

## **en/MK-Quadro**

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# 1 Info

Please read this manual **carefully**! This can avoid misunderstandings !  
Technical knowledge is recommended! Wrong soldering can cause damage!

 For the first test you should use a regulated power supply and **not** the Lipo (battery) !  
Wrong soldering or short circuit can destroy the electronics ! Use a power supply of 12V/500mA.

## 2 MikroKopter – Assembly instructions

How do you convert a heap of parts into a flying Mikrokopter? Here are a few tips which may be useful during the build.

Click on any of the pictures for a larger view.



[MikroKopter](#) Before and After

[This is a little video of the building procedure incl. Maiden Flight](#)

## 3 The Frame

The frame gives the Mikrokopter its core structure.

It must fulfil the following characteristics:

- Rigid and stiff
- Light
- Depending on personal taste – it should also look good



This is a frame-set for a standard Mikrokopter with 40cm motor-shaft separation. The weight of the frame (depending on type and number of bolts used) is approx. 100-110g.

The motor-shaft separation refers to the distance of one motor shaft diagonally to the next along the frame arms. The distance of one shaft to the next adjacent one is therefore  $40 / 1.4 = 28.5\text{cm}$ .

### 3.1 Painting the frame



The Frame should be painted such that the leading arm can be easily distinguished from the others. Colouring this one red generally works well.

Prior to painting, the frame arms should be degreased and sanded. This way the colour is held better and the leading colour becomes more distinguishable.

Alternatively it is also possible to cover the arms in coloured shrink tubing or have the arms [anodised](#)

### 3.2 Frame assembly

The frame from **above**:



The frame from **below**:



#### Things to note:

- The frame arms have **small holes** which are used for the motor mounting on the **top side**
- The innermost four bolts should be made of metal and should be well tightened (use locking nuts). These bolts are crucial to the frames rigidity and stiffness.
- The [FlightCtrl](#) will later be attached to the spacer bolts. These must face up on the top side of the frame - use [vibration dampers](#) for FC2.0 and FC2.1!
- The eight bolts on the outside additionally hold the frame arms in position. The nuts should be on the bottom side of the frame.

[Video of frame assembly \(8.8MB\)](#)

## 4 Electronics

- The electronics and the algorithms which run in the processors are the central core component of a Quadcopter. Only via sensor data and fast governing of the motors it is possible for a Quadcopter to fly.



It consists of the following:

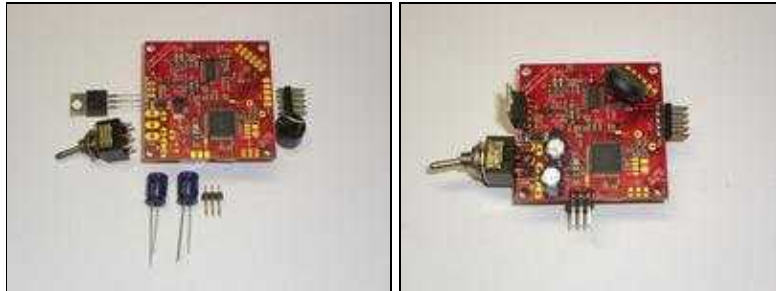
- [FlightControl](#) -> "Main controller with sensors" for calculation of the attitude control data.
- BL-Ctrl -> fast control of the BL Motors
- Receiver -> Interface to the transmitter and ultimately the pilot
- [LiPo](#)-cell -> Power supply

## 5 FlightCtrl

On the preassembled [FlightCtrl](#), various "through-hole" type components have to be soldered on for completion. Preassembled boards can generally be identified by the red colour.

The term [FlightCtrl](#) is often shortened to "FC".

Board before and after the assembly of the remaining through hole parts:



The mounting direction of the FC is fundamental for operation:

- The arrow near the switch must point towards the leading/front frame armder (BL-Ctrl number 1)
- Perfectly Horizontal
- Processor on top

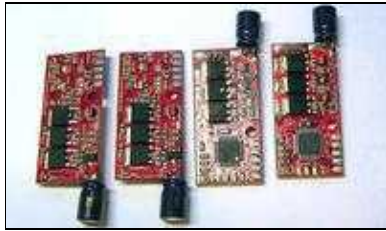
[Video of assembly of the remaining parts \(21.3MB\)](#)

[Further information for the assembly of the FC](#)



## 6 BL-Ctrl

The BL-Ctrl has been specially developed for quadcopters with BI Motors.



Compared with typical Brushless controllers, it has a fast data bus to the FC (I2C) which results in a spontaneous regulation of motor setpoints. Normal Brushless controllers can not be used.

The BL-Ctrl's are designated an address of 1-4 via a solder jumper.

### 6.1 Address choice

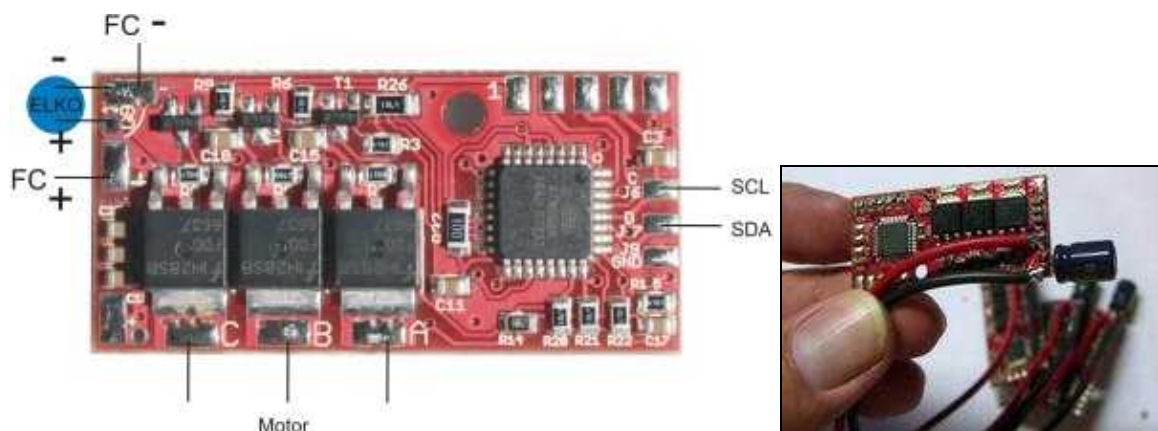
On the BL-Ctrl V1.2, motor addresses are set using a solder jumper on the board.



They are set in the following way:

| Address (Motor) | 1-2    | 2-3    |
|-----------------|--------|--------|
| 1 (front)       | open   | open   |
| 2 (back)        | open   | closed |
| 3 (right)       | closed | open   |
| 4 (left)        | closed | closed |

- On the preassembled BL-Ctrl V1.2, the supplied Electrolyte Capacitor will have to be soldered on:



[General info for the BL-Ctrl](#)

[BL-Ctrl V1.2](#)

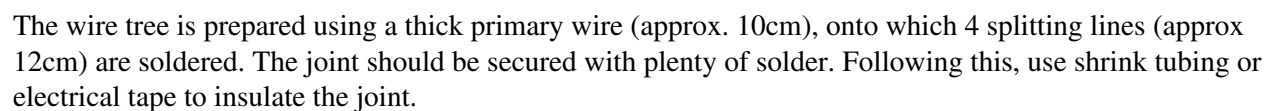
## 7 NaviCtrl

[NaviCtrl](#)

This **Overview diagram** shows amongst other things the wiring, addresses and positions of the Motor Controllers aswell as the rotational direction of the propellers:

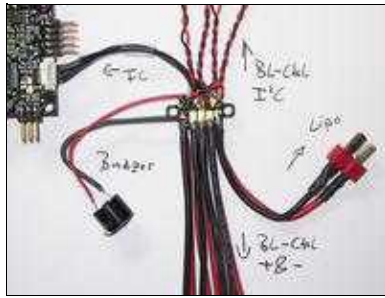


Start by preparing the DC cables for the DC power supply.



The splitting lines (Plus and Negative) are connected to the four BI-Ctrl's.

With this [small PCB](#) it is very easy to realize the distribution. The Cables don't have to soldered directly to the [FlightControl](#)



Note in this case: If the FC is connected via the molex-cable, the switch on the FC can't be used. The FC is powered up when the supply is connected to the [MiniPowerDistribution](#)

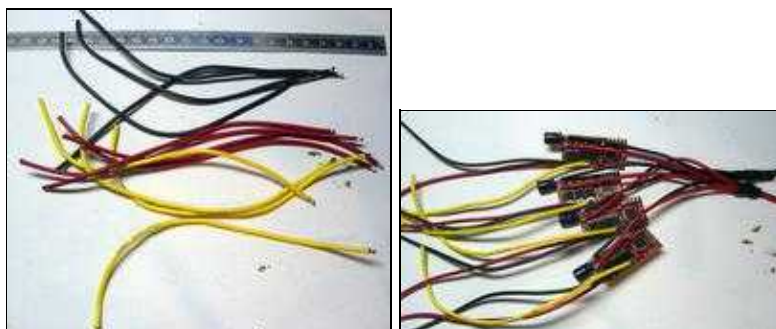
See also: [MiniPowerDistribution](#)

### 8.1.2 Things to note

- Plus and Negative must under no circumstance be exchanged!
- Red = Plus
- Black = Minus
- The bare wires should not be exposed to far in order to avoid electrical shorts
- The wire ends need to be well tined to ensure that no copper strands are freely exposed

## 8.2 Motor Lines

The motor lines connect the motor with the output of the BL Ctrl. The BL Motors require a so called rotary field. For this reason three lines are required.

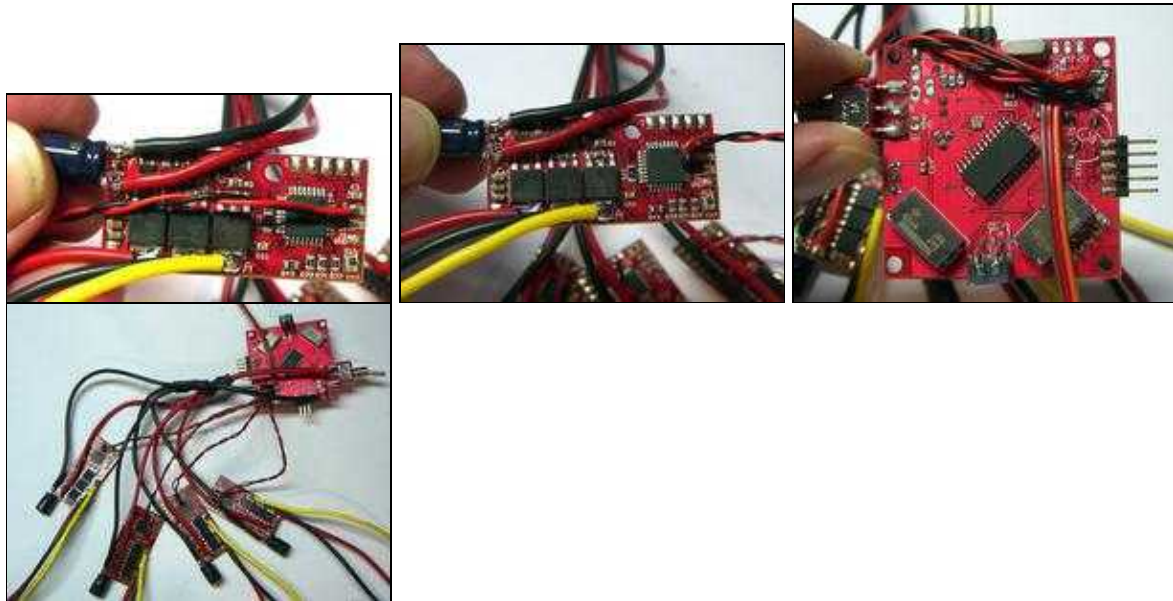


For clarity we use three different colours. The rotary directing of the motors can be changed by switching any two of the three lines. It is therefore not important at this stage in what way these three lines are connected.

The lines should be approx. 22cm long. They will be shortened later.

## 8.3 I2C-Dataline to the BI Controllers

The [I2C Bus](#) provides the communication between the BI Ctrl's and the FC.



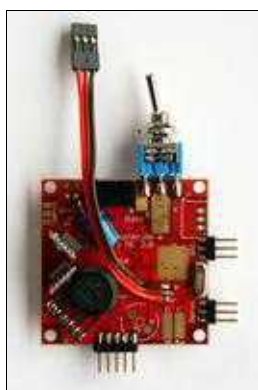
It consists of two signals

- SCL (Tact) shortened "C" (in this case the red signal line)
- SDA (Data) shortened "D" (in this case the black signal line)
- Each "C"-Line (Clock) of the four BI Ctrl's needs to be connected to the "C"-Pad of the [FlightCtrl](#).
- Each "D"-Line (Data) of the four BL Ctrl's needs to be connected to "D"-Pad of the [FlightCtrl](#).

It has proven useful to solder and bend the I2C lines as shown in the pictures in order to avoid them tearing off during any mechanical stress.

## 8.4 Attachment of the Receiver to the FC

Connect the small receiver Cable to the FC. On the FC you will have the corresponding colors (**Brown/Red/Orange** AND **GN/+5V/PPM**)

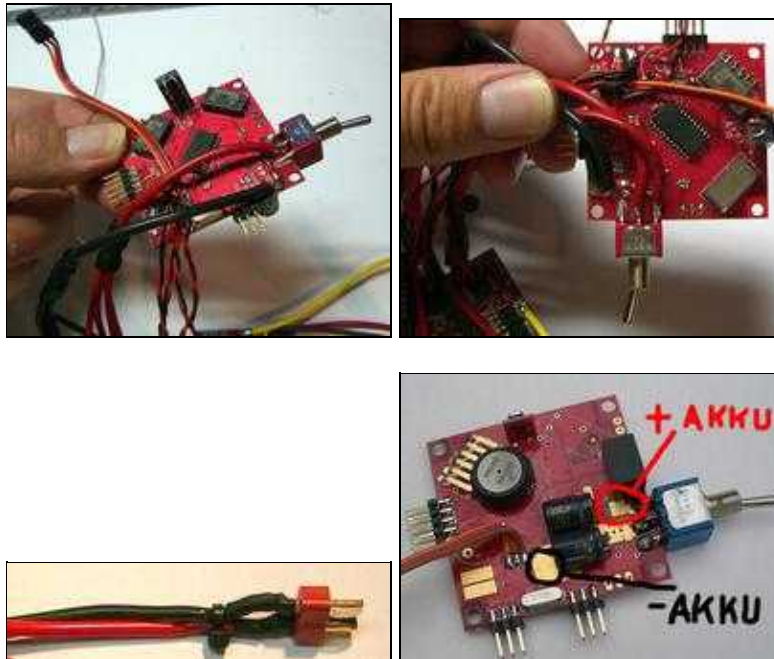


**⚠ Attention Spektrum (DX7) Users** see [more details about the Digital Transmitter Spektrum DX7](#)

See also: [Receiver connection on FC2.1](#)

## 8.5 Attachement of the supply lines to the FC

The Wire Tree to the BL Ctrl's and the Power line is now attached to the FC.



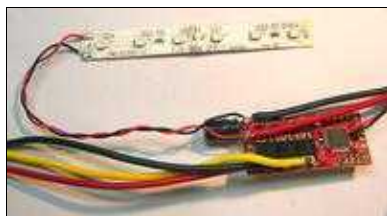
The Battery cable utilises the male battery connector(Description: [DEANS](#) ) (is labled with + and - ) and an approx. 15cm long connection line. The contacts on the battery connector must be protected against electrical shorts using shrink tubing.

The Plus of the battery lines is soldered onto the Pad at the switch (towards middle of the board). The Plus of the wire tree is soldered onto the pad on the middle of the switch connections.

The two Minus lines are soldered onto the solder pad facing towards the near corner of the switch.

## 8.6 Attachement of Lighting systems

At least the leading frame arm should be clearly marked for orientation when flying. At long distance this can be nicely achieved using a lighting system.



The light strips need to be supplied by a 12V source. The easiest way to achieve this is to connect them via a thin line to the power supply of the front BL Ctrl (Number 1). In this case a 4-5cm line length is sufficient.

Later on, the lighting, together with the frame arm needs to be covered with shrink tubing to avoid electrical shorts.



## 8.7 Attachement of the the Buzzer

Initially the buzzer used to be located directly on the FC. However, due to its strong magnetic field we will isolate it from the start by placing it at the end of one of the frame arms.

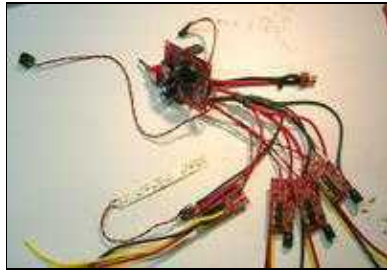
Otherwise, the buzzer will interfere with the **electronic compass (MK3Mag)**, which may be added as a later option.



Important: The Plus of the buzzer (marked) must be connected to the + on the FC board

## 9 Instalment of electronics into the frame

The entire electronics should now look like this:



### 9.1 Dry test of the electronics

The basic functions of the electronics can already be tested at this stage. There is no need to connect motors for this.

#### Procedure:

- Connect Receiver (with crystal) using the output for the sum signal (channel 1 on the DSL4TOP)
- Spread out electronics so that no electrical shorts can occur.
- Connect 12V (from a powerpack – this is safer in case an electrical short occurs. Connect the FC and BL Ctrl's to the same powerpack to ensure correct operation of the I2C Bus.)
- Turn on Transmitter
- Turn on FC

#### Control:

- The green LEDs on the BL Ctrl's must be on. This indicates that they have a power supply
- The red LED's on the BI Ctrl's must be off. This shows that the I2C-Bus works.
- The green LED on the FC must be on to show that it has a power supply.
- The red LED on the FC is off when it has a signal from the receiver.
- The Buzzer is off when; The FC has a receiver signal, the I2C is ok and the supply voltage is > 9.6V
- The Buzzer beeps when the transmitter is turned off.
- One may attempt to start the motors (which are not connected). This results in a flickering of the green LED's and the red LED's stay off. (To start = Throttle at zero and rudder full right)

[Video of a "Dry test" \(5.6MB\)](#)

### 9.2 Assignment of the BI Ctrl's

The addressed BL-Ctrl's must now be placed as follows:

| Motor | Position |
|-------|----------|
| #1    | front    |
| #2    | back     |
| #3    | right    |
| #4    | left     |

**Rule of Thumb:** Controller #3 at 3 o'clock

The BL Ctrl's can be threaded through the middle of the center plates (the corner bolts may have to be



loosened for this). Following this the motor cables should run outwards and the supply lines towards the center.



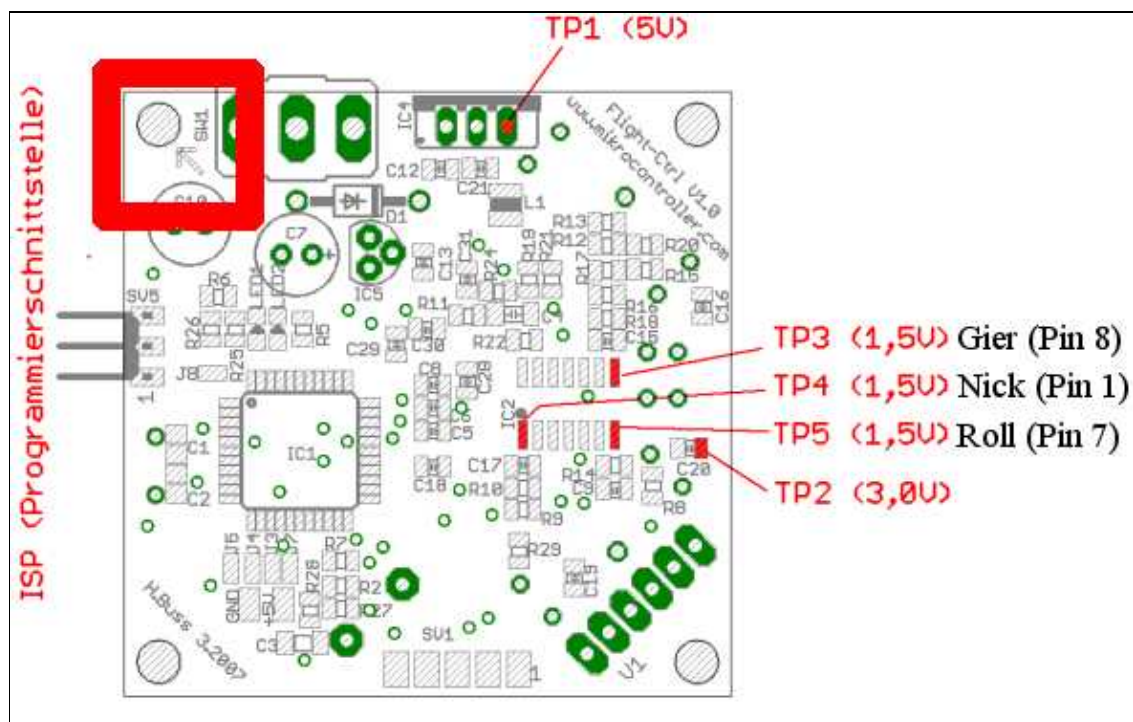
[Video of instalment \(14,5MB\)](#)

[Video of shrink tube insulating of the BI Ctrl's \(5MB\)](#)

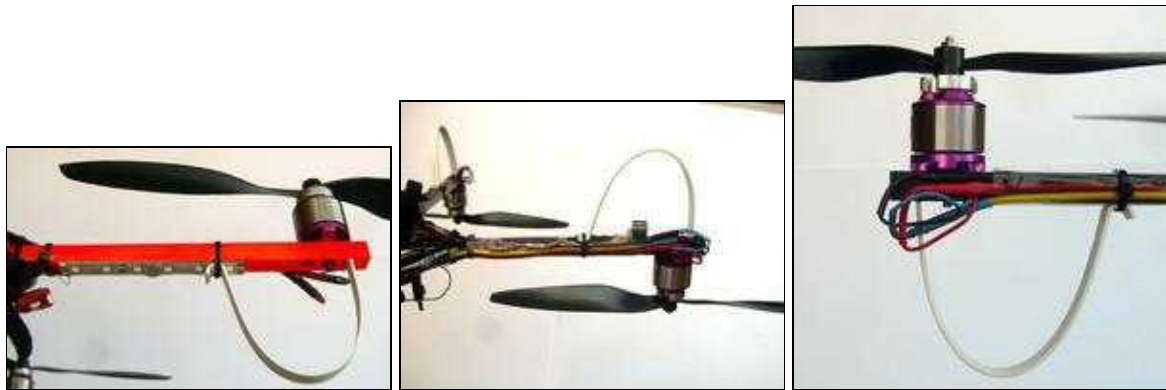
## 9.3 Instalment of Flight-Ctrl

A directional arrow is located in a corner on the top side of the Flight Control. It is important that this arrow **MUST** point forward i.e. towards motor 1!

The arrow is marked by a red square in the following illustration:



## 9.4 Instalment and mounting of Motors and Propellers



The motor lines should be encased in heatshrink (or at least secured well using cable ties). On the rear arm, the buzzer may be attached at the same time using the heat shrink.

The colour of the frame arms will last longer if they are encased in shrink tubing.

The Motors include connectors.

The use of these connectors has the advantage that the motors can (if required) be quickly exchanged or rotary directions changed by switching two of the three lines.

## 9.5 Mounting of the Battery



In some cases a female Deans-Connector needs to be attached to the Battery. The plug is labeled with Plus and Minus.

Again, ensure that soldered points are well tinned and protected against electrical shorts using shrink tubing.

**⚠ Under no circumstances short circuit the Battery Lines!**

The Battery is secured using two double sided hook and loop (Velcro) tapes(Photo). The Hook and Loop bands should be attached to the centre of the frame using cable ties.

**Tip:** The Battery can be mounted more securely by sticking Velcro tape onto it.

## 10 First start

Now the Kopter is ready assembled and soldered. The next step is now to check and set the Kopter and the function of the transmitter.

For this we use the KopterTool.

Where you can get the KopterTool and what you have to check/set is explained in simple steps.

Here we go to the easy "steps": [Initial startup](#)

# 11 safety

A Kopter can be dangerous. Safety comes first, so read carefully:

- [SafetyFirst](#)
  - [Safety references of LiPos](#)
- 

- [KategorieManual](#) [KategorieEnglish](#)