

# XXcontroller V1.5

## Essentials

Currently available for TRI/QUAD+/QUAD-X/HEX6/Y6/H6 configs  
Runs on standard\* KK board (\* extra features available with KK+ board)  
You will need for configuration a Serial LCD display - this must be Sparkfun compatible  
eg: [www.multircshop.com/site/index.php?route=product/product&path=35&product\\_id=593](http://www.multircshop.com/site/index.php?route=product/product&path=35&product_id=593)  
or [www.sparkfun.com/products/9393](http://www.sparkfun.com/products/9393)

## Software Features

PID control loop  
Hierarchical (structured) menu

- Configuration changes made using Tx & LCD Display (no PC needed)
- Basic and Advanced setup menus available
- Diagnostic Menu info to help identify problems

Low Voltage Alarm (\*only available if board supports it)  
Copter automatically dis-arms if no RxCollective signal  
Start-up check on gyros will dis-able copter if a problem found

## Installation

Flash the relevant hex file.  
Hex files are in the form:

XX15x\_XXXX\_M999\_EN.hex  
^ ^ ^ ^ ^  
| | | | |  
+ Language (if present): EN=English  
+ Chip type M168 or M328  
+ Type: QUAD+, QUADX or TRI etc  
+ Version: V1.5h

Motor Configurations						
	M1	M2	M3	M4	M5	M6
TRI	Front-Left (CW)	Front-Right (CCW)	Tail (CW/CCW)	Tail-Servo		
QUAD+	Front (CW)	Left (CCW)	Right (CCW)	Back (CW)		
QUAD-X	Front-Left (CW)	Front-Right (CCW)	Back-Right (CW)	Back-Left (CCW)		
HEXA6	Front (CW)	Front right (CCW)	Back right (CW)	Back (CCW)	Back left (CW)	Front Left (CCW)
Y6	Top-Left (CW)	Top-Right (CW)	Top-Back right (CW)	Bottom-Left (CCW)	Bottom-Right (CCW)	Bottom-Back right (CCW)
H6	Front-Left (CW)	Front-Right (CCW)	Centre-Right (CW)	Back-Right (CCW)	Back-Left (CW)	Centre-Left (CCW)

note: the propeller directions (CW/CCW) are not fixed, they can be switched ie: on QUAD+, M1,4 can be CCW and M2,3 can be CW, but the Yaw gyro and the Tx Yaw stick must be reversed.

The Serial LCD Display connection on the board iis as follows:  
On KK+ 5.5d, this is the 10pin connector:  
LCD RX = Pin 9 LCD 5V = Pin 2 LCD Ground = Pin 10  
For KK5.5e, there is a dedicated LCD 3-pin connector  
Other KK boards, the LCD RX pin is ICSP pin 4

## **First-time Setup**

Plug in LCD, power on TX and connect battery.

wait for LCD to show main menu (eg: Copter QUAD+)

If the menu is constantly scrolling, make sure that your Rx connected light is on, if it is, then adjust the Tx Pitch Trim until it stops scrolling.

If your display is garbled then you will need to perform the 'Adjust the LCD Timing' procedure.

*note: the 'Adjust the LCD Timing' is not in all versions, so you may need to use a version which has this feature.*

### *Navigating through the menus*

use the TxPitch to cycle through the current menu level (and allows changing of settings)

use TxRoll → to enter a sub-level menu and TxRoll ← to return back

There are 2 important procedures you must perform before flying:

1. Tx Stick Calibration (or Stick Centering)
2. Calibrating the ESC throttle range

### **Tx Stick Calibration**

In the menu, go Setup:Basic/TxCalibration and perform this function.

Put Throttle stick to minimum and select the menu option.

The LED will flash for a second or two and the LCD will display message 'Done!'

*note: you can re-do this function at any time.*

### **Calibrating the ESC throttle range**

Please read the 'manual' that comes with your ESC for the correct sequence.

Generally, the procedure will be as follows:

Everything powered off

If you are new/unsure about this procedure, please Remove Propellers

Turn on Tx, and put Collective to Max

Connect battery and wait for ESC bleep sequence\* (\*see below for HobbyWing/Turnigy sequence).

Put throttle to minimum.

Disconnect battery.

Now re-connect battery and check that ESC's will arm and that they all start at the same time.

With the exception of TRicopters, if you have setup your copter in the manner stated above, then you are ready to fly!  
The default Stick-Arm side is Yaw-Right, but you can change this to your own preference.

### **TRicopters**

Because the mechanical setup of a TRicopter can vary, the default setup in the software may not be correct and the TxYaw and Yaw Gyro directions may need to be reversed.

Note that if you have to do this, all TxYaw direction references – such as Stick-Arming side – also need to be reversed. It is recommended that you set the TxYaw Trim to zero (centred) before running the Setup/TxCalibration option.

To set the servo arm position, you will need to arm the copter and then adjust the servo angle to be slightly against the propeller rotation direction.

Now you can tweak the angle in the Setup:Advanced/TxS/TrimAdj/Yaw menu option.

### **Low Voltage Alarm (LVA)**

If your KK board has LVA built in, then you can enable this option in the menu (default is disabled).

First, you need to check calibration of the unit.

Apply a known voltage to the LVA battery input, and in the Other/LVA/Calibrate menu-option, adjust the voltage until it shows your known voltage.

Now go into the Other/LVA/LowBatt option, and set the voltage you want the alarm to sound at.

*note: If you change the Vref (also known as Aref) voltage, you will need to re-calibrate.*

### **Adjust the LCD Timing**

Because the internal oscillator of the Atmega is not very accurate, it is sometimes necessary to adjust the UART timing for the Serial LCD to work properly.

Power on the FC board and hold the Tx Yaw stick right for 5 seconds.

The screen will display (if readable) LCD Timing. Release the Yaw stick.

On the bottom line will be, (but may be garbage!) show the timing parameter, the default is 102uS.

You can adjust the timing by moving the Yaw stick left or right (one way increases, the other reduces the timing), the LED will blink to confirm.

If the LED does not blink, either your Rx didn't connect fast enough, or you have reached the end.

Start by reducing the timing in increments of 2 (so try 100, then 98 etc).

Typically, most LCD's work from 96uS to 104uS.

Once corrupted, the LCD may not show valid data subsequently sent to it, so unplug the LCD and plug it back in and continue until display shows data.

You may find later the display gets the odd strange character, but you shouldn't worry too much.

*note: this procedure is not available in all versions.*

## **General Flying**

The default settings are from my mid-sized quad with KK board with enc03 gyros.

These gyros are not particularly sensitive, so if you're using other types, you will probably need to adjust the settings.

Good news is that there's a lot more scope for tuning, the bad news is getting to understand how they interact with each other....

To change the gyro gain, you can change it in the Setup:Basic menu, (or it is the 'P' term in the Setup:Advanced menu). Note that with the LCD, we can increase the range of the gyro gain adjustment, so whereas before you changed the gain (with the pots) in increments of say 5 or 10%, with the LCD firmware you need to change the gain in smaller increments.

To change the TxStick authority, you need to go into: Setup:Advanced/Profile/RollPitch/TxRate

As a general guide to setting Gyro gain, increase the gain until the copter starts to oscillate, and then reduce the gain by a small amount.

The hysteresis function only works correctly when TxStick trim is not used.

If you notice that your copter starts to drift from being level, this may be due to gyro drift/acclimatisation (Murata enc03's are quite temperature sensitive).

Just land, dis-arm and re-arm (re-calibrates gyros) and see if the hover is now stable.

If you want, you can add trim on the Copter.

If you don't know whether to add + or - adjustment, go to Diagnostics/Rx menu, and move the relevant Tx stick to see what happens.

If you find you need to constantly re-trim your quad using your Tx, then suggest you set the Hysteresis to 0

## Other Points

The copter will always power on with the first (Default) Profile.

The Profiles can be selected by a combination of stick movements while the copter is armed, but with with Collective at minimum:

DEFAULT: Roll Left + Pitch Down

STABLE: Pitch Up + Yaw Left

ACRO: Pitch Up + Yaw Right

*note: when Yawing, don't do it too long as you may dis-arm!*

The Configuration Menu is active whenever the copter is dis-armed.

The software doesn't know if the LCD is plugged in or not, so, whenever the copter is dis-armed, don't play around too much with the TxRoll/Pitch sticks as you could accidentally change some settings !

If you un-plug the LCD display, and then subsequently plug it back in, the display will be blank. Just move the Roll/Pitch sticks to get it to display something.

If when you power up the display says: 'controller error: gyro', then this is the start-up function checking that the gyro output is not too high.

The maximum allowed gyro output is 920 (see Diagnostics/Gyro/Roll etc menu options)

Occasionally, this is a false alarm and re-powering the board will clear the error.

If in the gyro menu option it says that the output(s) are 1023, then your board has a problem.

Please measure the Vref voltage, and the individual gyro output voltages (should be ~1.35V).

If however the gyro reading is simply too high (920 → 1022) then you can fix this by increasing the Vref voltage. On KK+ board, this can be achieved by turning the Adj-Ref pot CCW.

Other KK boards will require a component change (Resistor R10 needs to be increased).

Motor Outputs: when looking at the Motor outputs in the Diagnostic menu, you will see that the numbers do not stay constant despite the copter being stationary. This is because the PID loop is constantly correcting for errors which there will always be.

Gyro calibration takes place @ arming, but can also be done when dis-armed by putting Collective to maximum.

LED statii:

LED permanently off : either no power to board or Controller error (gyro problem) detected

LED flashes every 4/5 seconds : dis-armed status

LED permanently on : armed.

LED flashing fast : either Stick centering or Sensor Calibration taking place

Roll Stick not working or 'cannot select Menu option' , but Pitch works fine (KK5.5d board) : try switching the BootLoader switch.

Diagnostics for Rx

1.54mS [ +4/ +3]

1.54ms is the incoming Signal length

+4 (Raw) is the normalised level (centre point subtracted) from pulse length

+3 (Nett) is the normalised level (+4) after hysteresis, end-point limits and then Trim-Adjust have been applied (in that order)

Rx/Coll does not have Trim-Adjust or Hysteresis.

HobbyWing/Turnigy Plush ESC Throttle calibration:

The sequence of bleeps for these ESC's on 3S LiPo is as follows:

after power on:

3 bleep song: 'doh' 'ray' 'me' (rising tone)

pause

double bleep (← this is the key sound you need to listen for!)

at this point, put your TxCollective stick to minimum

there will be a single longer confirmation bleep, and thats it!