



Quadrino Nano User Guide

V1.0 - July 2015

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User Manual V1.0 - This version does cover most of the "Quick Start" section but, there will be future improvements for a better user experience. You are welcome to provide us with any feedback that you feel might improve that experience. We will add more information for DIY (do it yourself) people that want to use the Quadrino Nano as a development platform and/or are using their own Arduino code.

Updates will be posted to:

[Lynxmotion UAV/Drone Flight Controller User Guides](#)

Discuss and submit feedback about the Quadrino Nano:

[Lynxmotion Quadrino Nano Forum](#)

1 - Product Description

The Lynxmotion Quadrino Nano was created as a collaboration between FlyingEinstein and Lynxmotion. It was designed to be one of the smallest, most full-featured MultiWii-compatible flight controllers on the market. The board includes many functions normally reserved to much more expensive flight controllers, such as cutting-edge sensors, integrated GPS, easy to use software and a protective case with vibration damping.

The Quadrino is easy to configure using our free [FCT application \("Firmware Configuration Tool"\)](#) which eliminates the need to modify code in the Arduino Development Environment and the WinGUI configurator. This intuitive application will guide you through the entire process of setting up your flight controller while providing lots of documentation on the various options and parameters available. When you are done selecting your options this tool will compile and flash your Quadrino Nano with the custom firmware. It will also install the WinGUI or MultiWiiConf configuration GUI for you.

2 - Quick Start

We named this section "Quick Start" as it will guide you on all the steps required for the setup of your Quadrino Nano flight controller on a Copter. There are many steps and each one is important so please go over them at least once before performing any steps..

2.1 - MultiWii Setup & Load

Load the Quadrino Nano with your choice of Copter options with the FCT (Firmware Configuration Tool). We suggest that you take a look at our [Lynxmotion UAV - Quadrino FCT User Guide](#) which explains the procedure.

2.2 - Frame Mounting

Depending of your frame brand and model, there are a few ways to mount the Quadrino Nano. There is an optional mounting plate available if you would like to move your Quadrino Nano from frame to frame or to obtain a standard 45mm compatible mounting. Regardless of the way you mount the controller, always mount it with the USB/Antenna facing the front of your Copter and place it centered on your frame.

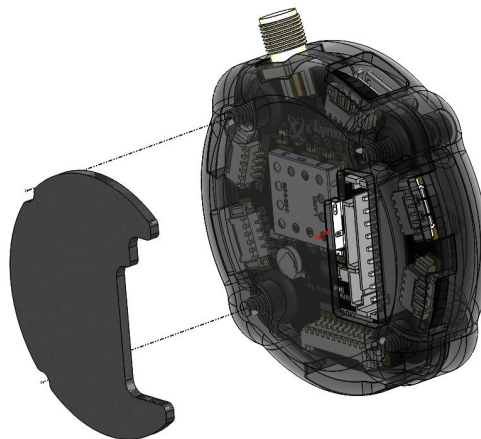


Quadrino Nano - Front View

2.2.1 Double Sided Tape

The preferred way to mount the Quadrino Nano is using the provided double sided foam tape on a flat surface. This option will give it even more vibration insulation and doesn't require opening the casing.

1. Prior to installing the tape, test fit the part to the Quadrino Nano to see where it should be located
2. Remove the backing on the Quadrino Nano side of the foam tape and apply it. Do the same for the other side and apply it to your copter frame.



Quadrino Nano - Double Sided Tape

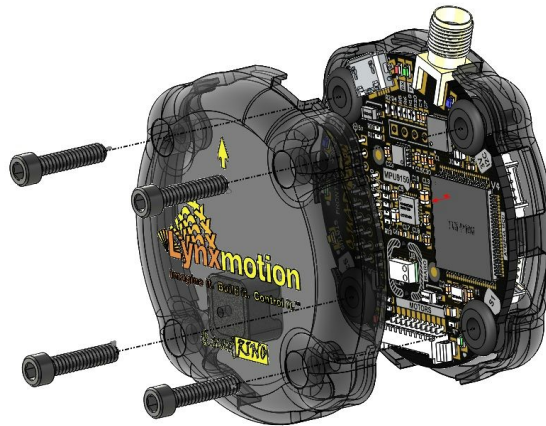
2.2.2 Through Hole

If you have a frame that doesn't allow you to mount the Quadrino Nano on the center using the double sided tape, you can use our through hole hardware provided with a 30.5mm spacing. Precaution must be taken when handling the bare PCB.

Material Needed

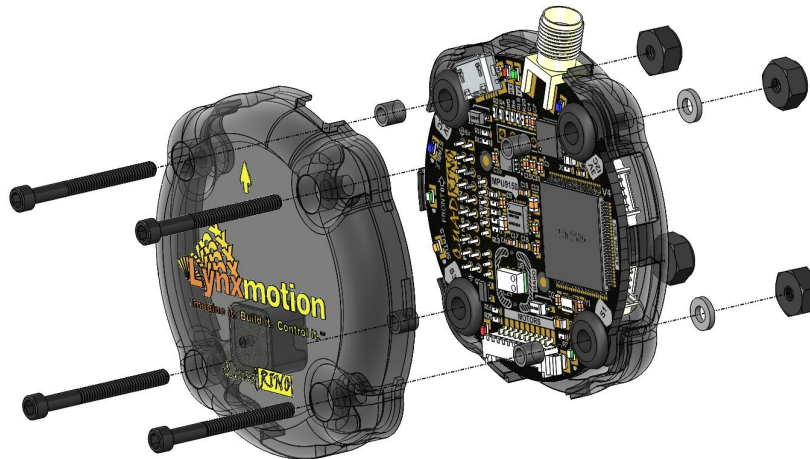
- 4x - 2-56 x $\frac{7}{8}$ " Hex Screw
- 4x - $\frac{1}{8}$ " Nylon Spacer
- 4x - #2 Flat Washer
- 4x - 2-26 Locknut
- 1x - $\frac{3}{32}$ " Hex Key
- 1x - $\frac{5}{64}$ " Hex Key

1. Remove all four 4-40 x $\frac{1}{2}$ " hex screws using the provided $\frac{3}{32}$ " hex key and open the top casing.



Quadrino Nano - 4-40 Hex Screws

2. Insert a nylon spacer in each of the rubber grommets surrounding the Quadrino Nano and close the top casing. At this point you can use the 2-56 screws, washer and locknut to secure it to your frame.



Quadrino Nano - 2-56 Hex Screws

Note: Do not overtorque the screws as it might lead to a broken top casing.

2.3 - Electrical Connections

A few mandatory connections need to be performed in order to get a fully working Quadrino Nano flight controller.

2.3.1 - GPS Antenna

The provided GPS antenna needs to be connected to the front SMA connector. Be sure to properly insert the thread all the way down and don't apply too much torque.

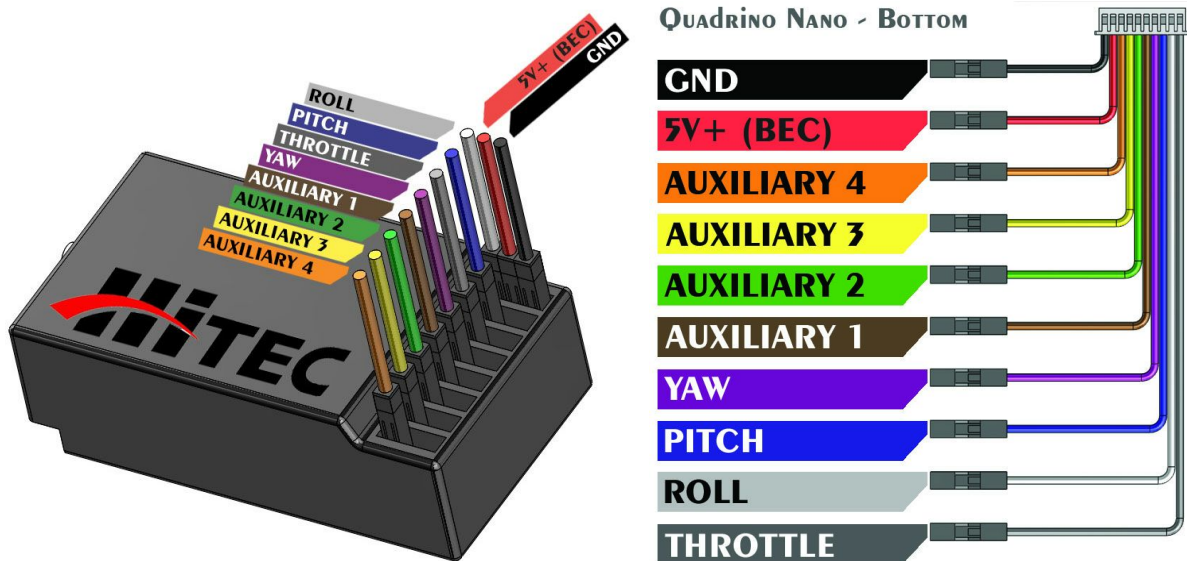
2.3.2 - Receiver

Each RC radio control manufacturer implements their own channel assignment for their receivers, you must therefore refer to your transmitter's setup in order to know which channels are assigned to which functions. The labeling here should help you find the right wiring sequence. The Quadrino's receiver wiring harness includes individual connections so as to be compatible with any RC transmitter / receiver.

The assignments are defined from your transmitter itself, not MultiWii, and are often configurable through your transmitter's menu (if it has an LCD).

Shown here are the default settings for the Hitec brand:

- CH1 - Ailerons / Roll
- CH2 - Elevator / Pitch
- CH3 - Throttle
- CH4 - Rudder / Yaw
- CH5... Other channels, if available, are set by the transmitter for Auxiliary

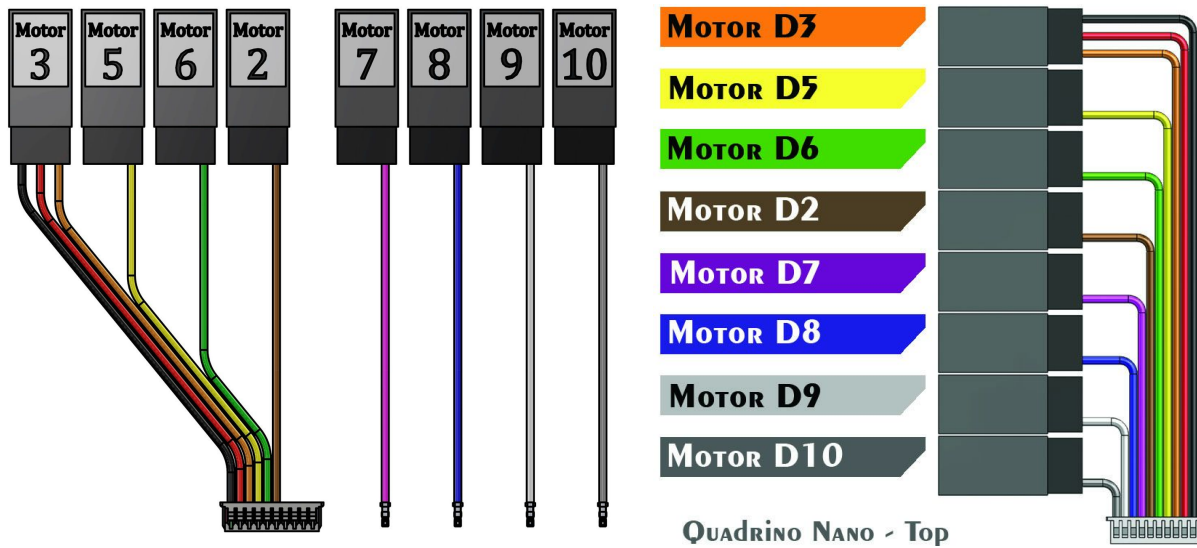


Quadrino Nano - Receiver Wiring Harness

2.3.3 - Motor Controller (ESC)

Each of the ESCs need to be connected to the Quadrino Nano. One of the ESCs will power the flight controller with its internal voltage regulator (BEC), which is why only one of the ESCs' connectors has all three wires (GND / +5V / Signal) and the other ones only have the signal wire. Use the [2.3.4 - Types & PinOut](#) to know how to connect each of your ESC's corresponding to your copter type.

Note: Cables 7, 8, 9 and 10 are not inserted in the wiring harness because most people use a Quadcopter configuration. Simply insert more as needed into the connector for Hexacopter and Octocopter multirotors.

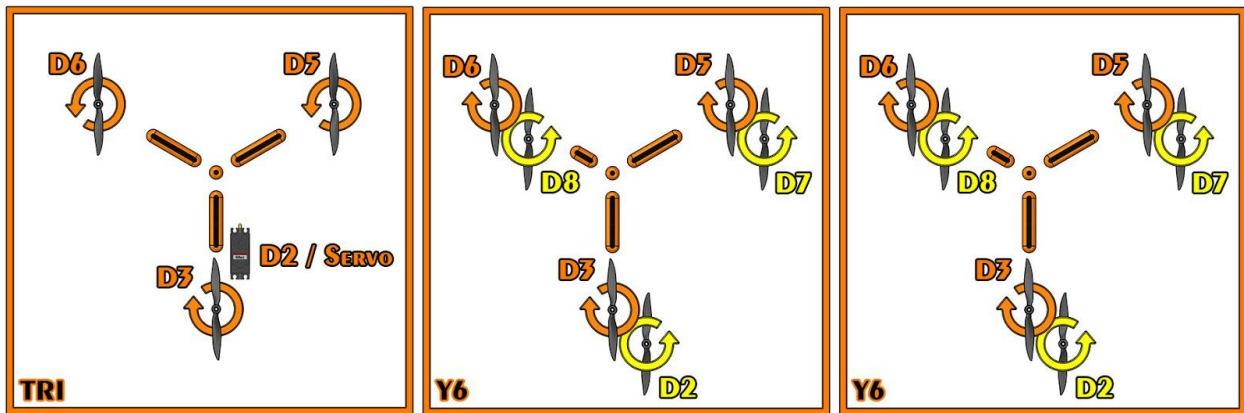


Quadrino Nano - Motor Wiring Harness

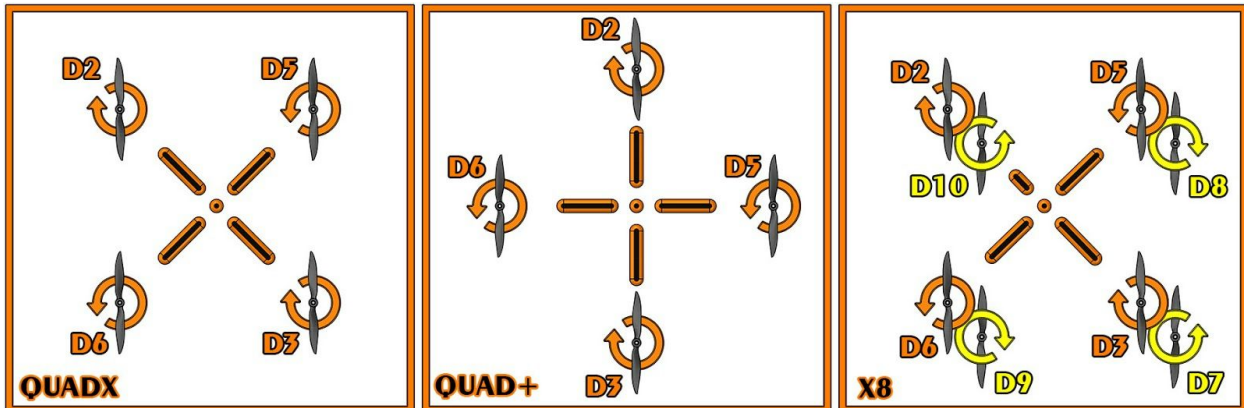
2.3.5 - Types & PinOut

Here are all the MultiWii supported copter types and their corresponding PinOut connection for an ATmega 2560 based flight controller like the Quadrino Nano. The numbers give you where to connect the corresponding ESC and the rotation is given by the arrow. All Orange arrows show the top motors and Yellow the bottom ones.

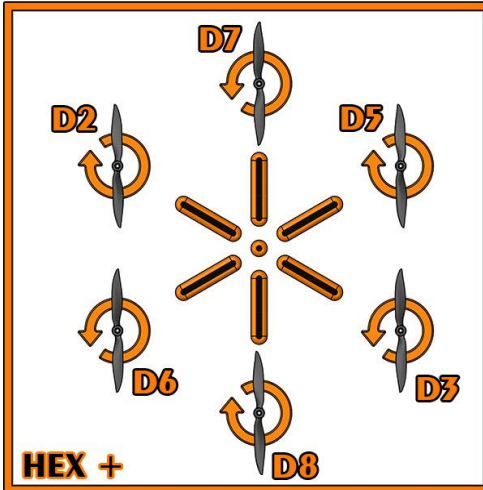
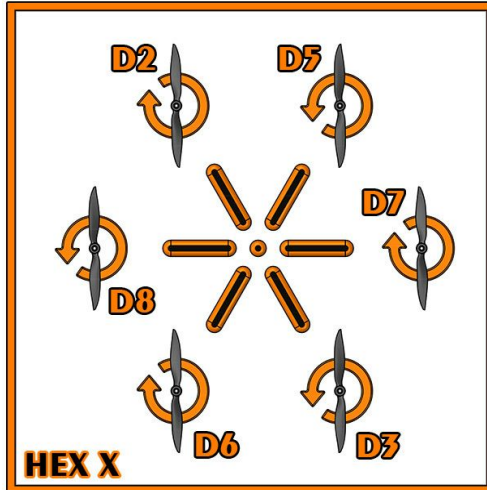
Note: This is a different PinOut than a ATmega 328P based controller



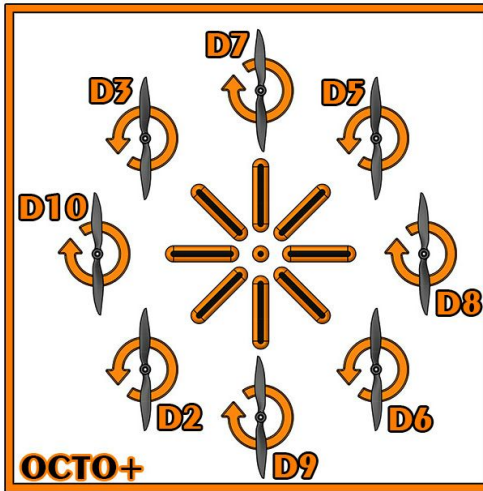
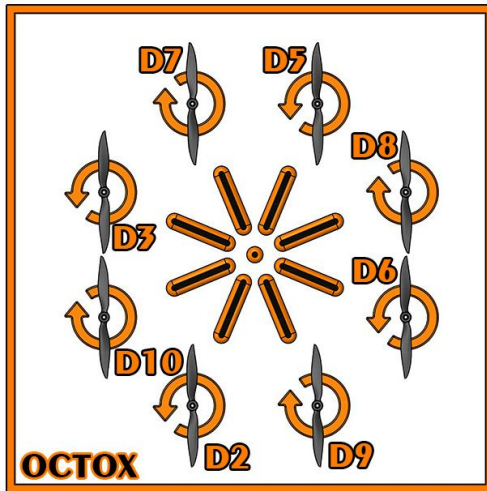
MultiWii - Tricopter Connections



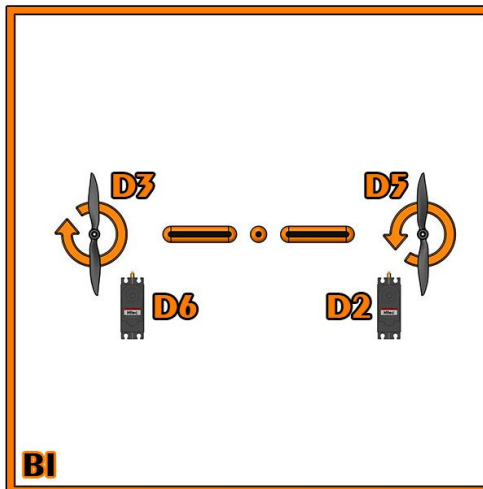
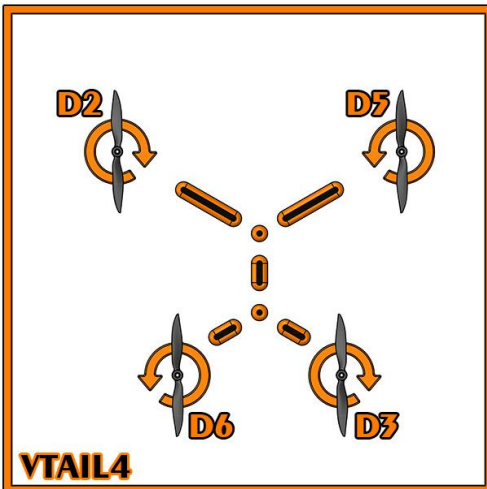
MultiWii - Quadcopter Connections



MultiWii - Hexacopter Connections



MultiWii - Octocopter Connections



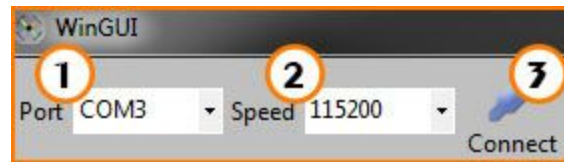
MultiWii - Others Connections

2.5 - WinGUI

WinGUI settings and tests need to be performed in order to get the best out of your Quadrino Nano flight controller.

2.5.1 - Serial Connection

A serial connection between the Quadrino Nano and WinGUI need to be initiated. They will share information and allow for setting up all the needed options. Before starting WinGUI, make sure the Quadrino is connected with it's USB cable unless the COM port will not be available in the drop-down menu.



WinGUI Serial Connection

1. Select the COM port in the drop-down menu. This should be the same COM number that the FCT used for your Quadrino earlier.
2. If you have setup a different baud rate speed in the FCT, you can set the same here unless the default is 115200.
3. Click on the "Connect" button. This should start the connection and the Red and Green LED right next to the USB cable (on a Quadrino Nano) should start blinking rapidly.

2.5.2 - Sensors Calibration

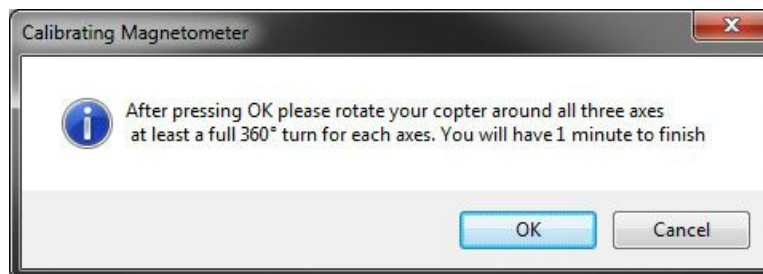
Two sensors need to be calibrated before being able to use your Quadrino Nano. The Accelerometer (ACC) and compass (MAG). Both have a button on the "Flight Deck" page to start the calibration.

1. ACC: Make sure your Copter is sitting on a flat and level surface (important) prior to clicking "Calibrate ACC"



ACC Calibration using the WinGUI application

2. MAG: Once the MAG calibration is started, you have 1 minute to turn your copter in each rotation axis full 360deg.

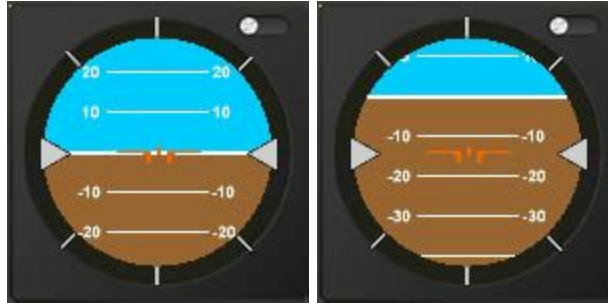


MAG Calibration using the WinGUI application

2.5.1 - Sensors Orientation

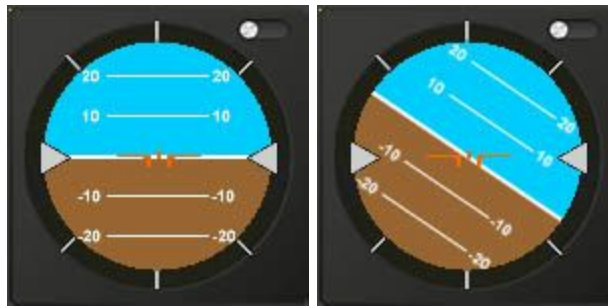
With the "Flight Deck" tab opened, use the various dials to verify the sensor's orientation as well as the installation of the Quadrino Nano on your copter frame.

1. Pitch forward: The Horizon brown portion will get bigger and blue smaller



WinGUI Horizon Pitch Forward

2. Turn on it's Left: The Horizon line will turn to the left.



WinGUI Horizon Turn Left

PEOPLE OFTEN CONFUSE THIS ATTITUDE INDICATOR AS BEING "REVERSED". THE KEY TO REMEMBER IS THE BROWN AREA IS THE GROUND AND THUS A LEFT BANK WILL CAUSE THE HORIZON TO SHIFT AS SHOWN HERE

3. CW Rotation: Making a clockwise rotation will make the compass turn clockwise

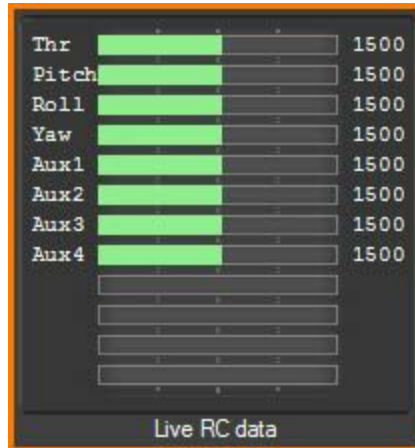


WinGUI Compass Clockwise

2.5.2 - Receiver & End Points

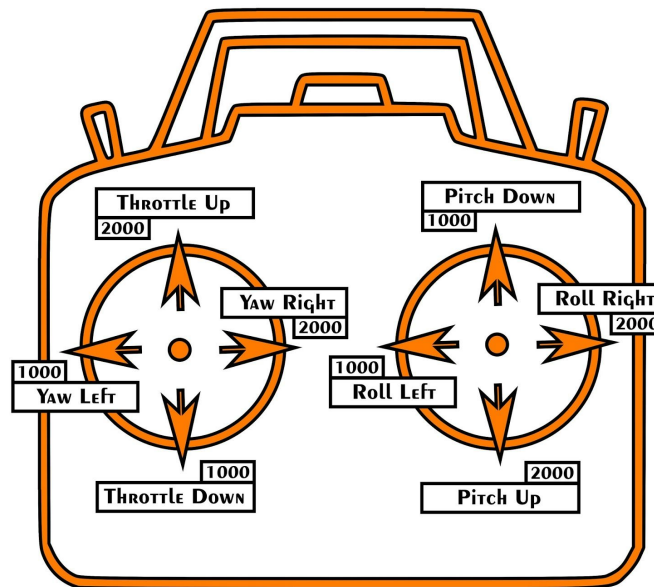
You have a live view of what the Quadrino Nano reads from your R/C receiver. Still in the “Flight Deck” tab, look at the Receiver information at the top right. You should be able to make the signals move on each of the connections.

Note: The Receiver, if the Quadrino Nano is properly wired, can be powered by the USB cable.



WinGUI Receiver Live-View

- Channels may need to be reversed in your Transmitter to obtain the proper behavior. The exact value (1000 / 2000) will be calibrated in the next step. If the value, for example, is more toward 2000 when it should be around 1000 than you need to reverse that channel direction in your Transmitter.



MultiWii Transmitter & Receiver Signals Values

- In most transmitter, you will need to extend the End Points for each channels up to 120/125% and for each direction. You need to extend it until you reach 1000 to 2000 on each of them in WinGUI.

2.5.3 - ESC Calibration:

In a multirotor UAV, each motor is connected to its own electronic speed controller (“ESC”), which is then connected to the flight controller. The ESCs do not “know” the range of values which they will receive from the controller as each controller is different. Calibrating the ESCs provides new min / max throttle values and will also ensure that all motors start simultaneously.

1. Connect one of the motors to one of the ESCs (it doesn't matter if you connect the motor in clockwise or counter-clockwise mode)
2. Connect the ESC's RC cables to your receiver's throttle channel.
3. Turn ON your transmitter and push your throttle stick to the highest (max) position.
4. Connect the battery to your ESC's power input
5. You will hear 3 beeps coming from the motor (confirming max position has been set), then wait 1s for a short beep to indicate it's now waiting for min value.
6. Immediately lower the throttle stick to the minimum position
7. You will hear 2 beeps that confirm the minimum value has been set
8. If you hear a long beep, it means the minimum throttle value has been set. If not, you will need to start the procedure again from step 2
9. Disconnect the receiver and the battery from the ESC
10. Set aside that motor + ESC combination
11. Repeat steps 2 to 11 for each ESC + motor

2.5.4 - Arming Test

Perform an ARM test but, make sure you have your propellers REMOVED before doing it. This can be dangerous if they start turning. To ARM a MultiWii flight controller you need to:

- Have the Accelerometer calibrated
- Be on a level surface (status LED will flash if you're not)
- Have the End Points set right
- Use the right “Stick Commands”



MultiWii Arming Stick Commands

Note: At this stage you should always perform tests with the propellers REMOVED.

2.5.5 - Flight Modes

If your transmitter has more than four channels, the RC Control Settings tab gives you control over which auxiliary channels on your transmitter controls which flight modes. Notice how multiple boxes can be selected. This approach gives the most options possible, though be sure not to have conflicting information / settings.

- Green boxes mean the field is selected
- No border means that the fields are being read from the board (already written)
- Orange border indicates that the field was changed but not written to the board

Auxiliary channels are associated with two or three-way switches or potentiometer inputs from your Transmitter.

- L: Low, corresponding to a signal of 500 (switch down, or knob fully counterclockwise)
- M: Medium, corresponds to 1500 (center position of a three-way switch, or mid-rotation on a knob. Does not apply to or work on a 2-way auxiliary switch)
- H: High, corresponds to 2500 (switch up or knob fully clockwise).

To set the flight mode, you need to check the box according to the High - Mid - Low state of your auxiliary switch that you want the Mode to be activated. You need to click "Write Settings" after making changes for them to be loaded into your Quadrino Nano.

Here is an example setting modes with the AUX1 channel:

- ACRO - When the AUX1 is LOW (1000); when nothing is selected, the mode is ACRO
- ANGLE - When the AUX1 is in MID (1500)
- HORIZON - When the AUX1 in HIGH (2000)



Flight Modes Example using the WinGUI application

More information about MultiWii flight modes, as well as which sensors are used, can be found here:
<http://www.multiwii.com/wiki/?title=Flightmodes>

MultiWii Flight Modes Explanation:

- ACRO (Default mode and not in list): Made for Acrobatic flight and is the default setting (uses gyro only) This is the default mode when the HORIZON or ANGLE mode are not activated and is more “acrobatic” flight
- ARM: Arming is a safety feature which is required in order for the motors to start spinning (at below takeoff speed) or stop spinning (after landing). If no aux channel is assigned, you arm the motors by positioning the left joystick to the bottom right, and the right joystick to the bottom left (at the same time)
- HORIZON: This keeps the roll of the UAV level and is a mixture of ACRO and ANGLE modes. Stable with slow RC commands / acrobatics with fast RC commands. Will be in ANGLE MODE mode when PITCH / ROLL sticks are centered and in ACRO MODE mode when full PITCH or ROLL sticks are applied, allowing flips.
- ANGLE: A stable mode (when the PID values are adjusted correctly and Gyro and ACC are calibrated and trimmed). It will try to keep the model level to the ground. **Note: According to MultiWii developers, ANGLE MODE is virtually obsolete. HORIZON MODE is preferable in most cases.**
- BARO: The barometer is used in order to keep a certain (fixed) height when no other commands from the RC transmitter are received. If you activate BARO (ALT HOLD) and the GPS modes, they will use the same calculated altitude.
- MAG: UAV will keep pointing in the same direction (compass / yaw) until there is yaw input from the transmitter. Can be activated in all flight stabilization modes. Without this mode, you will still have slight deviation (like a tail gyro in heli). Compared to no MAG, this mode offers a drift free tail
- GPS HOME: Activates return to home (RTH) feature. Requires GPS lock before takeoff. Uses compass and GPS for the purpose of returning home to the starting point. Stabilisation is done in accordance with the flight mode (ANGLE / HORIZON). GPS altitude is not accurate and therefore not usable for holding the height.
- GPS HOLD: Hold current position using GPS and baro (if available). GPS modes can be activated in ANGLE or HORIZON flight modes. will be ignored if there is no GPS lock at time of arming. are generally used along with ALT HOLD, but this is not mandatory. The mag sensor is mandatory for GPS control, but MAG mode is not. Activation of MAG MODE has no effect in GPS MODE. GPS altitude is never used in a control loop (only for display).
- BEEPER: Not really a flight mode; if you have a beeper connected, useful for lost UAVs

Flight Mode Sensor Summary

Mode	Gyroscope	Accelerometer	Barometer	Compass (Mag)	GPS
ACRO / Gyro Only	- X -				
ANGLE (Stable/Level/Acc)	- X -	- X -			
HORIZON	- X -	- X -			
BARO (Altitude Hold)	- X -	- X -	- X -		
MAG (Heading Hold)	- X -	- X -		- X -	
HEADFREE (CareFree)	- X -	- X -		- X -	
GPS Return to Home	- X -	- X -		- X -	- X -
GPS Waypoint	- X -	- X -		- X -	- X -
GPS Position Hold	- X -	- X -		- X -	- X -
Failsafe	- X -				

Flight modes showing sensors required (X = Required Hardware for the Mode)

2.6 - Pre-Flight Check

Now that you have your copter ready to fly you need to do a proper pre-flight check. This means starting up the motors at the lowest power level and performing some basic checks. It may be best to do these checks on your floor with the propellers off. (Setup in WinGUI need to be done prior to proceed with those checks)

2.6.1 - Pre-Flight Steps

1. All motors must start and stop at the same time as you move the throttle to power-up or power-down. If any motors start late or stop early, then you must increment the MINTHROTTLE value in the Quadrino Firmware Tool (Copter Page) and reflash your firmware.
2. At the lowest power output, moving the roll or pitch stick the motors should respond but never should any of them spin-down or sputter. If so, see MINTHROTTLE above.
3. With the propellers on but still at a very low power output, perform more roll and pitch stick movements and confirm the copter attempts to turn accordingly. This is best done on some grass for visual confirmation. If the copter doesn't respond as you expect, you probably have motors connected in the wrong order. By the way, if you are coming from another board such as the KK, the numbering and lettering of the motors may not correspond.

2.6.2 - Basic MultiWii Stick Commands

In order to "Arm" a MultiWii board you need to have the Accelerometer calibrated and being on a Level surface. The stick commands for doing that are as follow:

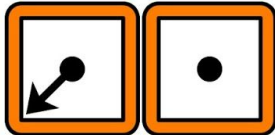
To ARM
LEFT STICK Low RIGHT



Gyro Calibration
LEFT STICK Low LEFT - RIGHT STICK Low CENTER



To DISARM
LEFT STICK - THROTTLE Low & Yaw RIGHT



ACC Calibration
LEFT STICK High LEFT - RIGHT STICK Low CENTER

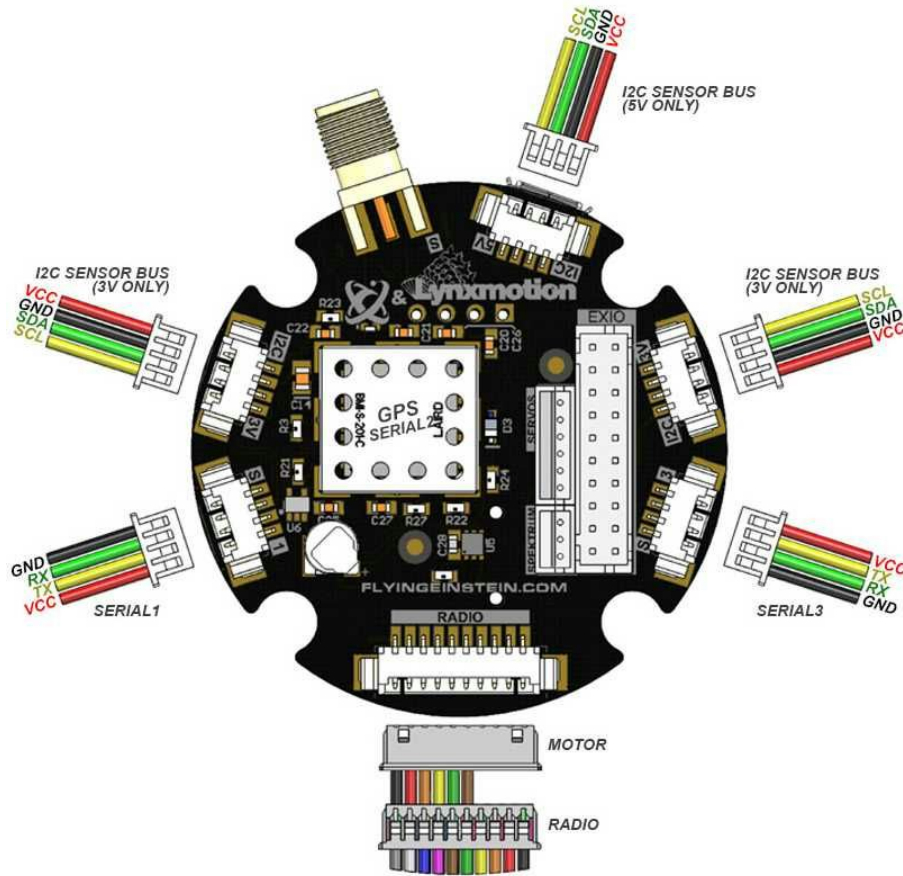


MAG Calibration
LEFT STICK High RIGHT - RIGHT STICK Low CENTER

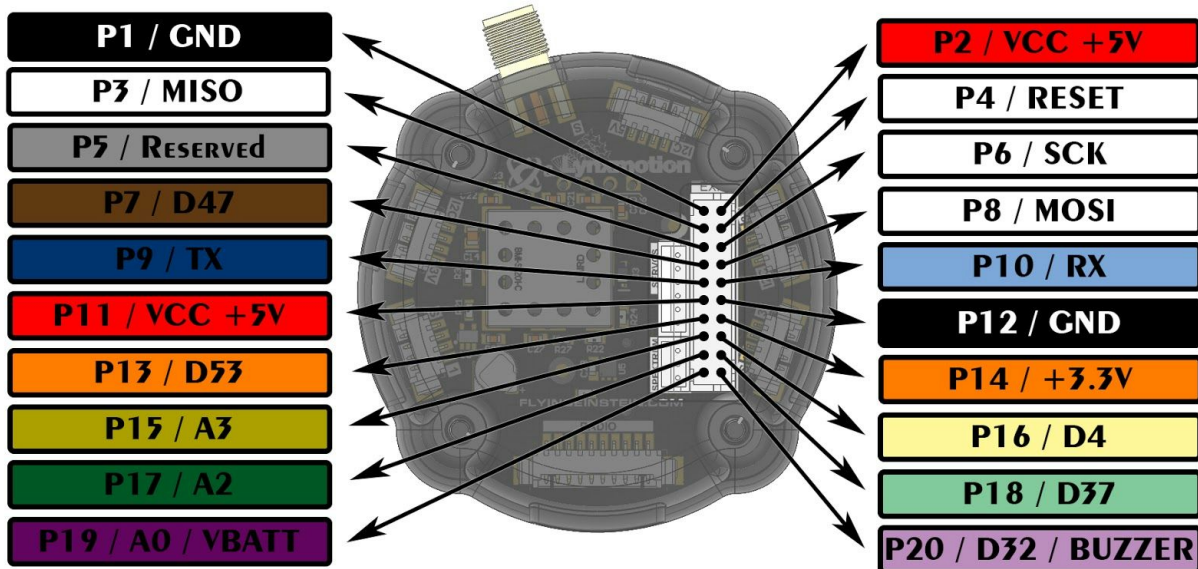


MultiWii Basic Stick Commands

3 - Ports Pinouts



Quadrino Nano - I2C & UART Pinout



Quadrino Nano - 20 Pins IO Pinout