motor balance” will display an imbalance between the clockwise propellers or counter clockwise propellers when the aircraft is in a static hovering position. The propellers need to be balanced or replaced with higher quality units.

To ensure stable flight, accurate examination must be made of the balance and horizontal symmetry of the motors and propellers until the motor balance parameter displays “Good” when hovering the aircraft.

10.1.2.2 Real Throttle Position

The throttle position of the aircraft when hovering is usually at 40-65, which is considered normal (in green). Any position lower than 40 (shown in yellow) indicates the aircraft is maintaining a light load on the ESCs while higher than 65 (in red) indicates that the aircraft is heavy or the battery is delivering a low voltage. This situation requires a load adjustment or battery replacement.

10.1.3 Adjusting Aircraft Vibration Parameters

The following factors affect the flight stability of the aircraft and corresponding adjustment measures need to be carried out:

1. Shaking, vibration or poor installation of the IMU will affect flight stability. Therefore attention should be paid to the following:

   – Make sure the host and slave controllers are in the correction direction (facing the aircraft nose) and firmly fixed in a position of as little resonance as possible on the aircraft.

   – The coefficients of shake and vibrate on the ground station indicate the amount of vibration of the IMU. Therefore, when installing the flight controller make sure the motors and propellers are installed in balance to reduce the shake and vibration state to lower than 10 (use smaller propellers to reduce the amount of vibration in the trial). An airframe structure of higher rigidity is recommended as a softer frame will cause additional vibration.

Note:

The Shake state and Vibrate state can be checked as follows:

- **Mobile ground station**: open the mobile ground station and click “Data”, as shown in Figure 49.
- **PC ground station**: Open Wi-Fi and the “Flight data” section will open at the bottom or select “View” → “Flight data” to check. The parameters are indicated in Figure 50.

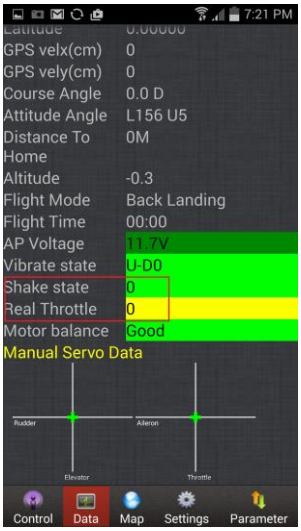


Figure 49

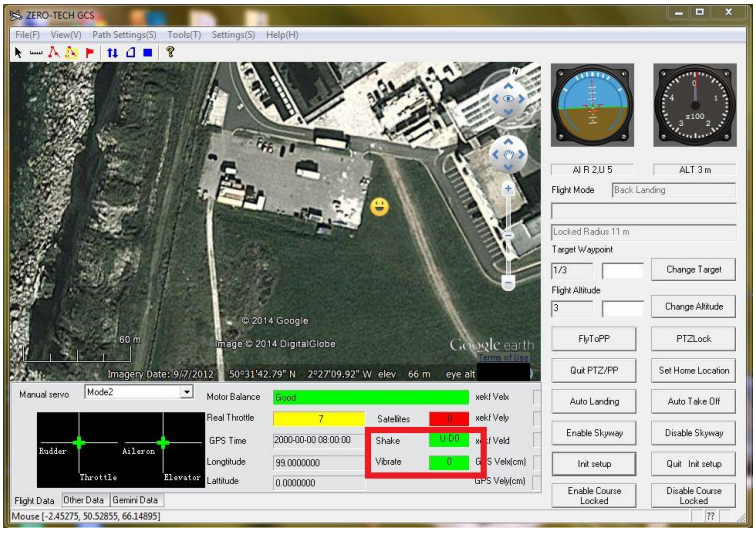


Figure 50

2. The orientation of multiple axis aircraft is adjusted by adjusting speed of the motors. The sensitivity of the axis control will make a direct impact on the accuracy of the aircraft response. Adjust the match between the aircraft weight and the screw pitch of the propeller to make sure the motor can generate an adequate rotation speed, producing enough control response. The lightest propeller possible, should be selected to reduce inertia and to improve command response. There should be a proper balance between flight efficiency and stability.

3. The symmetry of multiple axis aircraft has a vital influence on flight stability.
   The symmetry of the motor and propeller can be evaluated in horizontal flight by referring to “10.1.2.1 Motor Balance”.

4. Further improvements can be made to the stability of the aircraft by adjusting “Roll sensitivity”, “Pitch sensitivity” and “Sway Compensation” after completing the above three steps.

Note:

“Roll sensitivity”, “Pitch sensitivity” and “Sway Compensation” can be checked as follows:

- **Mobile ground station**: open the mobile ground station and click “Parameter”, as shown in Figure 51.
- On the PC ground station select “Settings” →“Parameters” to check, as shown in Figure 52.

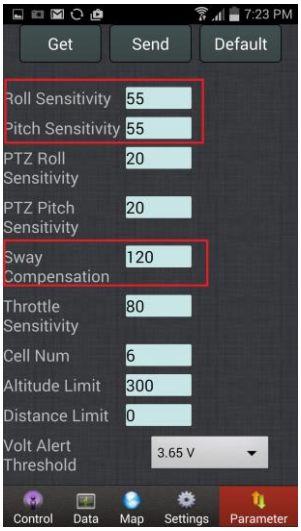


Figure 51

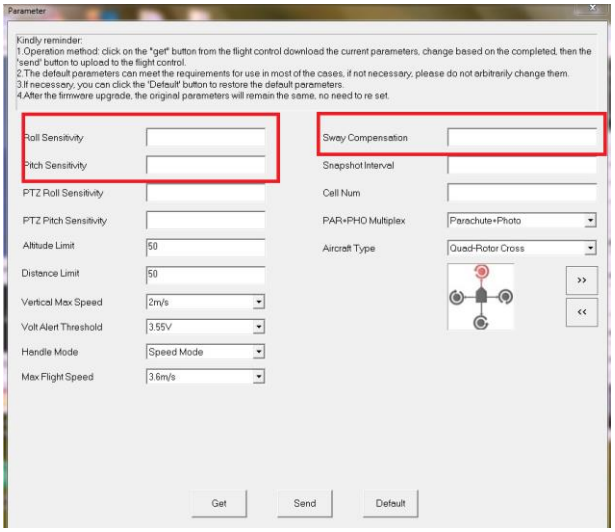
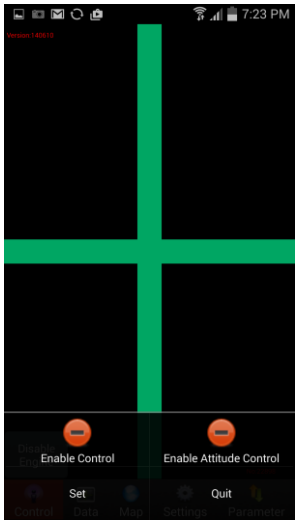


Figure 52

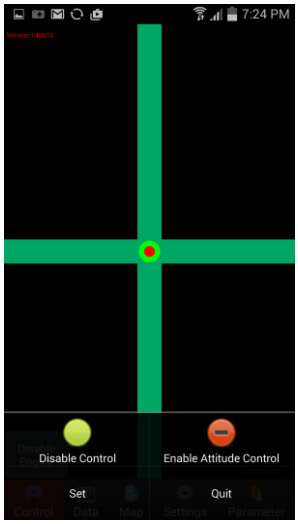
10.2 Flight Functions

10.2.1 Using Your Mobile Device for Remote Control of the Aircraft

In automatic hovering status, click the menu key on the mobile ground station to select “Enable Control” to enter mobile remote control mode, as shown in the figures on the right: The button will change to “Disable Control”.



Non-remote control mode



Remote control mode

The transmitter sticks cannot be used in mobile remote control mode. Remote control using your mobile device is explained in the following table:

After Enable Control	Remote control interface operation	Aircraft status
Dot status	Red: non-positioning Green: positioning	-
Hovering operation	Do not touch any area of the screen	Hovering
Advance operation	1. Touch the central circle and drag up or and down 2. Touch the central circle and drag left or right 3. Touch the central circle and drag	1. move forwards or backwards 2. move left or right 3. move forward left, backward left,

After Enable Control	Remote control interface operation	Aircraft status
	diagonally	forward right or backward right
Climb / descend / rotate	1. Touch the area above the circle (on the cross) 2. Touch the area under the circle (on the cross) 3. Touch the left side of the circle (on the cross) 4. Touch the right side of the circle (on the cross) **Note:** ● The distance between the click position and the center of a circle is equivalent to the change of speed of the aircraft, meaning the farther from the center, the higher speed of the aircraft. ● The touch time is equivalent to the moving time of the aircraft.	1. Climb 2. Descend 3. Rotate left 4. Rotate right

Note:

Mobile remote control mode cannot be used without GPS positioning. (Indoors for example)

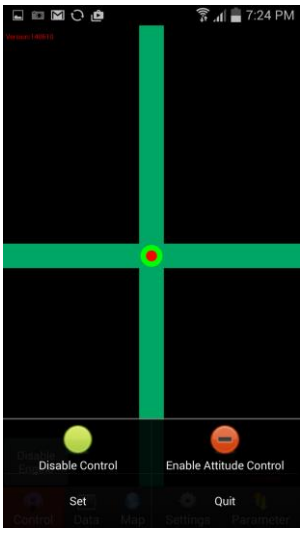
10.2.2 Mobile Attitude Control Mode

NB

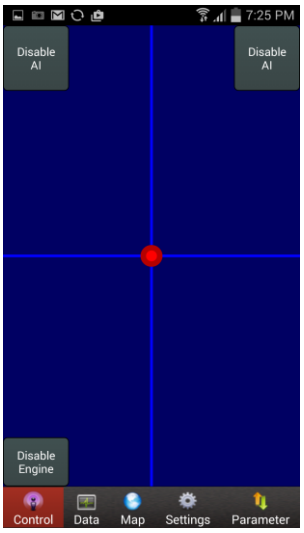
- Please keep the aircraft horizontal before starting attitude control mode. Otherwise, the aircraft will fly off in the direction that the mobile dips, after switching to this mode.
- Mobile attitude control mode can only be used in mobile remote control mode.
- Control mode will automatically switch immediately to mobile remote control mode after exiting from the mobile attitude control mode. However exiting mobile remote control mode will revert to transmitter control.

Click the mobile device menu key and click “Enable Attitude Control” to open the attitude option, the remote control interface will switch to a blue cross, indicating that mobile attitude

control mode is started as shown the figures on the right.



Non-attitude control mode



Attitude Control mode

The status of attitude control mode can be seen in the following table:

After Enable Control	Remote control interface operation	Aircraft status
Dot status	Red: non-positioning Green: positioning	-
Hovering operation	Hold the mobile device horizontally and do not touch the screen	Hovering
Advanced operation	1. Tilt the mobile device forwards and backwards 2. Tilt the mobile device from left to right 3. Tilt the mobile device from upper left to bottom left or upper right to bottom right	1. Move forwards and backwards 2. Move left and right 3. Move forward left, backward left, forward right and backward right
Climb / descend / rotate	1. Click any area on the screen and drag upwards 2. Click any area on the screen and drag downwards 3. Click any area on the screen and drag to the left 4. Click any area on the screen and drag to the right **Note:** ● Dragging distance is proportional to the	1. Climb 2. Descend 3. Rotate left 4. Rotate right

After Enable Control	Remote control interface operation	Aircraft status
	speed of the aircraft, meaning that the longer the dragging distance, the higher the speed of the aircraft. ● The time spent touching the screen is equivalent to the move duration of the aircraft.	

10.2.3 Semi-automatic Take Off

The flight status will display “Auto hover” when seven or more satellites are in view and CH5 is in position 3 and CH6 in position 1. Now push the throttle after arming and the aircraft will take off after the throttle is in mid position and will hover automatically at a height of approximately 2-3 metres.

10.2.4 Return and Land

NB

For safety reasons it is not recommended to switch to return and land mode if the aircraft is too near to people.

Return and land is achieved as follows:

1. The aircraft will record automatically the starting position, after having attained GPS lock with seven or more satellites.
2. Carry out any of the following operations to hand over control to the aircraft to return and land. The aircraft will not respond to the flight control sticks on the transmitter during this time:
   - Switch CH5 and CH6 to position 3 on the transmitter.
   - On the mobile ground station: click “Map”→“SPC”→“Auto Landing”;
   - On the PC ground station: select “View”→“Panel” and open the instrument panel and click “Auto landing”.
3. The aircraft will land slowly after reaching the take-off point and at this stage you can adjust the position of the aircraft if you need to find a better landing position.
   The flight controller automatically applies throttle at this time and the throttle stick of the transmitter is inactive.

4. The motors will gradually stop rotation when the aircraft is fully on the ground and the throttle stick reduced to minimum. The motors will be locked after 5 seconds and a CSC operation is required before restarting.

Note:

- If the aircraft is 25m or more away from the return point and less than 20m in height, the aircraft will climb to 20m before returning when switched to auto land mode. The Aircraft will return to its original height after switching to auto land mode if the aircraft is higher than 20m. The aircraft will return at its current height if the aircraft is less than 25m away from the return point.
- The aircraft will exit from return and land mode only after switching CH5 to position 1.

10.2.5 Fly to Point on the Map (FlyToPP)

10.2.5.1 Mobile Ground Station Fly to Point

NB

Take care when using FlyToPP that the aircraft does not fly out of sight.

FlyToPP can only be carried out in GPS automatic hover mode. The procedure is as follows:

1. Switch CH5 to position 3 and CH6 to position 1 on the transmitter.
2. Select a point on the map interface, a yellow smiley will appear at that point, as shown in Figure 53.
3. Click "SWP" then "OK" the smiley will change into a purple star, as shown in Figure 54.
4. Perform the same procedure to fly to the next target point.

Figure 53

Figure 54

Note:

The aircraft will fly without turning if the distance between two target points is less than 10m; the nose of the aircraft will turn towards the next target point if the distance is larger than 10m.

10.2.5.2 PC Ground Station Fly to Point (FlyToPP)

Fly to point can only be achieved in GPS automatic hovering mode. The procedure is as follows:

1. Switch CH5 to position 3 and CH6 to position 1 on the transmitter.

2. Open the ground station and select "File"→"Open Wi-Fi", a yellow smiley will display on the map, as shown in Figure 55: a purple star is beneath the yellow smiley.

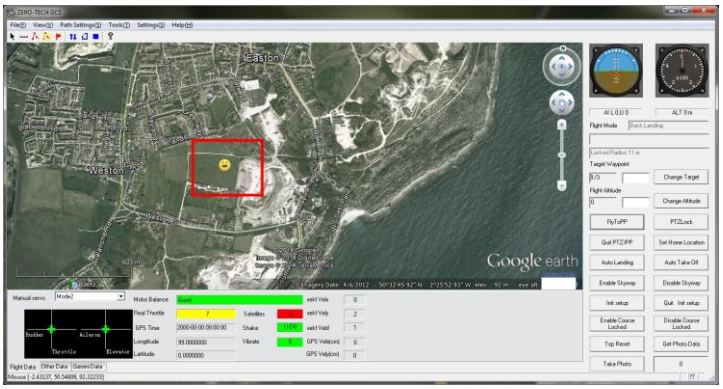


Figure 55

3. Click a target point, the yellow round smiling face will move to the point and the covered purple star will be exposed, as shown in Figure 56.

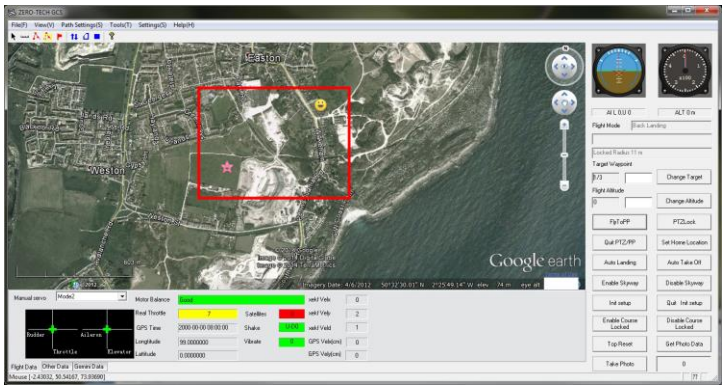


Figure 56

4. Click "Fly to PP", the purple star will move to the position of the yellow smiley, as shown in Figure 57.

5. The aircraft will fly to this point and to the next target point if the same procedure is followed.

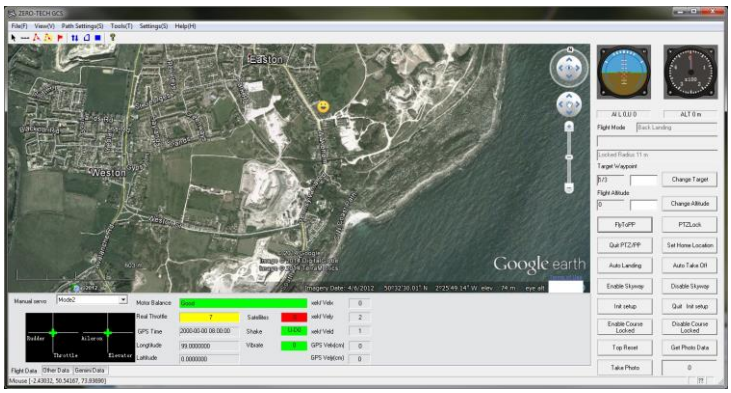


Figure 57

10.2.6 Way Point Flight

10.2.6.1 Mobile Ground Station Waypoint Flight

Waypoint flying is carried out as follows:

1. **Route design**: Click "Map"→"Tool"→"Add Waypoints" then "OK" to open the route design interface; complete waypoint the design clicking each point on the route.

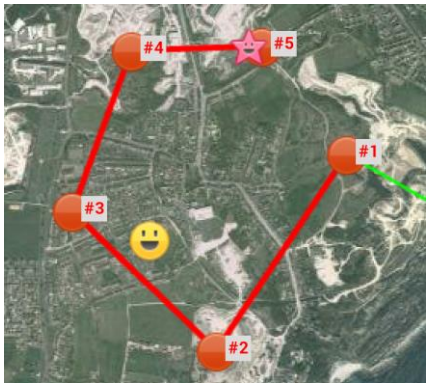
Route design can be made by adding single points consecutively (manual generation of route) or automatic route generation.

- **Editing single points**: each waypoint contains the key parameters of “Height”, “Hovering time” and “Speed”. To edit waypoints, click on the waypoint and then select “Edit waypoint” from the pop-up window.

  - **“Height”**: means the altitude of the aircraft relative to the takeoff point at that waypoint. The aircraft will gain or lose altitude between waypoints if they are of different heights. The default altitude of a waypoint is the current height of the aircraft when switching to navigation mode.

  - **“Hovering time”**: is the time spent stationery at each waypoint. The default setting for the first waypoint is 65535.

  - **“Speed”**: is the speed of the aircraft to the next waypoint.



Single point editing (manual generation of route)

  - **“Photography setting”**: sets up the ability to take a photograph at intervals or at each waypoint indicated along a route. The initial point, where the first photograph is taken should be set up according to the “Start photograph” routine described below.

- **Automatic generation of route**: at least 4 waypoints should be set up with the same height and flight speed at each waypoint.

  After setting up the waypoints, click “Tool” → “Auto Make Waypoints” and edit the correct settings for “Delay”, “Interval”, “Altitude” and “Speed”. The software will now automatically generate a waypoint route.

Automatic waypoint route generation

2. **Uploading a route**: after drawing a route, it must be uploaded to the flight controller. Click “Upload Waypoints” in the Tools menu. The route can also be stored as a file for use in the future. Click “Save Waypoints”

   To examine whether each waypoint has been uploaded successfully, the color of the waypoint will change to blue indicating success or change to orange to indicate failure. Uploading should be done again in case of failure.

3. **Route verification**: Click “remove route points” to change blue points into orange points and click “verify waypoints”, to download the currently uploaded waypoints into the ground station for comparison. If all waypoints change to blue, the route stored in the flight controller is consistent with that in the ground station, indicating no errors. If this is not the case the route should be uploaded again.

4. **Waypoint flight**

   ❖ **Automatic flight**

   1) Switch CH5 to position 3 and CH6 to the position 2 on the transmitter.

   2) Click “Map”→“SPC”→“Enable Skyway”, the aircraft will fly automatically to the first waypoint and hover.

   3) Enter 2 in the text box “Target” in “Map”→“SPC”, and click “Target” now push the elevator stick up and the aircraft will fly to waypoints in the order 2, 3, 4… Until the route is complete when it will fly to the first waypoint and hover.

   ❖ **Semi-automatic flight**

   1) Switch CH5 of the RC control TX to position 3 and CH6 to position 2.

   2) On the Android GCS select “Map ”→“SPC ”→“Enable Skyway ”→“Semi-Auto Skyway” and click “OK”, the aircraft will stay in its current position;

   3) Push the elevator stick on your TX and the aircraft will fly in the order 1, 2, 3, 4…etc. until completion of all waypoints.

      Throttle and rudder can be used as normal during the flight.

2. **Exit**: Switch CH5 to position 1 (in manual mode) or CH6 to position one (auto hover mode) to exit waypoint flying.

Note:

- If you have not set up a waypoint route the aircraft may fly away if you switch to auto navigation mode. **After starting the motors, the flight status of the aircraft will change to automatic navigation 3 seconds after switching to automatic navigation mode.**
- The nose of the aircraft aligned to the next waypoint during waypoint route navigation.
- If you want to control the direction of the nose, click “Map”→“SPC”→“Disable course locked” during waypoint flight. The aircraft will fly the route is normal but the nose will not point to the flight direction. It will be controlled by the rudder stick on the transmitter. Click “Enable course locked”, and the nose of the aircraft will point towards the flight direction again.

10.2.6.2 PC Ground Station Waypoint Flight

Waypoint route flying is carried out as follows:

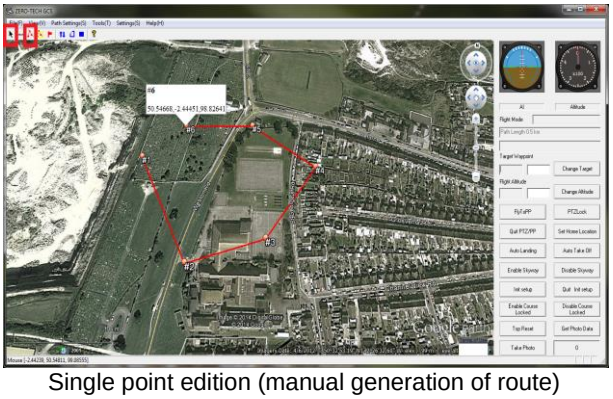
1. Connect the PC via Wi-Fi and open the ground station. Select “File”→“Open Wi-Fi”;

2. **Route design**: Click “ ” to open waypoint route design, click on each waypoint in turn, then click “ ” to exit waypoint generation.

   Waypoint route design can be single point editing (manual generation of route) and automatic route generation.

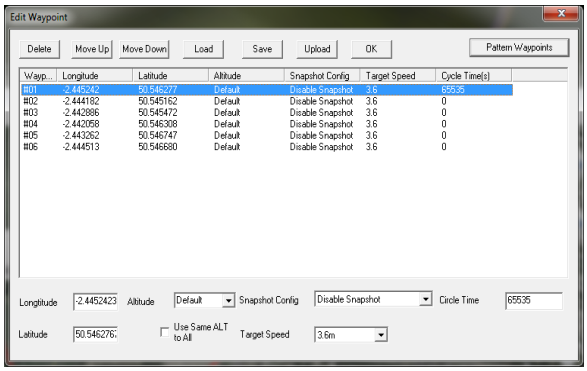
   - **Single point editing**: each waypoint contains key parameters of “Height”, “Cycle time” and “Speed”. Right click on the waypoint and select “Edit” to change these parameters.

     - **“Height”:** is the altitude of the aircraft relative to the takeoff point at that waypoint. The aircraft will gain or lose altitude between waypoints if they are of different heights. The default altitude of a waypoint is the current height of the aircraft when switching to navigation mode.
     - **“Cycle time”**: is the time spent stationery at each waypoint. The default setting for the first waypoint is 65535.
     - **“Speed”**: is the speed of the aircraft to the next waypoint.



Single point edition (manual generation of route)

     - **“Snapshot config”:** sets up the ability to take a photograph at intervals or at each waypoint indicated along a route. The initial point, where the first photograph is taken should be set up according to the “Start photograph” routine described below.



Route edition window

Note:

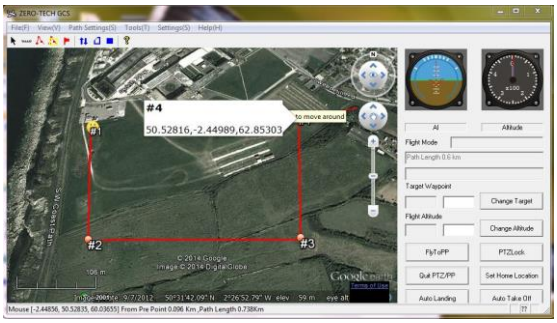
- Clicking the right button on a selected waypoint will give you the option of uploading editing or deleting.
- Left click on the waypoint to display the waypoint properties.

❖ **Automatic generation of route**: at least 4 waypoints should be set up with the same height and flight speed at each waypoint.

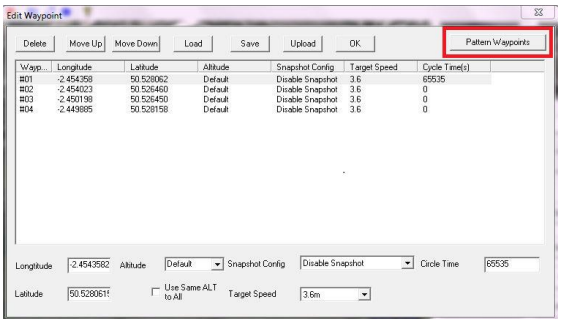
1) Select “Path Settings” “Edit Current Path” after setting up route points and the “Edit Waypoint” window will pop up.

2) Click “Pattern Waypoints” and the “Pattern Waypoints” window will pop up.

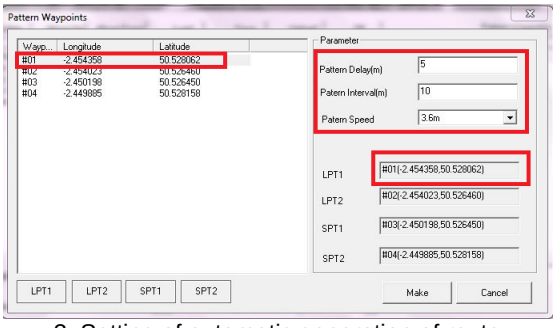
3) Select a waypoint and click LPT1 and enter a setting for “Pattern Delay”, “Pattern Interval” and “Pattern Speed”, then click “Make” and the software will automatically generate a flight route for the aircraft.



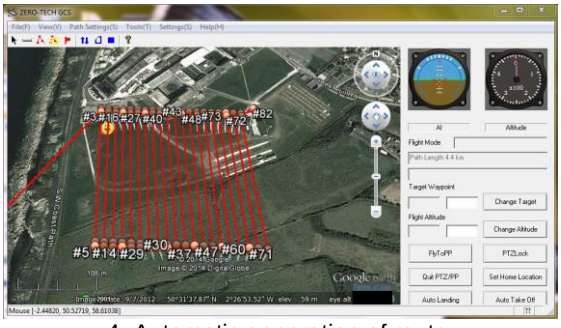
1. Setting up waypoints



2. Route edition window



3. Setting of automatic generation of route parameters



4. Automatic generation of route

3. **Uploading the route to the aircraft:** right click a waypoint and click“Upload” or select “Path Settings” → “Upload Path to AP” after setting up the route. The route can also be stored as a file for use in the future. To examine whether each waypoint has been uploaded successfully, the waypoint color will change to blue indicating success, any other color would indicate failure, as shown in Figure 58.

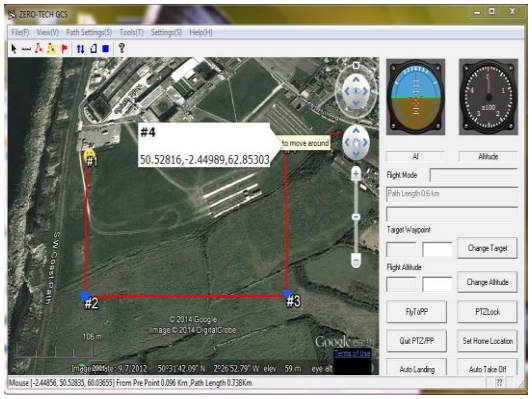


Figure 58

4. **Route verification**: select “Path Settings” → “Download and Check Path”, to download the waypoints from the aircraft to the ground station for comparison. All route points will change into orange and then blue. All route points in blue indicate that the route stored in

the flight controller is consistent with that in the ground station, indicating no error in the route. If not, the route should be uploaded again.

5. **Waypoint flight**

❖ **Automatic flight**

1) Switch CH5 to position 3 and CH6 to position 2.

2) Click “Enable Skyway” on the right hand panel and a confirmation will pop up, as shown in Figure 59, click “Enable” and the aircraft will fly to the first waypoint and hover.

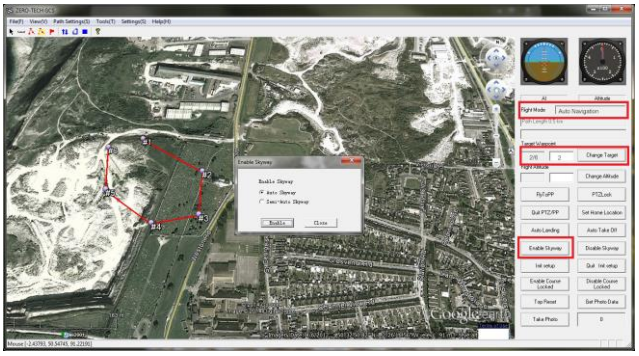


Figure 59

3) Enter 2 in the textbox “Target Waypoint” in the instrument panel and click “Change Target” Now push the elevator stick and the aircraft will fly between waypoints in the order 2, 3, 4…etc. until the route is complete when it will hover at the first waypoint.

❖ **Semi-automatic flight**

1) Switch CH5 of the RC control TX to position 3 and CH6 to position 2.

2) On the Android GCS select “Map” → “SPC” → “Enable Skyway” → “Semi-Auto Skyway” and click “OK”, the aircraft will stay in its current position;

3) Push the elevator stick on your TX and the aircraft will fly in the order 1, 2, 3, 4…etc. until completion of all waypoints.

Throttle and rudder can be used as normal during the flight.

6. **Exit**: Switch CH5 to position 1 (in manual mode) or switch CH6 to position 1 (auto hover mode) to exit the function.

Note:

- If you have not set up a waypoint route the aircraft may fly away if you switch to auto navigation mode. **After starting the motors, the flight status of the aircraft will change to automatic navigation 3 seconds after switching to automatic navigation mode.**
- The nose of the aircraft aligned to the next waypoint during waypoint route navigation.
- If you want to control the direction of the nose, click “Map” → “SPC” → “Disable course locked” during waypoint flight. The aircraft will fly the route as normal but the nose will not

point to the flight direction. It will be controlled by the rudder stick on the transmitter. Click “Enable course locked”, and the nose of the aircraft will point towards the flight direction again.

10.2.7 Tracking Mode (Heading Hold)

This function can only be used in GPS mode and when seven or more satellites are in view.

In tracking mode the aircraft flies along the waypoint route with the aircraft nose direction locked.

Tracking mode is carried out as follows:

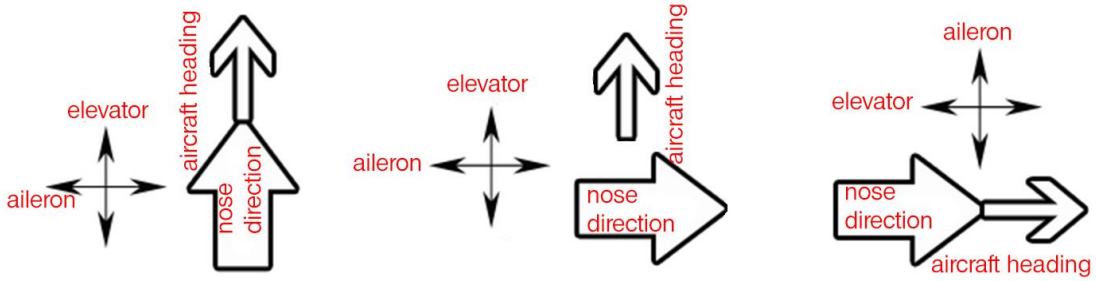
1. Switch CH5 to position 3 (GPS hover mode) and move the transmitter sticks to as near neutral as possible.
2. On the ground station, click “Enable Course Locked” on the instrument panel to start.
3. Click “Disable Course Locked ” on the instrument panel to exit.

10.2.8 Carefree Mode

This mode must be used in GPS Hover Status.

In carefree mode, the navigation direction of the aircraft is locked (i.e. the direction the aircraft is heading when entering this mode). Whatever direction faced by the nose of the aircraft, the flight direction will remain unchanged. The nose of the aircraft automatically keeps track of the gimbal so that the camera avoids the landing gear. The elevator and aileron of the aircraft take the navigation direction of the aircraft as reference.

A schematic diagram of carefree mode is shown below:

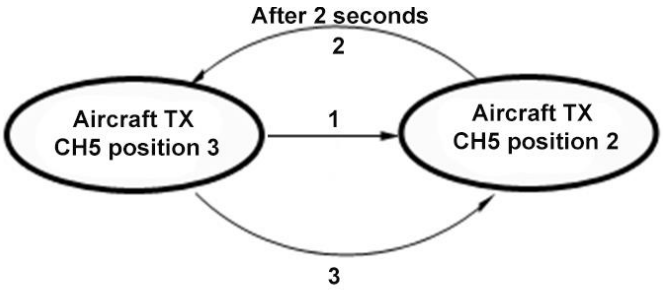


Direction relationship when entering carefree mode Direction relationship when changing direction of aircraft nose Direction relationship after exiting Carefree

Enter carefree mode as follows:

1. Switch to GPS mode after take-off, the aircraft will hover as normal.
2. After selecting the desired flight direction align the nose of the aircraft in this direction. Switch CH5 from position 3 to position 2, switch back to position 3 then return to position 2.

You will now be in carefree mode.



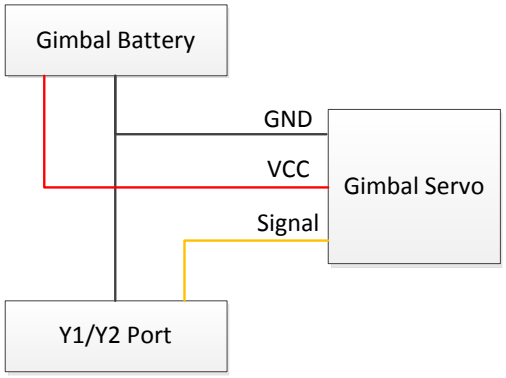
3. When you need to exit carefree mode, switch channel 5 to position 1 or position 3 (manual mode or GPS mode).

11 Tasks

11.1 Servo Driven Gimbal

The Y2 and Y1 ports on the flight controller are connected respectively to the gimbal pitch servo and the roll servo. You must power the servos separately from the flight controller when using a servo driven Gimbal.

When using a servo driven gimbal the transmitter should have at least seven channels.



- **Gimbal pitch control:** assign CH7 to a knob switch on the transmitter. Any adjustment of the knob will produce a corresponding tilt on the pitch servo.
- **Gimbal roll control**: with no initial signal to the roll channel, the roll servo will remain in the neutral position to stabilize the roll axis of the gimbal. Adjust the roll channel according to the following procedure:

  a) Switch CH5 to position 1 and throttle back to minimum.

  b) Click “Settings” in the mobile ground station or the button “Init Setup” on the PC ground station. The knob currently assigned to CH7 is changed to control Gimbal roll.

  c) Click “Quit Setup” after adjusting the gimbal roll position, the new central position will be fixed and stored. CH7 will return to control Gimbal tilt.

Note:

- Octocopter does NOT support servo gimbal.
- “PTZ Roll sensitivity” and “PTZ Pitch Sensitivity” on the parameter interface are used to adjust the gimbal correction angle. If the correction angle is too small that it should be increased and vice versa. A negative value should be entered to indicate reverse PTZ sensitivity. **The range of PTZ sensitivity is -127 to 127.**

  On the mobile ground station: click “Parameter”, as shown in Figure 60.

  On the PC ground station: select “Setting” → “Parameter Setting”, as shown in Figure 61.

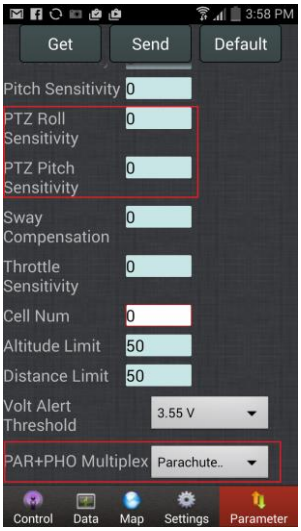


Figure 60

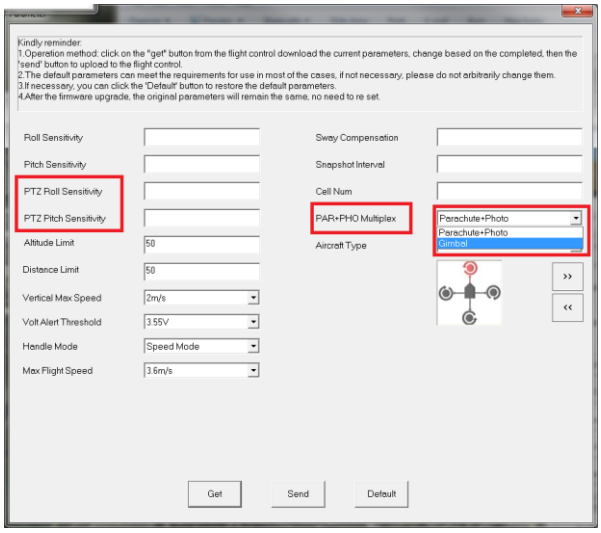


Figure 61

12 Safety Features

12.1 Starting and Stopping the Motors

12.1.1 To Start Motors

The motors will be locked after 5 seconds if no throttle is applied before take-off, or after landing in manual mode with the pulled back to minimum. The motor will not rotate after it has been locked even if throttle is applied. Motors will rotate only after unlocking. Reference can be made to "9.2 Unlocking and Arming the Motors".

12.1.2 To Stop Motors

The motors will stop when the throttle is pulled back to minimum in manual mode. In GPS mode, reducing the throttle to minimum will have the following differing results:

– The aircraft will reduce altitude but the motors will not stop if the aircraft is in flight;

– The motors will stop slowly until fully locked if the aircraft is on the ground.

12.2 F/S Protection

❖ **Loss of Wi-Fi signal**

Full control of the aircraft will be handed to the transmitter if the loss of Wi-Fi signal exceeds 1 second when flying the aircraft with the Android mobile device. If the aircraft is waypoint flying, it will not be affected and will complete the route where it will hover awaiting further commands.

❖ **Loss of R/C transmitter signal**

F/S (failsafe) should be correctly set up. Refer to the RC transmitter manual to set CH5 in position 3, CH6 in position 3 and throttle in neutral for correct operation of failsafe.

Failsafe will initialize when there is signal loss from the RC (receiver).

– The aircraft will switch to auto hover for 5 seconds and then return and land if the signal is not recovered within five seconds.

– The aircraft will keep flying for 5 seconds in automatic waypoint mode and will return and land if the signal is not recovered within 5 seconds.

12.3 Data Record

12.3.1 Flight Data Record - “Black Box Function”

The X4V2 flight controller has a flight data record function for fault analysis. It is not necessary to have any external memory or to initiate any application for this function to work. A record is made automatically during every flight. However, only the data of the last one minute before landing is recorded. Therefore if you need to examine this data, please do not make another flight or unlock the motors again.

12.3.1.1 Obtaining Mobile Ground Station Data

The flight data can be obtained from the mobile ground station as follows:

1. Connect the power supply to the flight controller, open the mobile ground station and connect via Wi-Fi;
2. Click “One minute data” in the “Setting” interface and a confirmation dialog box will pop up, as shown in Figure 62.
3. Click “OK” and the flight controller will upload to the mobile device the last minute of recorded flight data.
4. It will take 1 minute to obtain the data and then report that completion of 1 minute data reading.
5. The file “T-1min.hj” can be seen in the directory “YShj” in the root directory of the mobile device. You can make your own analysis of this data or email it to the manufacturer for debugging.

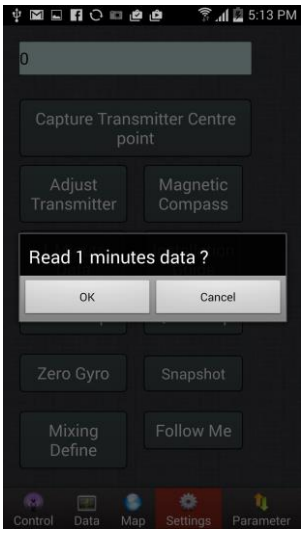


Figure 62

12.3.1.2 Obtaining PC Ground Station Data

Flight data can be obtained from the PC ground station as follows:

1. Connect the power supply to the flight controller and to the PC via Wi-Fi.
2. Select “Settings”→“1 Minute Data” and a confirmation dialog box will pop up, as shown in Figure 63.
3. Click “Yes” and the flight controller will blow to the PC the last minute of flight data.

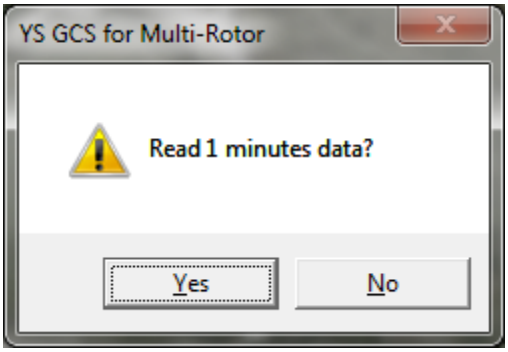


Figure 63

4. After 1 minute to obtain the data, the instruction of completion of 1 minute data reading will pop up on the ground station;

5. The file “T-1min.hj” can be seen in the “Hj” directory of the PC ground station software package. You can make your own analysis of this data or email it to the manufacturer for debugging.

12.3.2 GCS Data Record

This function needn't any external device, just keeping the flight controller powering on and WIFI connecting, then all of the operation record will be saved by hj files in the related folder of GCS for analyzing.

One hj file will be created once closing the GCS and all of data will be in one hj file if not closing GCS.

- saved file path
  - mobile GCS: root folder in cellphone/YShj catalog
  - PC GCS: GCS/Hj catalog
- document format: time.hj, for example, 20150506110410.hj, 20150506 means date,110410 means recording begin time from 11:04:10

13 Extending the Range of Capabilities

13.1 Radio Connection

The XB-PRO900 radio can be purchased as an option to extend the control distance, overcoming the distance limit of Wi-Fi for ground station and mobile device control.

This radio has an RF power of 100mW on a frequency of 900MHZ and its measured two-way communication distance is 1-2 km in open ground. The radio has a RS232 port and the communication Baud rate is 115200bps.

XB-PRO900 consists of two interchangeable radios, one on the aircraft and the other on the ground.

13.1.1 Airborne Radio Connection

Remove the Wi-Fi module from the aircraft and install the radio in the aircraft in the same way as the Wi-Fi module; connect to the COM port of the flight controller; the radio should be powered by a 3S-6S lithium battery.

13.1.2 Ground Radio Connection

Connect the Wi-Fi module to the other radio on the ground with the connection cable provided with the radio, which is powered separately. The unit on the ground consists of the radio and the Wi-Fi module.

Note:

The radio and Wi-Fi are powered with a 3S-6S lithium battery with the red/black cable, the red for anode (+) and the black for cathode (-).

13.2 Connecting the Power Management Module

Real-time current draw (Amps) and electricity consumption (mAh) can be observed in the “Data” interface of the ground station after connecting the optional Power Management Module to the X4V2 flight controller.

To use this function connect the power management module (to the A1 port on the X4V2), reduce the throttle to minimum and then power the flight controller. The current (A) and electricity consumption (mAh) will be displayed, as shown in Figure 64.

13.3 OSD Connection

After the OSD (On Screen Display) has been connected to the X4V2 flight controller, flight parameters will be overlapped in real time on the video display. This improves the quality of the flight experience because the pilot is constantly aware of vital flight parameters. Connect the OSD COM port to the COM port on the flight controller. Full details are available in the ZerOSD manual.

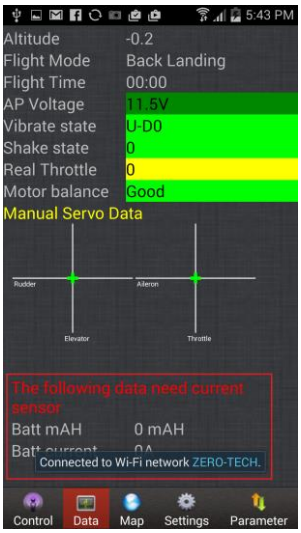


Figure 64

14 Upgrading the Firmware

NB

Make sure the flight controllers not powered, if it is please disconnect.

Before upgrading the firmware, please download the special firmware upgrade tool on the Zero UAV official website.

http://www.zerouav.com/en/service/Download/Firmware/

Upgrading X4V2 firmware is simple! Upgrade the firmware according to the following procedure:

1. Download the USB driver from the ZERO official website and install it.
2. Plug the serial converter end of the USB cable into the PC USB port, the other end to the COM port on the Flight Controller, **white cable upwards.**
3. Extract the "YS-X4-X4V2-X4P-Gemini-M-S" firmware upgrade archive and double-click "UpgradAP(En)-TOOL.exe" and the window "AP Firmware upgrade" will pop up, as shown in Figure 65.

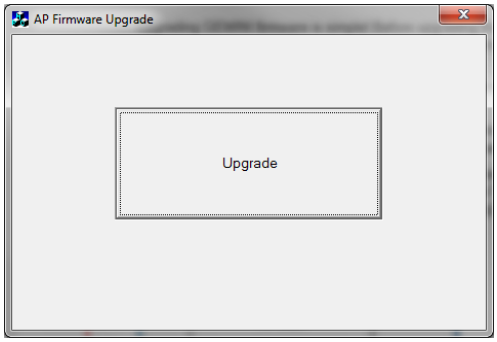


Figure 65

4. Click "Upgrade" and the window "AP Firmware upgrade" will pop up, as shown in Figure 66.

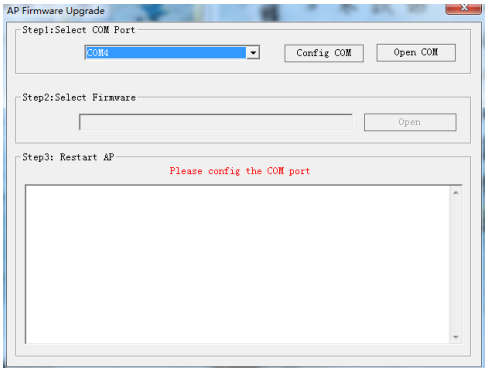


Figure 66

5. Select the appropriate COM port for upgrading; (if you do not know which COM port on your PC is being used, right click "My computer"->"Properties"->"Device manager" ->"port"(COM & LPT) to check, as shown in Figure 67)

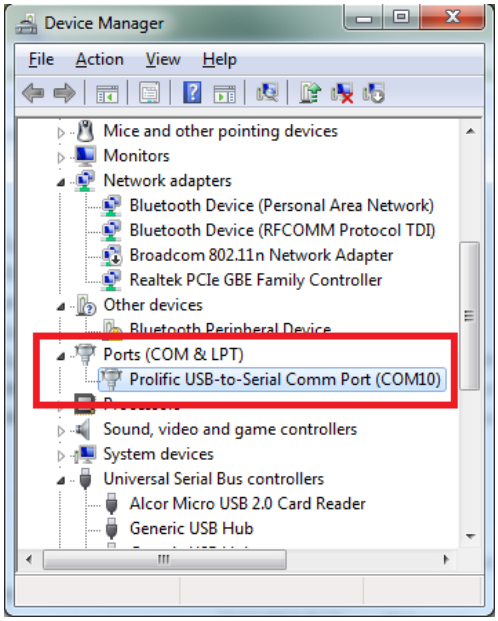


Figure 67

6. Click “Open Com”, if successful, the “Open” button will change from gray to black and become clickable;

7. Click “Open” and to select the firmware file which will have a “.arm” extension from its stored location on your PC, as shown in Figure 68.

8. Power up the flight controller and to wait for the automatic upgrade process to activate, as shown in Figure 69.

9. Power-off the autopilot when it says in red, “Please Restart AP!” and then close the window, as shown in Figure 70.

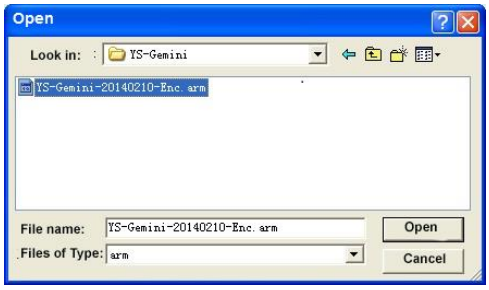


Figure 68

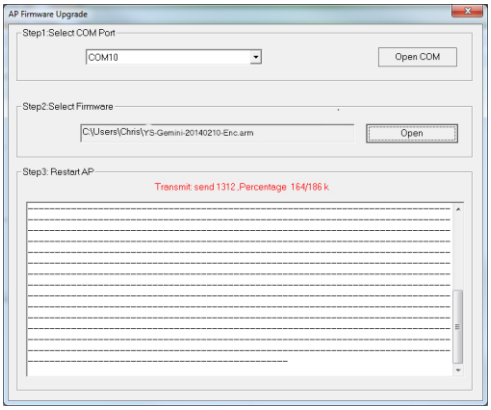


Figure 69

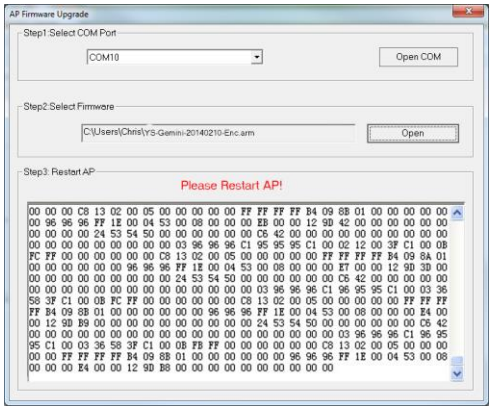


Figure 70

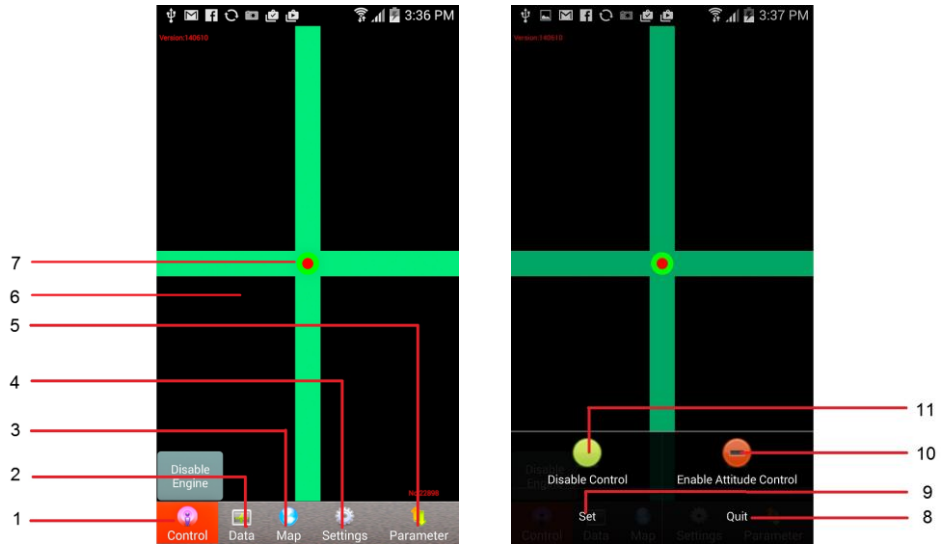
Note:

Please close the software and unplug the USB/serial port adapter if the upgrade operation fails. Restart the operation from the beginning.

Appendix

Appendix 1 Introduction to Mobile Ground Station (Android)

1. GCS Remote Control Interface



The interface functions are introduced in the following table:

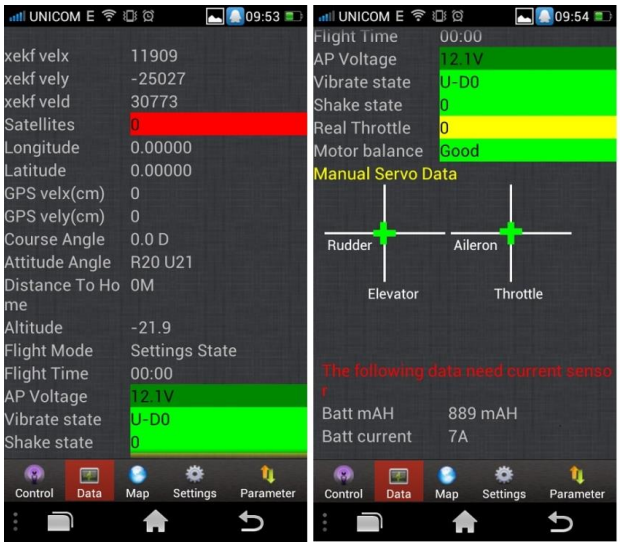
No.	Menu Item	Function
1	Remote control	Default setting: use the Green Cross to control flight
2	Data	Real time flight data
3	Map	Cached map or active real time map (Google Earth)
4	Settings	Set up aircraft status
5	Parameter	Adjust aircraft parameters
6	Control interface	Multiple control modes using mobile device
7	Central button	Directs the aircraft in simple control mode
8	Quit	Exit GCS software
9	Set	Define system settings
10	Enable attitude control	Click “Enable Attitude control” (red button) to start simple mobile device control mode. “Disable Attitude control” (green button) Click “Disable Attitude control” to exit.
11	Enable control	Click “Enable control” (red button) to start simple mobile device control mode. “Disable control” (green button) Click “Disable control” to exit.

Note:

The aircraft serial number and firmware version will display on the remote control interface after data connection.

2. Data Interface

Click the “Data” tab for the data interface to see the screens shown below: the software will display communication disconnected in the center if there is no link with the aircraft.



Descriptions of the parameters are as follows:

Name	Description
Satellites	Shows number of GPS satellites in view and locked
GPS velx(cm) GPS velx(cm)	GPS velocity displays a value below 10 when static
Xekf velx Xekf vely xekf veld	Speed of the aircraft after Kalman filtering A value of 0-10 is displayed when the aircraft is static on the ground.
Attitude angle	Displays real-time attitude angle during flight
Flight mode settings state	Displays current craft status: Manual, Manual Altitude Hold, Auto Hover, Auto Navigation, Auto Go Home and Land; setup status.
Altitude	Barometer altitude of aircraft, units in metres
Course angle	Aircraft compass heading: Due North= 0°, clockwise direction is positive, counterclockwise direction is negative. For example: Due East=+ 90°, Due West=-90°, Due South=+ 180°. Does not apply in manual mode.
AP voltage	Power supply voltage
GPS longitude GPS latitude	GPS longitude and latitude
Motor balance	Motor balance performance
Vibration State	Displays the influence of shake and vibration on the IMU from different

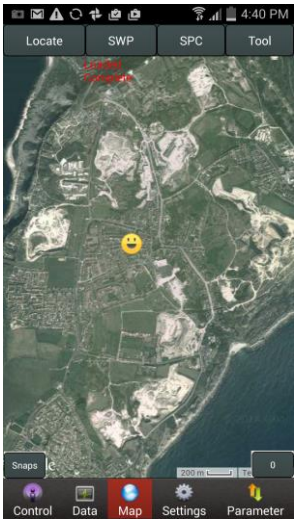
Name	Description
Shake State	directions: a parameter under 10 indicates normal, larger than 10 indicates that shake and vibration exceeds the limit, requiring adjustment to the airframe to reduce vibration.
Distance from home	The distance of the aircraft from the starting point
Flight time	Flight time of the aircraft
Real throttle	Actual position of throttle

3. Map Interface

A map must be downloaded from the Internet before the initial opening of the “Map” interface. The map will return to its last closing position, when reopening the map.

The map interface is shown on the right side.

Map parameters are shown in the following table:



Name	Description
Snaps	Manual photography
	Show the number of photos. The maximum number of pictures recorded is 250. The ground station will restart the count if this number is exceeded.
Locate	My location, Plane location and Search location.
SWP	Fly to Point (FlyToPP)
SPC	Waypoint and Route flying
Tool	Map tools related to the defined waypoint route

4. Waypoint Editing

The waypoint editing interface are as shown in Figure 71 and Figure 72.

Figure 71

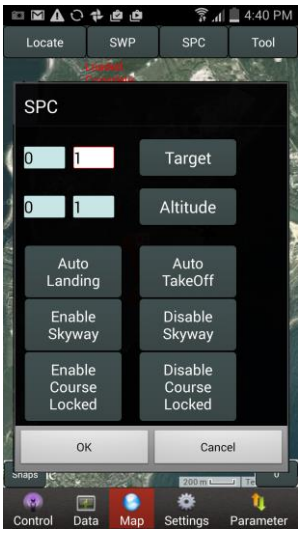


Figure 72

Figure 73

Waypoint editing parameters are shown below:

Name	Description
Single point edit	Edit longitude, latitude, height and speed between waypoints
Single point upload	Upload waypoint
Single point cancel	Cancel waypoint
No.	Number of waypoints
Height	Waypoint altitude in meters
Longitude	Longitude of single waypoint
Latitude	Latitude of single way point
Hovering time	Time spent at each waypoint. Zero means no delay at waypoint.
Photograph setting	Setup photographic task at waypoint
Target speed	Flight speed between waypoints

5. Settings Interface

Please take care with these settings as they are vitally important.

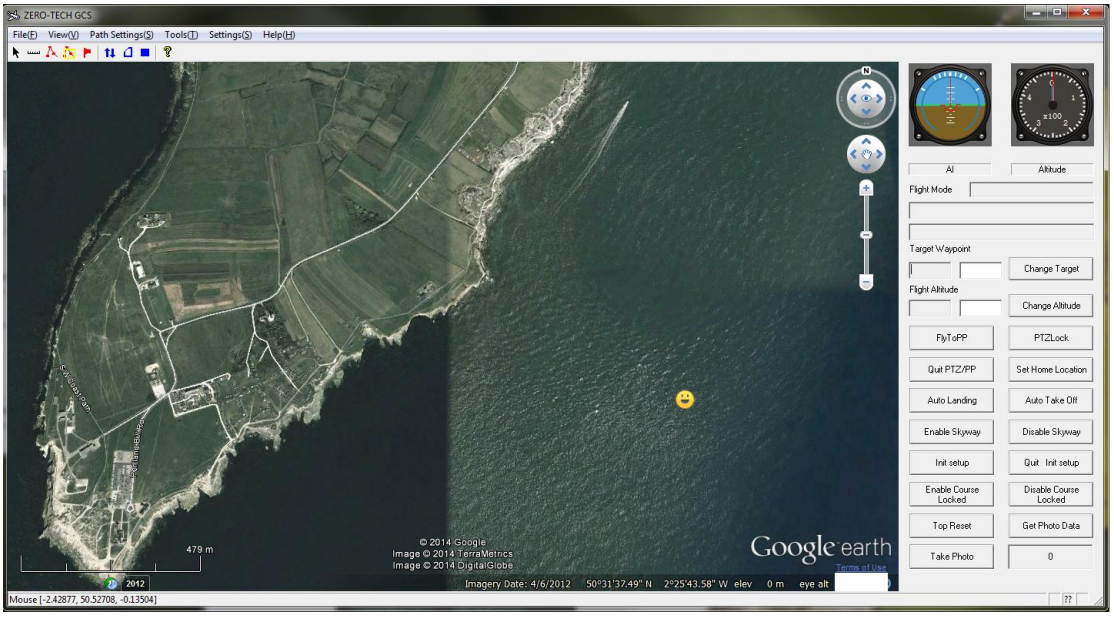
The settings interface is as shown in Figure 73. The parameters are shown below.

Parameter name	Parameter description
Capture Transmitter Centre point	With no wind, in manual mode, after flying and trimming, activating this will define the neutral point. **NB:** Make sure your TX throttle stick is in the middle position; it does not affect the actual throttle position.
Adjust transmitter	Used to calibrate the transmitter's joystick

Parameter name	Parameter description
Magnetic compass	Click to enter "Magnetic Compass" Calibration mode, the status bar above displays the calibration status.
1 Minute Data	Used to initiate reading the data saved in the FC within the last minute of flight. Please refer to “12.3.1Flight Data Record - “Black Box Function””.
Installation guide	The "Installation Guide" will guide you through installation and alignment step by step
Init Setup	Used to align channels or enter parameters of craft. Flight status will display "Settings" after clicking this button. Once in settings, the control channels for each motor on the craft are directly connected to the throttle channel of the TX and there is no mix output.
Quit setup	After completing Throttle Alignment and when all parameters have been entered, you may click this button to exit from settings.
Zero Gyro	Zero the gyro. The aircraft should be perfectly level when you do this.
Snapshot	Trigger camera shutter manually
Mixing Define	Defines custom mixing of throttle, roll, pitch and yaw.
Follow Me	If the Android Ground Station has GPS enabled, the aircraft will follow the moving course of the Ground Station.
Test Open Parachute	Test parachute open before flight, hold down the container lid to prevent deployment.
Test Close Parachute	Close parachute after testing.

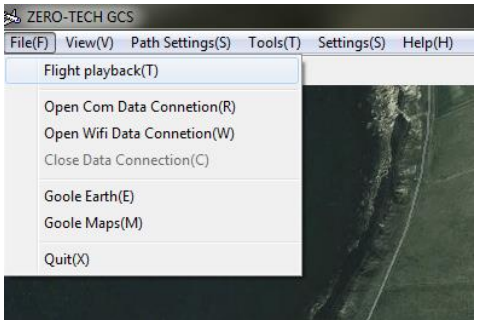
Appendix 2 Introduction to PC Ground Station

1. Main Interface



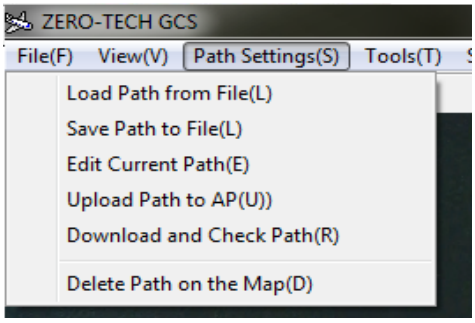
2. Menu Bar Profile

❖ **File(F) Tab**

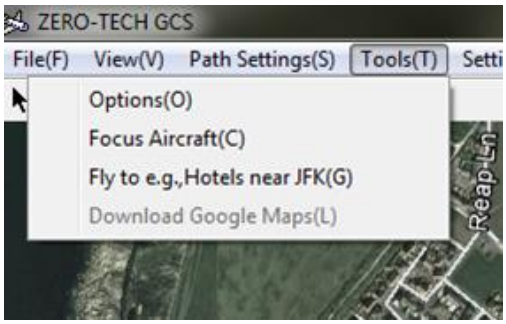


❖ **View (V) Tab**

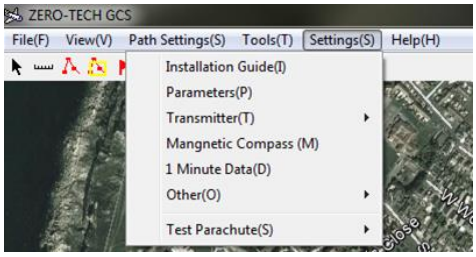
❖ **Path Settings (S) Tab**

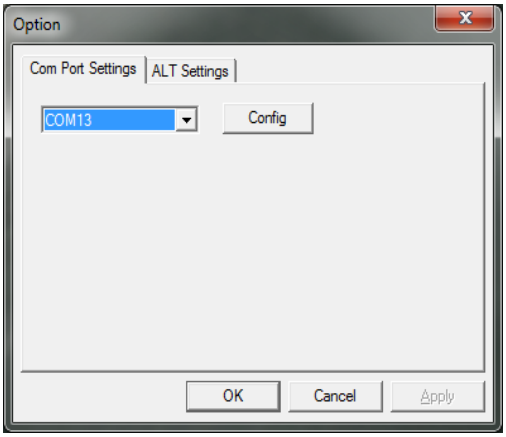


❖ **Tools (T) Tab**

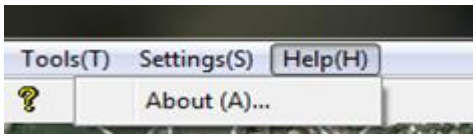


❖ **Settings (S) Tab**





❖ **Help(H) Tab:** software version

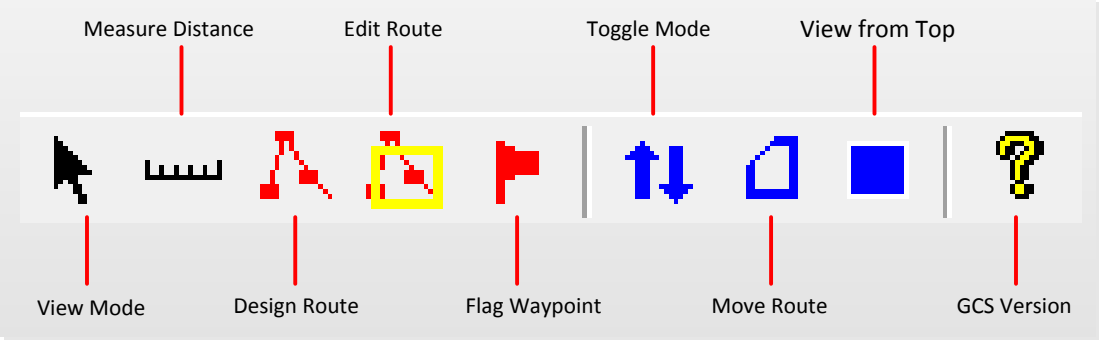


Note:

- The correct COM port must be selected when connecting to the flight controller with the USB/serial port adaptor cable.
- When the map is flat mode, you can download offline maps.

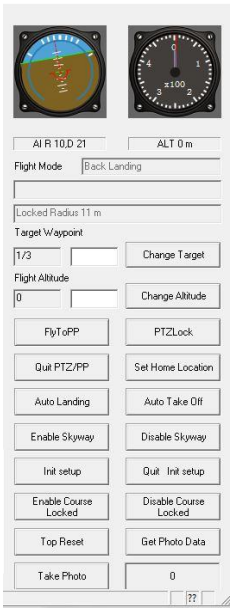
The view tab includes the following sections:

✧ **Toolbar**



✧ **Flight Data (F)**

✧ **Dashboard**



Appendix 3 Installation and Configuration Videos

- Setting up the Futaba T8FG transmitter radio:
  http://www.tudou.com/programs/view/e1ai526Mbt4/
- Wi-Fi configuration:
  http://v.youku.com/v_show/id_XNTE2OTY4MjQ4.html/
- Upgrading firmware:
  http://v.youku.com/v_show/id_XNTE3NzEzOTky.html/

Appendix 4 Technical Support

Please contact ZERO UAV for technical support for any problems arising from actual operation. Relevant technical documents can be downloaded in the download section in the official

website of ZERO UAV.

- ZERO UAV official website: www.zerouav.com
- ZERO UAV Tel: +8610-82825271
- ZERO UAV QQ Group: 168451730(Group1), 228669705(Group2), 242018689(Group3), 53371874(Group4)

Appendix 5 Reference Manual Update History

No.	Version	Modification	Modifier	Date
1	V1.0	To prepare first version	Technical support 1	2014.9.1
2	V1.0	English revision	Chris Hornby	2014.12.25
3	V1.1	1. Format Adjustments 2. added functions: 10.2.1.6 Way Point Flight: Semi-automatic flight	Technical support 1	2015.1.23
		1. Format Adjustments 2. Modify parameters, diagram	Technical support 1	2015.5.4
		Added function: GCS Data Record	Technical support 1	2015.5.14