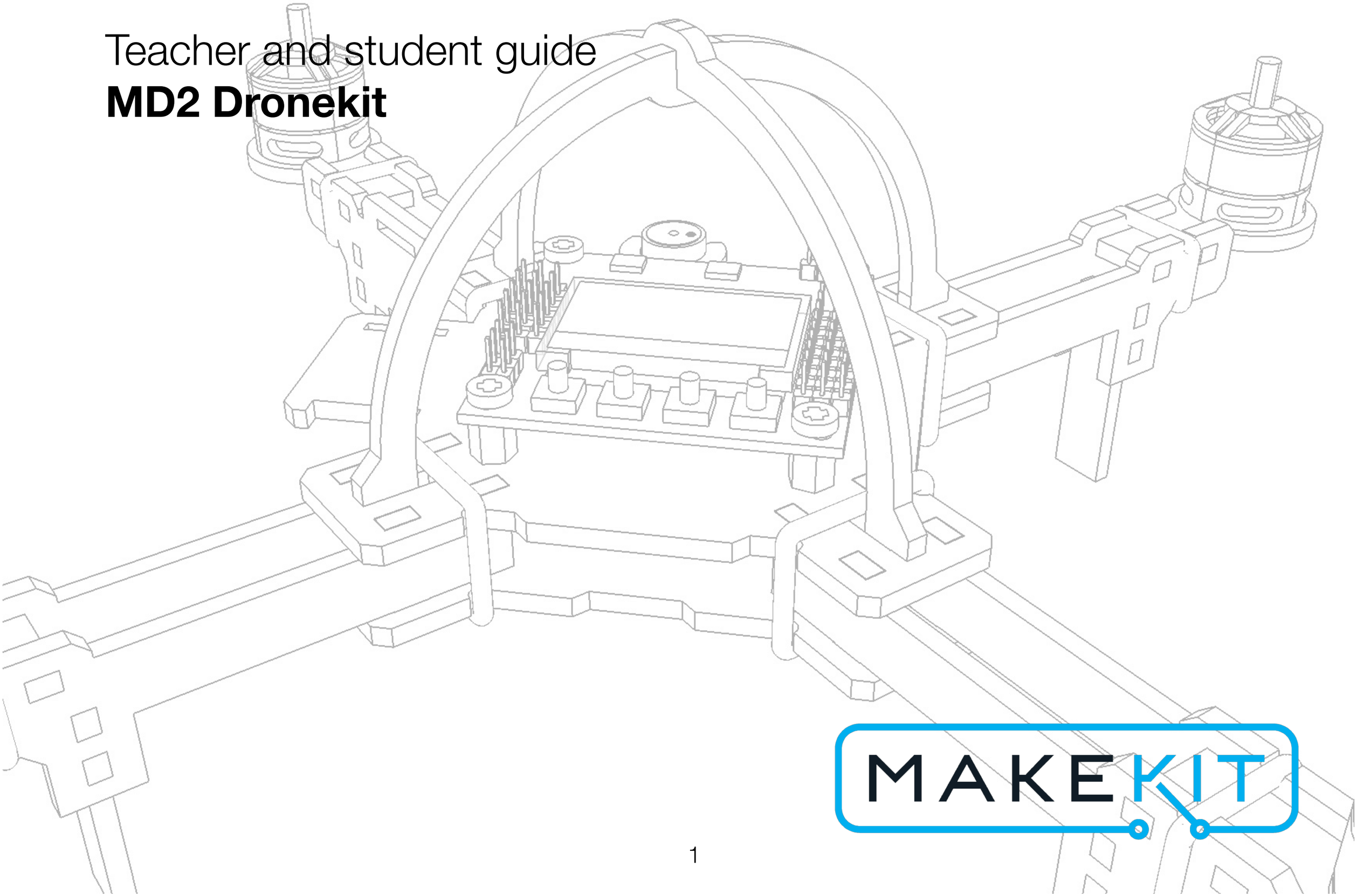
Teacher and student guide

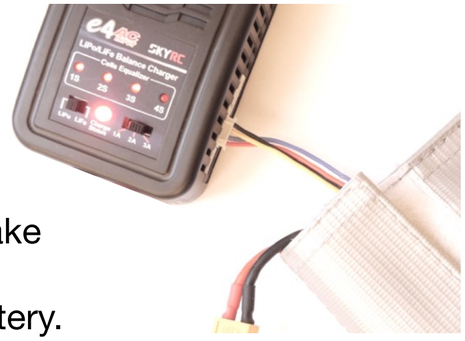
MD2 Dronekit



MAKEKIT

To the teacher

Start by studying the safety information on the next page. Propellers can cause damage and must therefore be distributed at the end. Paper propellers are used temporarily to test that the motors are going in the right direction.



Charge the batteries. Put the battery in the enclosed charging bag. All lights should be green before charging is complete after 1-2 hours.
Insert 4 AA batteries into the radio. We recommend rechargeable batteries for the sake of the environment.
The drone flies for 11-13 minutes on one battery.
Reset the drone's control card by selecting “factory reset” which is located at the very bottom of the menu.

Tools:
1.5mm Allen or Torx. Star puller medium size. Scissors if you want to cut out paper propellers.

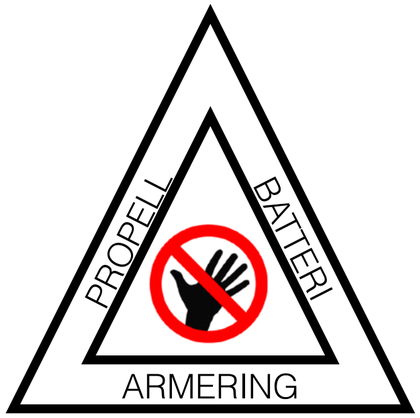
Construction plan:
There are four main areas, which should be done in this order: **assembly, electrical connections, programming and flying**.
You are welcome to delegate the four tasks to different students, who are each given their own main responsibility, which they can later roll on (especially the flight).
Once the drone is built and the electrical connection is made, check the following before getting the battery:
Layout, page 8. Silver motor in the right place. Two different colors of propeller protectors, one at the front and another at the rear. (Color may vary).
Wiring diagram, page 15. It is especially important not to switch between + and - between ESC (speed controllers) and power distribution boards, as well as not to change the battery measuring cable and speaker cable.

- When they have finished programming, you or students (other than those who have programmed) should check the following:
- The paper propellers should rotate straight in accordance with the layout, page 8.
- Review receiver test, page 18. Check that the movements of the connectors are correctly reflected on the screen. Throttle = gas, left stick down = 0, up = about 100
- Yaw (rudder) = side rotation, left stick to the right / left results in “rudder left / right” +/- about 100
- Pitch (elevator), right stick forwards or backwards, +/- approx. 100
- Roll (aileron), right stitch to the side, +/- approx. 100
- Check that all wires and components are attached correctly and that no wires or antenna can be cut by the propellers.
- Once this has been checked, you can distribute the propellers. It is important to distinguish between up and down, as well as right- and left-rotating propellers. See page 9. Make students aware of the dangers associated with propellers.

Flight:
The pilot and the rest of the team take the drone to a suitable flight area. Gym or other open space indoors is the safest and is unregulated by FAA and aviation authorities. Avoid third persons entering the flight area and especially smalle children must be kept at a safe distance. Low ceiling height can also be an advantage as you can not crash from a great height.

Outdoors, large grass pitches are the best place to fly as it is open, and the surface is soft and damages the drone less in the event of a crash. Provide the required safety distance to outsiders. Check local rules regarding flight outdoors.

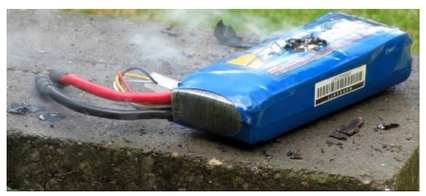
Safety



Rule 1:

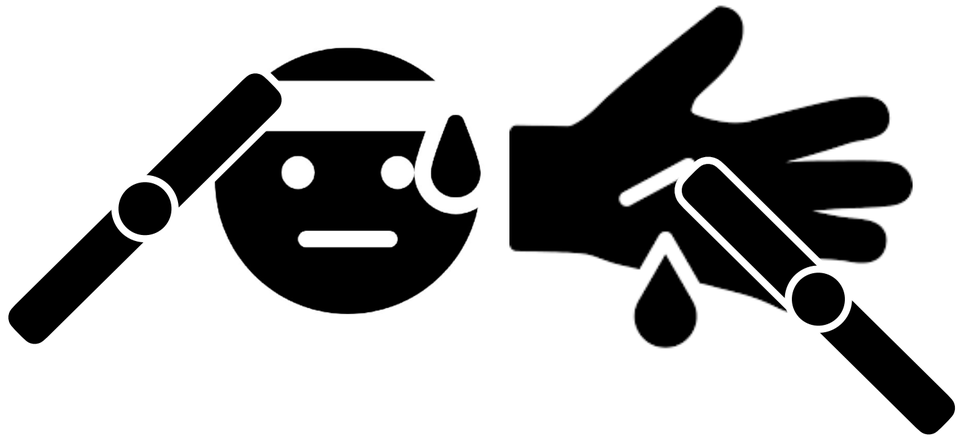
When the drone is armed* and the propellers are mounted.
you must have at least 2 meters safety distance to the nearest person.

*Arming: The drone is activated and the propellers can spin. Characteristics: Red light on control card, it says "ARMED" in the display.



Rule 2:

The drone battery (LiPo), can develop heat and toxic fumes if it is severely damaged. It the batteri suddenly inflates or starts to extract smoke, get the battery outside the premises, and away from people as quickly as possible.
Have a plan for this in advance.

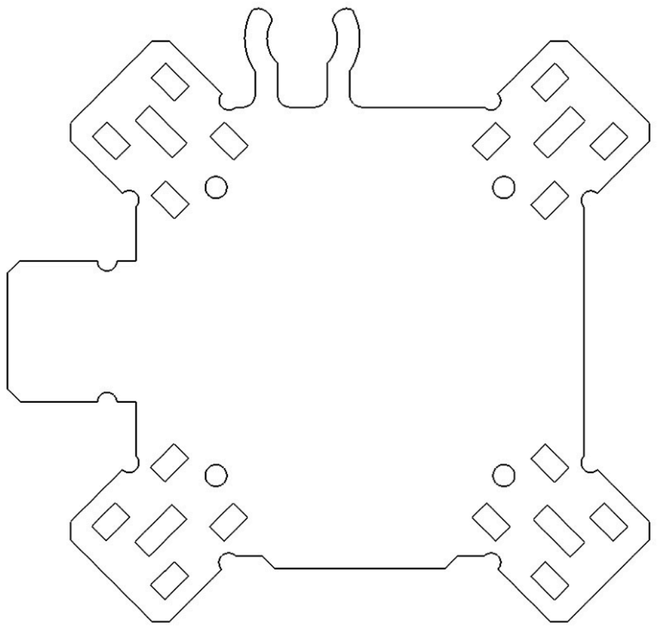


Propeller hazard
The propellers rotate at up to 28,000 rpm. minute. Show respect for the forces and damage potential of the propellers when the drone has battery connected. Keep the required safety distance when the drone is armed.

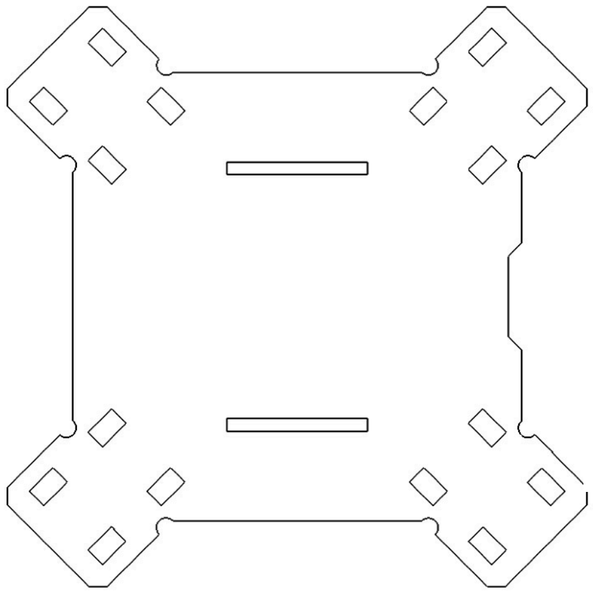
Aviation rules
When flying outdoors, make sure to follow local drone rules. Keep a safe distance so as not to endanger other people.

It is not recommended to fly this drone higher than the roof of the nearest building and no more than 30 meters away from yourself. This will help you retain control of the drone.

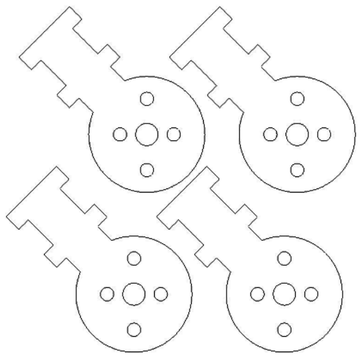
Deleliste - Ramme



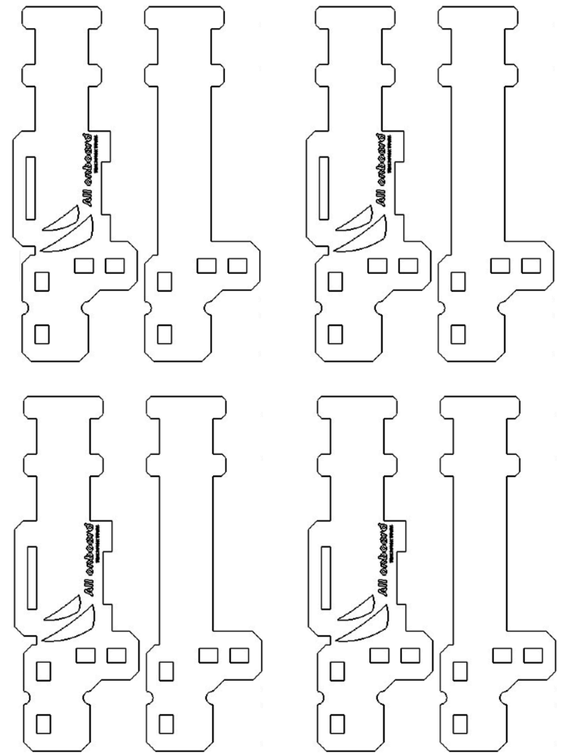
Top plate



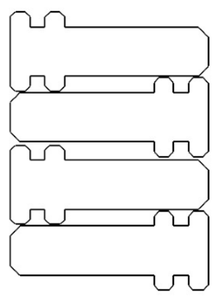
Bottom plate



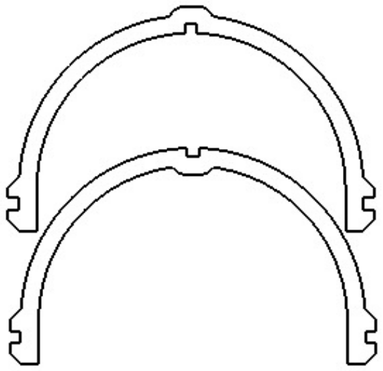
Motor holders,
4x



Arm pieces,
type A and B, 4 of each



Landing legs



Protection hoops
upper / lower part

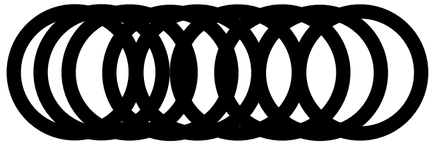
Nylonskruer,
4 stk

Battery strap

Avstandsstykker,
8 stk

Velcros, 4x

Nylonnuts,
4x



o-rings:
8x

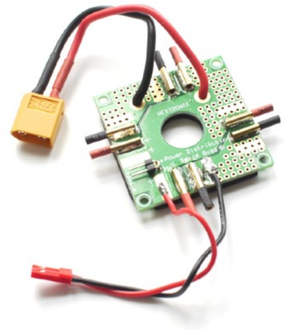
Deleliste - Elektronikk

1 stk
Radio with receiver

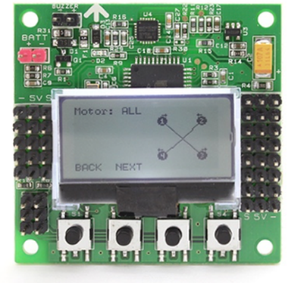
4 x regulators
(ESC)

1 x
3 cell LiPo-battery

1 stk fire proof LiPo
Charging bag

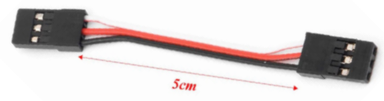


1x Power distribution board



1 stk KK2 flight controller

2+2 propeller, CW
and CCW type
(+4 spares)



4 servo cables

Piezo-speaker with cable

2+2 1806 2300 kv
brusless motors, CW and
CCW type

Assembly

As assembly manager, your job is to make sure that all the parts are assembled together in the right way. Use the attached drawings and get a couple of free hands from your team members.

You are responsible for all assembly except connection of wires, which is left to a knowledgeable electrician when your job is done.

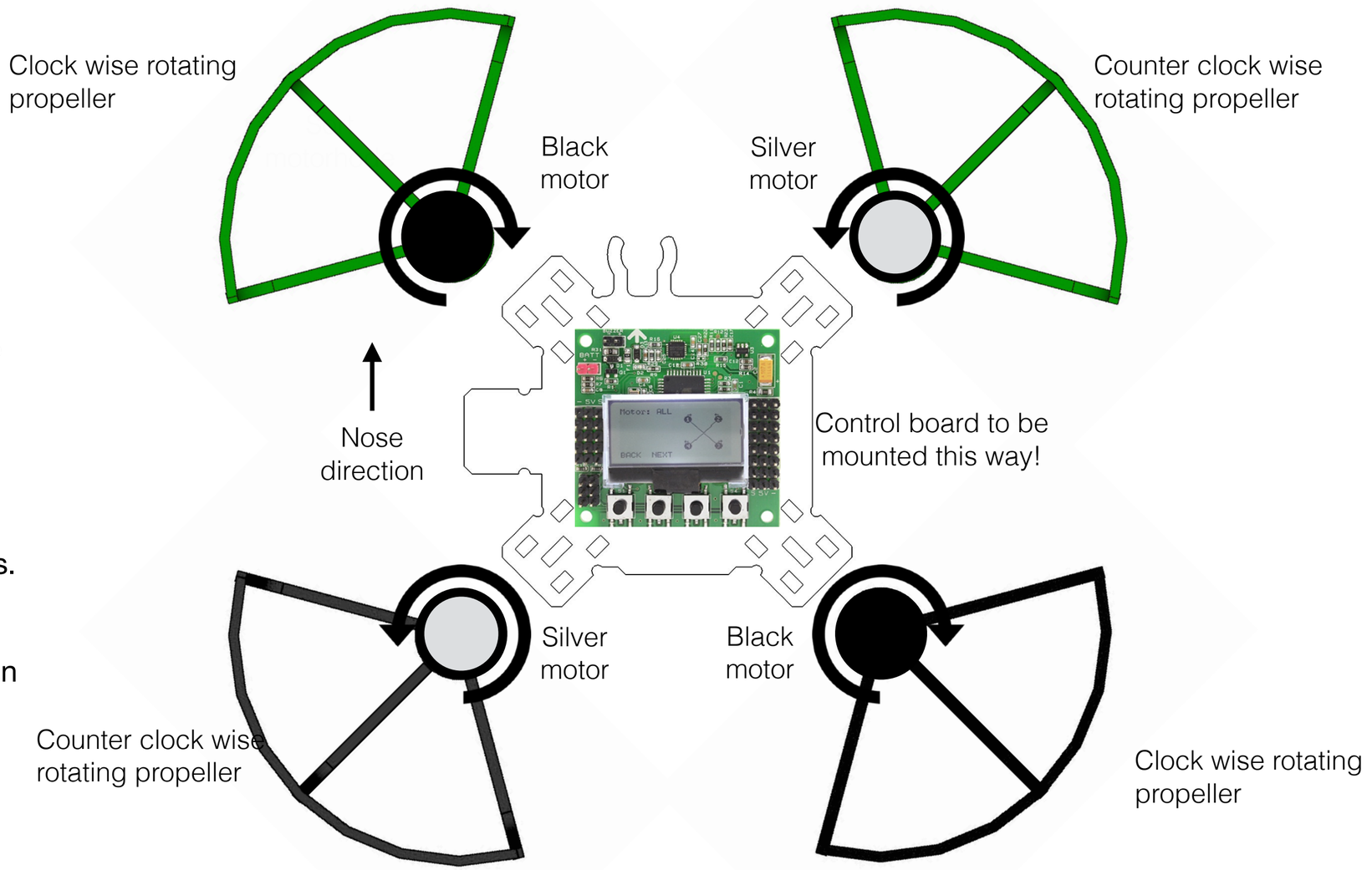
What you need to do:

- Get the necessary tools: Medium-sized Phillips screwdriver, 1.5mm Allen key, scissors
- Follow the construction instructions. You will receive parts from the component manager as you need them. Bring helpers with you, then it might go faster.

Layout

Make sure:
You must have two identical colors on the front of the propeller protectors, and another color on the back.
This is to make the flight easier for the pilot.
You must place the black and silver motor as shown in the picture. The engines must go their separate ways.
You must place the top plate as shown in this picture. The control board must be placed in the direction shown here.
The direction of the nose on the drone is then to the north.

Finally, you must mount the right propeller in the right place. See next page.



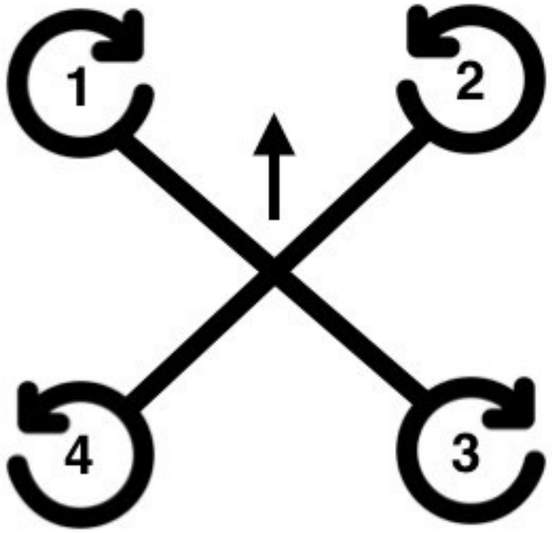
Mounting the propeller

We recommend saving this part until everything else is mounted.

Always make sure that the battery is disconnected before mounting the propeller!

Also, make sure that you have tested and adjusted the direction of rotation so that they are correct.

Clockwise (CW) Counter clockwise (CCW)

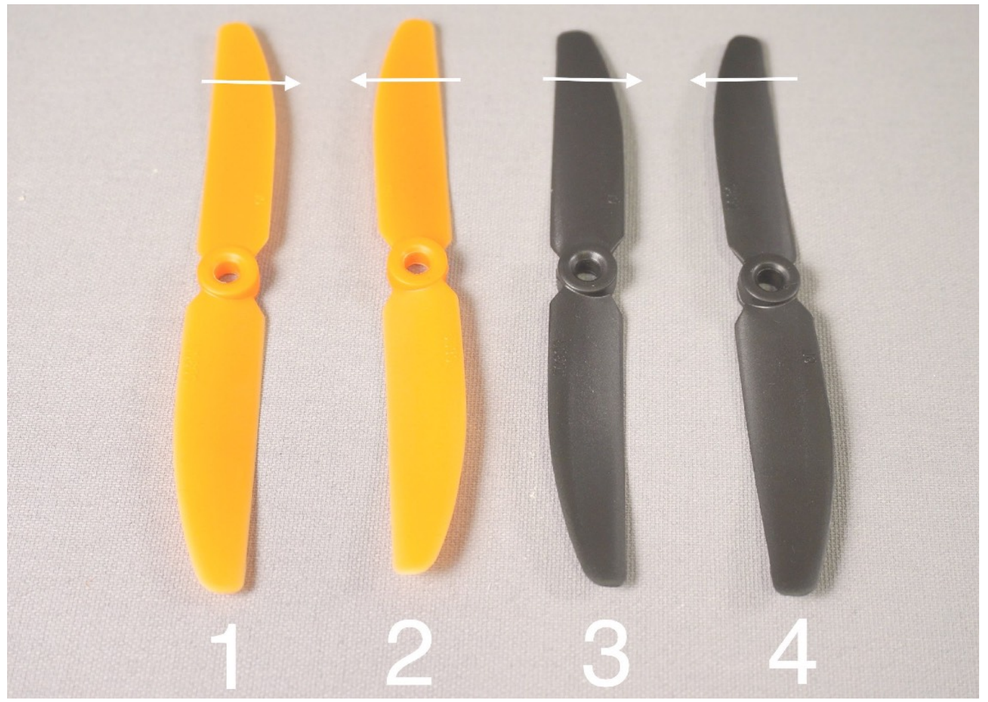


Counter clockwise (CCW) Clockwise (CW)

We have two types of propellers, right and left rotating. (Regardless of color)

Right-rotating is marked R, eg 5030R. Install the propellers according to the overview above.

The writing on the propellers is going up towards the sky.



5030R 5030 5030R 5030

Unscrew the bolts on top of the engine and place the propeller on the screw.

Tighten the bolts again. They can be screwed with your fingers and should not sit particularly hard. They tighten themselves during flight.

Silver motor head should be screwed the opposite way of black motor head.

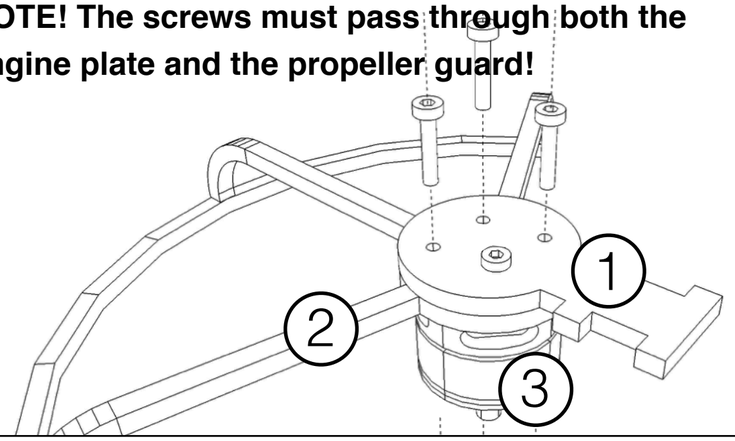
Motors and arms

Tools: 1.5mm Allen wrench

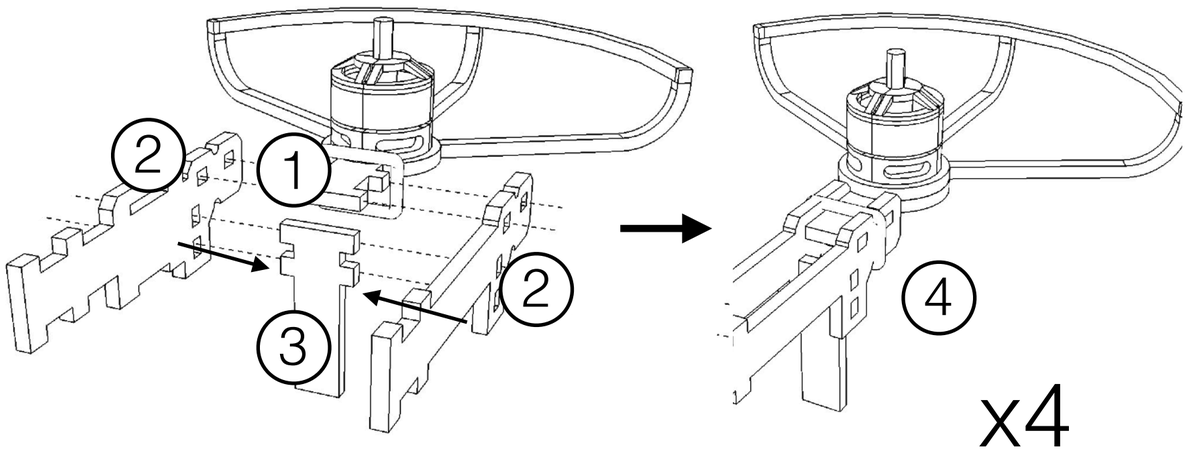
Parts: 4 engine plates, 4 engines, 4 propeller protectors, 8 arm pieces (two variants), 4 landing legs, 16 pcs 10mm m2 screws, 4 o-rings

Screw in all four engine screws through the engine plate (1), the propeller guard (2) into the engine (3).

NOTE! The screws must pass through both the engine plate and the propeller guard!



x4



x4

Temporarily thread a small rubber ring onto the motor plate (1). Click the engine plate with armrest type a and b (2) and the landing legs (3). Finally, tighten the rubber ring (4).

Repeat for all four arms.

Senter plate

Tools: Star puller

Parts:

1 top plate

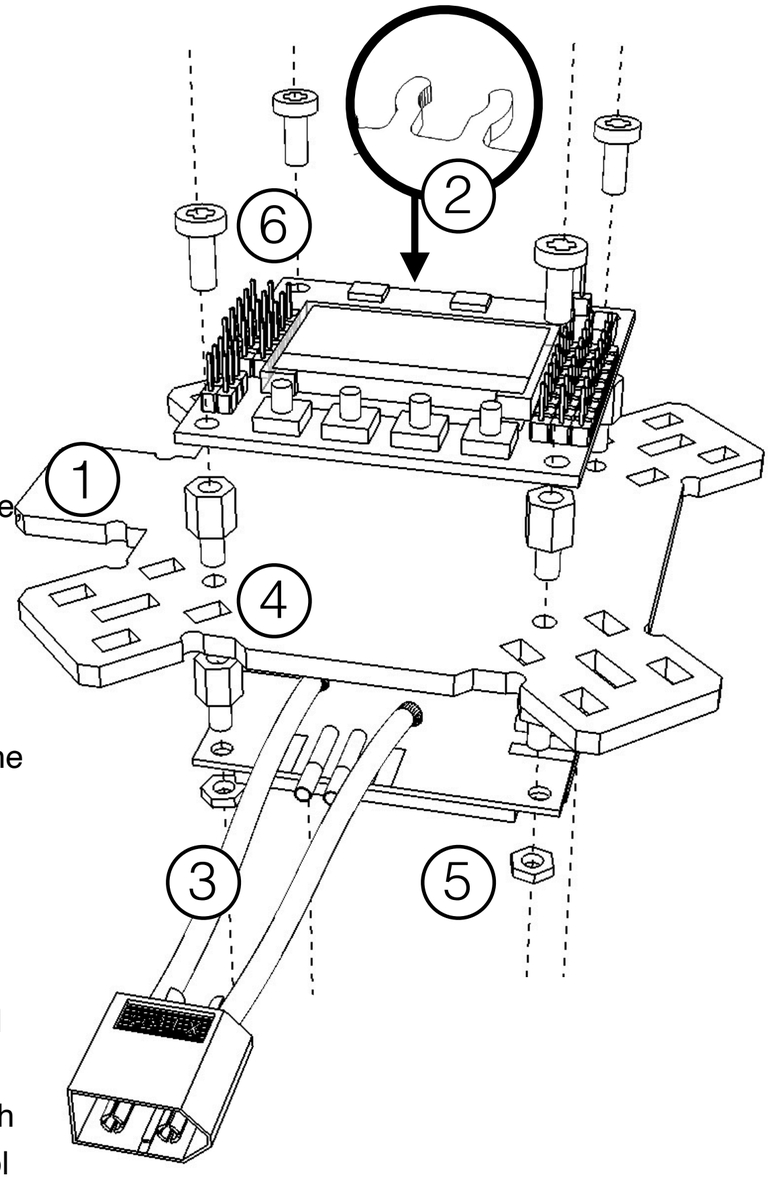
4 nylon screws

8 spacers

4 nylon nuts

1 control card

1 power distribution board



Note the location of the top plate with the holder for the receiver located on the left (1) and the holder for the buzzer (2).

Also note the location of the power distribution board, with the battery cable facing south (3)

and the thinner battery measuring cable facing north (not shown)

Screw the 8 spacers above and below the top plate (4), fasten the power distribution board with 4 nuts (5), and finally the control board with 4 screws (6).

Final frame assembly

Parts:

1 pre-assembled top plate,

4 pre-assembled arms,

1 bottom plate,

1 battery strap

2 roll bars upper and lower part

4 o-rings

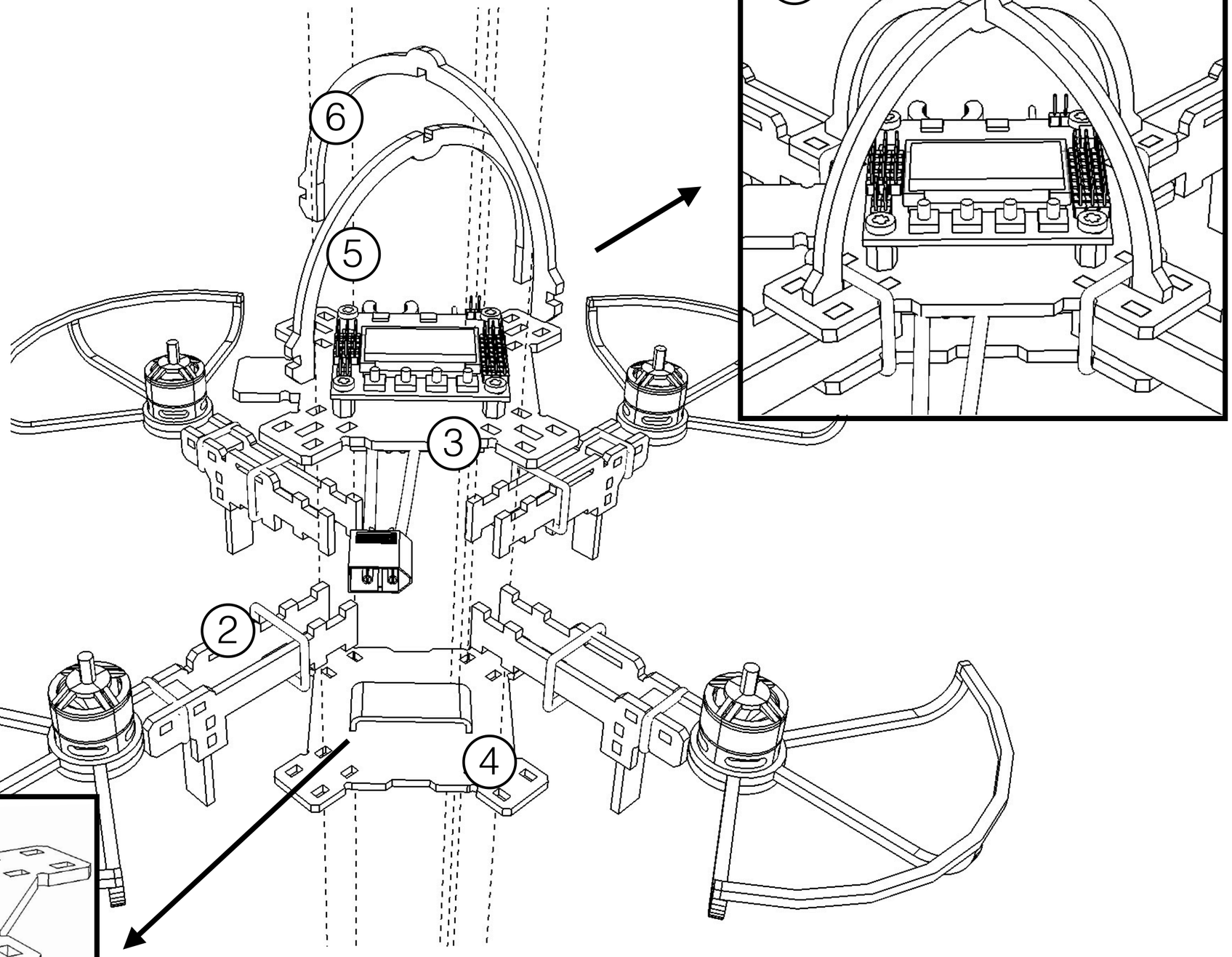
Mount the battery strap on the lower base plate so that it can hold the battery later (1)

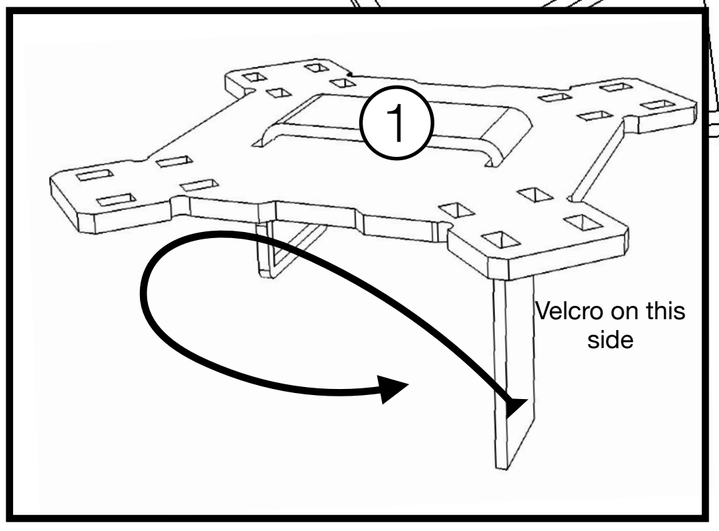
Place a large o-ring on each arm (2) click together the arms between the top plate (3) and the bottom plate (4)

click in place lower roll bar (5), then upper roll bar (6).

Thread the o-rings into place so that they hold the top and bottom plate together.

Check everything everything fits well together in the end (7)





Electrical connections

As an electrician, your job is to connect all the electrical components together correctly. The components must be connected in the right place, and all plugs must be connected in the right way.

Be careful: Faulty connection can lead to malfunction and damage to components, when connecting the battery.

Elektronikkmontering

Parts:

4 pieces of fastening tape

1 radio receiver

1 o-ring

1 piece of elastic

4 servo cables

1 radio receiver

4 servo cables

1 pc buzzer

4 pcs regulators

Mount a fastening strap on each arm (1)

Attach the radio receiver with a large o-ring (2)

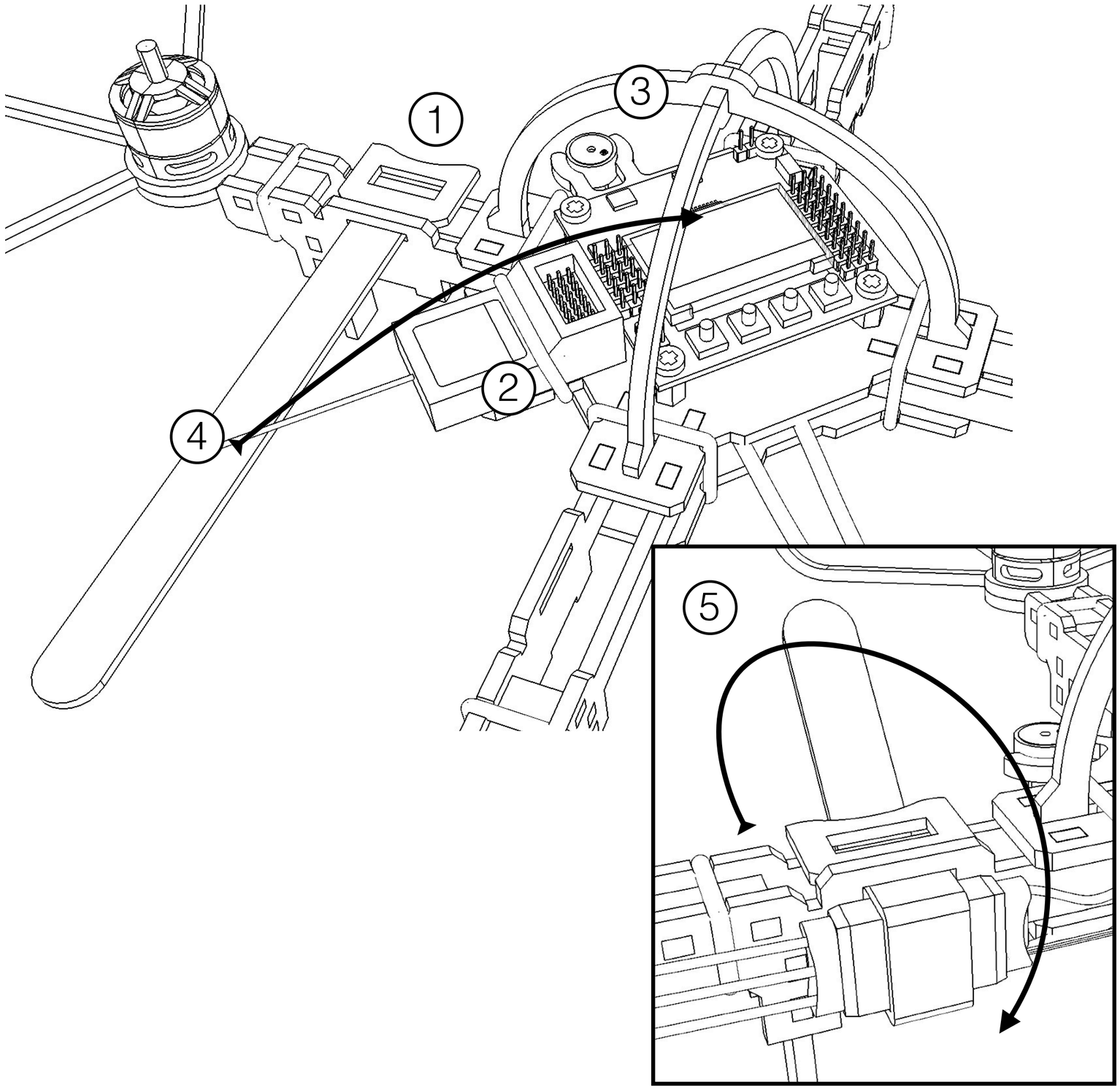
Attach the buzzer to the holder (3)

Thread the antenna through the hole next to the radio so that it points downwards and cannot be hit by propellers (4)

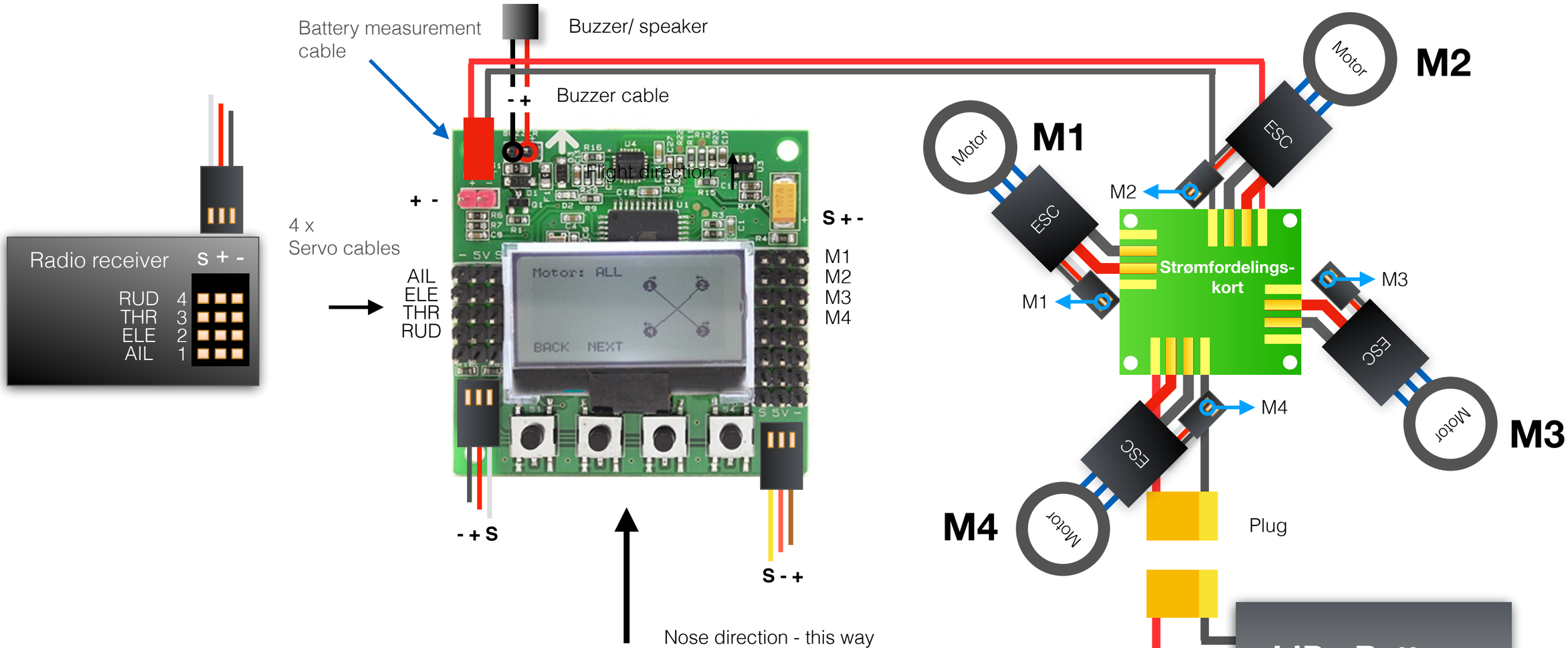
Connect regulators, buzzer and power cables according to the wiring diagram on the next page.

Attach the regulators along the arms and tighten the fastening strap around. (5)

You can now pick up the drone battery. This must be strapped in the middle underneath the quadcopter



Connection diagram



Servo cable: Minus is the darkest color, then red is +5v, then S is the signal (PWM)

Programming

As a programmer, you must make sure that the control card is configured with the necessary parameters and calibrations that are necessary for the quadcopter to work. Be careful so that the drone flies stably.

Oppstart

Turn on the radio transmitter.

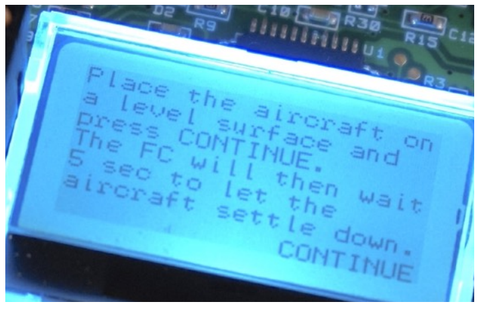
Then connect the power by plugging in the drone battery in the yellow plug. The control board then starts up and you should hear a beep in the buzzer.

- There should also be a beep every time you press a button.
- If the buzzer does not make a sound, tell the electrician to fix it.
- There may be error messages on the screen, which will disappear later.
- Check that the battery meter works. A full battery is about 12.6 volts. The display should then say: “Battery: 12.6 volts”

ACC Calibration

We need to calibrate the accelerometer so that the control board knows where the ground is.

Click “MENU” and “UP / DOWN” until you find this item. Follow the instructions.



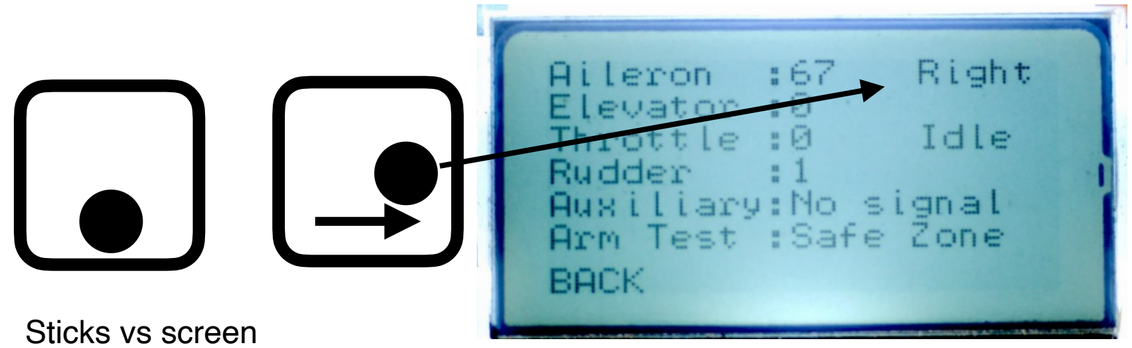
Setup radio receiver

This must be done together with the pilot.

Go to “Receiver Test”. Here it is important that both jacks on the remote control correspond to the deflections on the screen. Each stick represents two channels and is called Aileron (Roll), Elevator (Pitch), Throttle and Rudder (Yaw). It is very important that the movement detected on the screen is correct. For example, a right movement with the right stick should result in the effect "Aileron: Right" on the screen. **Check that all four directions of flight are correctly registered by the control card, both in cases of "left" and "right" as well as "forward and" backward ".**

The throttle should go from about 0 when it is down, to about 100 when it is at max. If this is reversed, you can use the reversal buttons:

You should also make sure that the numbers are around 0 (+/- 5), when the sticks are in the neutral position, ie the throttle is in the lower position, while the others bounce back to their starting point. The trim buttons are used for this.

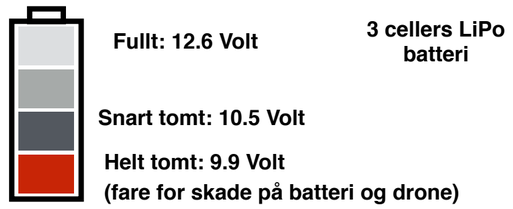


Sticks vs screen

Battery alarm

To know when the battery is nearing the end, we must program the voltage alarm. Go to Misc settings 1 -> Alarm 1/10 volts. Enter 105 (10.5 volts).

Our 3-cell battery will be fully charged at 12.6 volts and completely empty at 9.9 volts.



Self-level

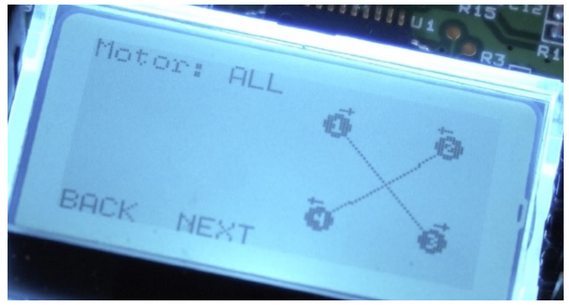
Self-level means that the quadcopter returns to a horizontal position when we release the plugs. Go to Mode settings -> Self-Level: Always

Motor Layout

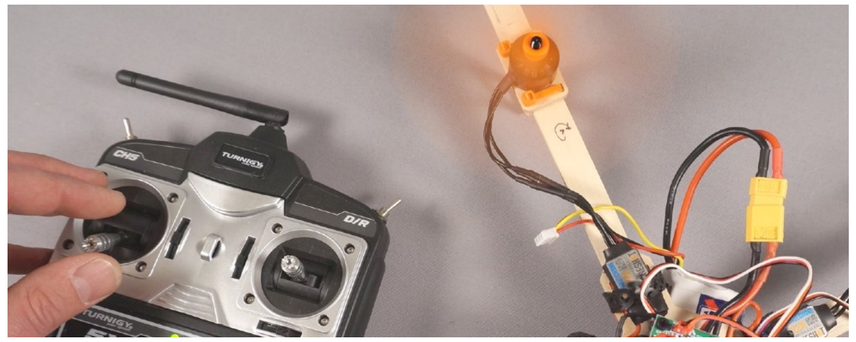
It is important to let the control card know what kind of multirotor you have. Navigate to “Load motor layout” and select quadrocopter X mode ”.

You will then get an overview of:

- Location of engines
- Directions of rotation
- Engine number

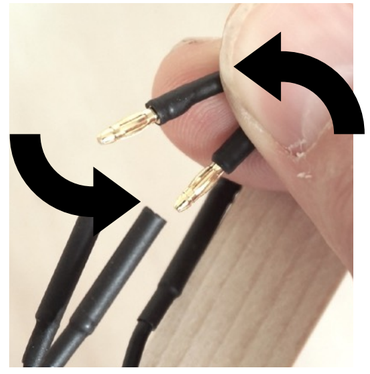


Check with the electrician if the controllers 1-4 are connected to the correct output on the control board, according to the wiring diagram (page 14)

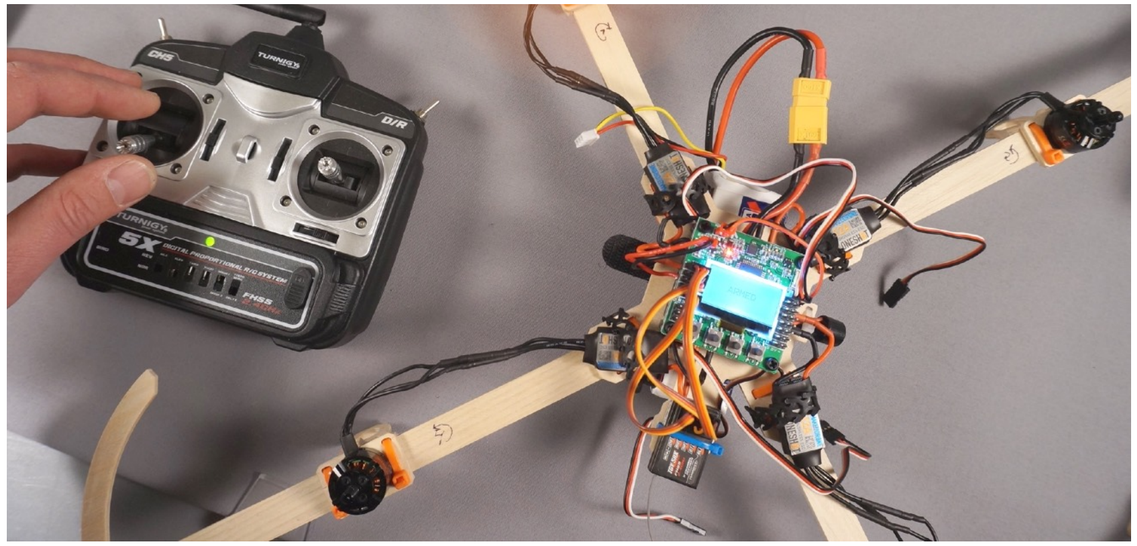


Now, together with the pilot, check the direction of rotation of the engines, one by one.

- Install paper or paper propellers (page 24) on the motors.
- Arm the drone (see page 23) and gently accelerate until the engines spin.
- Check if the motors are going in the right direction. See layout page 6
- If an engine does not spin directly in relation to the engine layout, the direction must be reversed.
- You do this by switching any two plugs between motor and regulator.



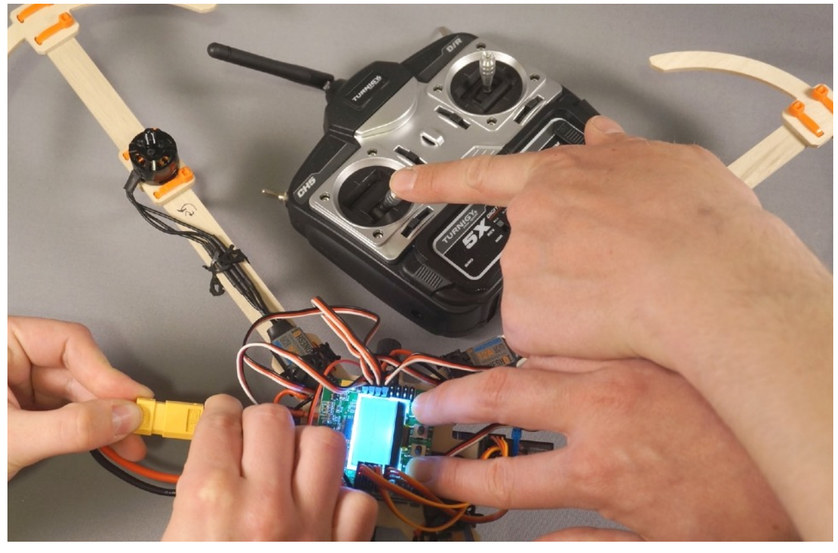
Kalibrering av regulatorer



The next thing to do is called the throttle range and is done to calibrate the controllers so that they interpret the control signals from the control board in the same way. Here you must be two people. **No propeller can be mounted at this stage.**

Disconnect the battery on the drone.

Start by turning on the remote control and set the throttle to max. Person 1 holds down buttons 1 and 4 on the flight controller at the same time and holds these until the procedure is completed. Person 2 then connects the battery on the quadcopter. The screen should show "**Throttle pass trough**". Wait about 4 seconds - a beep sounds.



As soon as this signal is complete, immediately lower the throttles to zero. Wait for a new signal. You can now release buttons 1 and 4. Restart the quadcopter by pulling out and inserting the battery again (the radio transmitter is on all the time).

Verify that all the motors spin up when arming. Propeller should still be off! Gently accelerate with the throttle. At a certain point, all the motors should start spinning almost as fast. It is an advantage that the quadcopter stands horizontally on this test.

Flying

As a pilot, it is your job to fly the quadcopter in a controlled way. Here it is important to keep a cool head, at the same time as coordination and fast reaction time are important. Study the attached information carefully, they will give you good conditions for completing a controlled flight.

Before flight:

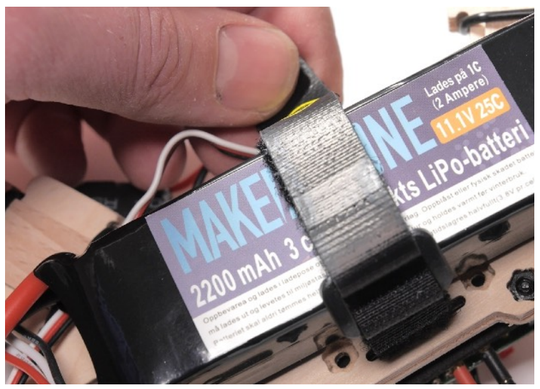
Securing cables

Before we fly, we must secure the cables.

Disconnect the battery.

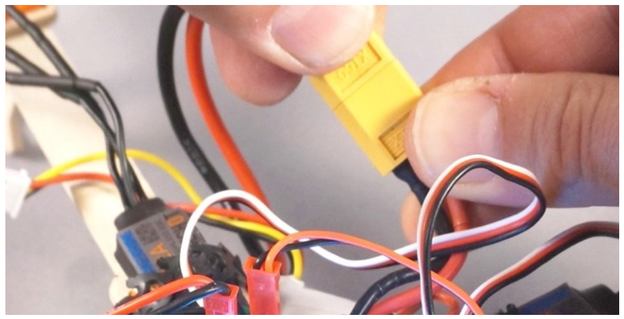
Place all cables so that no wire can come into contact with the propellers. Imagine that turbulence and wind could cause the cables to blow into the propellers.

Mounting the battery



Power on drone:

Always turn on the radio transmitter before turning on the drone. The drone starts when the battery is plugged in.



Power off drone:

First, unplug the battery on the drone. Then turn off the radio.

Radio controller

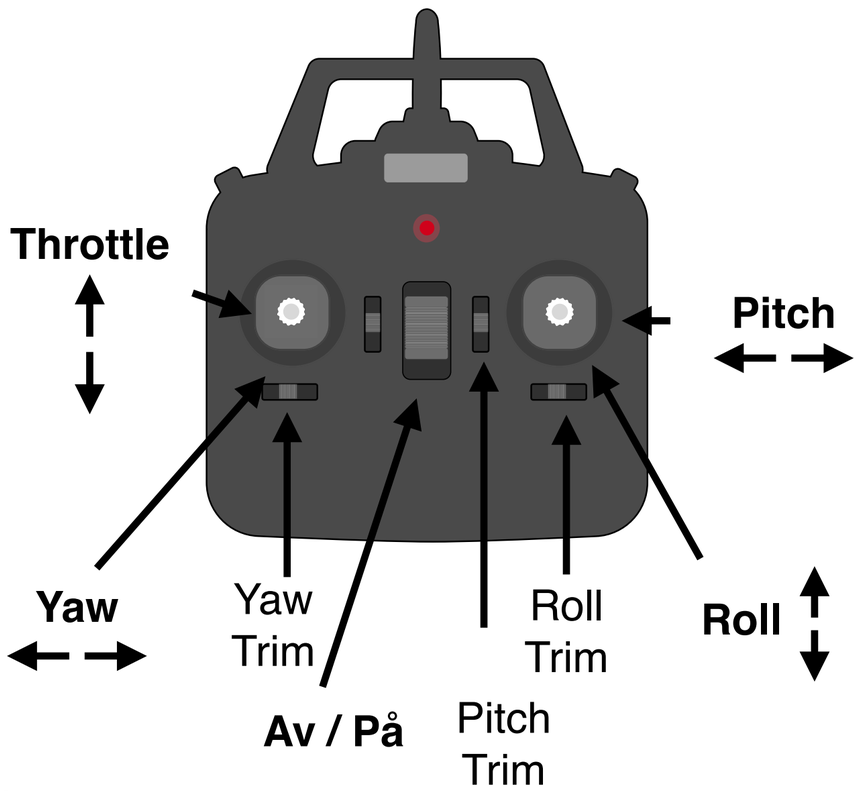
Make yourself familiar with the sticks and what they do.

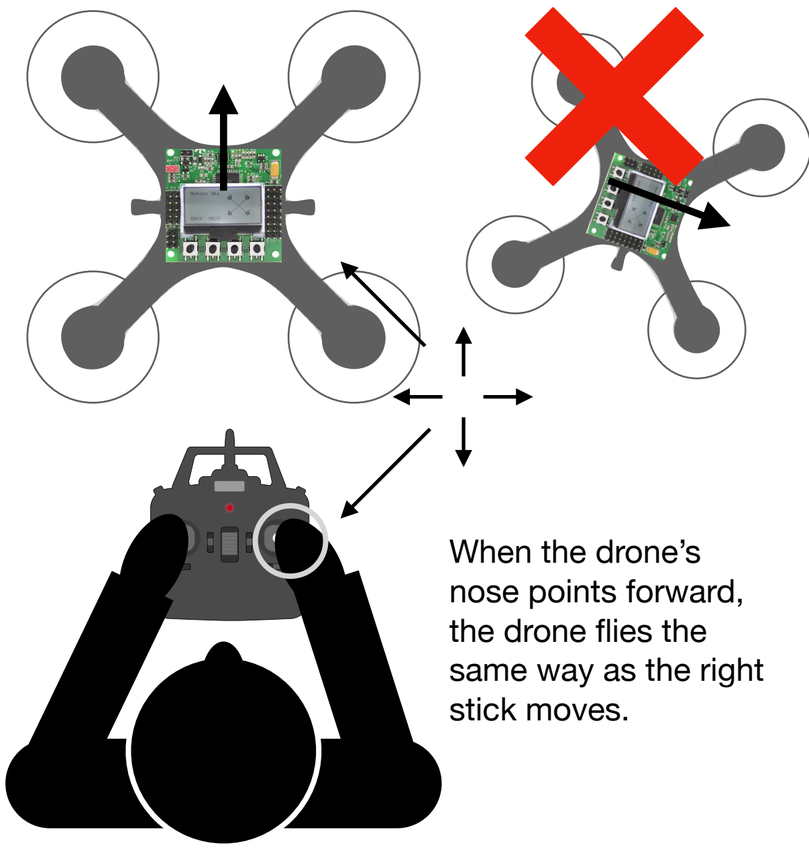
Throttle: Gas, increases speed upwards. The drone will normally stand still approximately when the throttle is at 50% (in the middle). This stick should normally be down when not flying.

Yaw (rudder): Sideways rotation. The drone turns / rotates to the left or to the right.

Pitch (elevator): Forward/backward

Roll (aileron): Left/Right





When the drone's nose points forward, the drone flies the same way as the right stick moves.

To turn on the radio and drone:

The throttle plug must be down. First turn on the radio, then turn on the drone by plugging in the battery.

Calibration

The optimum is that the drone is relatively immobile in the air, as long as you have the right amount of throttle and the other sticks are in the neutral position. Then the drone should not move to the side or forwards / backwards. It should also not rotate (yaw).

If the drone is more than 1 meter above the ground, and still tilts to the side or rotates, use the trim sliders. Carefully pull them in the opposite direction of the path the drone is spinning or rotating, to weigh up.

Arming

Before we can fly, the drone must be activated. This is done by pulling the left stick down and to the right.

A beep will sound, along with a red light and the text "armed" will appear on the display. The safety distance must then be at least 2 meters.

Before taking the drone, always disarm first!

To disarm, drag the left stick down and to the left.

Strategy for steady flight

Make sure the quadcopter always points the same way as yourself. Have a clear idea of what the nose direction of the drone is (when you can read the text on the screen, it is in the right direction). If the drone turns, turn it back with the yaw stick. If the drone is well calibrated, you will first need to use throttle, pitch and roll to fly.

If you lose control

The easiest thing you can do, if you feel you are losing control of the drone, is to land relatively quickly. Carefully pull the throttle down to zero before the drone goes astray.

Battery alarm and flight time

When the battery approaches empty, a battery alarm starts beeping. You must then land as soon as possible before the battery or drone can be damaged. It can be difficult to hear, so you need to pay close attention. The flight time on this drone is 11-13 minutes.

It is important to land as soon as the volt alarm starts beeping.

Otherwise you can damage the battery permanently!

Testpropeller

Cut out the test propellers and make a hole in the middle. Mount them on the motors to test the directions of rotation.