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## 1. Introduction

### IMPORTANT:

- The propellers could cause injuries, therefore the Quadcopter never should be used around people or in situations where you can lose control and cause an accident that could hit a person or cause material damages.
- Never place the propellers in the Quadcopter to be sure of the direction of rotation of these have been mounted and should to be controlled safely.
- Never leave charging batteries unattended or exposed to direct sunlight.
- Never allow the cell voltage of the battery drops below 3.3V in shock.



## 2. Kit Contents

### 2.1. Kit S250 SPEDIX



### 2.2. Extra Propellers Black 5x4.5 (CW / CCW)



### 2.3. Turnigy 9X 9Ch & 8ch Receiver Module



2.4. Battery Turnigy 2.2 Amps 11.1V (3S) 1.5C



2.5. Battery MultiStart 3.0 Amps Battery 11.1V (3S) 20C



2.6. HobbyKing® B3AC Compact Charger





## 3.2. Mechanical assembly

For chassis assembling, we should follow the manual accompanying the kit SPEDIX.

## 3.3. Electronic assembly

### 3.3.1 APM 3.6 vs CC3D

The main differences between these autopilots are:

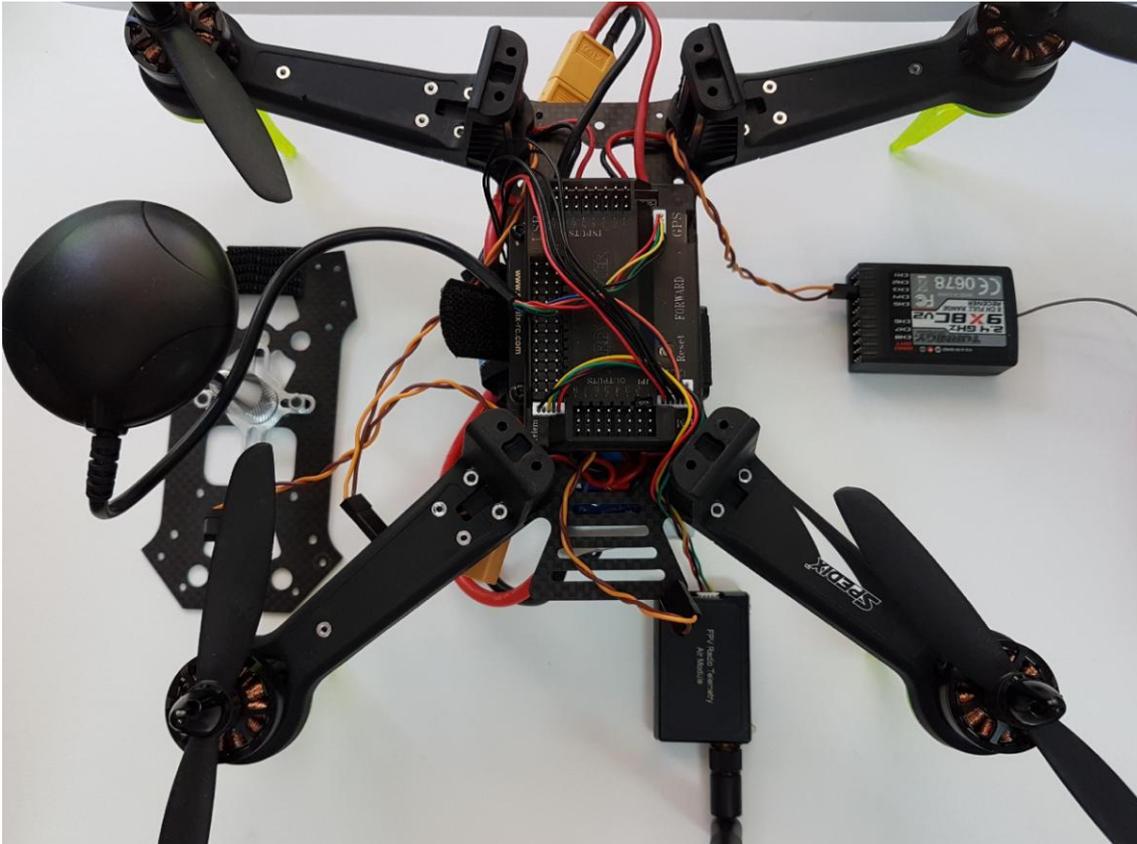
	CC3D	APM 2.6
Accelerometer	YES	YES
Gyroscope	YES	YES
Magnetometer	NO	YES
Barometer	NO	YES
GPS	NO	YES
Barometer	YES	YES
Battery Monitoring	NO	YES
Maximum engines No.	6	8

At first glance it can be seen that APM 2.6 is a higher version to CC3D both hardware and software. Thanks to the magnetometer and a barometer built 2.6 AMP control of two degrees of freedom to our drone (Altitude and YAW), degrees of freedom that could not be controlled with precision CC3D model are added. For the above and adding the GPS can say that this new model allows flight in automatic mode, the CC3D big change that allowed only a manual flight.

### 3.3.2 Preset engines

**IMPORTANT:** Make sure the propellers are not placed before performing the following steps.

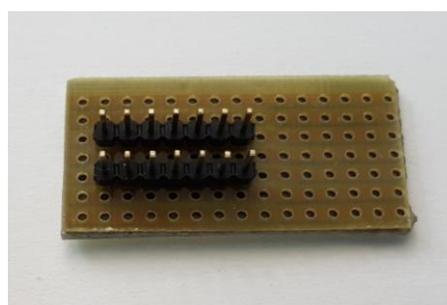
Unlike CC3D, must be pre-set engines for greater engine performance. To do this, connect each engine with RC receiver channel 3 as shown in the following figure:



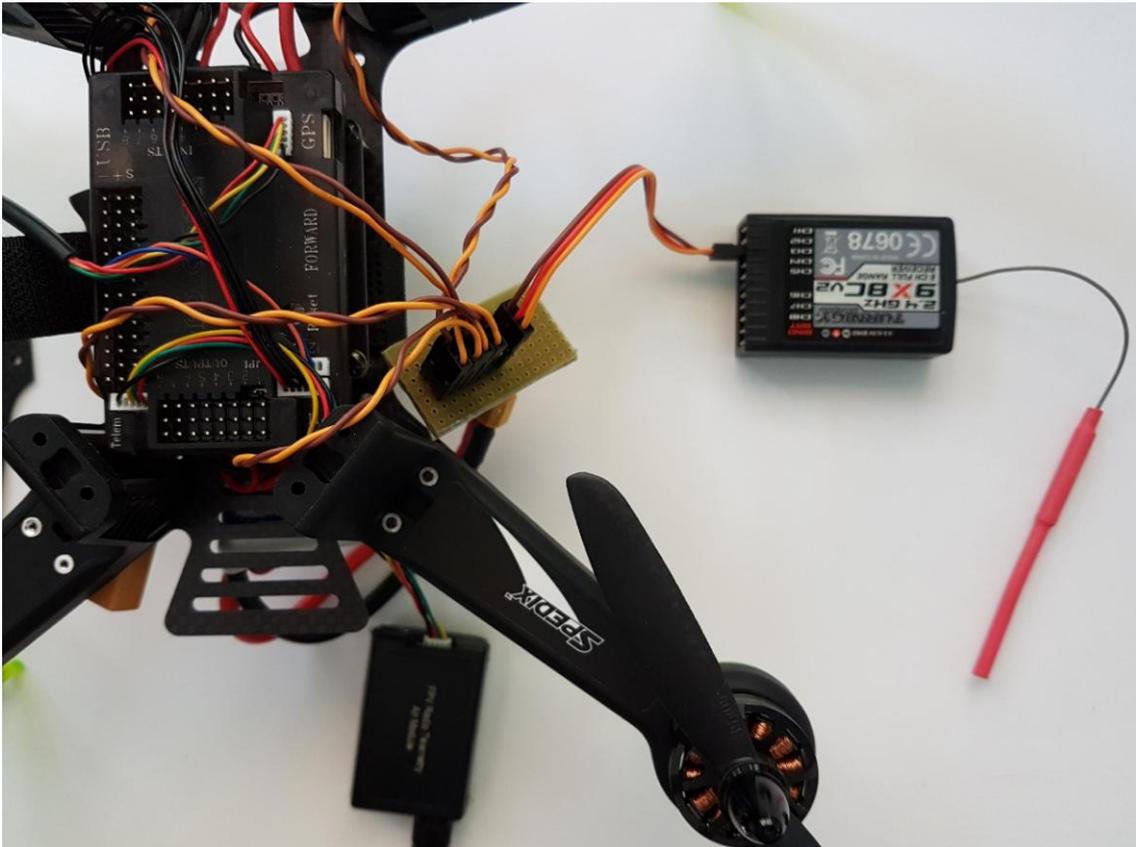
- Why channel 3 of the receiver?

This channel is transmitting the value of the transmitter stick corresponding to the throttle or also known as gas, which is the value that allows us to give power to the engines.

A solution to streamline this process, may be the implementation of the next plate of simple and quick installation:



Thus the final assembly would be:



It should be very careful with the wiring, all cables must be connected in the same sense of colors, as shown in the image.

You can also make individually calibrated as shown in the picture, repeating the action in all esc.

- Why do this procedure done?

The engines used for Spedix are called brushless engines. These motors works in conjunction with an ESC (Electronic Speed Controller) and APM to control them.

The APM processes the value that sends the station and he sends it to the ESC to vary the speed of the motors. As the value sent to the ESC is directly the value of the station, the engines must be prepared to don't start rolling just start moving the stick of the transmitter, so you change the minimum value that begin move motors with this procedure.

Once we make these steps, the procedure is as follows (for connecting both ways):

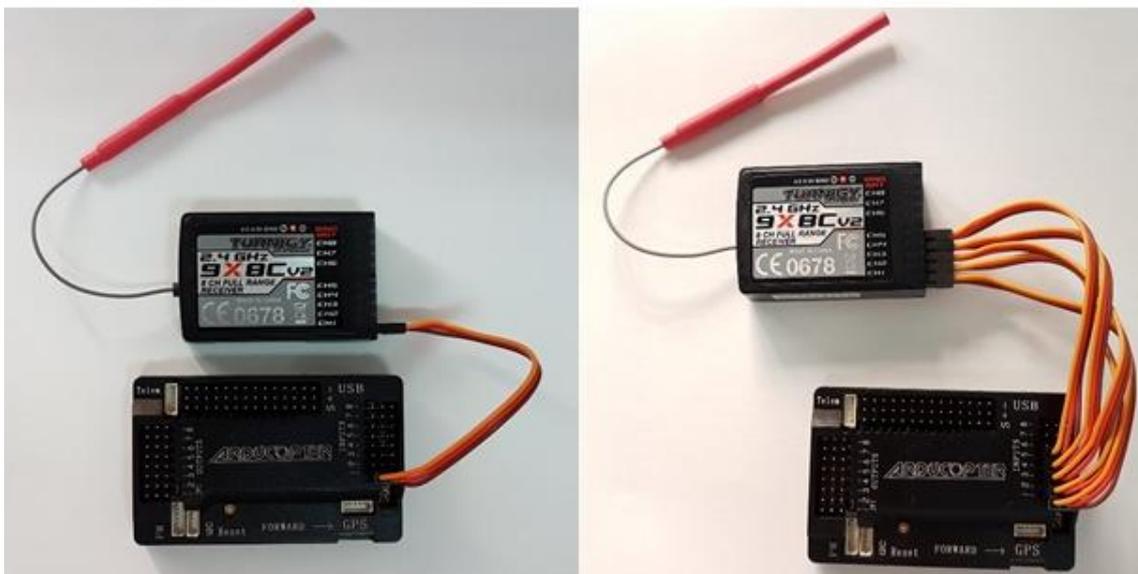
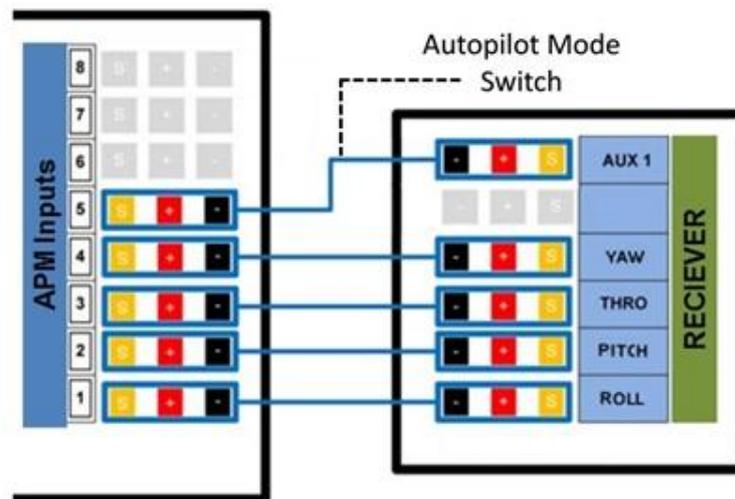
- Connect a tricolored cable channel 8 RC receiver to the port channel 8 OUTPUTS APM 2.6. This will cause the receiver to work when the battery is connected.
- With the transmitter battery still connected and disconnected, the throttle stick will move to its maximum position.

**IMPORTANT:** Be sure the propellers are not placed before the next step.

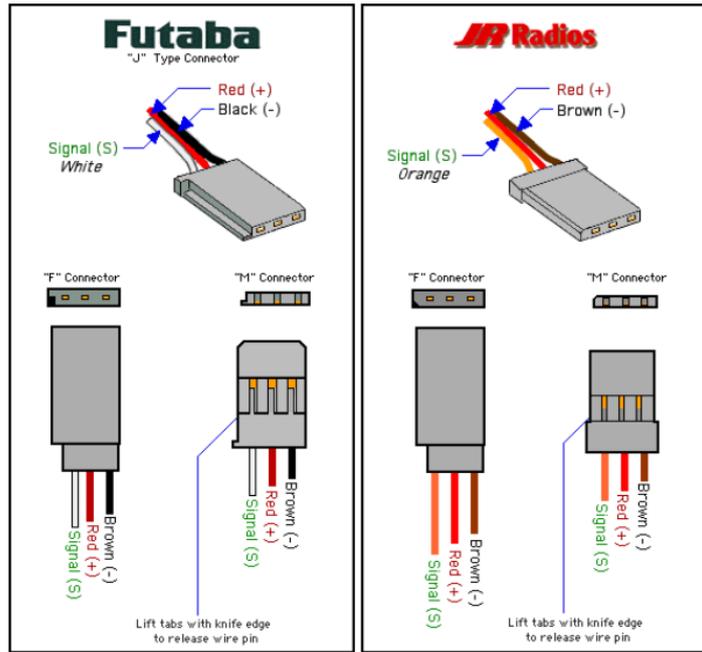
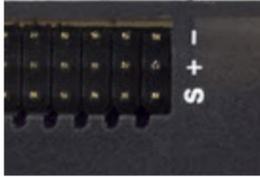
- Connect the battery, starting a small tune, followed by a short beep sounds.
- Move the throttle stick to a position about 25% of full throttle and leave it alone, two short beeps and long will be heard, this indicates that the procedure was successful.
- Place the throttle stick to the minimum and carefully check the throttle stick moving the engines begin to move about 25% of the value of the maximum throttle.

### 3.4. Connection Diagram (APM 2.6)

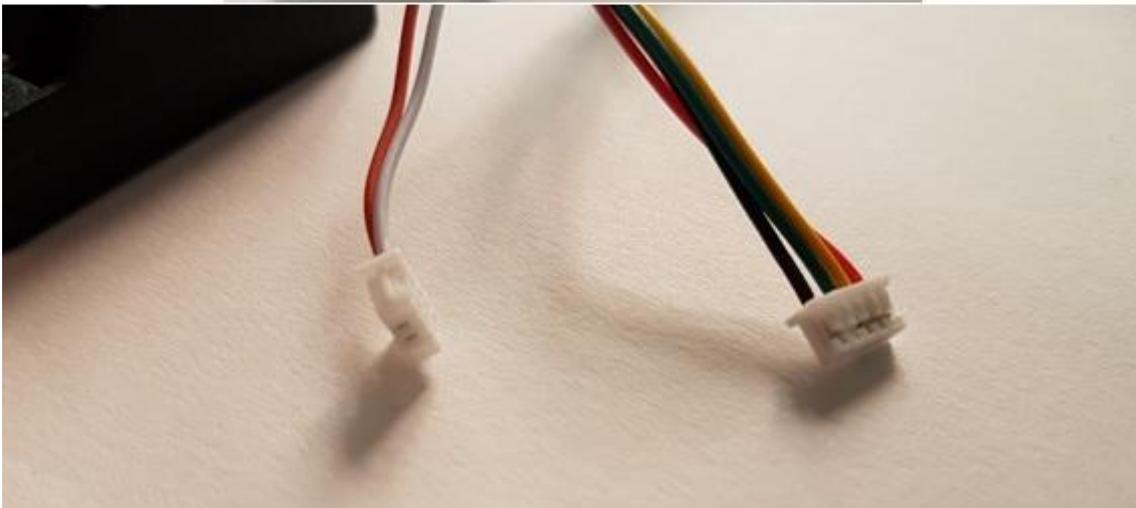
#### 3.4.1 INPUTS PORT APM 2.6 (Receiver RC)



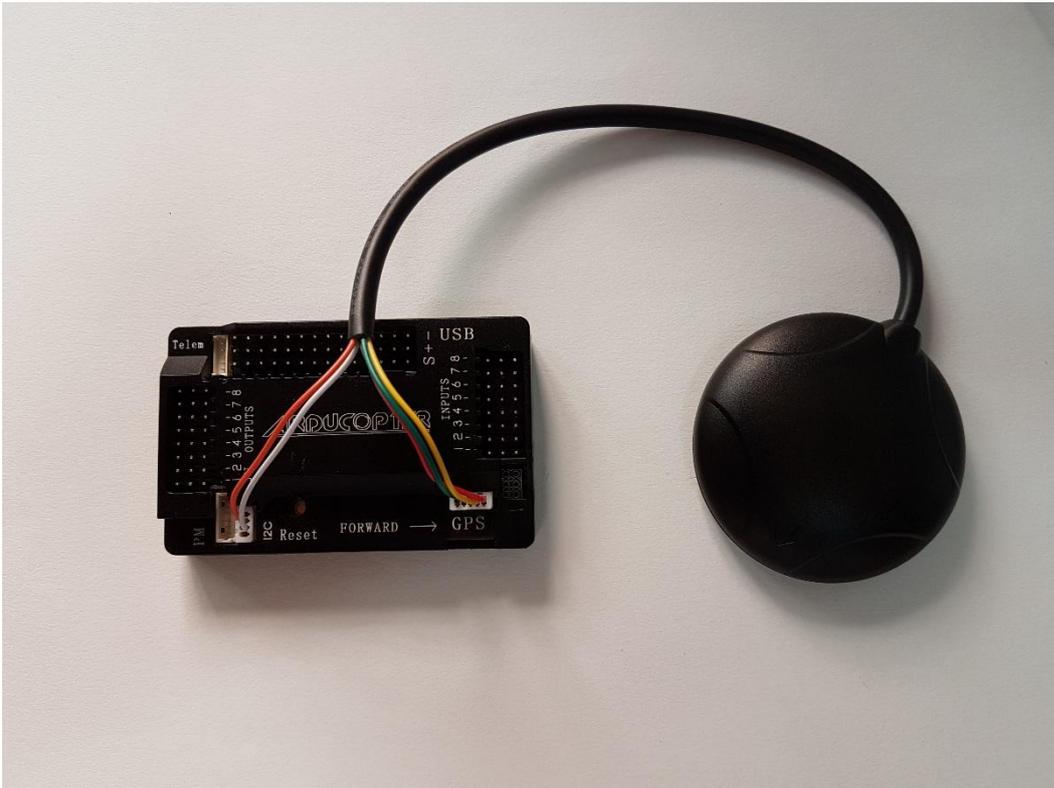
Look for markings like this -



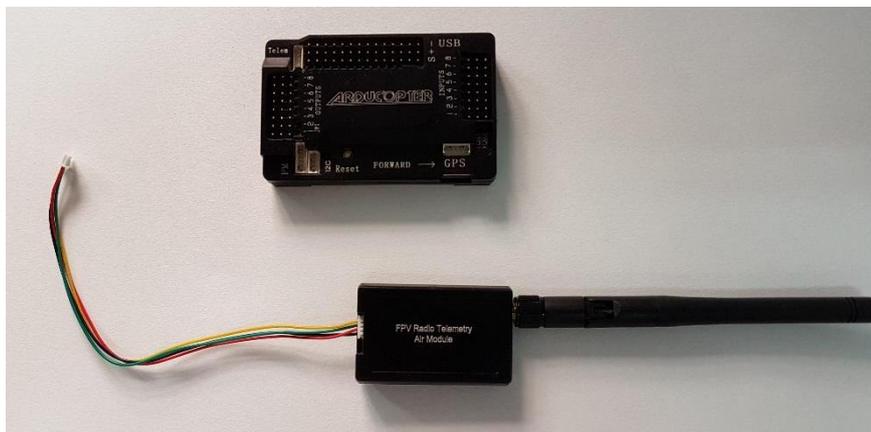
### 3.4.2 GPS



The connector with 2 wires must be connected to the I2C port (Magnetometer) and formed by 4 in the GPS connector, as shown in the following figure:



### 3.4.3 Telemetry



Telemetry must be connected to the TELEM connector, as shown in the following figure:

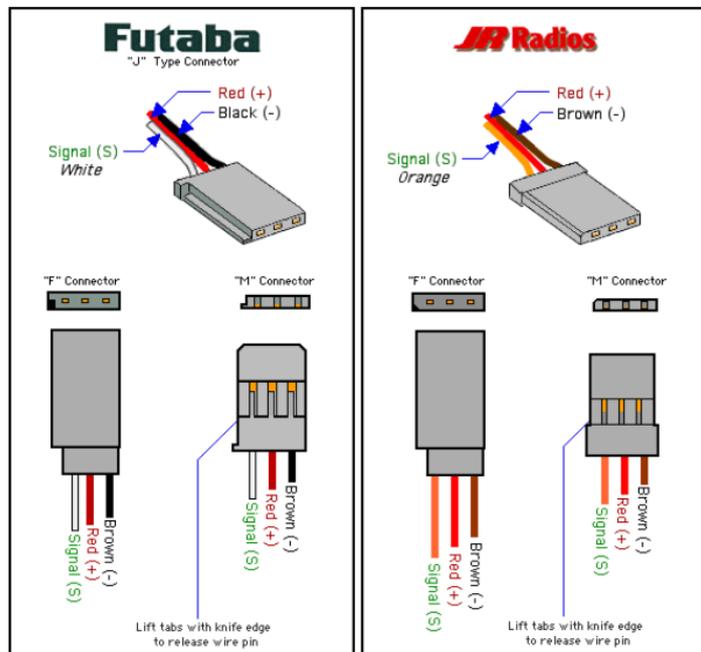
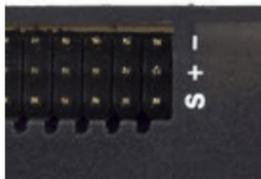




### 3.4.5 OUTPUT PORTS APM 2.6 (Engines)



Look for markings like this -



### 3.5. Final assembly

For correct mounting Spedix APM is it important to define the position in which certain components are placed.

**(TAKE CARE TO THE RIGHT ADDRESSES AND MAGNETOMETER APM)**

Once finished both electronic/mechanic assembly, it's suggested for the flight as follows:



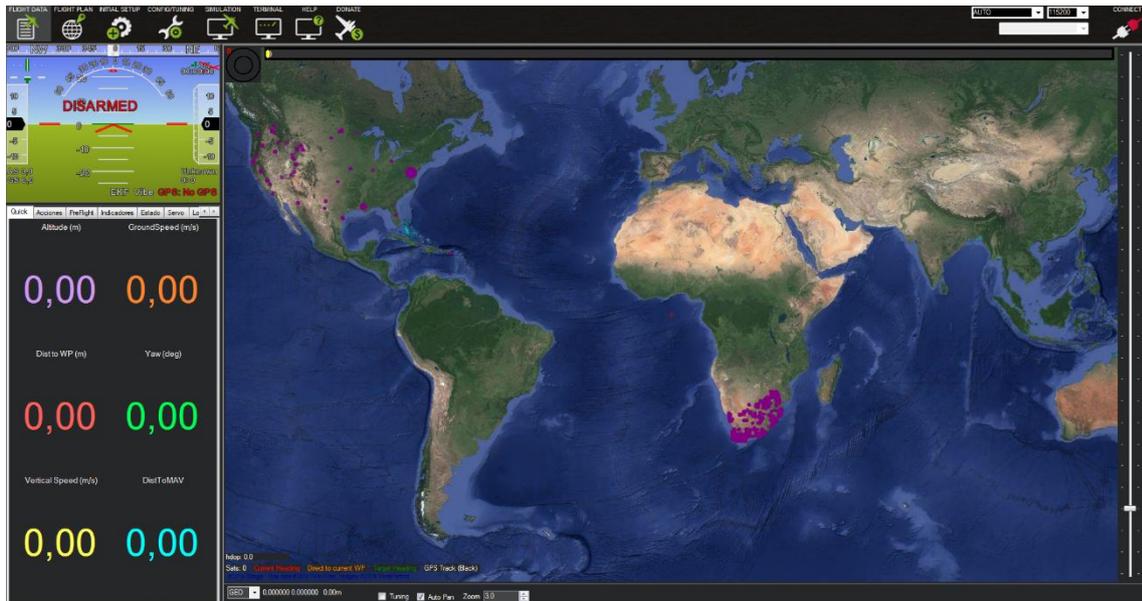
### 4. Setting Mission Planner

For optimal configuration of your drone, follow these steps:

- Download this version of Mission Planner: [enlace](#)

Mission Planner is a platform created for configuring certain autopilots (ArduPilot, PixHawk ...) open source and free. Allow the configuration and monitoring for our autopilot data received from this.

- Connect your APM to the PC.
- Start the program, it is important don't update the program, although it is recommended, but this is a stable and fault-free software.



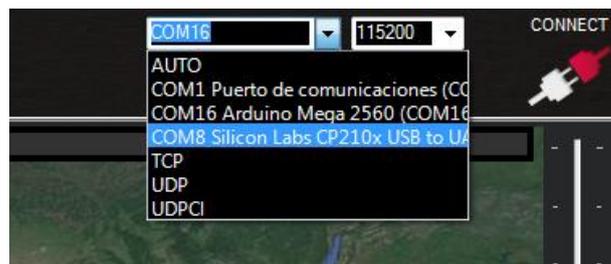
**IMPORTANT:** Make sure the blades are not placed before performing the following steps.

- In the upper right corner, a tab like the one shown below is appreciated. You must select the device to be connected (or Telemetry APM):

or If the device to be connected is your APM, you must select the option that reads "Arduino Mega 2560" and the secondary option "115200".

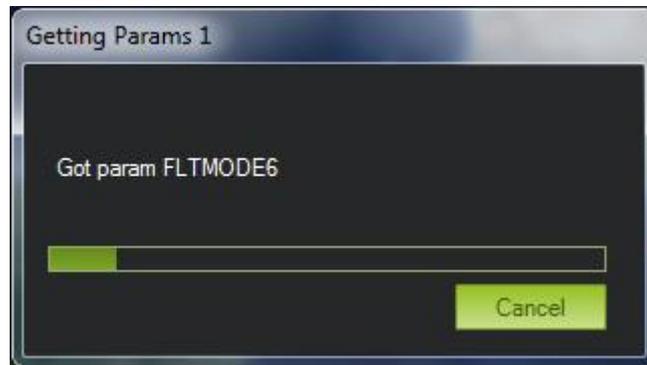


or If the device to be connected is the telemetry AutoPilot, you must select the appropriate port, in our case "Silicon Labs USB to UART CP210x" and the secondary option, select "57600".



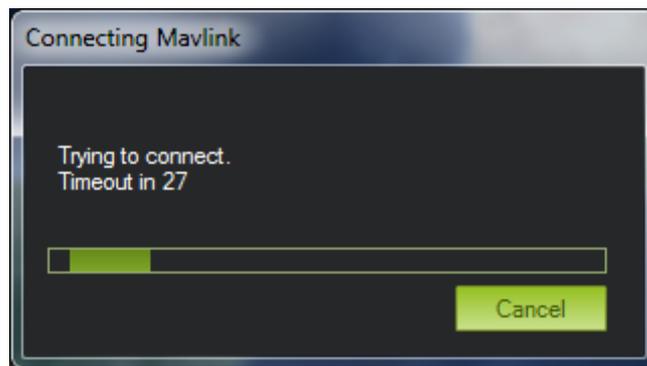
- Press the "CONNECT" button.

A tab as the following, which first if everything is correct "DONE" will appear and then load a set of returning parameters. Wait until the tab disappears.



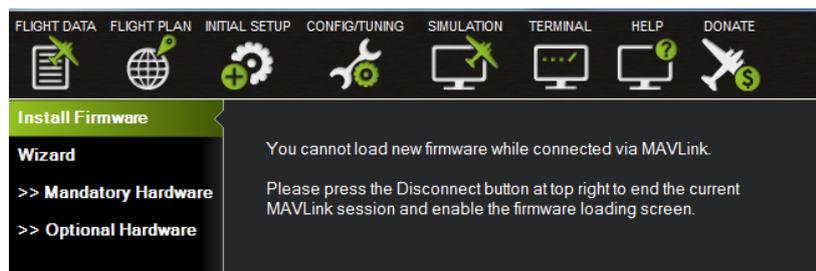
If an error occurs, it will start a countdown, to solve this problem, try the following solutions:

- or Reconnect the device and try again.
- or Make sure that the connection settings are correct.
- or restart the program.



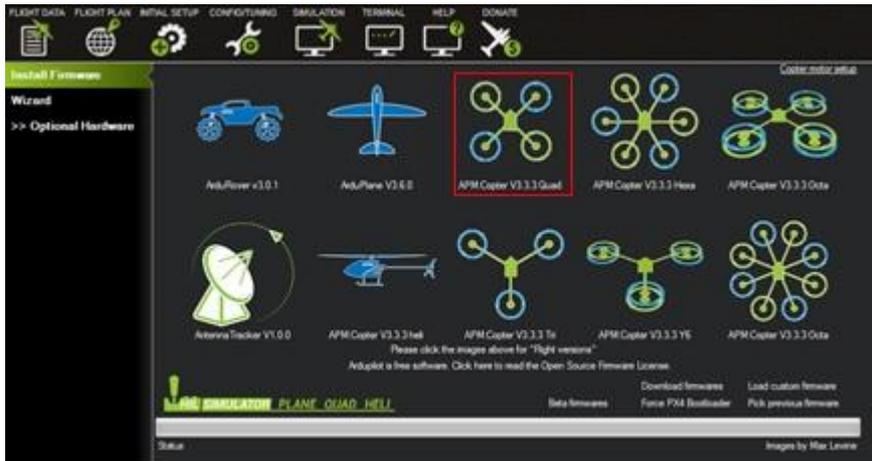
If everything is correct it will show the main screen again, this time showing real-time data AutoPilot.

- In the left upper, click "INITIAL SETUP". the screen will refresh and a small menu with 4 options appear. Click on "Install Firmware".



- As shown in the picture, it requests disconnection via MAVLink of the APM for upgrade. Click "DISCONNECT" on the top right of the screen.

A small tab appears updating and checking the available versions for autopilots. Once complete that process a new screen like the one shown in the following image appears:



- Click on "APM: V3.3.3 Copter Quad", a tab will appear asking for upgrade confirmation, press "YES" and hope to finish the upgrade process.
- Click on the left side part of the "Wizard" option a tab such as that seen in the following image and proceeds to APM settings will be displayed.



- Click on "Multirotor" and then on "Next".
- Selection of frames will be displayed. Click the Frame to configure, in this case in the "V" form, as shown in the following image and then press "Next".



**IMPORTANT:** For the next step is necessary that the APM is connected directly via USB to PC, invalid realize through telemetry.

- Proceed to connect for update, select the port to APM (Arduino Mega 2560) and press "Next".

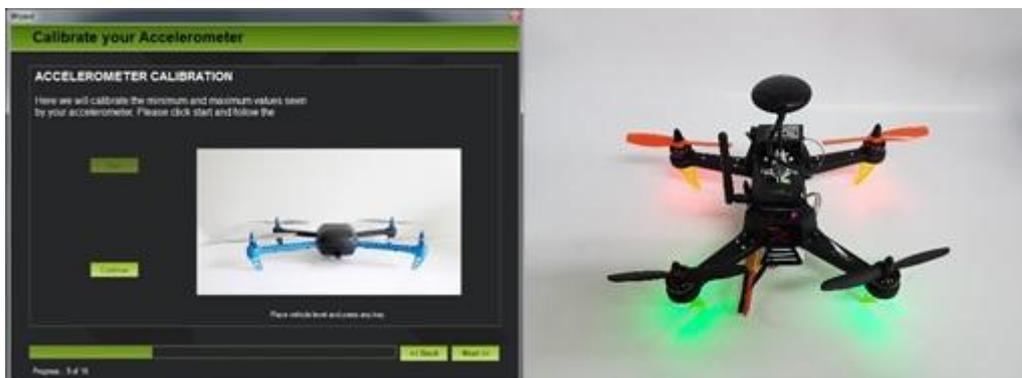


A small tab appears with the upgrade process.

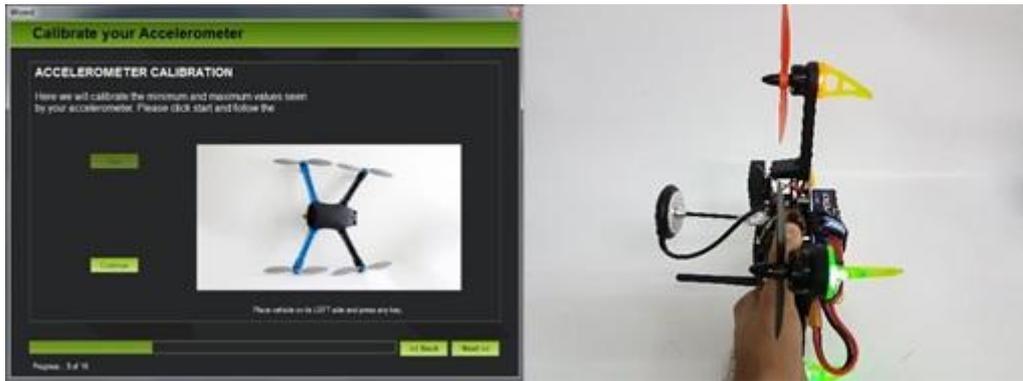
**IMPORTANT: Don't disconnect your APM during the firmware update or APM can be damaged.**

- Select Frame again in "V" as in the previous steps and click "Next".
- Then we proceed to calibrate the accelerometer APM, the following steps should be followed as quickly as possible, since the calibration has time between steps and if not met fail calibration:

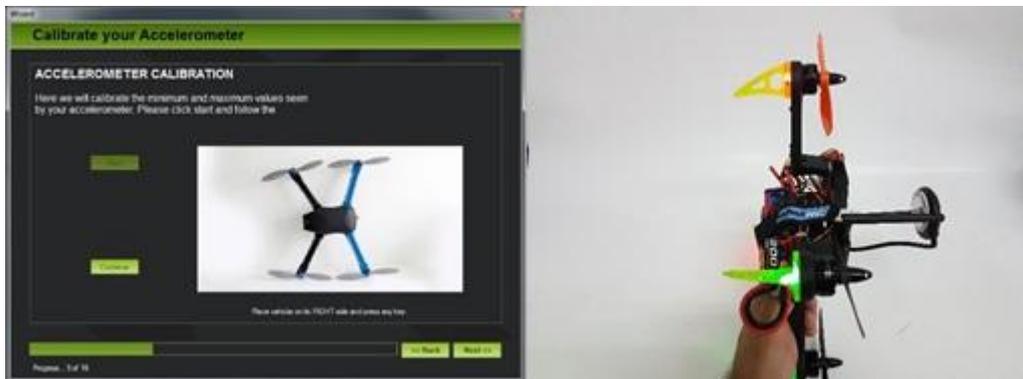
- o Press "START" and place the drone horizontally on a flat surface, as shown in the figure below. Once done, click "Continue".



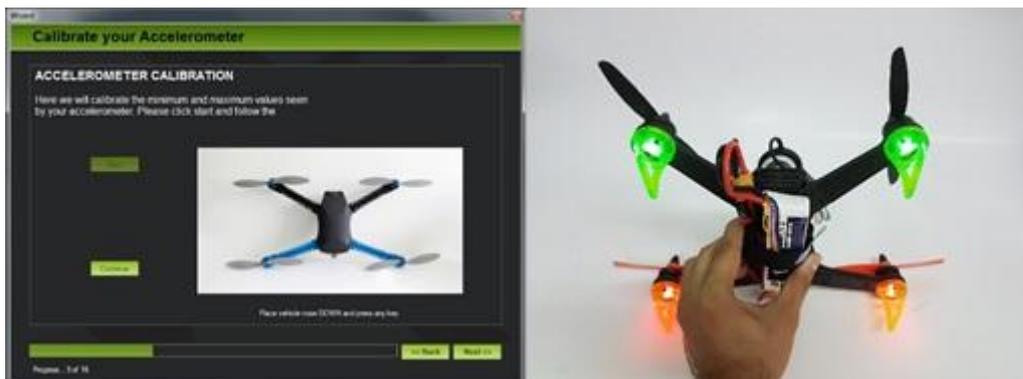
o Place the drone turned left 90 degrees as shown in the picture below and press "Continue".



o Place the drone turned right 90 degrees as shown in the picture below and press "Continue".



Place the drone tilting or 90 forward as shown in the picture below and press "Continue".



Place the drone or tilting 90 degrees backwards as shown in the picture below and press "Continue".



Place the drone tilting or 180 forward as shown in the picture below and press "Continue".



- If the process is completed correctly will show "Calibration successful" confirming that the process has completed successfully, as shown in the figure below.

- Then we proceed to the calibration of the magnetometer APM. For this test you need a compass to know where it is oriented north previously. Once known, the drone facing north and "Live Calibration" is pressed is placed.

The procedure is simple, we must approach each of the axes of the drone north, once faced you must turn the drone 360 ° around the axis.

Check that the option "Use auto accept" is marked in this way when they have received enough data automatically finish the whole process, returning to the previous display. Click "Next".

- Then the tab for configuring the power module is shown for it in the first option should be selected "2: APM2.5 - 3DR Power Module" in the second option should be selected "3DR Power Module" and the third section should be written the capacity of the batteries that are

being used (in the case of using this tutorial, you should write "3000" mAh). Once finished click "Next".

- Then Sonar settings will appear, as have none connected, simply press "Next".
- Then the station settings will appear. Click "Continue".

- A new screen as shown in the following picture:

IMPORTANT: Make sure the blades are not placed before performing the following steps.

- Press "Calibrate Radio". The procedure is, move the sticks of the transmitter to extremes in all directions, including 3-position switch to select the flight mode.

- Once done the screen should be something like the following image:

- Press "Click when done" and wait a few seconds until a small sign confirming that the values have been stored.

- Once stored, press "Next". a new tab called "Flight Modes" appears, apply the values set out in the following image:

- Select flight mode 1 "Stabilize".

- Select flight mode 4 "AltHold".
- Select flight mode 6 "Land".

Following is a brief explanation on the flight modes and how they work:

#### Flight mode

- Stabilize: The 'Stabilized' mode allows the vehicle to fly manually, auto leveling levels 'roll' and 'pitch'.
- Altitude hold: constant altitude mode allows the vehicle to maintain a constant altitude, allowing to modify the levels of 'roll', 'pitch' and 'yaw'.
- Loiter: It is a way to loiter, it tries to maintain the position and attitude ( 'roll', 'pitch', 'yaw' and altitude) of the vehicle. Pilots use the 'Loiter' mode like 'manual'.
- RTL Mode: In the 'Back to the launch site (Return To Land)' mode, the vehicle navigates from the current position in which it is to go flying around the area of initial release.
- Auto Mode: In automatic mode, the vehicle follows a previously scheduled flight plan stored in the autopilot which includes both the route such as where to take a picture.
- Acro: The acro mode (aerobatic mode) uses the sticks of the transmitter to control the vehicle turns. If the sticks are released, the vehicle maintains the altitude at which it is located. This mode is useful as its name suggests for aerobatics.
- Sport: The sport mode was designed to fly FPV and recording in difficult areas, since the vehicle can be positioned at an angle and hold it.
- Drift: The mode 'float' allows the user to fly the multicopter like a plane, automatic coordinated times.
- Guided Mode: The guided mode is a feature of APM. The guide wirelessly vehicle to a location using a wireless telemetry module and an application on the ground station.
- Circle Mode: The vehicle will sail in circles on the point of interest, with the front of the vehicle pointing to the center.
- Position Mode: This is a mode similar to 'Loiter' mode but with manual control of the 'throttle' flight. This means that the vehicle maintains the attitude ( 'roll', 'pitch', 'yaw') and the position while allowing the operator to control the 'throttle' manually.
- Land Mode: The object of this mode is the automatic landing on the ground.
- Follow me mode: This mode is designed for the vehicle to follow the movements of the pilot, using telemetry and within a ground station.

Simple and Super Simple Modes: The 'Simple' and 'Super Simple' modes are used in combination with the Stabilize, Sport, Drift and Land modes to allow the pilot to control the movement of the vehicle from their own point of view, regardless of where they set the stand.

- Then press "Next". the "Verify" tab appears as shown in the following image, which will verify that all previous steps have been correctly performed.

- The first verification, "Verify GPS" may not appear in green, does not indicate that the GPS is not running, simply that it is not able to capture enough satellites to locate your position. This occurs when you set the GPS indoors where the GPS signal is severely attenuated.

- The last check "Verify Pre-Arm Test" appear in red, check that the transmitter and APM communicate properly and is able to arm themselves to fly.

IMPORTANT: Make sure the blades are not placed before performing the following steps.

- Connect the transmitter and slide the stick 'Throttle' down and then to the right for 5 seconds.

- If the process is successfully completed, the "Pre-Arm Test Verify" box will change color to green.

- Press "Next". the "Failsafe" tab appears. This set of options protect the vehicle during flight to certain mishaps, such as loss of ground station battery level or below the recommended minimum.

It is important to note that with a battery down the drone will return to the takeoff point, so it can cause problems inside, so we must have the fail safe mode off when we fly indoors

- Press "Next". the "GeoFence Settings" tab appears. This set of options allows you to define a flight zone which the vehicle may not exceed.

It is recommended to turn on outdoor test flights so that aircraft do not leave your virtual frame. It can cause failures in indoor flights, so it is recommended to disable the option in indoor flights.

- Press "Next" and the last tab of the "Wizard" Mission Planner, in which certain pages to read and expand knowledge about APM Mission Planner and recommended appear.

## 5. Checks

Before the first flight, it is advisable to always check certain steps. A series of checks and possible solutions are as follows:

- Check the connection via MAVLink through telemetry is functional, they are received and data is sent. For it is as simple as checking on the home screen in the bottom left of the tabs "Quick" or "state" data are being updated.

If this does not happen:

- Check if the computer recognizes the telemetry device correctly.
- Check that the connection with the APM telemetry is correct and the device is being fed properly.
- Check that the stick 'Throttle' is at the minimum value when the battery is connected and starts the APM.

- Check that the 'Roll', 'Pitch' and 'Yaw' are correctly oriented, that is, the APM revolves representation of the main screen and the controls correctly responds in the right direction.

○ If the orientation of the 'Roll', 'Pitch' and 'Yaw' in their representation does not correspond to what should, must check if the APM incorrectly placed inside the vehicle. If you placed rotated, you can be changed without changing the assembly. For that:

- Access to the "CONFIG / TUNING" tab on the "Full Parameter Tree" option. Within this tab are all data records APM. We must seek "AHRS" family and then choose the "AHRS\_ORIENTATION" parameter taking into account the direction of APM . The most common mistake is to place the APM turned "Yaw 180".

- Press the "Write Params" button so that the changes are made.

- Recheck the main tab apm response is correct.

○ If the APM does not respond in accordance with the instructions that are sent from the station, you have to check first instance that the sticks are not reversed. To do this go to the "INITIAL SETUP" tab to the "mandatory HARDWARE" option and select it "Radio Calibration".

Testing is simple, move the sticks and display the answer.

Example: Move Roll to the right, the screen should display as the green bar Roll call must be filled to the right. Do the same on all sticks all except the pitch. This bar should run inverted to stick to the station, that is, if you move the stick up, the bar must be filled down.

If any of the controls are reversed follow these steps:

- Access the "CONFIG / TUNING" tab on the "Full Parameter Tree" option.

Depending on the channel that has to be inverted must access a different record:

- If the pitch is reversed access the "RC1" family and in the "RC1\_REV" choose the inverted value.

- If the Roll is inverted access the "RC2" family and in the "RC2\_REV" choose the inverted value.

- If the Throttle is inverted access the "RC3" family and in the "RC3\_REV" choose the inverted value.

- If the Yaw is inverted access the "RC4" family and in the "RC4\_REV" choose the inverted value.

- Press the "Write Params" button so that the changes are made.

- Return to the "Radio Calibration" option and check again that everything works correctly after the change.