Quadrino Nano - FCT User Guide

V1.0 May 2015

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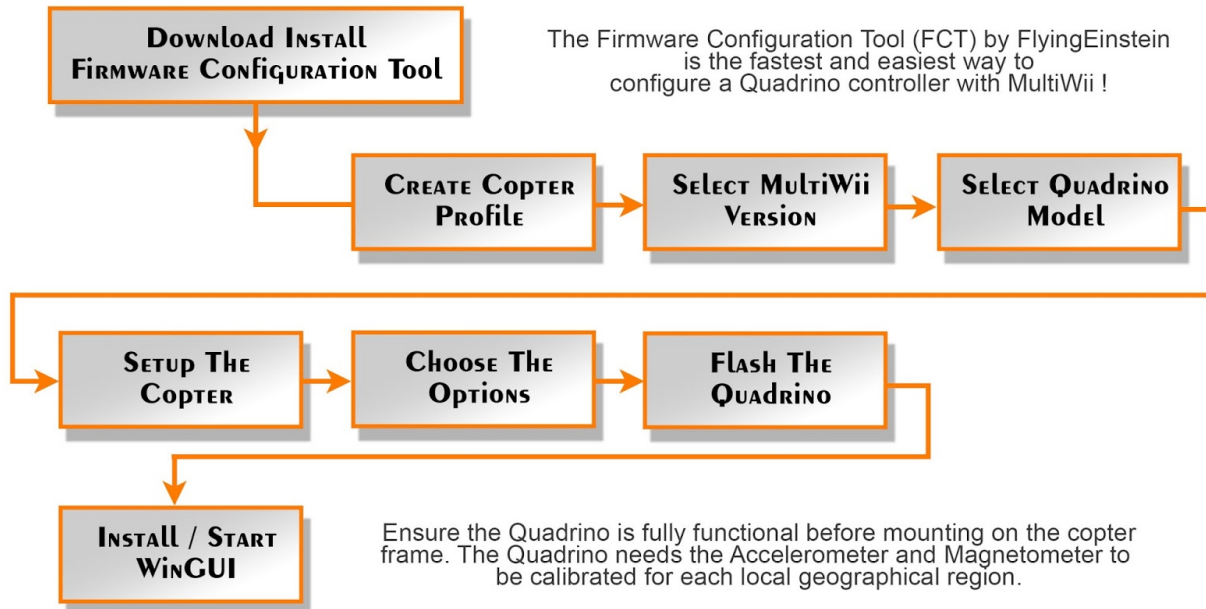
1 - Firmware Configuration Tool (FCT)

The Firmware Configuration Tool was developed for the Quadrino series of flight controllers. It allows users to easily set up MultiWii files prior to loading them to the flight controller board. This procedure is usually done by manually editing code in the Arduino IDE which can be very difficult and complicated for anyone who is not a programmer, or familiar with Arduino coding. By eliminating those steps we can bring the great MultiWii code to anyone.

2 - Quick Start

This quick start will help you go over the critical steps to get your Quadrino up and running. If you ever need more information about one of the steps simply look at the matching section of the manual.

1. Download Install Firmware Configuration Tool:
    Firmware Configuration Tool (FCT)
    Note: Windows and/or Anti-Virus programs might block the installation. Just acknowledge to install, it's virus and spyware free.
2. Create Copter Profile:
    Create your copter Profile to allow for multiple copter setup to be saved and recalled when needed. All the options will be saved under that profile.
3. Select MultiWii Version:
    Select the latest MultiWii version unless you have good reasons to use an older one.
4. Select Quadrino Model:
    Since we support the older models of Quadrino, you need to select the version you are using.
5. Setup The Copter:
    In the Copter page adjust the values to match your copter mode and flight style. This will generate the PID values and load them to the board after the Flashing process.
6. Choose The Options:
    Choose the additional options needed for your particular application.
7. Flash the Quadrino:
    Flash the firmware to the Quadrino. By hitting the FLASH FIRMWARE button, your options will be compiled and uploaded to the Quadrino.
8. Install / Start WinGUI:
    Install and Start the WinGUI software to continue the board setup. (MultiWiiConf is still available to install and use but not supported by Lynxmotion)
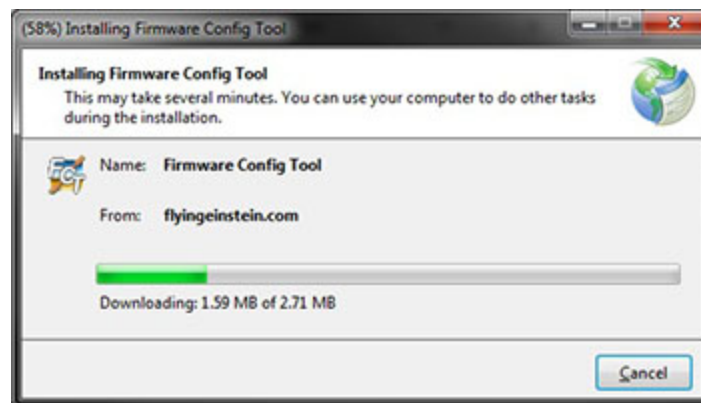
3 - Installing the FCT software

1. Download the "setup.exe" file to install the FCT: Install Quadrino Firmware Configuration Tool
2. Once the file is downloaded, you can start the installer "setup.exe". Windows will ask you to confirm the installation from an "Unknown Publisher" so to continue click "Run", followed by "Install".
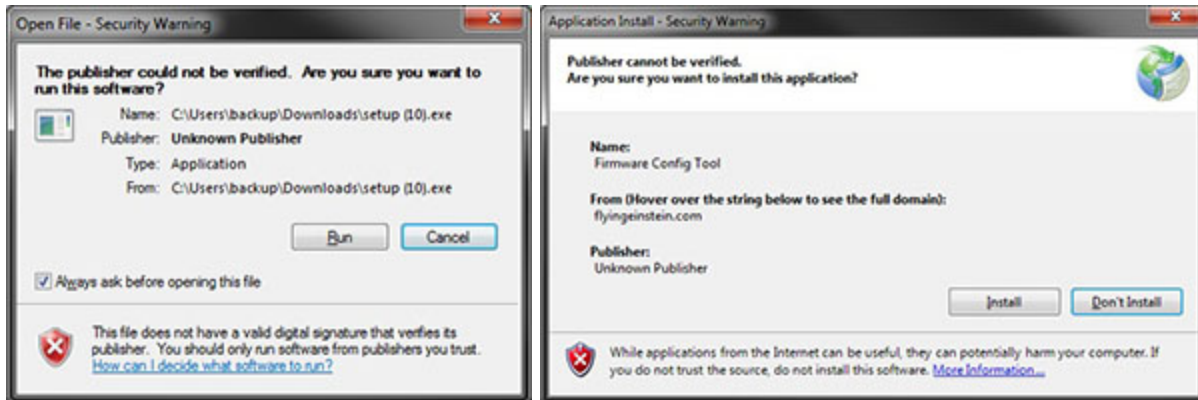
Note: These warnings are different between versions of Windows

3. The application will download the latest version of the FCT software and install it. There will be a verification of the version each time the software will start and you will get a notification to update if there is a newer version available.

FCT - Downloading the latest version available

4. The FCT application will automatically start at the end of the installation.

4 - Using the FCT Software

4.1 - Navigation

Inside the FCT application, you have more than one way to navigate between the different configuration screens.

The top navigation icons are essentially "shortcuts" between sections. There is also a drop-down menu for the Options page which doesn't include all the options pages, only the main ones. We only suggest using these top navigation icons once you have become familiar with the FCT software.

FCT - Top Navigation Bar
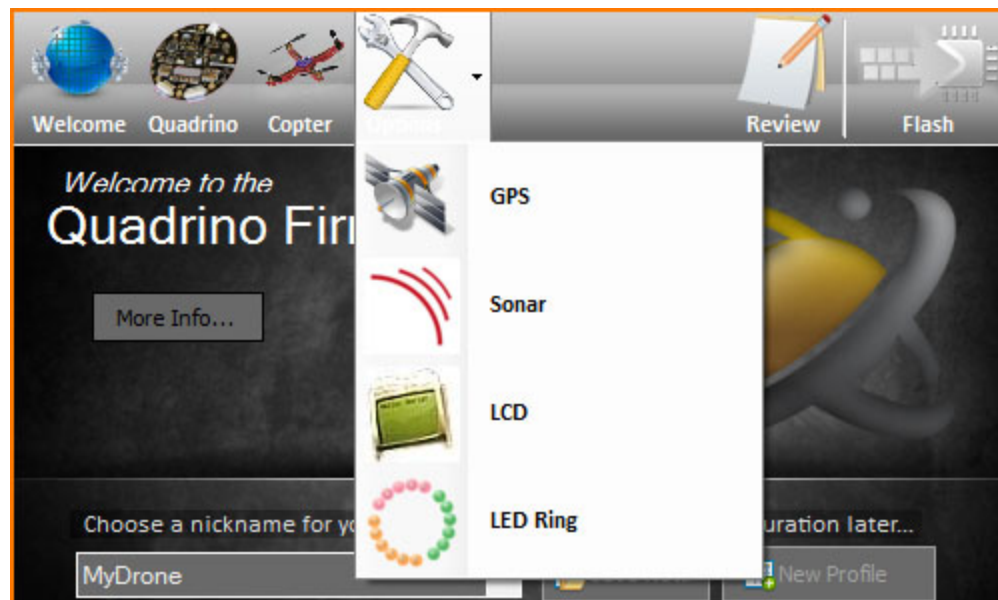

FCT - Option Drop-Down Menu

The bottom navigation uses buttons to move from one page to another in their normal sequence and is the suggested way for new users as it will get you to all the pages one by one in the right order. This guide is also laid out following the bottom navigation sequence.


FCT - Bottom Navigation Bar

4.2 - Welcome Screen

The first step is to select a name for your "Profile" since you could have multiple Drones and/or Quadrino flight controllers. All of the settings selected in subsequent steps will be saved to that profile. A record of previous profiles / setups is available in the FCT installation folder.
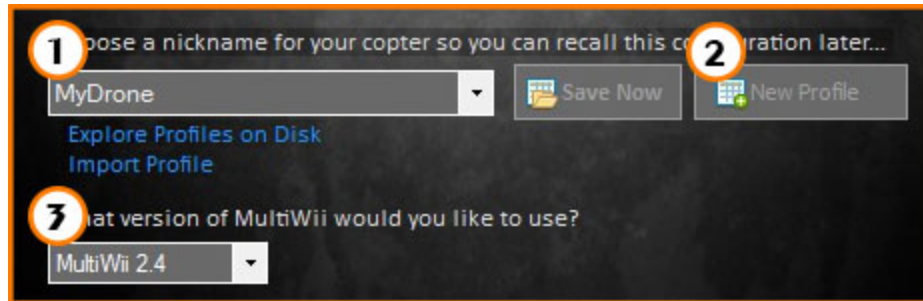
FCT - Welcome Screen

1. **Select Existing Profile:** Used to save or select a previous drone profile based on the profile name.
2. **Create New Profile:** Opens a new window where you can enter the name of your new profile. All the values for that profile will be set to default.
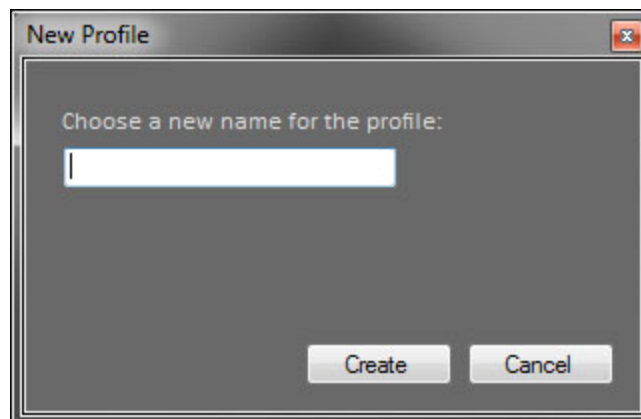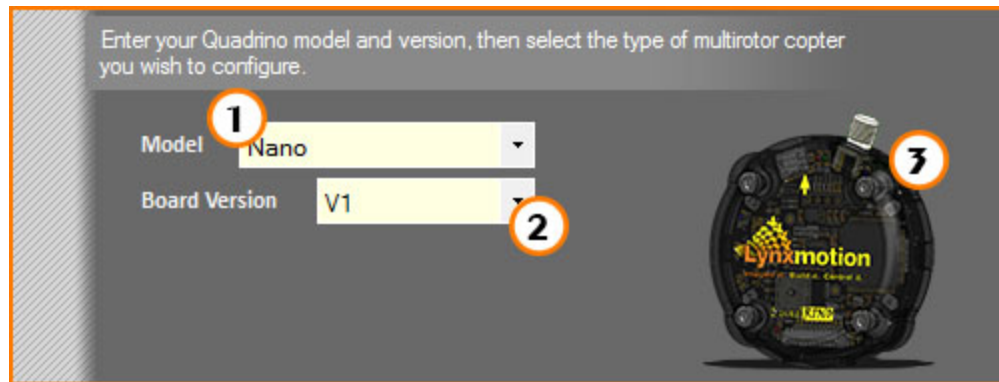

FCT - New Profile Screen

3. **MultiWii Version:** Normally one will use the latest version available unless there are known issues in the setup or you want to use / need a previous version.
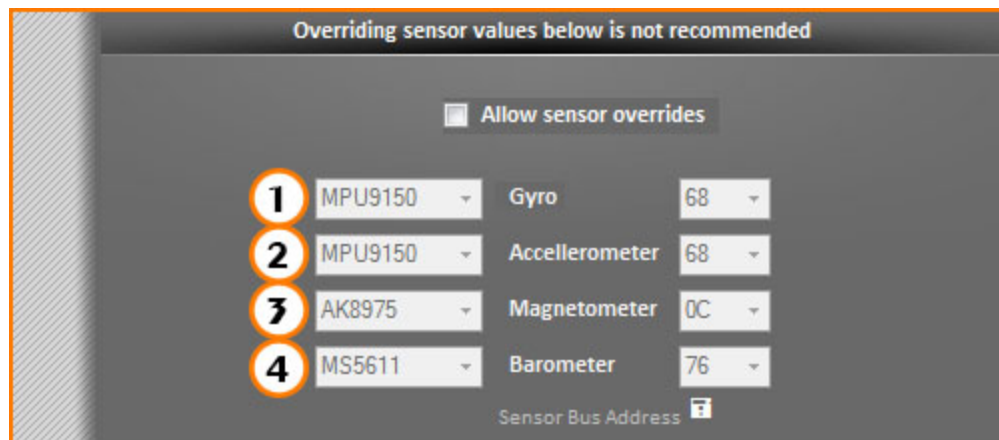
4.3 - Quadrino Board

The sensors present on each board change between versions as well as their orientation.

FCT - Quadrino Board

1. **Model:** Model of Quadrino you want to setup (Nano is the latest board).
2. **Board Version:** Version of the board (If applicable)
3. Image showing the flight controller selected for verification
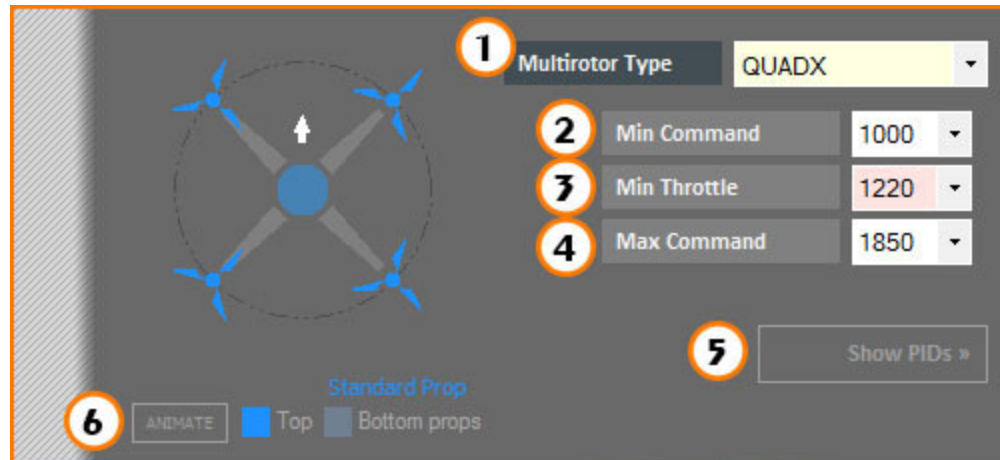

FCT - Quadrino I2C Address

If you are an advanced user and need to change the sensor present on the board and its address (I2C) you can do this once you check the "Allow sensor overrides" box. This is not recommended for most users and is greyed out by default.

1. Gyroscope (GYRO)
2. Accelerometer (ACC)
3. Magnetometer (MAG / COMPASS)
4. Barometer (BARO / PRESSURE)

4.4 - Copter Type

FCT - Copter Type

1. **Multirotor Type**: The drop down menu shows all compatible MultiWii types currently supported by the FCT. Choosing the type will change the image on the left. Mouse over the image and you will get an animation showing the direction which the propellers should be rotating as well as the pinout to the Quadrino. White arrow indicates the forward direction.
2. **Min Command**: Value sent to the ESCs when the copter is not armed. ESCs require a signal to initialize and some brands of ESCs need a different value than the default 1000us.
3. **Min Throttle**: Signal sent to the ESCs when you arm the copter. Depending on brand and calibration, this value might need to be tuned so the motors turn at a slow speed (below takeoff speed). *THIS VALUE MUST BE DETERMINED CORRECTLY* to maintain proper flight *at all times*! Yet it cannot be determined by the controller and must be determined by you.
4. **Max Command**: Maximum signal to be sent to the ESCs (corresponds to max throttle).
5. **Show PIDs**: This opens a PID editor, the values of which are automatically generated in the flight characteristic settings. Manually changing these values are not normally needed and the FCT will warn you after you "Flashed" your board to load the PID settings. If you are an advanced user, you can use that window to manually change them.
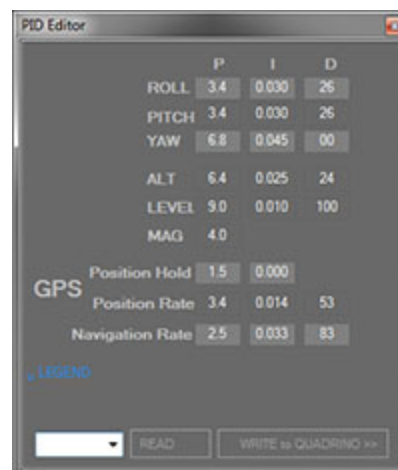
FCT - PID Editor Screen
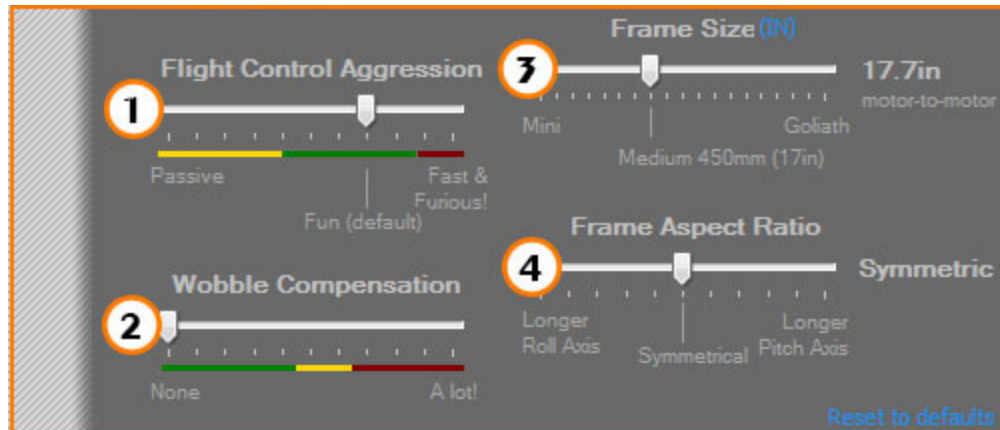
FCT - Copter Specification

The flight characteristic settings in this section are used to generate the PID values. PID generation uses the copter style and physical measurements as well as the desired level of stability. For first time users it's not necessary that these be really accurate, which is why the sliders do not provide values. The image at the top left will change, and you can use it as a visual reference.

1. **Flight Control Aggression:** This will affect how aggressively your Copter will react to your inputs. It controls the overall gain of the control system PID response. FPV pilots would likely lower this some and acrobatic pilots would increase it but we recommend changing in small increments.
2. **Wobble Compensation:** If you experience some "wobble" from your copter during maneuvers, this will often solve the issue.
3. **Frame Size:** Distance between motors. This value is based on a circle that would reach each motor center.
4. **Frame Aspect Ratio:** Some frames are wider than they are long, or vice versa. Often done to keep the landing gear or arms out of view in FPV or camera setups. Using the same PIDs for both roll and pitch in this case makes one axis perform better or at least different than the other. If you happen to have one of these frames you can adjust the ratio of PIDs between the roll and pitch axis. Change the ratio slider until the graphic roughly matches your frame. Rough estimate by eye-balling it is enough.

Note: You can always click the "Reset to defaults" to bring back the original values.

4.5 - Additional Options

The additional flight options are all on one page but there are multiple "tabs" where you can configure various settings. These are for specific needs and give you control over different options already supported by MultiWii.

4.5.1 - Flight
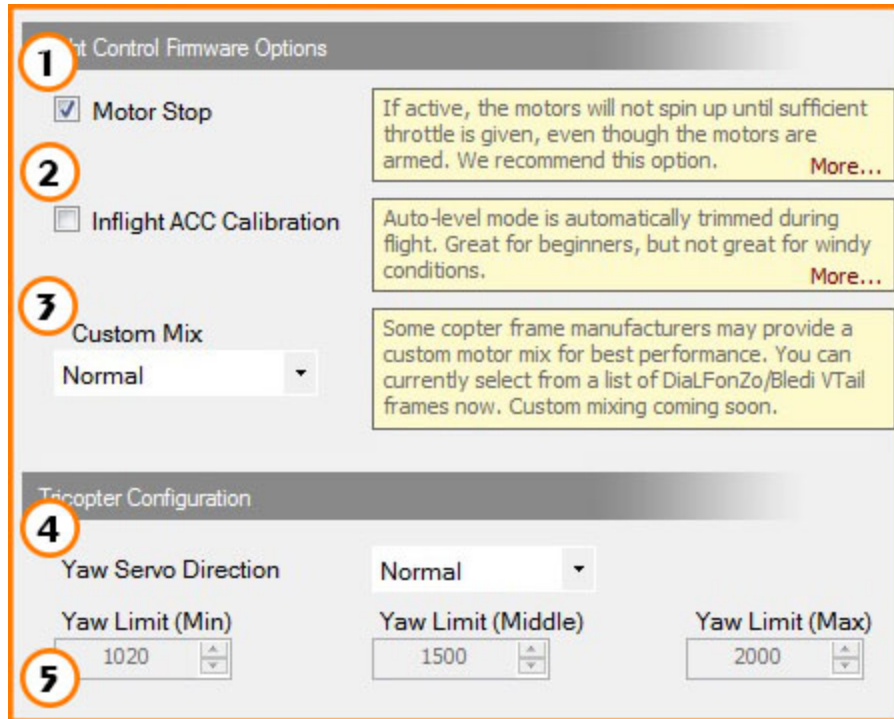
FCT - Flight Options

1. **Motor Stop:** If active, the motors will not spin up until sufficient throttle is given, even though the motors are armed.
2. **Inflight ACC Calibration:** Auto-Level mode is automatically trimmed during flight. Great for beginners, but not great for windy conditions.
3. **Custom Mix:** This is reserved for VTail application at the moment. It will load different mixing map than the standard VTAIL4 that's been proven on Lynxmotion VTail's platforms. (KipKool suggested)
4. **Yaw Servo Direction:** give you the option to change the direction of the Yaw servo when doing a Tricopter.
5. **Yaw Servo settings:** Used for Tricopter. Will adjust the Minimum / Middle / Maximum signal sent to the servo.

4.5.2 - Peripherals
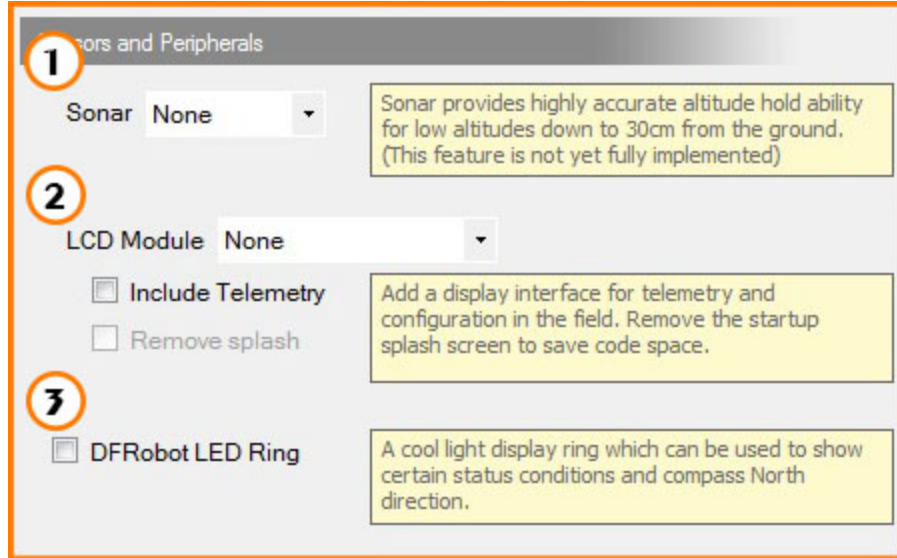
FCT - Peripherals Options

1. **Sonar:** MultiWii can work with some pre-configured sonar systems. At the moment there are no vertical stabilisation code behind but the values can be used and will be displayed in the GUI.
2. **LCD Module:** Add a display interface for telemetry and configuration on the field. Remove the startup splash screen to save code space.
3. **DFRobot LED Ring:** A cool light display ring which can be used to show certain status conditions and compass North direction. The DFRobot Rainbow LED Ring can be found at RobotShop.

4.5.3 - GPS

FCT - GPS Options

1. **GPS module:** Selection of the right GPS module for you Quadrino.
    a. NotPresent: GPS not activated in MultiWii
    b. QuadrinoNanoWithGPS: Quadrino Nano internal GPS
    c. QuadrinoGPS: Original Quadrino with the FlyingEinstein GPS
2. **Serial Port:** If using an external GPS, you can change the serial port to which it's connected.
3. **Baud Rate:** Serial speed at which the GPS will talk to the Quadrino.
4. **Magnetic Declination:** Needed for your particular position.
5. **Options:**
    a. Warn user that there are at least 5 satellites locked
    b. If selected, the HOME position won't be reset after each ARM of the Quadrino.
    c. If selected it will allow for Waypoints navigation with the Quadrino.
6. **Navigation:**
    a. NAV Controls Heading: If checked, the copter will turn to face the direction of travel during navigation. Otherwise, the copter will simply bank in the required direction of travel. This does not affect position hold operation.
    b. NAV Returns Tail First: If checked along with "NAV Controls Heading", the copter will return home with the tail of the copter facing you (assuming you are at the home position). Otherwise, the copter will return with the front facing you. *If, like a beginner pilot, you have difficulty flying with the copter facing towards you (so called "nose in"), then you should definitely have this checked!*
    c. NAV Restores Takeoff Heading: Once the copter returns to the home position it will yaw until the copter is facing in the same direction as it did during take-off.

4.5.4 - Filters
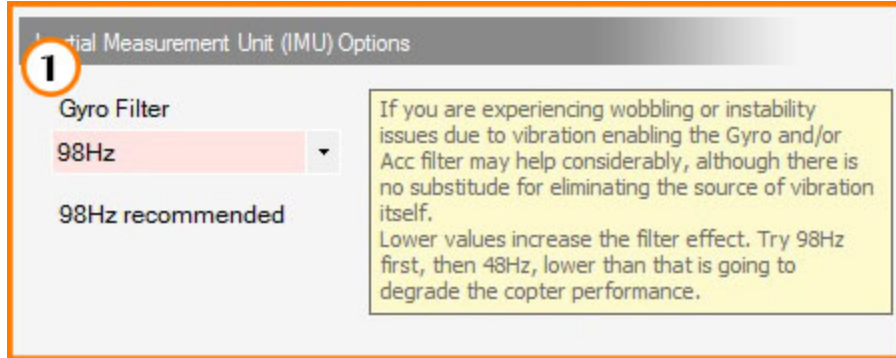
FCT - Filter Options

1. If you are experiencing wobbling or instability issues due to vibration, enabling the filter may help considerably. Although there is no substitute for eliminating the source of vibration itself. Lower values increase the filter effect. Try 98Hz first, than 48Hz, lower than that is going to degrade the copter performance.

4.5.6 - Failsafe

FCT - FailSafe Options

1. **Enable Fail-safe:** The Failsafe, if enabled, will help you recover from a lost of R/C signal by keeping the outputs to the motors alive to slowly land the copter.
2. **Activation Delay:** Seconds before fail-safe is activated after a transmitter lost of signal.
3. **Fail-safe Off Delay:** After this time, the fail-safe will assume the copter has landed and disable the motors.
4. **Throttle Level:** The amount of throttle maintained during fail-safe. Expressed as MINTHROTTLE plus throttle amount.

4.5.7 - Receiver

FCT - Receiver Options

1. **Receiver Protocol:** If you have more than 3 wires your StandardPCB, otherwise you are probably using SerialSumPPM or Spektrum.
    a. StandardPCM: One wire for each signal. Standard for most R/C systems.
    b. SerialSumPPM: Stream of signal on a single wire
    c. Spektrum: Spektrum receiver (serial connection)
    d. SBUS: Futaba and such serial receiver.
2. **Transmitter Model:** This option will match the channels order to your model brand.
3. **Deadband:** Space around the stick center that will still be considered neutral stick.
4. **Channel Ordering:** Only available in SerialSumPPM and allows you to change the channel order.
5. **Neutral Zone:** Another deadband (neutral zone) around the throttle during altitude hold. Within this range the copter will not change the desired altitude.
6. **Fixed Midpoint:** Fixes the throttle stick center during altitude hold instead of using the throttle value on activation.

4.5.8 - Camera

FCT - Camera Options

Stabilization will control the gimbal servo motors to keep the camera pointed steady at one fixed position. Channel mix allows you to control the pan and tilt angle from your transmitter.

1. Drop down menu to select the different camera stabilisation systems.
    Gimbal - Standard outputs for two servos. One for the Roll and one for the Tilt
    GimbalWithMix - Two servo mixed together that give a Roll and Tilt gimbal.
2. Adjustment for each servos of the Gimbal.
3. Lets you setup a Trigger system which would be R/C servo based.

Note: Number 2 & 3 settings are available to be changed in the GUI since MultiWii 2.3 so they can't be changed here. Older version when available will take advantage of those settings in the FCT.

4.5.9 - Battery
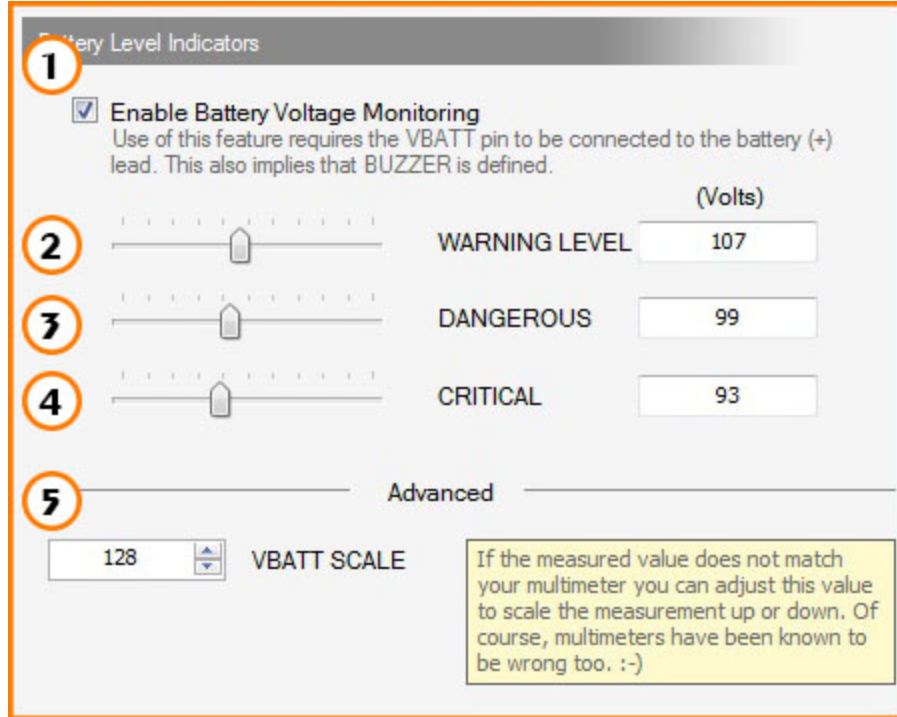
FCT - Battery Options

1. **Enable Battery Voltage Monitoring:** Enable the VBAT function which send the battery voltage to the Quadrino and trigger Buzzer outputs for different values.
2. **Warning Level:** First alarm will be heard from the Buzzer
3. **Dangerous:** Second alarm will be heard from the Buzzer
4. **Critical:** Continuous alarm will be heard from the Buzzer
5. **VBATT SCALE:** Used to scale the battery input signal to the real Voltage. If using an Quadrino Nano the default value of 128 will get you working with a 3S LiPo battery.

Note: The values are in Volts but without the dot so 107 will be 10.7V.

4.5.10 - Misc
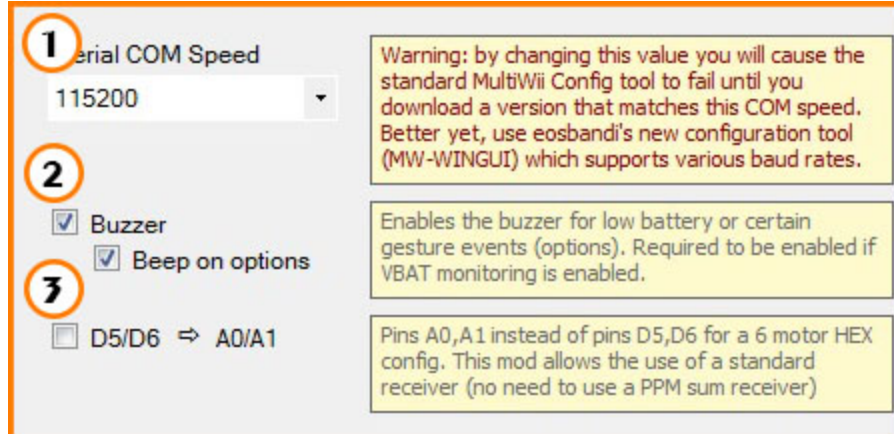
FCT - Misc Options

1. **Serial COM Speed:** Baud Rate at which the GUI (General User Interface) and the Quadrino will talk. (default 115200)
2. **Buzzer:** Let you enable the Buzzer for low battery or certain gesture event (options). Required to enable if VBAT monitoring is enabled.
3. **D5/D6 to A0/A1:** When using a previous version Quadrino based around an ATmega328P processor, you can change the normal PIN association. This is to use a normal receiver with Hexacoper mode.

Warning: By changing the baud rate you will cause the standard MultiWii config tool to fail until you have a matching version. The WinGUI will support various baud rates.

4.6 - Flash
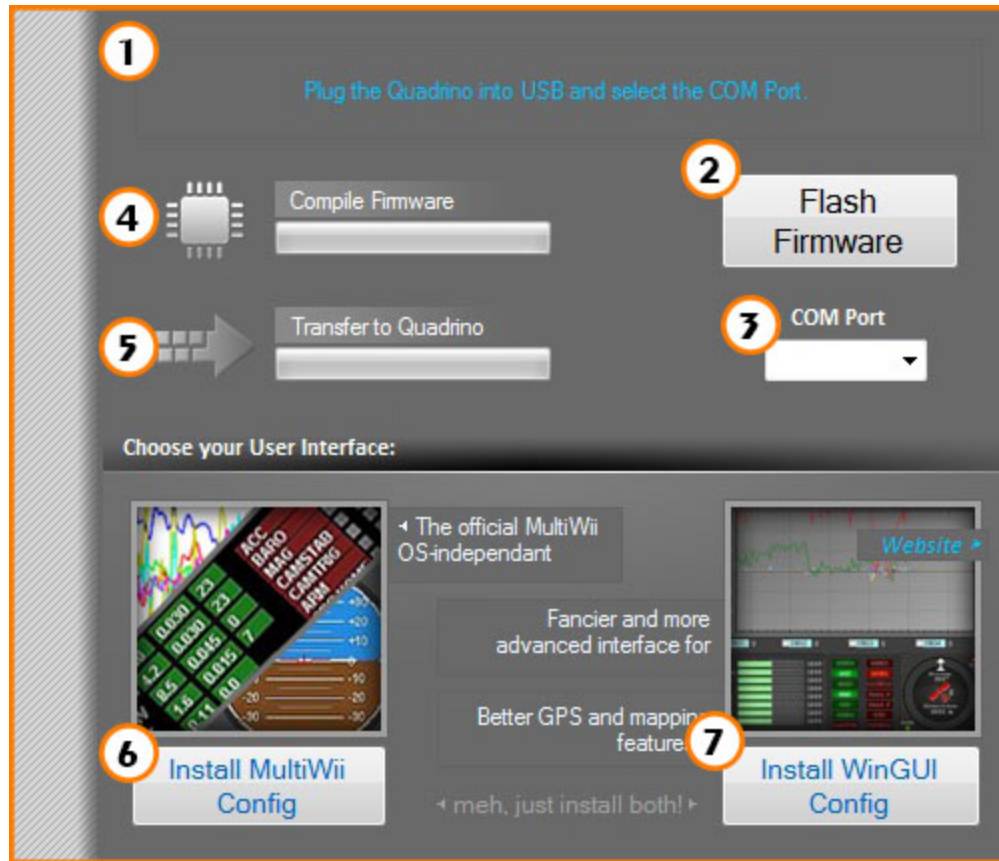
FCT - Flash Screen

1. **Message Section:** The message section informs you of what to do and what's going on.
2. **Flash Firmware:** Flash button to load your MultiWii project to the Quadrino.
3. **COM Port:** Serial COM port drop down. If you don't know which COM port to choose, use the "Auto Detect" option and follow the on-screen instructions.
4. **Compile Firmware:** Progress bar linked to the Download and Compile of the MultiWii firmware.
5. **Transfer to Quadrino:** Progress bar linked to the firmware transfer of code to the Quadrino.
6. **MultiWiiConf Installation Button:** MultiWii standard GUI (General User Interface) software.
7. **WinGUI Installation Button:** Suggested GUI (General User Interface) software.

4.7 - GUI Installation (General User Interface)

There are many different GUI (general user interface) available for MultiWii compatible flight controllers. The MultiWiiConf is a Java based application and is created by the MultiWii team. However it's limited and doesn't include the GPS waypoints. WinGUI is much better and does have GPS waypoints capability. Both software can be installed and started from the FCT "Flash" page. At first you will see an "Install" button and once installed it will change to a "Start" button.

Applications once installed can also be started from the Windows start menu:
Start Menu\Programs\Quadrino Tools\MultiWii MultiWii 2.4
Start Menu\Programs\Quadrino Tools\WinGUI MultiWii 2.4

FCT - GUI Installation

FCT - GUI Installed

4.7 - Review

The Review page is aimed for Advanced users that know how to setup the config.h file of MultiWii. It gives a lookup of what's been "defined" by the FCT application. This page was removed from the standard navigation process so it goes from the "Options" page right to the "Flash" page. The "Review" page is only available by clicking the "Review" icon in the top navigation bar.

```
#ifndef CONFIG_H_
#define CONFIG_H_

①
/**  *************************************************************************
/****        CONFIGURABLE PARAMETERS                    MultiWii 2.4   ****/
/**  *************************************************************************

/* this file consists of several sections
* to create a working combination you must at least make your choices in section 1.
* 1 – BASIC SETUP – you must select an option in every block.
*     this assumes you have 4 channels connected to your board with standard ESCs and s
* 2 – COPTER TYPE SPECIFIC OPTIONS – you likely want to check for options for your copte
* 3 – RC SYSTEM SETUP
* 4 – ALTERNATE CPUs & BOARDS – if you have
* 5 – ALTERNATE SETUP – select alternate RX (SBUS, PPM, etc.), alternate ESC–range, etc. he
* 6 – OPTIONAL FEATURES – enable nice to have features here (FlightModes, LCD, telemetr
* 7 – TUNING & DEVELOPER – if you know what you are doing; you have been warned
*     – (ESCs calibration, Dynamic Motor/Prop Balancing, Diagnostics,Memory savings.....)
* 8 – DEPRECATED – these features will be removed in some future release
*/

/* Notes:
* 1. parameters marked with (*) in the comment are stored in eeprom and can be changed
* 2. parameters marked with (**) in the comment are stored in eeprom and can be change
*/
```

FCT - Review Screen