

ARF-MikroKopter



OktoXL + OktoXL 6S12

Instruction manual

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Introduction

Dear Valued Customer,
thank you for purchasing our product..

This manual is part of the product. It will provide you important information regarding the operation and handling. To ensure a safe operation please read this instruction manual carefully before using.

Please keep this manual handy at all times as a reference!

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Symbols

This symbol alerts the reader to important points, such as hazards during operation and handling.



The "Info-Arrow" shows locations with additional tips and hints.



Intended Use

The ARF-MikroKopter is a model aircraft. An appropriate liability insurance is mandatory for operation. Please check your insurance cover before using !

You as a user / pilot are responsible for a safe operation and correct function of the model !

The product is not a toy and it is not suitable for children under 14 years.

It is not allowed to make any unauthorized changes or modifications on the ARF-MikroKopter.
Operation is allowed only with the ARF- MikroKopter approved modules, batteries and the original software.



Please follow all safety instructions in this manual. It contains important information about using the product.

Safety

General

The **ARF-MikroKopter** (ARF = **A**lmost **R**eady to **F**ly) is a pre-assembled, pre-set and tested model aircraft.

Among those connections and/or adjustment work, a proper execution must be ensured.

No liability will be assumed for damage caused by not following instructions in this manual. Improper connection and adjustment will also void the warranty.

Normal wear, crash damage or consequential damage are also excluded from the warranty.



- Those at the ARF-MikroKopter assembled motors can cause a noise during operation and also with an increased use.
- Those at the ARF-MikroKopter used batteries will lose power with an increased use.
- Plastic propellers can become brittle / fragile through time and by sun exposure.



Please observe the following notes:

- The pilot must be able to fly the ARF MikroKopter in any situation without aids, such as the GPS system.
- If you see a malfunction of the AltitudeControl or the GPS function, switch off the functions and fly the copter manually.
- Please note the information in the manual about your charger and transmitter.
- Do not switch off the transmitter while the copter is ON and the propellers turn.
- Model aircrafts can cause significant property damage and / or personal damage with improper handling.
- Do not touch a moving propeller. This can cause severe injuries.
- Never catch the Kopter out of the air! This may also lead to significant injury.
- Never turn the transmitter off during the flight. The Kopter can crash and can cause considerable damage.
- Leave the transmitter switched on while the ARF-MikroKopter is operating.
- When starting, landing and flying make sure a sufficient large distance away from people, animals and objects is ensured.
- Make sure the Kopter can not take off unintentionally when making adjustments. If necessary remove the propellers for your own safety (such as during an engine test).
- Do not expose the Kopter to rain, moisture, excessive heat, cold or vibration.
- Do not control an ARF-MikroKopter if you are under the influence of drugs or alcohol.
- Check the tightness of all connectors and screws as well as the mechanical integrity of the **ARF-MikroKopter** before each start / flight.
- Never start if you have discovered a damage to the **ARF-MikroKopter** or to the transmitter / receiver.
- Fly with your **ARF-MikroKopter** always in sight. So you are able to respond quickly if a fault occurs by external influences.

Functions of the ARF MikroKopter

The ARF MikroKopter comes with the GPS-System. You can use many additional functions with this GPS-System.

Functions of the **ARF-MikroKopter**:

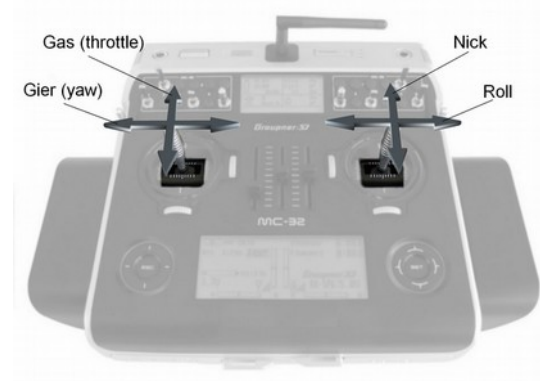
- Highly versatile. For example Photo / Video flight, action shots, inspection / maintenance flights, surveys, documentations, and much more.
- Easy to fly with automatic attitude stabilization (gyro and ACC support)
- Redundancy by 8 propellers
- Secure fly further and be able to land even if one engine / propeller fails
- Fly securely at high wind strengths
- All functions are easy to use with the transmitter
- Safely carry payloads of up to 2500g or >5.5 lbs (e.g. SLR camera, thermal imaging camera, etc.)
2500g => ARF-OktoXL / 4000g => ARF-OktoXL 6S12)
- Automatic alignment of a connected camera mount
- Additional control of the camera mount via the transmitter
- (Video-) Camera control and trigger via the transmitter
(optionale Shutterkabel, IR-Ctrl oder LANC-Ctrl required)
- Start and Stop of a camcorder
(optional IR-Ctrl or LANC-Ctrl required)
- Live view from camera on the ground
(optional Videos transmitter/-receiver is needed)
- Automatic "*AltitudeHold*" during flight
- Automatic "*PositionHold*" during flight
- Automatic "ComingHome" to the start point
- Automatic Start/Land
- Automatic „*FailSafe*“ if signal lost
- Automatic "BatterySafe"
(audible warning => Auto-ComingHome => AutoLanding)
- Wireless data transmission can be connected
- Display of telemetry data with all important data like battery power, flight time, and more.
- See the current position of the Kopter in a map (MikroKopter-Tool on a Laptop required)
- Display of telemetry data in the "OSD" of the MikroKopter-Tool
(optional Wi.232 or Bluetooth and a Laptop required)
- Place up to 200 Waypoints and/or POI (point of interest) on a map
- Fly waypoints and POI automatically
- Automatic alignment of a camera during a waypoint flight
- Can follow a „FollowMe“ transmitter automatically
- and much more

Control

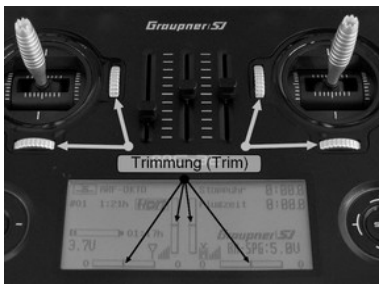
An **ARF-MikroKopter** is easy to fly. But it takes practice and time to be able to control the Kopter safely. The pilot must also be able to fly the Kopter in any situation without aids such as the GPS-System.

The Kopter is controlled by a RC-transmitter. The Throttle, Yaw, Roll and Nick functions can be controlled by the sticks.

- **Throttle**
 - Controls the speed of the motors (up/down)
- **Yaw**
 - Turns the Kopter around
- **Nick**
 - Flies forward or back
- **Roll**
 - Flies left or right



(Example: Mode2)



Ideally the ARF-MikroKopter can stay on position with no wind.

Info: Please leave the trim of the transmitter always in middle position (off)

Via the switches, buttons and potentiometer of the transmitter further functions like e.g. the automatic hold of the actual position (PositionHold), an automatic

back-flight to the start point (ComingHome) or non-directional flying (CareFree) can be used. For this purpose the mounted GPS-System and the compass-sensor is used. The GPS system consists of the MK-GPS and NaviCtrl. The compass sensor is installed on the NaviCtrl. The functions are further described in „Functions / Flight modes“ Page 37.

Before each flight

Check the Kopter always for:

- Damage to the frame, cables, motors, propellers and electronics
- Tightness of the rigger, motors and propellers
- Functions of the motors
- Tightness of all screws (Motors, Rigger etc.)
- Loaded and not damaged batteries (**ARF-MikroKopter** and transmitter)
- That the microSD card is insert into the NaviCtrl. (see page 62).
 - The SD card will save the LOG file during flight. This can help if you have a problem with the copter.



In the Settings the function „*no start without SD card*“ is activated.
So if the SD-Card is not there or not plugged in correctly into the NaviCtrl, you can not start the Copter.
In this case the Copter will beep during you try to start the Copter.

(See also „Maintenance“ Pg. 56)

The order of switching on / off the ARF-MikroKopter and the transmitter:

Switch on (before the flight):

1. All switches on the transmitter put into the default „OFF“.
2. Switch on the RC-Control (if necessary choose the right model memory).
3. Bring the trim of the control-sticks into the middle position.
4. Connect the **ARF-MikroKopter** to the battery (LiPo).

Switch off (after the flight):

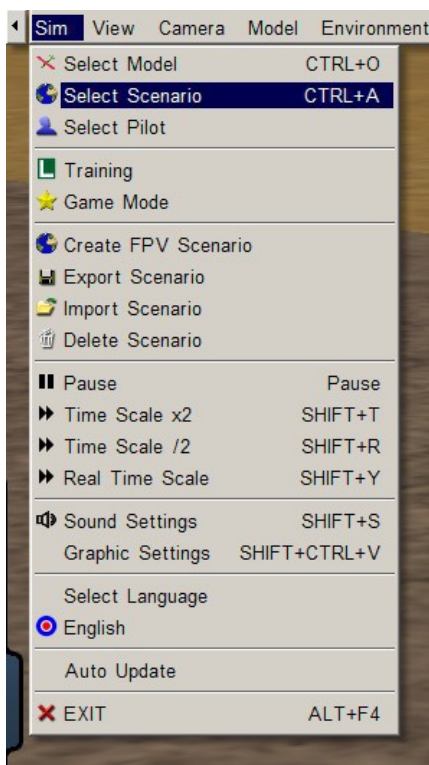
1. Switch off the motors.
2. Disconnect battery (LiPo) from the **ARF-MikroKopter**.
3. Switch off the transmitter.

Flight simulator

To get familiar with the controls we recommend practicing with the AeroSIM RC – Flight simulator. In this PC-Program various MikroKopter models can be flown like in reality. The same transmitter can be used, which is later also used for the control of the **ARF-MikroKopter**.



With different training programs in this simulator your flying can be trained and improved.



Battery (LiPo) – General information

ARF-MikroKopters use Lithium-Polymer-Batteries, called LiPo. The **ARF-MikroKopter** is designed for the use with 4S (14,8V) LiPos. The right LiPos can be purchased through us.

The **ARF-MikroKopter** monitors the battery during the flight. If the voltage gets low, a warning tone will sound from the buzzer on the Kopter.

This alarm is also signaled by an existing telemetry transmission on the transmitter (with the HoTT system) or PC (when viewing in the MKTool OSD).

Once this alarm sounds, land **immediately** and load or change the LiPo..

Continuing the flight with a warning signal can permanently damage the LiPo and the Kopter could crash.

After landing the Copter and turning off the motors the connection between LiPo and copter should be separated. Keep the battery pack out of the ARF-MikroKopter if that one is not used (e.g. storage or transport). That avoids a fully discharge of the battery.

Do not charge the LiPo directly after landing. Let the LiPo always cool down. Improper handling of LiPos causes burns / explosion hazard! Do not use damaged or defective LiPos!



Before using the LiPo the first time it must be fully charged!

The first charge of LiPos, depending on the charge level of the individual cells and operation / performance of the charger been used, will take up to several hours.



The proper charging and discharging of the cells / LiPos can not be monitored by us. Any warranty is excluded for incorrect charging or discharging.

Safety rules for LiPos

Lithium-Polymer-batteries (LiPo) require particular careful treatment. This applies to charging, discharging, storage and other handling. Incorrect usage / treatment of LiPos can cause performance problems, explosion, fire, smoke, poisoning and other problems.

Do not cause short circuits as permanent short circuits lead to the destruction of the battery. High temperatures and possibly spontaneous combustion can be the result !

Each charge / discharge and storage at too high / low temperatures reduces the capacity of the battery. The recommended temperature range for charging and storing LiPo - batteries is 0-50° C.

A battery is a wearing part. Please be aware that batteries will wear out with use, and flight time will decrease.

For charging LiPo batteries the approved charger with the appropriate charging cable must be used. The max. loading capacity must be limited to 1.05 times of the battery capacity.

(Example: 5000mAh Akku = 5250mAh max. loading capacity)

Use for charging and discharging of LiPo batteries only the especially designed charger / discharger.

The battery temperature should not rise above 70°C during the discharge.

Make sure that the number of cells and the charge voltage are set correctly. A voltage above 4,25V per cell must be avoided otherwise the cell will be damaged permanently.

Further information about the settings get out of your instruction manual of your charger / discharger.

The battery which need to be charged must be while charging on a non-flammable, heat resistant and not conductive surface ! Combustible or flammable materials need to be away from the charging spot. Charge batteries only under supervision !

To store LiPos they should have a charge level of around 10-20%. During the storage the LiPos should be reviewed regularly. This is easy with a LiPo-Tester. If the voltage of the cells go down to 3V they must be necessarily charged.

Deep-discharge and storage in discharged condition (cell voltage less than 3V) makes the battery useless..

The foil / outer shell of the LiPo can be easily damaged by sharp objects such as needles, knives, nails, etc. If the foil is damaged it makes the battery useless..

Mechanical shocks e.g. throughout dropping, hitting, bending etc. can also make the LiPo unusable.

Do not use damaged batteries under no circumstances ! Damaged or exhausted batteries are hazardous waste and must be disposed accordingly.

If a LiPo is damaged, avoid any direct contact with the electrolyte. By contact with the skin, eyes or other body parts you

need to clean or rinse it immediately with plenty of clean and fresh water. Then a doctor should be consulted.

Charging the LiPo



Only charge a LiPo with an appropriate charger and integrated balancer.

The necessary settings can be found in the manual for the charger.

It is absolutely necessary that the recommendations in the instruction manual be followed. After use the LiPo should cool down before the next recharge.

The LiPo in the ARF-MikroKopter consists of multiple internal cells. In addition to the cable with the Deans connector another jack, the balancer, is connected with 5 cables to the LiPo. In that case the individual battery cells are monitored during charging. With properly set values on the charger, charging the LiPo will be finished at a charge voltage of 4,22V per cell.

The settings you need to charge a LiPo can be found in the manual of the charger.

Example: Connection to a Robbe POWERPEAK charger:

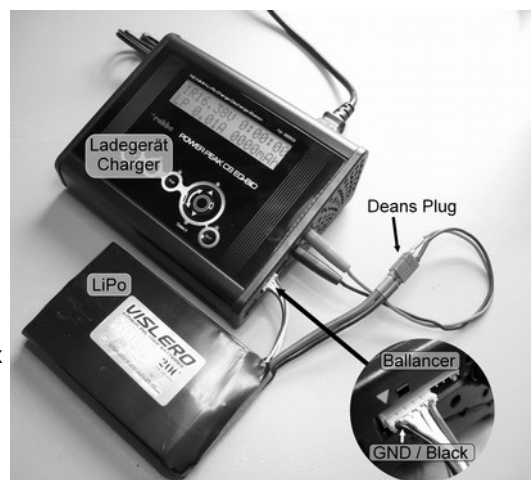


What does the inscription mean on the LiPo?

Example: 5000 / 14,8V / 4S1P / 20C / 4C Charge

5000	=>	Capacity of the LiPo (here 5000mAh = 5Ah)
14,8V	=>	Voltage 14,8Volt
4S1P	=>	4S = 4 cells are connected in series / 1P = no further cell is connected parallel.
20C	=>	Maximum current of the LiPo. This is calculated as follows: $(\text{Capacity}/1000) \times \text{current}$ (5000/1000) x 20 = 100A).
Max.		
4C Charge	=>	Maximum permissible charging current. A 5000mAh LiPo can be charged with max. 20A (4x5000mA).

For a longer life LiPos should be charged only max. 1C.



LiPo storage

For the storage of a LiPo over a longer time period (e.g. over the winter months), he should not be quite fully charged. Recommend is a single cell voltage of ~ 3.8 V. Fully charged LiPos can otherwise be damaged during long storage. The LiPo should be checked at longer storage and, if necessary, be refueled.

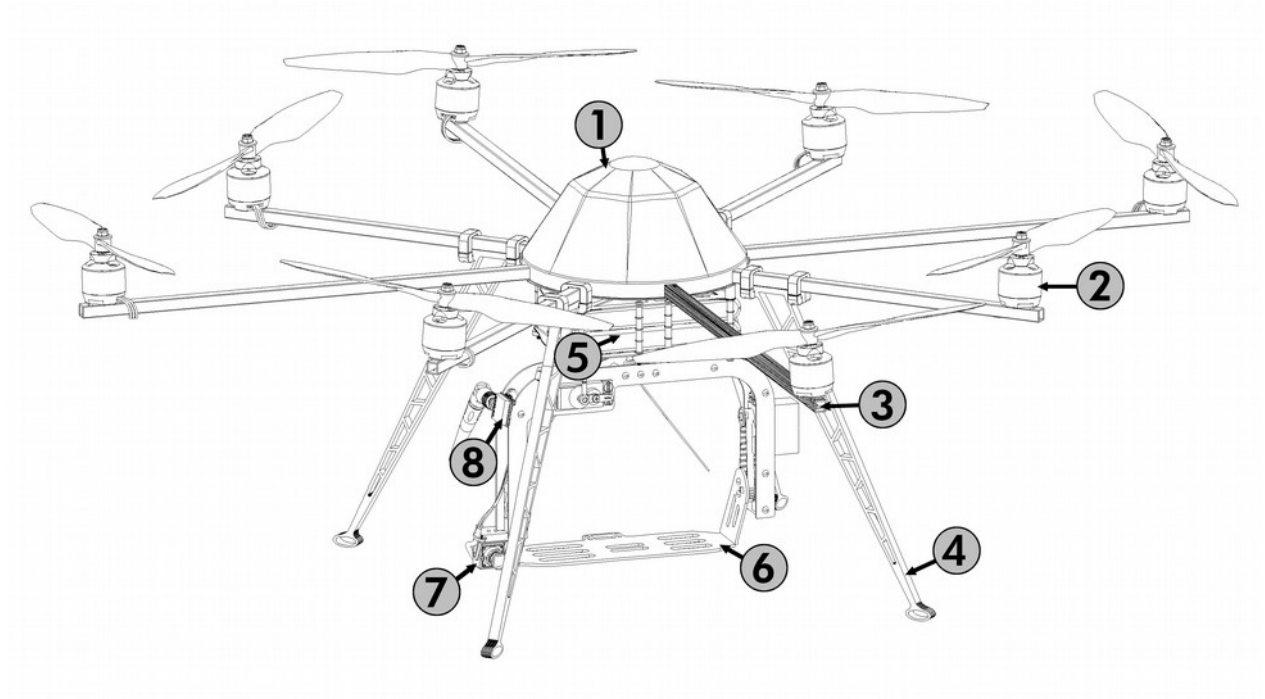
Using BID (Robbe)

If a Robbe charger is used to charge the LiPos a BID-Chip can be assigned to each LiPo. This BID chip stores all the relevant data for charging the battery. When charging a LiPo, the corresponding BID-Chip is connected to the charger. This gives the battery charger the necessary battery parameter for specific LiPos.

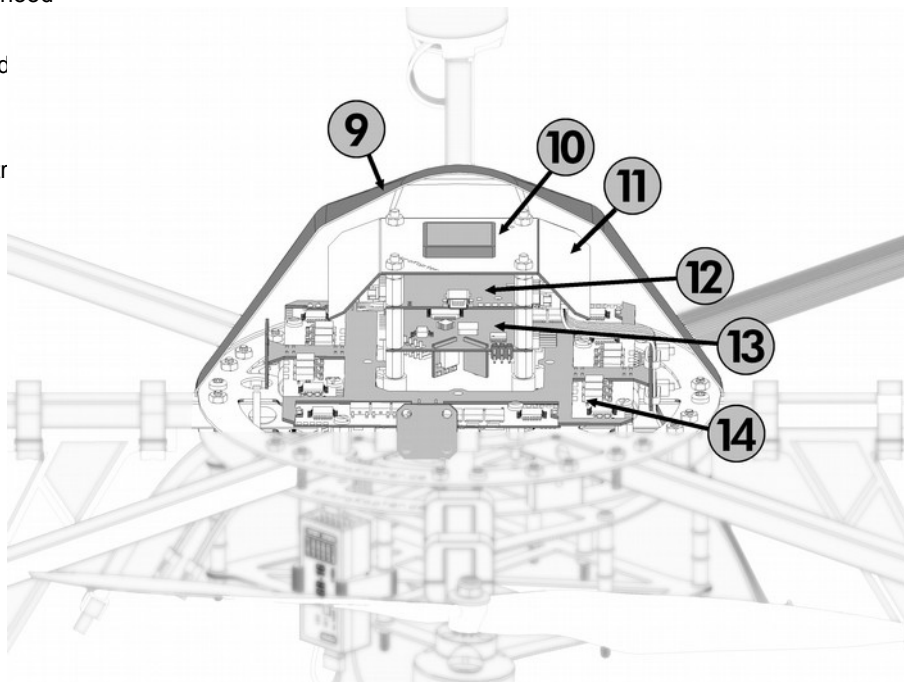


Overall View

- 1 – Protective hood
- 2 – Motor MK3638 / MK3644 with 12" propeller
- 3 – Rigger
- 4 – Landing gear „HiLander-26“
- 5 – Battery holder with LiPo
- 6 – Camera mount SLR2 (optional)
- 7 – Additional camera (optional)
- 8 – Video transmitter (optional)



- 9 – Protective hood
- 10 – MKGPS
- 11 – GPS-Shield
- 12 – NaviCtrl
- 13 – FlightCtrl
- 14 – Motor contr

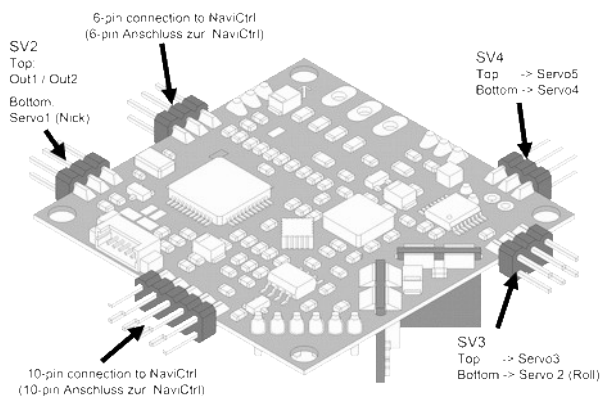


ARF-MikroKopter Connections

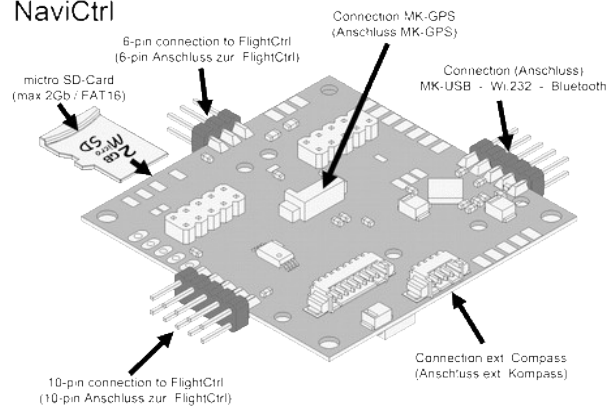
As shown in the „Overall View“ (Pg.7) the **ARF-MikroKopter** is already equipped with the FlightCtrl and the GPS-System (NaviCtrl + MKGPS). The GPS has an additional GPS-Shield to get a better receiving signal of the GPS-Satellites.

All required connections can be found on the Flight- and NaviCtrl boards
Some connections are already passed out on the bottom-side of the **ARF-MikroKopter**.

FlightCtrl



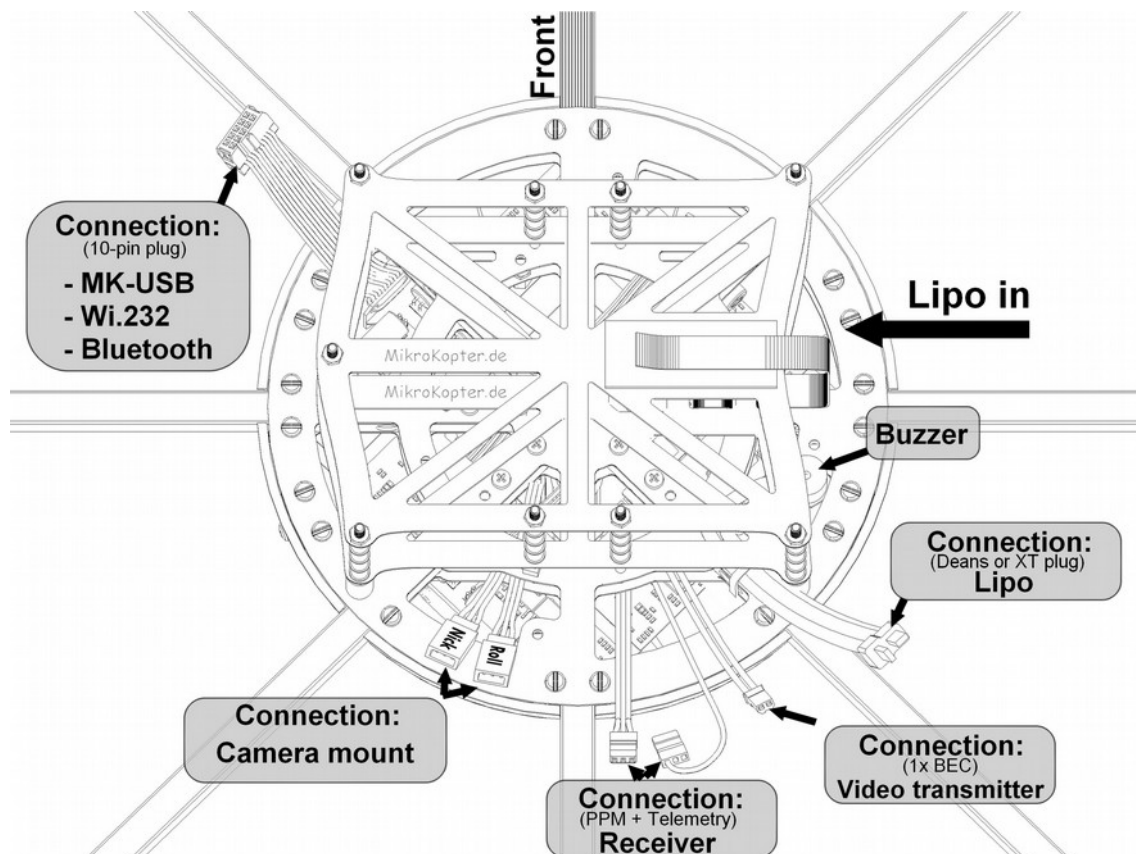
NaviCtrl



The bottom side

At the **ARF-MikroKopter** the connection for the battery (LiPo), a PPM-Sum-signal receiver with telemetry connection, the connection for the MK-USB (or Wi.232 / Bluetooth), the connection for the servos of a camera mount as well as the 2 supply cables for the video transmitter are already provided.

These cables are easily accessible on the bottom:



Final Assembly + First Test Flight

Final Assembly ARF-OktoXL

First at all the landing gear, the battery holder, the propellers and a suitable receiver need to be assembled.



For the first start-up the propellers should not be mounted.

An assembly of the propellers can be done just before the first flight (see page 21).

For the assembly you need the following tools:

- Phillips screwdriver (Size PH1)
- Screwdriver
- Ring spanner (SW 8)

Mounting the battery holder

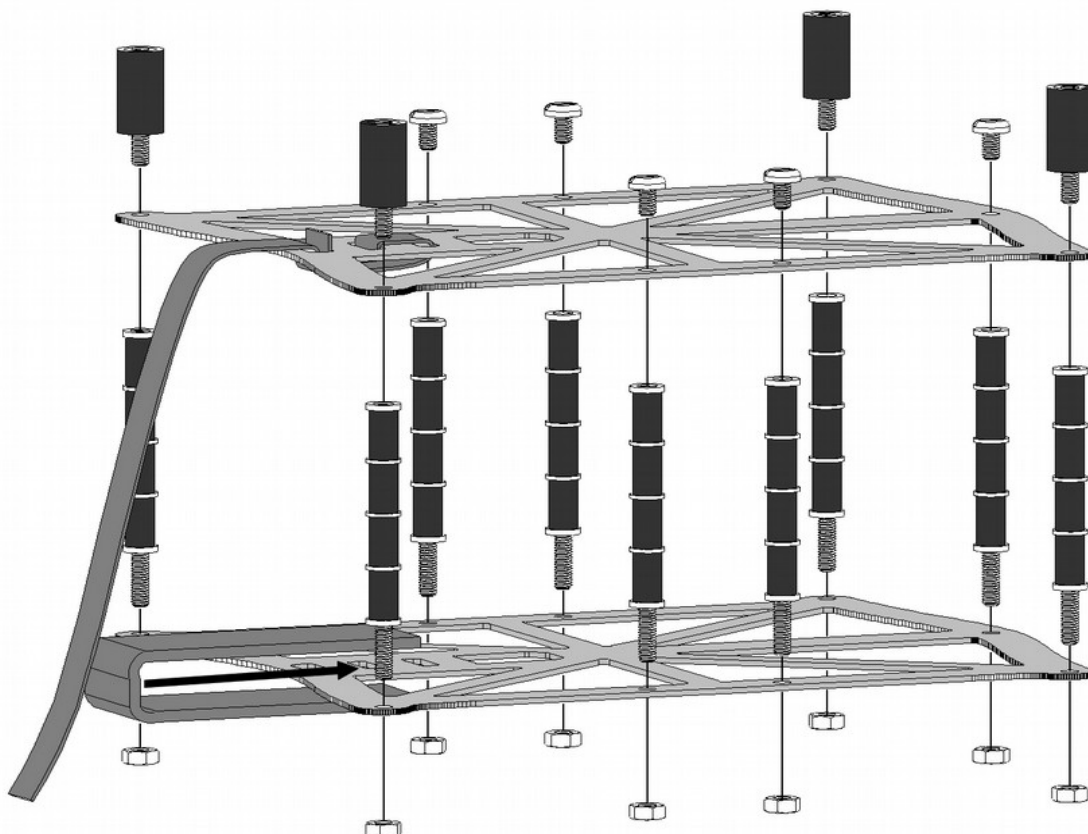
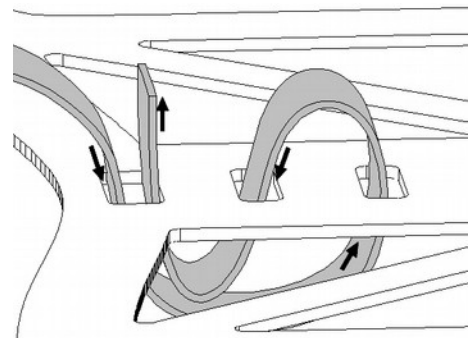
The battery holder is composed of multiple components which can be easily assembled.

First the narrow hook-tape need to be threaded into the top plate.

Important: The soft side needs to face upwards.

The second self-adhesive hook-tape need to be applied to the lower plate as shown in the diagram.

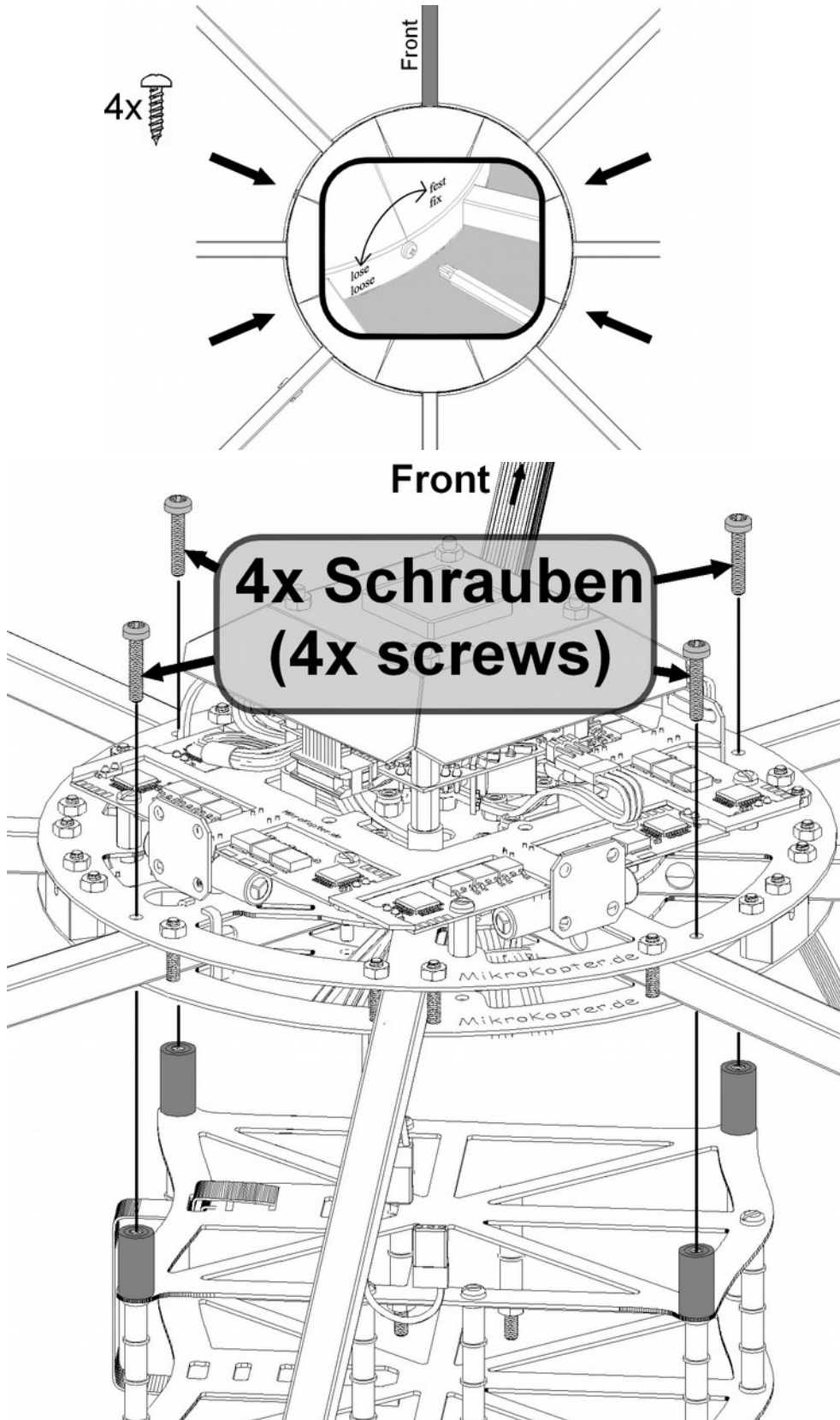
Once this is done, the top and bottom plate with the 9 Aluminium spacers, 4 rubber bumpers, 5 plastic screws and 9 plastic nuts can be assembled.



The completely assembled battery holder needs to be mounted on the bottom side of the **ARF-MikroKopter**. For this purpose the cover must be removed from the copter. Now the battery holder can be fixed with the 4 supplied metal screws (M3x16).

Attention: The opening of the battery holder must point to the LiPo cable.
(seen from above to the left)

The cover is mounted via 4 metal screws (3x10) to the frame.



Assembly of the landing gear

The landing gear "Hilander-26" can be mounted at any rigger. You can choose, if you want to mount 3, 4 or more landing feet.



When using a camera, the front rigger #1 should not have a landing gear (it will block the view of the camera).

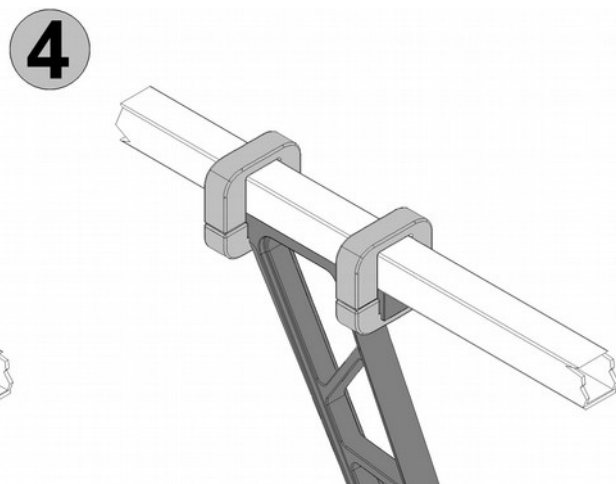
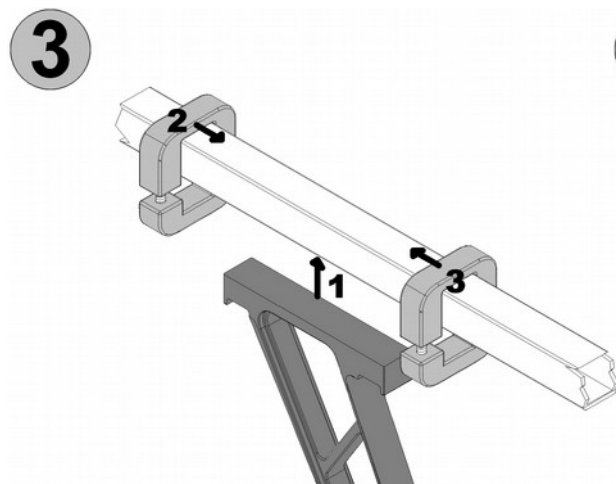
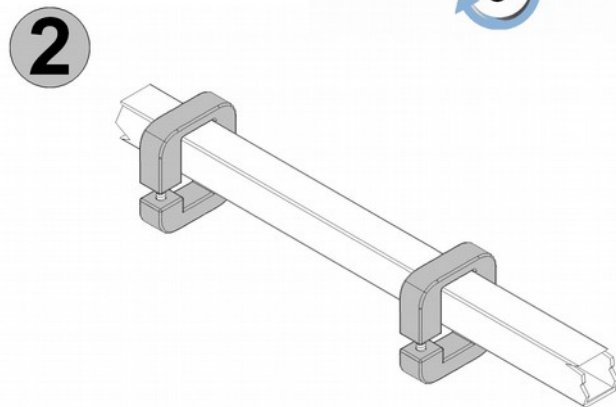
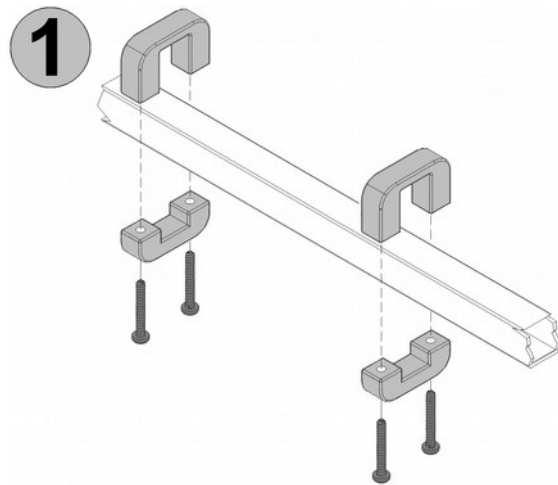
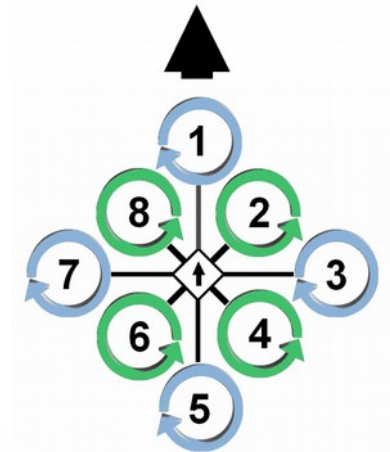
The numbering of the riggers is in a clockwise direction beginning with the different colored front rigger.

Example:

„ARF-MikroKopter“ with 8 rigger

=> Landing gear on rigger 2, 4, 6 and 8 (short riggers)

Assembly step 1 - 4:



Connecting the receiver

One 3-line PPM cable and one 1-wire data cable (for telemetry transmission) are used to connect the receiver.
(Those both cables come out on the back and the bottom side of the copter.)

Here, e.g. a Graupner GR-12/GR-16/GR-24, Jeti-RMK2 or a similar receiver with PPM sum signal can be connected directly. The data cable for the telemetry transmission is plugged into the appropriate port of the receiver (if present).



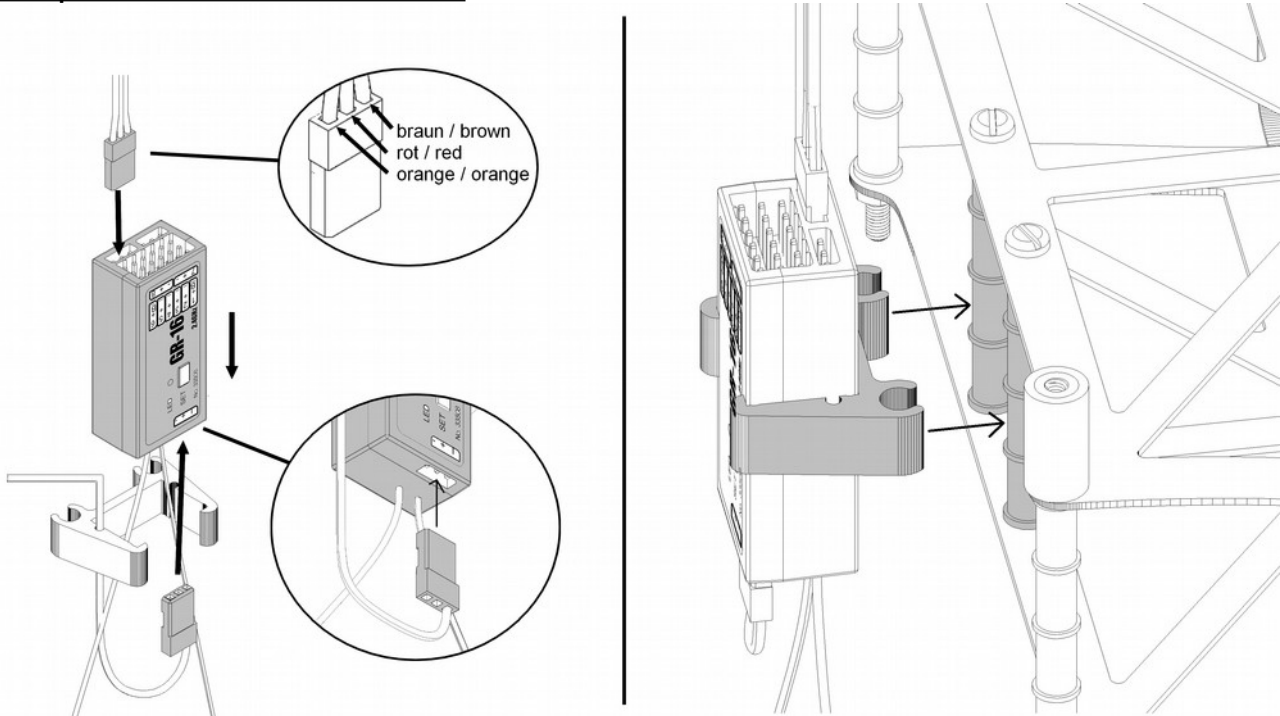
A telemetry transmission of the copter to the transmitter is possible with the Graupner HoTT-System.
No other sensors are required.

An appropriate mount for the GR-16 receiver is applied to the **ARF-MikroKopter**. This will be hooked up with the receiver to the back side of the battery holder.

You need to connect:

- the three-wire PPM-Connection PPM-Sum-signal
- the telemetry-cable to the telemetry input of the receiver (if available)

Example installation with receiver GR-16:



In case that a different transmitter and receiver are used, the receiver must be bound to the transmitter and set to the required sum-signal. Please refer to the manual of the transmitter how to activate the sum-signal

Final Assembly ARF-OktoXL 6S12

First at all the landing gear, the battery holder, the propellers and a suitable receiver need to be assembled.



For the first start-up the propellers should not be mounted.

An assembly of the propellers can be done just before the first flight (see page 21).

For the assembly you need the following tools:

- Phillips screwdriver (Size PH1)
- Screwdriver
- Ring spanner (SW 8)

Mounting the battery holder

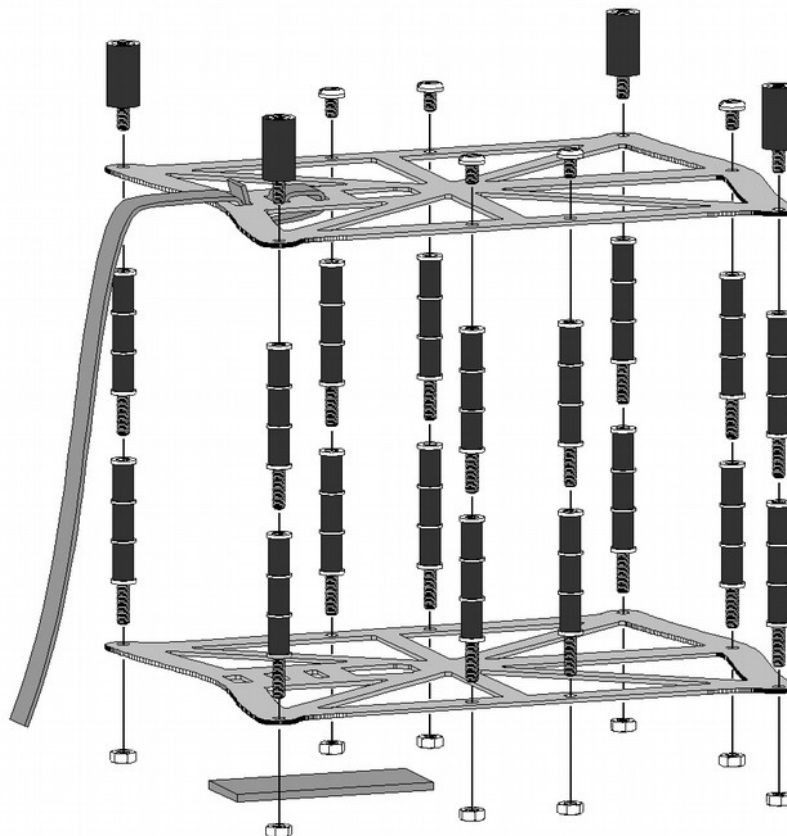
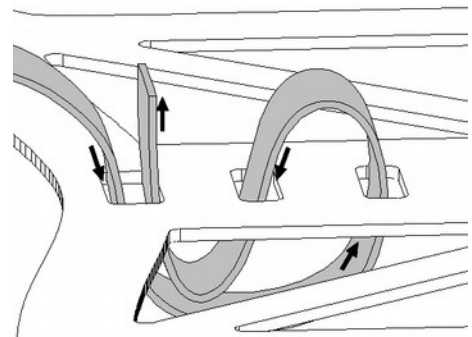
The battery holder is composed of multiple components which can be easily assembled.

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Important: The soft side needs to face upwards.

The second self-adhesive hook-tape need to be applied to the lower plate as shown in the diagram.

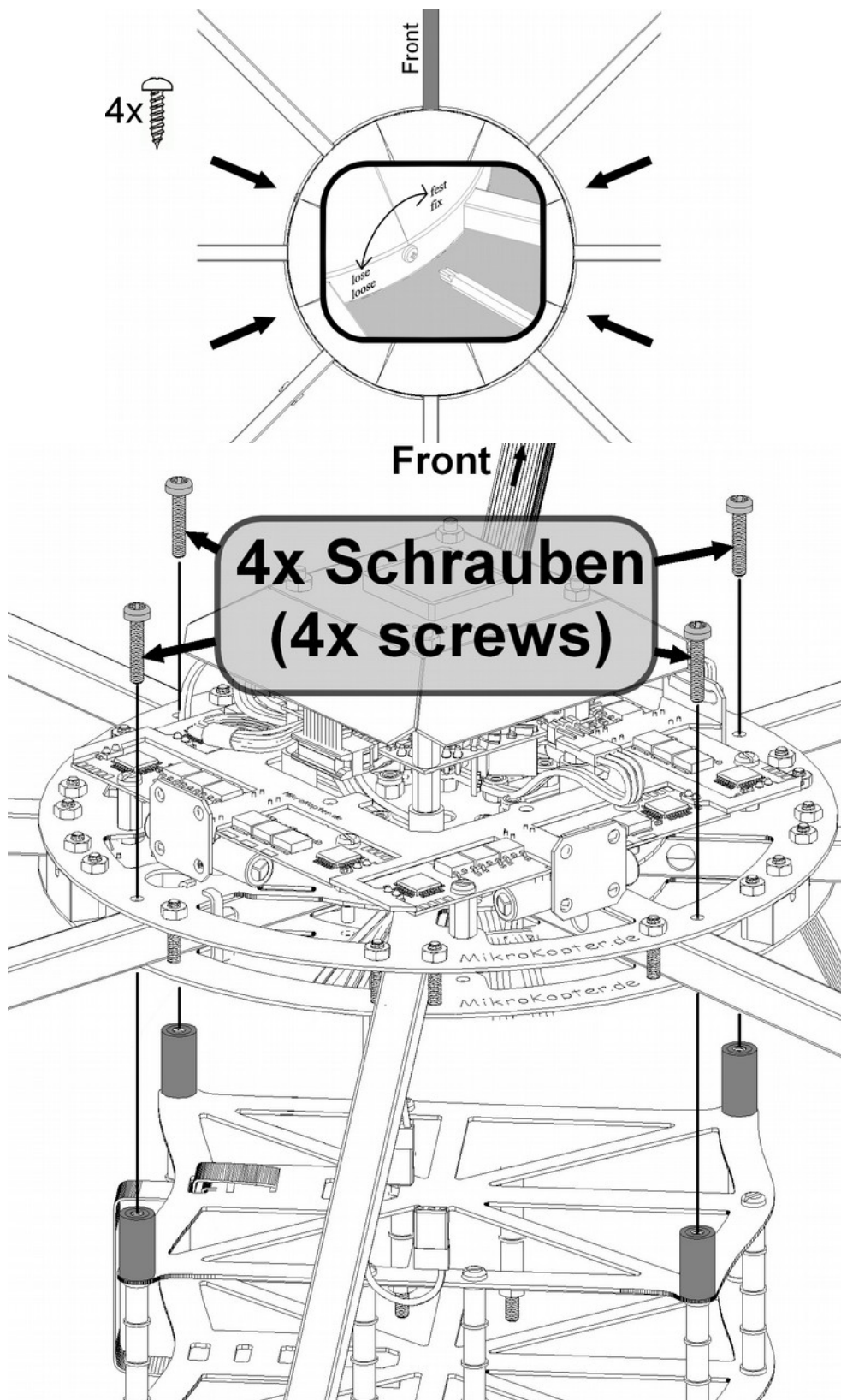
Once this is done, the top and bottom plate with the 18 Aluminium spacers, 4 rubber bumpers, 5 plastic screws and 9 plastic nuts can be assembled.



The completely assembled battery holder needs to be mounted on the bottom side of the **ARF-MikroKopter**. For this purpose the cover must be removed from the copter. Now the battery holder can be fixed with the 4 supplied metal screws (M3x16).

Attention: The opening of the battery holder must point to the LiPo cable.
(seen from above to the left)

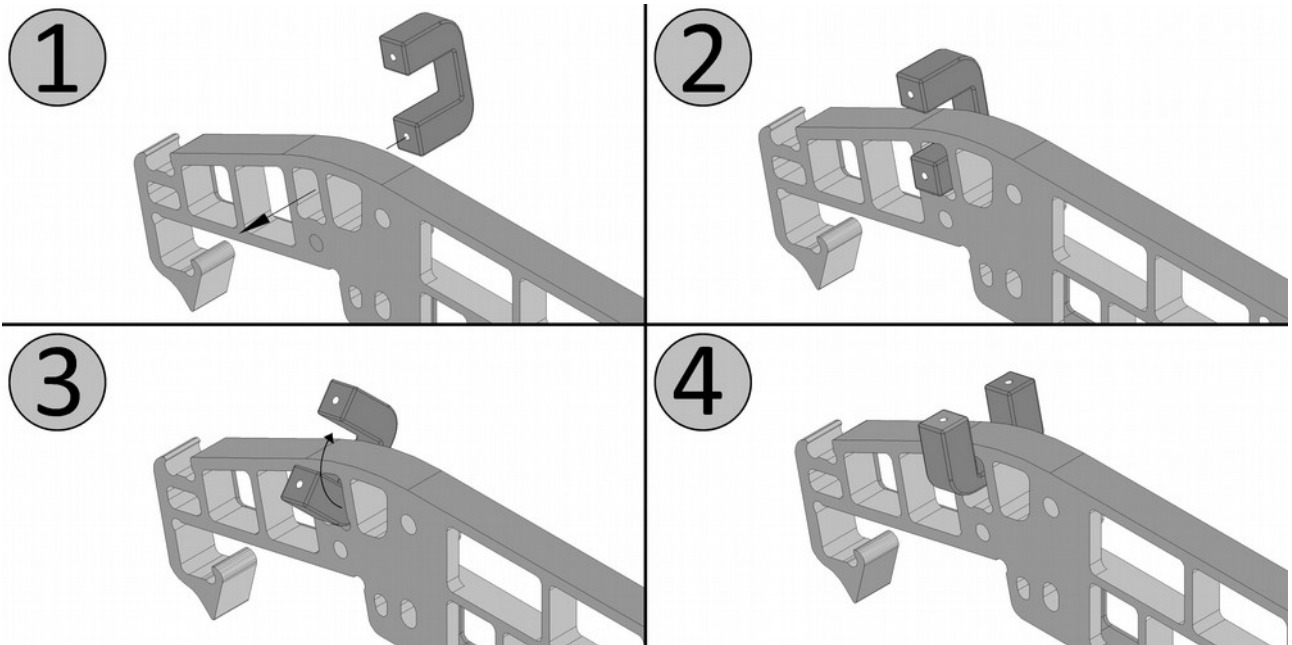
The cover is mounted via 4 metal screws (3x10) to the frame.



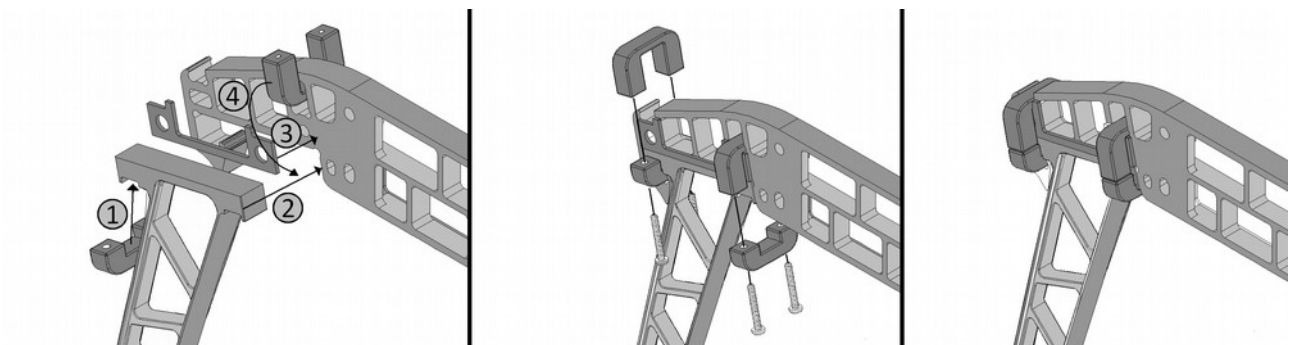
Assembly of the landing gear

The landing gear "HiFlexLlander" for the ARF-OktoXL 6S12 can be mounted at the battery holder.

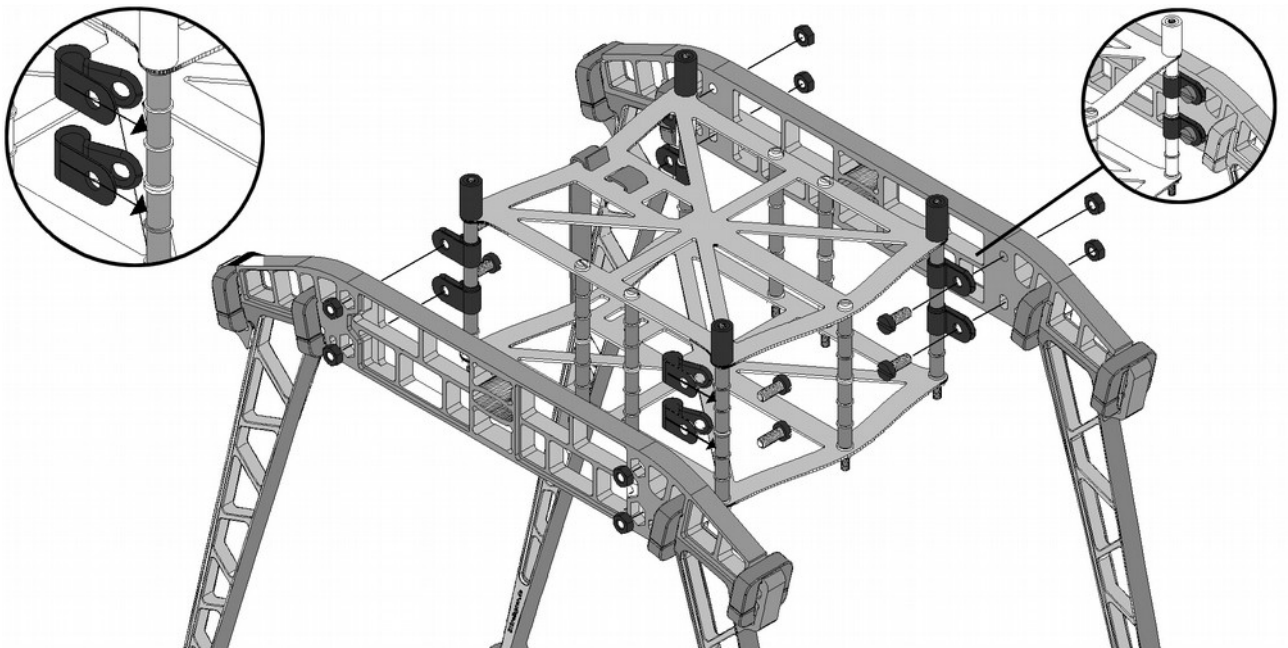
First you insert the upper clamp:



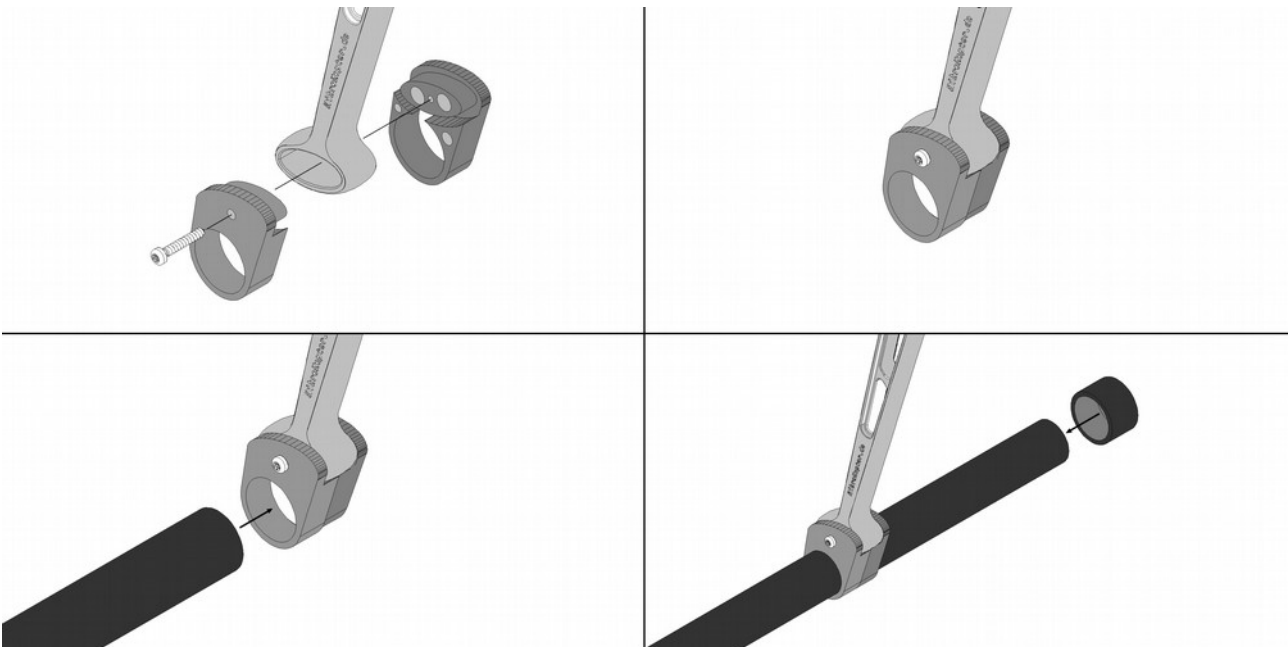
Then insert the HiLander-26 and the adapter plate and fix all:



If this is done the holder can be mounted on both sides of the battery holder.



Finally, the two landing tubes are inserted through the holder at the end of the landing feet.



Connecting the receiver

One 3-line PPM cable and one 1-wire data cable (for telemetry transmission) are used to connect the receiver.
(Those both cables come out on the back and the bottom side of the copter.)

Here, e.g. a Graupner GR-12/GR-16/GR-24, Jeti-RMK2 or a similar receiver with PPM sum signal can be connected directly. The data cable for the telemetry transmission is plugged into the appropriate port of the receiver (if present).

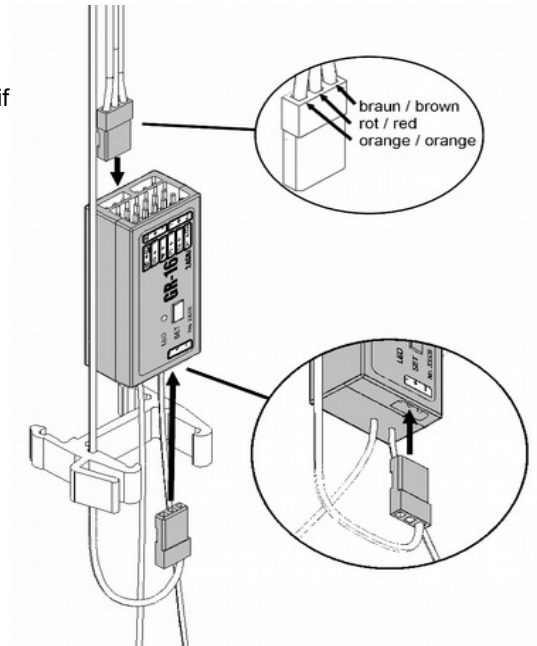


A telemetry transmission of the copter to the transmitter is possible with the Graupner HoTT-System.
No other sensors are required.

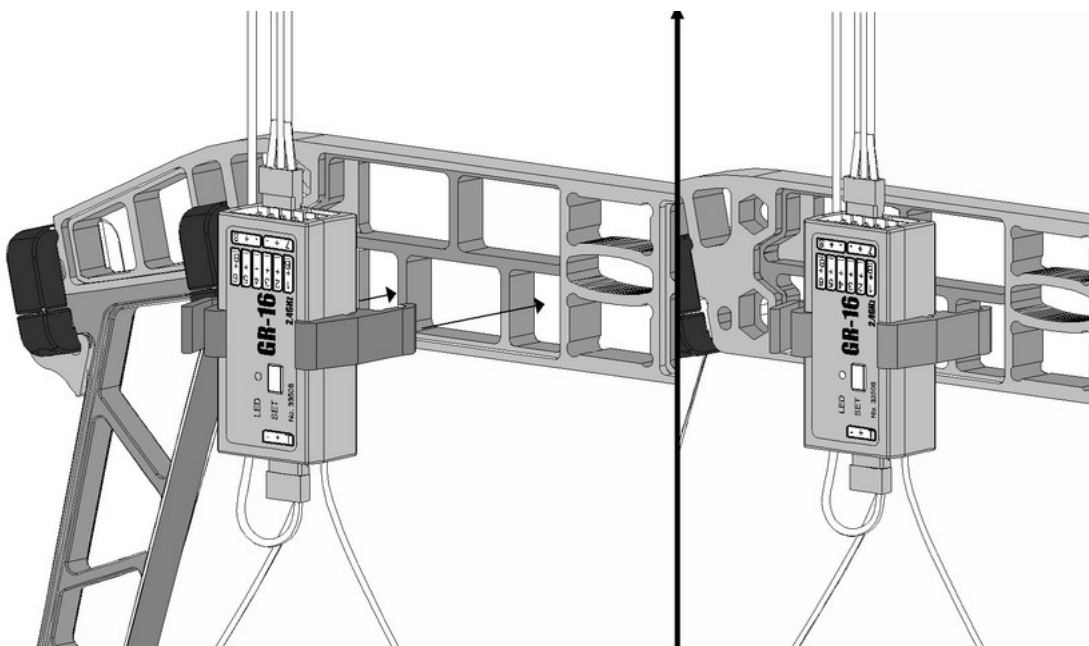
An appropriate mount for the GR-16 receiver is applied to the **ARF-MikroKopter**. This will be hooked up with the receiver to the back side of the battery holder.

You need to connect:

- the three-wire PPM-Connection PPM-Sum-signal
- the telemetry-cable to the telemetry input of the receiver (if available)



Example installation with receiver GR-16:



Propeller assembly



Propellers should not be mounted for the first start-up of the copter.

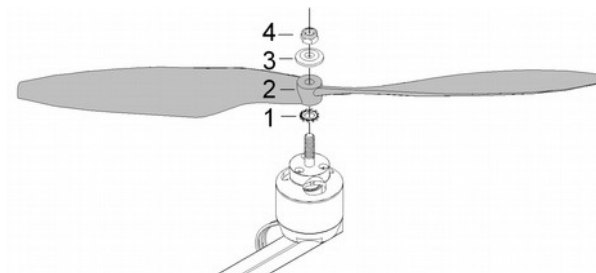
The **ARF-MikroKopter** comes with two different types of propellers:

- Propeller EPP1245 (for training flights)
- Propeller CFK 12x3,8 (for flights with payload)

Both propeller types (EPP/CFK) are mounted in the same way.

The order of the necessary parts are as follows:

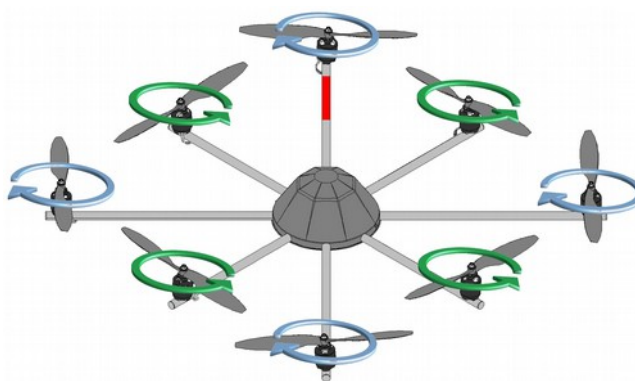
1. Lock washer
2. Propeller
3. Black washer
4. Self-locking nut



During the assembly it should be ensured that the propellers may have different directions of rotation and be mounted in an alternating arrangement.

Left-rotating propeller (top side)	Right-rotating propeller (top side)

The mounting order of the propellers is as shown:



ARF-OktoXL / ARF-OktoXL 6S12

Inserting the battery

The **ARF-MikroKopter** comes with four batteries:

ARF-OktoXL => 4x LiPo 14,8V / 4S / 5000 / 20C and a Y-adapter.
ARF-OktoXL 6S12 => 4x LiPo 22,2V / 6S / 4500 / 20C and a Y-adapter.

The batteries can be used alone or to extend the flight time in pairs.



When connecting a LiPo it can cause sparking at the plug, which is normal.
To keep the battery tight in the holder the hook and loop tape should be placed tightly against the lower hook and loop tape.

To operate two 5000 LiPos together on the ARF-MikroKopter, those can be connected via the included Y-cable. In this case proceed as follows:



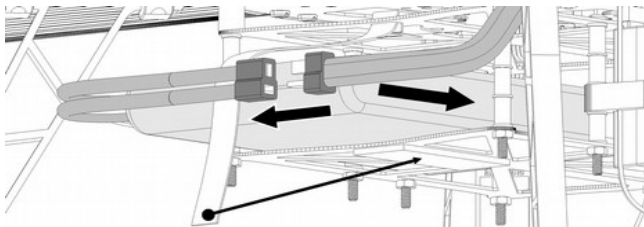
If two of them been operated in parallel it is important to ensure that both batteries have the same charge. If two differently charged batteries will be connected together (e.g. one battery is fully charged and the second one is half empty) it may result in damage to both batteries and heating.

1. First at all slide both LiPos over each other into the LiPo-Holder and secure it with the hook and loop tape on the battery holder. The connection cables of the LiPos face to the left.
2. First connect the Y-cable to the sockets of the LiPo power cable.

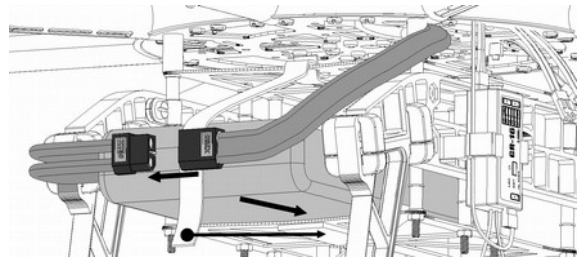
!!! ATTENTION !!!

After the first plug is connected to the socket, the full LiPo voltage is at the second connector of the Y-cable. Here shorts must be avoided.

3. Connect the socket of the Y-cable to the connector of the **ARF-MikroKopter**.



ARF-Okto XL with Deans-Plug



ARF-OktoXL 6S12 with XT60 Plug



Remove the LiPos in reverse order.
Do not use the Y-cable to charge the LiPos! Each LiPo must be charged separately using an appropriate charger.

Checking the functions / First-time start

Before the first flight the **ARF-MikroKopter** should be checked for its function. Here the functions of the individual channels, the motors and sensors can be checked using the MikroKopter-Tool. How to proceed you can read in „Settings“ (Pg. 27).



The compass is already calibrated at the factory. However – it is still recommended to calibrate the compass before the first test flights at the new flight location (see Pg. 35).

Channel assignment

The channels for each function are already pre-set on the **ARF-MikroKopter**. Once the channels on the transmitter were allocated to individual switches, buttons and potentiometer the function can be checked directly in the KopterTool.



If an optional transmitter like MX-20 or MC-32 was ordered it is already pre-set with these channels and can be used directly without modification. The assignment of the channels to the switches are described under „Transmitter assignment“ Graupner MX-20 / MC-32“ (see page 45).

The assignment of the channels incl. the individual functions are as follows:

Channel	Function
1	Control throttle
2	Control roll
3	Control nick
4	Control yaw
5	Function HoldAltitude
6	Function GPS <Free/PositionHold/ComingHome>
7	Function Camera Zoom
8	Function CareFree
9	Function Camera mount Nick
10	Function Camera mount Roll
11	Function Trigger camera (or LANC Off-trigger-rec)
12	Function Motor-Safety switch
13	Auto Start/Land
14	fre
15	free
16	free

First Test flight



Ensure that all steps of the **installation** and all steps of the **settings** have been followed.

The accelerometer (ACC) and the compass are already calibrated by the factory.
If you do not fly at your home location and the ARF-MikroKopter flies in circles in *GPS-Mode*, you should calibrate the compass (See **Calibration Pg. 35**).

Fly your first test flights on calm and not windy days and also not in a too high altitude. This will minimize the chance for crashes and damages occurring while you learn to fly the copter. Optimal is a test flight in around ~1,50 – 5 meter.

Get familiar yourself with the control in the first test flights. Practice initially starting, landing and hovering on the spot. Only when you feel safe enough you can start with little flights forwards, backwards and sideways and become more routine in dealing with your copter. Make sure that the front of the **ARF-MikroKopter** is pointed away from the pilot all the time.

Practice flying without the aid of additional functions like *PositionHold*, *CareFree* or *HoldAltitude*. Only in that way you are able later on to control the ARF-MikroKopter even in difficult situations.



Before the first flight it is recommended that the functions (such as turning ON and OFF the motors) be tested without mounted propellers. So you can go along with your transmitter and avoid injuries throughout mishandling.

Make sure that before turning ON the **ARF-MikroKopters** all switches on your transmitter are in basic position – OFF. This ensures that for the first test flight all auxiliary functions such as HoldAltitude, PositionHold and CareFree are off.

Place the MikroKopter on a sufficiently large and open flight field. The best way is on a model flight field so that no person, animals or property may be harmed.

After the transmitter and then the **ARF-MikroKopter** have been turned on, the copter will initialize.

Tip: The ARF-MikroKopter should be standing on the ground while being switched on.

When the initialization has been finished and there are no warnings, the sensors (gyroscopes) can be calibrated.

Calibration of the gyroscopes:



Before the first flight and after each battery change the gyroscopes of the **ARF-MikroKopters** must be calibrated. Otherwise the ARF-MikroKopter will not start.

During that procedure the ARF-MikroKopter must stand absolutely still.

You start the calibration via the transmitter with the following stick movements:

- throttle-Stick up and
- Yaw-Stick to the left

A confirmation beep will come from the copter.
(depends on the setting 1-5 „Beeps“)



(Example Mode2)

Starting / Stopping the motors:

The **ARF-MikroKopter** software allows you to use a motor safety switch. This prevents that during the flight the motors could be switched off by mistake. To avoid an inadvertent maloperation this function is already set to the optional transmitters Graupner HoTT MC-32 / MX-20.

If you use an own transmitter, channel 12 should be set also to a switch. Otherwise the copter will not start.

If you don't want to use those safety functions, deactivate them in the settings (Pg. 30).

To start and stop the motors the safety switch must be operated during starting or stopping the motors.

Start the motors

- pull and hold the motor-safety switch (button)
then:
- Throttle-Stick downwards + Yaw-Stick to the right

Now the motors are running idle. Moving the Throttle-Sticks upwards will increase the speed of the propellers. Moving it downwards will decrease the speed of the propellers.

Stop the motors

- pull and hold the motor-safety switch (button)
then:
- Throttle-Stick downwards + Yaw-Stick to the left

The motors are turning OFF. After turning OFF the motors the propellers are still rotating a little bit. Do not stop the motors or propeller manually.

Take off:

Make sure you have enough space around you to start the **ARF-MikroKopter** safely.

The front (rigger No.1) points away from you.

If the Throttle-Stick is moved upwards, the **ARF-MikroKopter** takes off. Here the Throttle-Stick should be moved gently (not too slow but also not too fast).



If the Throttle-Stick is moved too slowly the copter can keel over to one side during the start. That comes from the, so called, ground effect. If the Throttle-Stick is moved too fast, the copter can quickly rise to high altitudes. You need to develop the right feeling for the throttle.

If the copter is now in a height of around ~1,5 – 5m, the Throttle-Stick can be held in middle position. The copter should hover in the same altitude.

If the Throttle-Stick is now moved upwards, the copter continues to rise. If the Throttle-Stick is moved downwards the copter lowers down.

With the Nick- and Roll-Stick the copter can be flown forward, backward and also sideways.

Landing:

Make sure that there are no people in the landing zone before landing the copter.

To land the copter, move the Throttle-Stick slowly down until the copter touches the ground.

As soon as the copter is on the ground, move the Throttle-Stick completely down.

Turn OFF the motors and disconnect the power from the battery to the copter.



Avoid jerky movements on the sticks of the transmitter. This can lead to unexpected strong moves of the copter.


Settings
Functions
opt. Accessories
Maintenance
Troubleshooting

Settings for MikroKopter Tool and Transmitter




If you update the Software on the Copter, please use always the MK-USB.
The latest Software for the NaviCtrl and FlightCtrl include the right MikroKopter-Tool you can find and download here: <http://mikrokopter.de/ucwiki/en/Download>





If you make any changes to the following settings do not forget to write these changes into the **ARF-MikroKopter**. This will be done with a „Click“ on the button  (Write) which is located in the bottom of the settings window.

Parameterset / Settings

There are 5 settings (memory spaces) on the transmitter which can all be set individually. In the delivery status all 5 settings are already pre-set.

To change a setting individually, the settings must be open. This can be done by choosing the button  and a „Click“ on the button (Read).



If you want to create a backup copy of the open setting you can do that with the button  (Save).
On the other side you can load again saved settings. That can be done with the button  (Read).
Don't forget to write the loaded settings into the MikroKopter.

You can select a parameter-setting without the PC-Tool using the RC transmitter. The following stick positions correspond to the different settings:

Selecting => 1. Select the parameter 1,2,3,4 or 5 with the right stick and hold it. 2 Enable the left stick.



Parameter 1



Parameter 2



Parameter 3



Parameter 4



Parameter 5

After you chose the new parameter (1-5) the copter will give you a number of beeps
(parameter 1 = 1 beep, parameter 2 = 2 beep,)

Step 1: Setup MK-USB

The MK-USB will be connected via the USB-connection cable to the PC.

Plug the Mini-USB of the USB-connection cable into the MK-USB and the USB-plug into a free USB port of the PC.

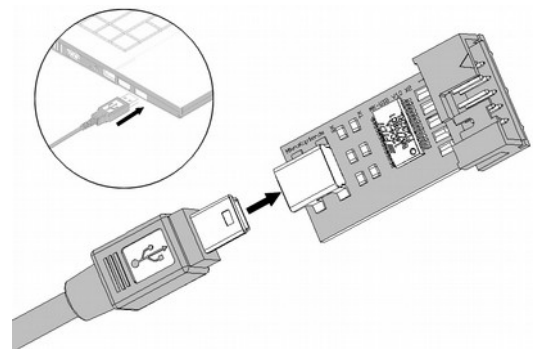
The device should be detected automatically and the device driver should be searched online and also installed.

For that procedure an online connection is necessary and the installation can take a few minutes.



If the automatic driver installation of Windows fails the COM-Port driver (VirtualComport VCP) can be downloaded here and installed manually:

<http://www.ftdichip.com/Drivers/VCP.htm>

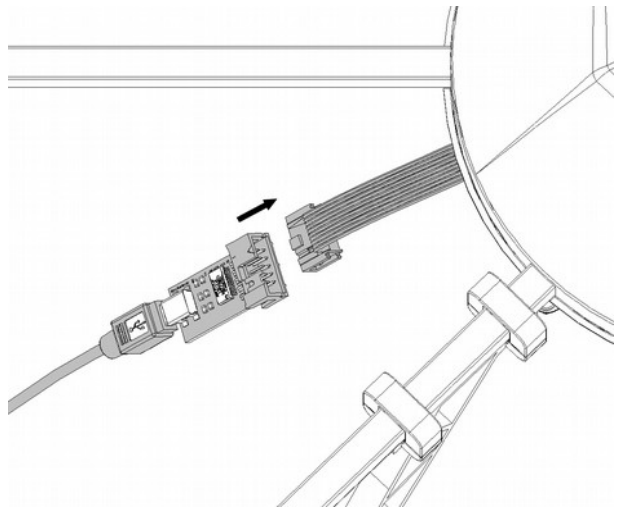


In the Windows Device Manager the new COM-Port for the MK-USB can be found under „Ports (COM & LPT)“. Here you can see the COM port number that will be needed later in the MikroKopterTool.

Step 2: Connect MK-USB to the ARF-MikroKopter

After the MK-USB has been installed, the **ARF-MikroKopter** can be connected.

Please use the 10 pin ribbon cable to connect the MK-USB to the **ARF-MikroKopter**.



Step 3: Download MikroKopter-Tool

You can download the latest MikroKopterTool at the following internet address:

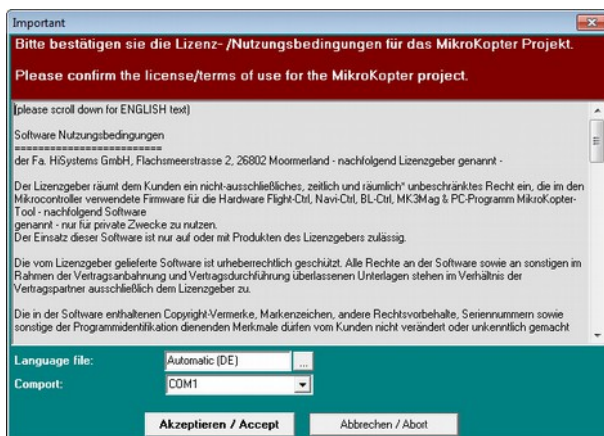
<http://mikrokopter.de/ucwiki/MikroKopterTool>

Unzip the ZIP file into a new folder.

Step 4: First Start MikroKopter-Tool

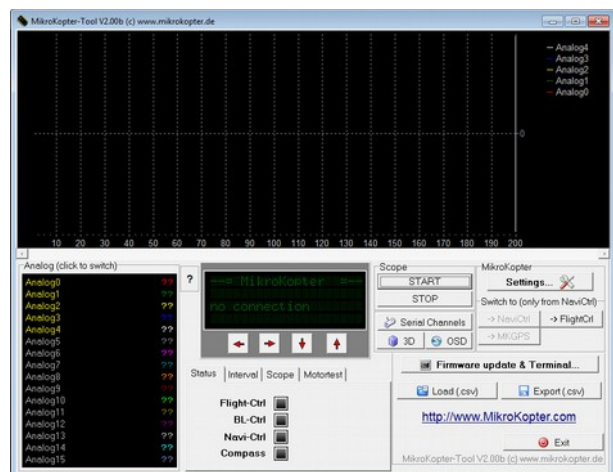
After extracting the KopterTool, the folder „KopterTool_V1_XXx“ (XXx = Version number) can be opened and „**MikroKopter-Tool.exe**“ started.

With the first start the following window will open with the general licensing / usage conditions =>



After choosing the language and the COM-Port for the **MK-USB or Bluetooth-Set** the window can be confirmed by a „Click“ on the button „**Akzeptieren/Accept**“ or be terminated by clicking the button „Abort“.

Click on „**Akzeptieren/Accept**“, the window of the MikroKopter-Tool will be displayed =>



Step 5: Connect the battery



The batteries of the transmitter and the **ARF-MikroKopter** should be fully charged.

Please note the order of switching on:

- First set all switches on the transmitter to „OFF“ position and turn the transmitter on.
- Then connect the battery of the **ARF-MikroKopter**.

Once the battery is connected to the **ARF-MikroKopter** the initialisation begins.

This initialization of the ARF-MikroKopter consists of two parts:

- Each BL-Ctrl (Motor controller) on the **ARF-MikroKopter** checks its own connected motor. It turns each connected motor a little bit and makes a tone sequence at the same time.

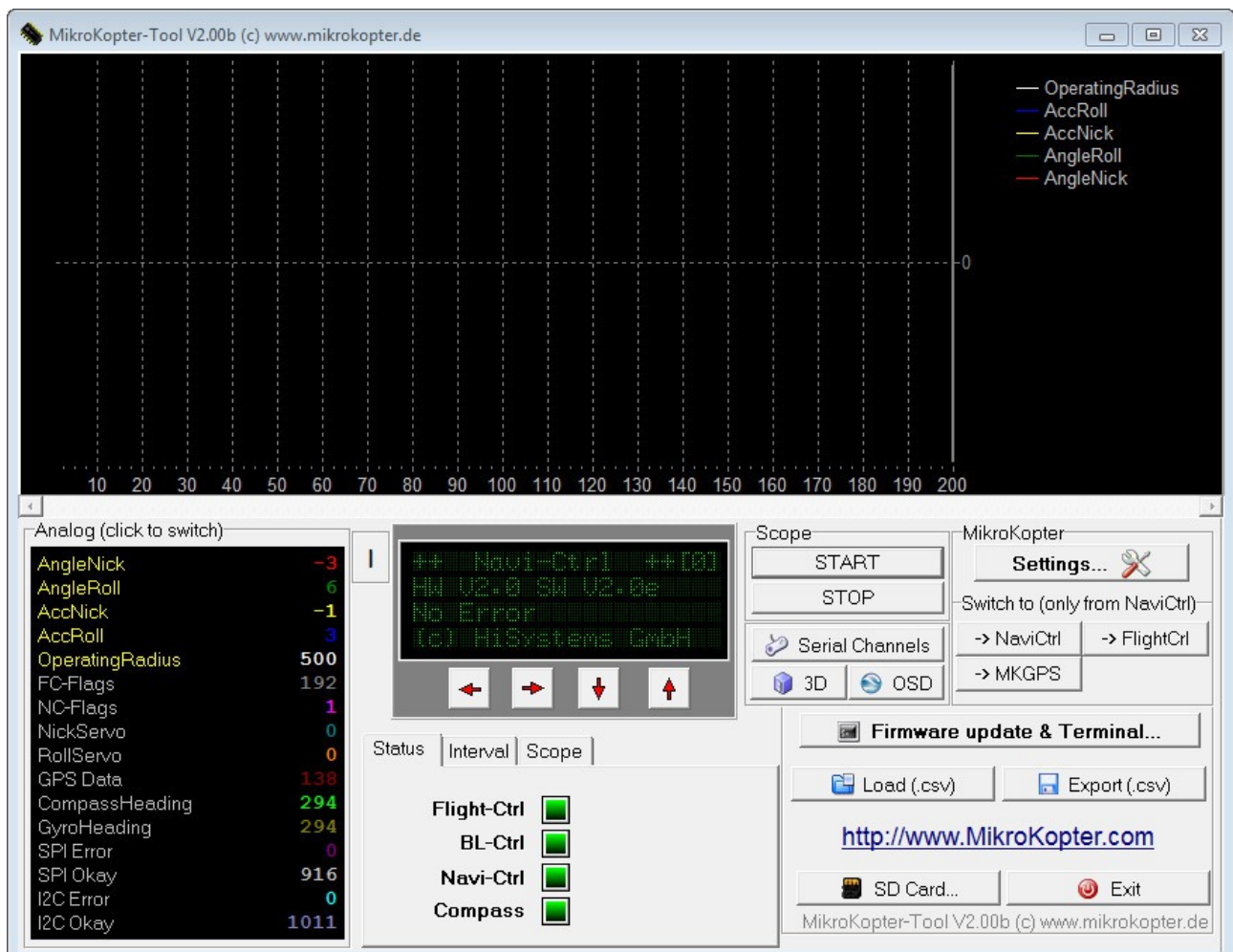
Also:

- The buzzer at the copter begins to „beep“ directly after connecting the LiPo. After a short period of time a short tone sequence sounds up again.

After initialization some values should be displayed in the KopterTool and the four buttons below the display should turn to „green“.



Just in case no values are displayed, exit the KopterTool, start it again and eventually set up the COM-Port again.



Step 6: Checking the channel assignment



Those, as well as all other settings, **do not** need to be changed in the first step. They are only there to verify.

To verify the assignment / function of each channel, please open the settings dialog. This can be done by a „Click“ on the button „Settings“.

„EasySetup“

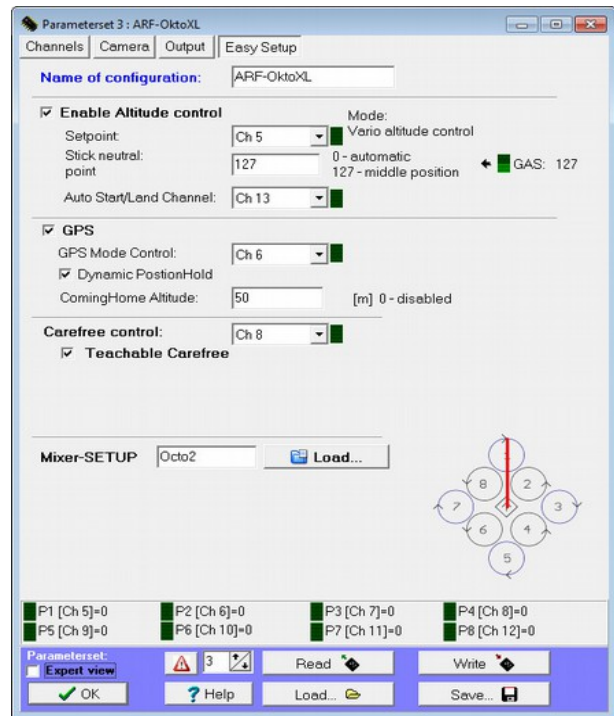
In the „EasySetup“ are all important functions, as well as their channel assignments are listed.



The channels 5-12 can also be entered as value „Poti1-8“. See also **Channel assignment**. (Ch.)

The setting is here as follows:

- Altitude control active => Ch. 5
- Stick neutral point => 127
- Auto Start/Land => Ch.13
- GPS (PositionHold, ComingHome) => Ch. 6
- ComingHome Altitude => 50 (meter)
- CareFree control => Ch. 8
- Mixer-SETUP => Okto2



To check on the function of the transmitter and each channel please select the tab „Channels“ at the top of the window.

In that window all available channel assignments (max. 16) are listed.

On the left side you can see the assignment of the individual channels (Function => Channel) and on the right half will be a green bar graph.

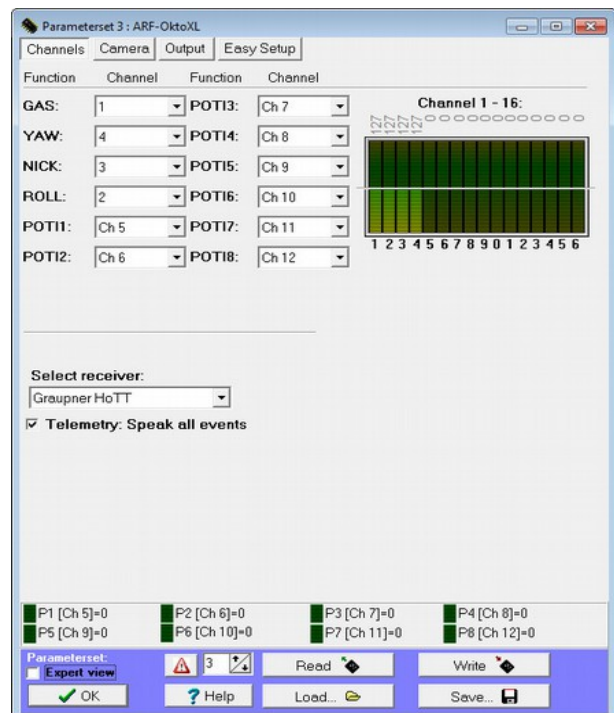
Using this bar graph all 16 channels can be individually checked for proper function.

Moving now the sticks, operating switches, buttons or potentiometer on the transmitter should display the corresponding channel with an appropriate peak:

- Control sticks / Slider / Potentiometer => variable from 0-254
- 2-way switch => „off“ = 0 / „on“ = 254
- 3-way switch => „down“ = 0 / „middle“ = 127 / „up“ = 254

IMPORTANT : The respective peak should be in the range between „0“ and „254“.

The correct receiver must be set under „Select receiver“ and saved with the button „Write“.



If you already have a RC-Transmitter/Receiver, you must program your transmitter with the associated instruction manual by yourself. To the FlightCtrl only accepts receiver with a PPM-Sum-signal or the S.BUS (Futaba). Please note also the folding box „Select receiver“. There, the correct receiver can be selected. After changing the receiver the selection must be saved with a „Click“ on the button „Write“ in the FlightCtrl.

Step 7: Testing the camera mount

If an optional camera mount has already been installed, it should be tested now.
Otherwise please skip this step and continue with „Step 8“.

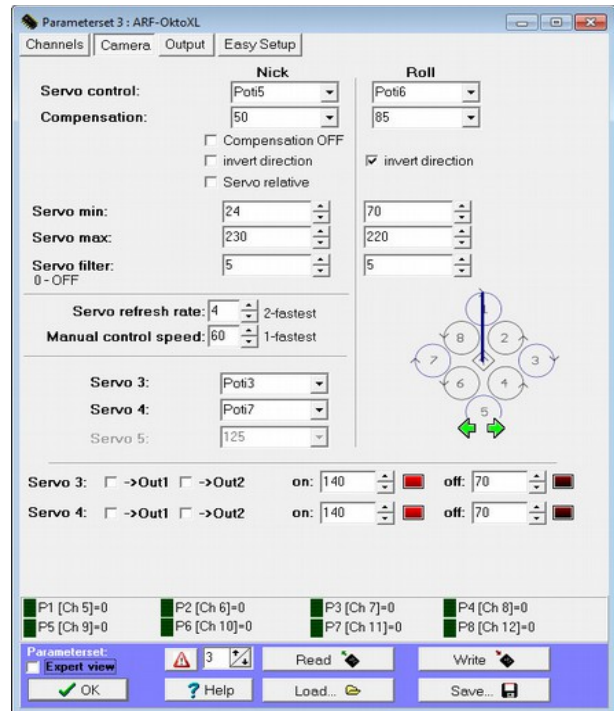
The Servos from a connected camera mount are automatically controlled from the FlightCtrl.
In this way the camera mount is always held in balance during the flight. Additionally the camera mount can be adjusted via the transmitter.

Through a „Click“ on the tab „**Camera**“, you can switch into the corresponding window.

Under „Servo Control“, „Nick“ and „Roll“ there will be „Poti5“ and „Poti6“ displayed for manual control of the camera mount.

If the assigned potentiometer on the transmitter will be moved now, there will be no reaction at this time.

The camera mount will start moving after the gyroscopes of the MikroKopter are calibrated (Pg. 35).



After the calibration of the Gyros the **ARF-MikroKopter** will „beep“ and the servos of the camera mount will adjust .

Now the camera mount can be moved through Nick- and Roll direction via the two assigned potentiometer on the transmitter.



If the **ARF-MikroKopter** moves, the camera mount automatically adjusts to that tilt.



If the camera mount is not moving you should check whether the Servo plug is fully inserted and also in the correct polarity.

Step 8: Camera trigger

Shuttercable

If a „Shuttercable“ has been already installed for the camera you need to test its function. Otherwise please continue with „Step 9“.

Through a „Click“ on the tab „**Outputs**“ you can switch into the appropriate window =>

The **ARF-MikroKopter** has two independently controllable outputs.

Both outputs are set in the basic settings to channel 11 = Poti7.

On the transmitter this channel is assigned to a button.

Output 1:

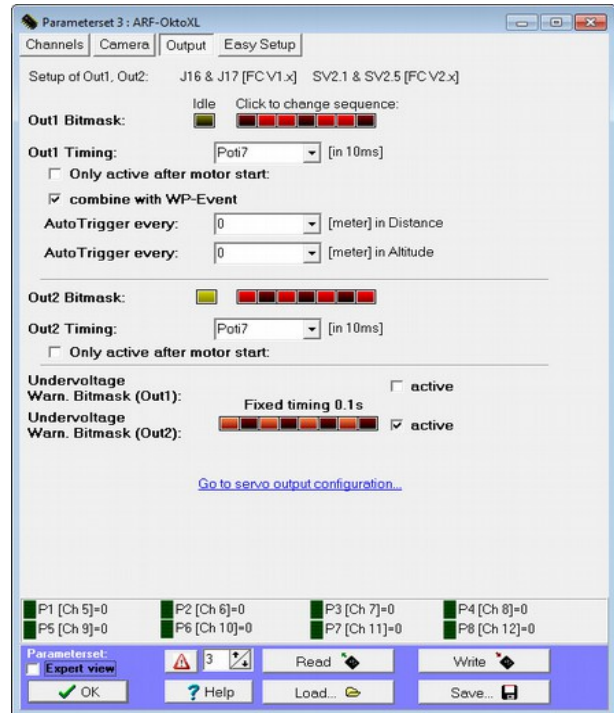
the „Shuttercable“ can be connected to trigger a camera.

Output 2:

not connected

Now if the appropriate button will be pressed on the transmitter the blue LED on the „Shuttercable“ should light.

If you release the button again the blue LED on the „Shuttercable“ goes off.



IR-Ctrl / LANC

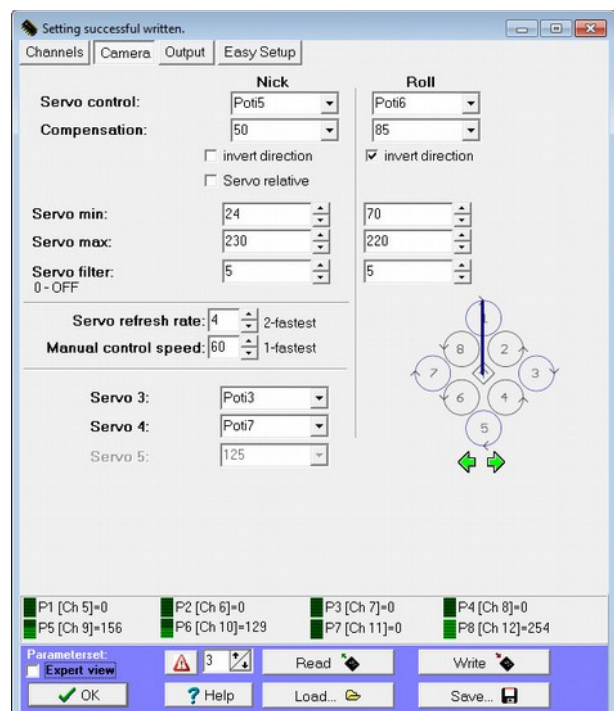
If an „IR-Ctrl / LANC“ has been already installed it can be now tested in conjunction with the used camera for its function. Otherwise please continue with „Step 8“.

Through a „Click“ on the tab „**Camera**“ you can switch into the appropriate window =>

The IR-Ctrl / LANC would be connected to the servo outputs **Servo3+4**.

Here you can select the assigned RC channel (Poti3+7).

After the calibration of the Gyros (Pg. 35) the functions on the servo outputs 3+4 can be used.



If everything is checked and set you get back to the main window of the MikroKopter Tool by clicking the button „OK“ (down left).

Step 9: Test motors individually



To test the motors the propellers **should not** be mounted.
The motors rotate during the test and it can cause injury!

With the KopterTool the motors can be tested individually for their function and rotation direction.

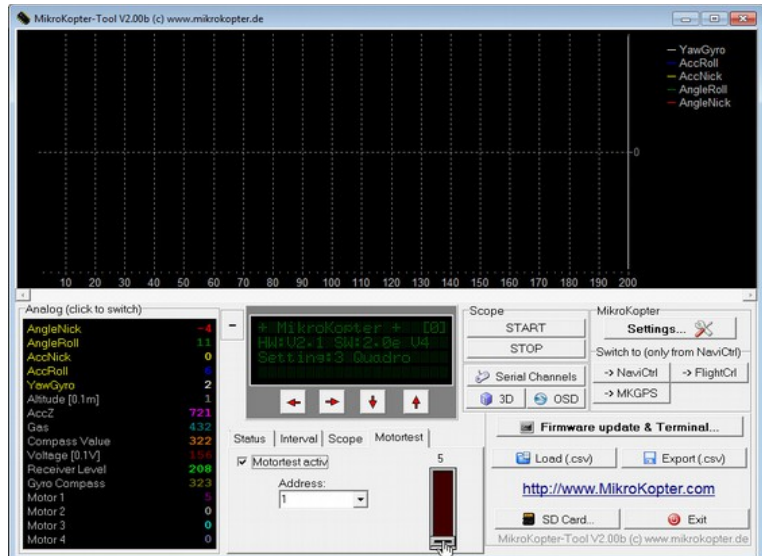
Important: To open the motor test it is necessary to click on the button „->FlightCtrl“ before.

Another tab „Motortest“ will appear. By clicking on this tab the dialog for the motor test will open.

First activate the motor test feature. That will be done by setting the check mark for „Motortest active“.

Now you can select motor „Address“ and power the motor using the slider.

After finishing the motor test make sure you deactivate the motor test.
(Uncheck „Motortest active“ box)



Step 10: Test Gyroscopes

The **ARF-MikroKopter** is controlled by different sensors. You can check the function of the sensors „ACC“ and „Gyro“ in the KopterTool.

Important: To be able to check the sensors you need to click on the button „->FlightCtrl“ before.

Please click the tab „Scope“ and choose the following sensors:

- AngleRoll
- ACCRoll
- AngleNick
- ACCNick
- GyroYaw

With a „Click“ on the button „Start“ the scope will start.

If you move now the **ARF-MikroKopter** over the Nick-, Roll- and Yaw-axis you will see the function of the Gyroscopes and the ACC.

Here the lines for:
„AngleRoll“/„ACCRoll“ and
„AngleNick“/„ACCNick“
should be close together.



If the lines are running very far apart the gyroscopes should be re-calibrated.
(See chapter „Calibration“ Pg. 34)

Calibration

The **ARF-MikroKopter** uses different sensors which makes a flight quite easy.

The **ACC-Sensor** as well as the **Compass** are already calibrated at the factory.

On the other side the **Gyros** must be calibrated new after each switching ON (or battery change).

If you don't do that you are not able to start the **ARF-MikroKopter** and a warning signal will sound while trying to start.



During calibration of the sensors the copter need to stand absolutely still. Moving or shaking the copter can lead to error messages.

During calibration of the **ARF-MikroKopter** the trim for the control sticks of the transmitter should be in middle position. Otherwise it will lead to malfunction.



A new calibration of the ACCs or the compass may be necessary after a software update.

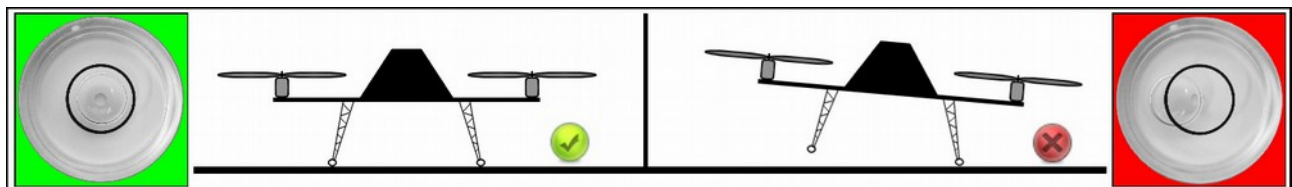
If the copter in the "GPS Hold Position" (see: Features / flight modes) makes circles around the logged position the compass should be re-calibrated.

Acceleration Sensor (ACC)

The acceleration sensor (ACC) helps with the automatic and straight hovering of the copter. If the copter, while hovering (calm wind), begins drifting sideways the ACC should be re-calibrated.

To calibrate the ACC the **ARF-MikroKopter** must stand absolutely straight. The easiest way is to remove the cover and place a circular level on an even spot of the MK-GPS.

Now the copter needs to be aligned until it is horizontal.



Once that is done you can start the calibration.

On your transmitter you do as follows:

- Throttle-Stick up and
- Yaw-Stick to the right

A confirmation tone comes from the copter.



(Example transmitter: **MODE 2**)



You have to do this calibration only once.

The ACC has been calibrated before delivery. A new calibration is only required if the copter, with disabled functions and by totally calm / in a hall and central position pitch / roll stick, clearly and quickly drifts away from the position.

Gyroscopes (Gyros)

For a proper flight function the gyroscopes need to be calibrated after connecting a LiPo.
If you don't do that you are not able to start the copter and a warning tone will sound while trying to start the copter.

On your transmitter you do as follows:

- Throttle-Stick up
and
- Yaw-Stick to the left

A confirmation tone comes from the copter.
(depends on the setting 1-5 „beep tones“)

After successful calibration the motors can be started.



(Example transmitter: **MODE 2**)

Compass

A properly calibrated compass ensures a smooth operation of the GPS functions.

When should the compass be re-calibrated?

This can be necessary if:

- you change the location you are flying by more than a few hundred kilometers.
- The software been renewed or updated.
- The error codes „error6“ or „error22“ been displayed in the KopterTool.
- The copter is not starting after the calibration of the Gyroscopes.
- the copter is not holding the position in the function „PositionHold“ (See: Functions / Flight modes) and makes bigger circles instead.
 - That can is caused throughout bad calibration of the compass,
 - or if you fly in a different location.



Calibrate the compass away from interfering magnetic fields and also outside of buildings.
The following example images of the transmitter are shown in **MODE 2**.

The calibration of the compass is done in several steps:

Step 1 - Initiate compass calibration

Method:

- **Pull Nick downwards**
and then
- **Throttle up + Yaw to the left**
(the copter beeps 1x)



Step 2 - Start calibration of the X+Y Axis

Method:

- **Pull Nick 1x downwards**
(the copter beeps 2x and the buzzer of the copter will give a creaky tone)



Step 3 - Calibration of the X-Axis (Nick-Axis)

Method:

- Align the copter with the front (rigger / Motor No.1) towards south or north.
- Then turn the copter a few times over the **Nick-Axis** until the buzzer stops „creaking“.



Step 4 - Calibration of the Y-Axis (Roll-Axis)

Method:

- **Turn the copter by 90°.**
The creaky tone begins again.
- Turn the copter a few times over the **Roll-Axis** until the buzzer stops „creaking“.



Step 5 - Finish calibration of the X+Y-Axis.

Method:

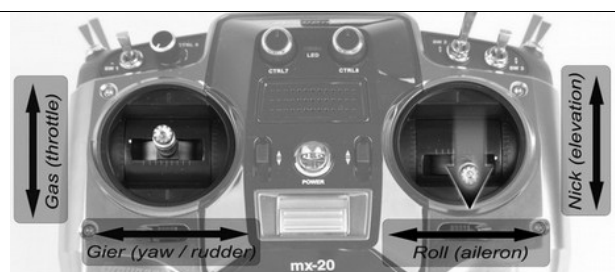
- **Pull Nick 1x downwards**
(the copter beeps 3 x for the confirmation)



Step 6 - Start calibration of the Z-Axis

Method:

- **Pull Nick 1x downwards**
(the copter beeps 4x and the creaky tone begins again)



Step 7 - Calibration of the Z-Axis (Yaw-Axis)

Method:

- INFO: It doesn't matter in this case if the copter points with the X- or Y-Axis to the south (north).
- Turn the copter a few times over the Roll- or Nick-Axis until the buzzer stops with the „creaky“ tone.



Step 8 - Finish calibration of the Z-Axis.

Method:

- **Pull Nick 1x downwards**
(the copter beeps conclusively 2x)

The calibration is done.



Functions / Flight modes

The ARF-MikroKopter has 5 individual settings. All 5 parameters are already set at the factory and need not be changed.

Which channel / switch is provided for the activation of the individual functions please get out of the chapter **Channel assignment**.



With the used GPS-System on the ARF-MikroKopter many additional features are possible. These features make flying the copter much easier.

But for safety reason and in case of a technical disturbance of the GPS system, the pilot must always be able to fly the ARF-MikroKopter without these additional features.

The GPS-Functions *PositionHold*, *ComingHome*, *Teachable CareFree*, *FailSafe* are only usable if a *Sat-fix* is available and the compass as well as the GPS- receiving signal are working properly. Solar storms, shading from buildings / mountains, strong magnetic fields or other influences can disturb these functions. Please be aware!



To check if the GPS receive enough Satellites and get a "SarFix" you can do this: Switch to "PositionHold" during the copter stand on the ground. If the copter now beep once every second the GPS did not have a "SatFix". If the copter get it he is quiet and you can fly.



To start and to land the ARF-MikroKopter the additional functions should be OFF.

The functions

The following functions can be activated during flight:

Free flight

This mode should be used for starting and landing. Because the **ARF-MikroKopter** stabilizes itself by its sensors flying with no additional functions is quite easy.

For free flights without any additional functions the model pilot must handle in any situation the model aircraft safely in the air.

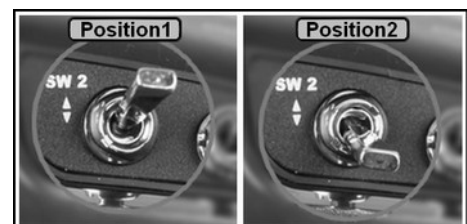
Altitude control

The Altitude control can be activated / deactivated via the transmitter. With the activated height regulator and Throttle-Stick in middle position on the transmitter the ARF-MikroKopter will automatically hold the actual altitude.

If you move the Throttle-Stick (slowly) upwards the copter begins continuously to climb.

If you move the Throttle-Stick (slowly) downwards the copter begins continuously to fall.

(assigned to a 2-way switch on the transmitter)



Both will be accompanied via the buzzer by a „tone interval“. If the Throttle-Stick will be moved back into the middle position the copter will hold the actual altitude.

A switched ON altitude control can support the free flight. If GPS functions are used the altitude control should also be activated.



Flying in windy conditions or with a very large payload may result in an oscillation of altitude, even if altitude control is being used.

GPS-Functions

The GPS-System allows the **ARF-MikroKopter** to hold on to a position or automatically fly back to the starting point.

Those functions are so called:

- **PositionHold** and
- **ComingHome**



(assigned to a 3-way switch (OFF/ON/ON) on the transmitter)

Via a 3-way switch on the transmitter you can switch between the functions:

- Position 1 => GPS-Function **switched OFF** (Free flight)
- Position 2 => Function **PositionHold** activated
- Position 3 => Function **ComingHome** activated

If you use one of these functions the altitude control should be also enabled.

PositionHold:

If the function *PositionHold* is activated the copter holds the actual position. Here, the ARF-MikroKopter can, depending on the received signal from the satellites and the accuracy of the GPS-System move around its position (1-3 m).

If you move the sticks on the transmitter the copter will move in the appropriate direction. If you release the sticks on the transmitter the copter will hold the new position.

ComingHome:

Switching ON the function *ComingHome* the **ARF-MikroKopter** will automatically fly straight back to the point where the copter was started.

Important: The copter will use a pre-set altitude for the flight back, which is set in the settings for *ComingHome-Height* (e.g. 50m).

This value can be set in the KopterTool in the tab „Easy Setup“ and „*ComingHome Height*“ individually if necessary. (See Page 20 – *Easy Setup*)



This under "Coming Home-height" listed altitude is also used for the FailSafe function!

In order for the use of the GPS-Functions a Satfix is needed. To get a Satfix it can take up to a few minutes after switching ON the **ARF-MikroKopter**.

Is a Satfix available a short confirmation beep sounds up. The blue LED on the MK-GPS module under the cover starts blinking in intervals.

If you switch ON the function *PositionHold* or *ComingHome* without a Satfix a „beep tone“ sounds from the buzzer in second-intervals. The beeps go OFF if a SatFix is available or if the function PositionHold or ComingHome is switched ON again.



The GPS-Functions can be disturbed through solar storms or other influences e.g. magnetic interferences. If you determine that the copter shows unusual behavior using a GPS-function in that case switch OFF all GPS-functions **immediately** and fly and land the copter manually. Otherwise the copter may cause a crash or could fly off.

Teachable CareFree

Prolog:

The function CareFree helps the pilot to control the **ARF-MikroKopter** in a contact flight. It also helps if the copter is far away and you cannot determine the front of the copter anymore.

On the ARF-MikroKopter the different colored rigger No. 1 is the „front“. If you control now the MikroKopter via the transmitter the copter flies forwards if the „Nick“-Stick will be moved forwards. The copter flies backward if you move the „Nick“-Stick backwards. Or sideways by moving the „Roll“-Stick.

It can be a little bit difficult if the **ARF-MikroKopter** will be turned during the flight with the „Yaw“-Stick. When turning the copter necessarily rotates the front, too and you need to rethink controlling the copter.

Who has not that much practice in those situation and is inexperienced in a so called „flying nose“ can control the ARF-MikroKopter easily wrong.

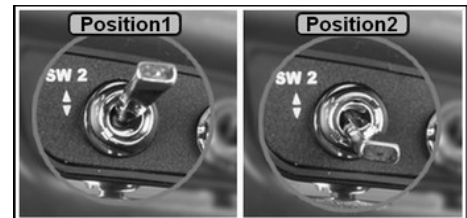
If, in example, the rigger No.1 points towards the pilot the copter will fly while moving the „Nick“-Stick forward – into the direction of the pilot. The same is with the „Roll“-Stick. If you move the stick e.g. to the right, the copter moves left and reverse.

The function:

The function (Teachable) CareFree can be activated / deactivated via the transmitter.

Example: The different colored rigger No.1 points away from the pilot.

If you enable now the function *CareFree*, it doesn't matter which direction the front rigger points. With this enabled function you can turn the copter during the flight as you like. If you move the „Nick“-Stick forwards the copter flies away from the pilot all the time. Moving the „Nick“-Stick backwards, towards yourself, the copter flies to the pilot. It doesn't matter in which direction the copter was turned.



(Assigned to a 2-way switch (ON/OFF) on the transmitter)

For an easier use of this function they are divided into two sections. Depending on whether the ARF MikroKopter is inside or outside of a 20-meter radius around the starting point.

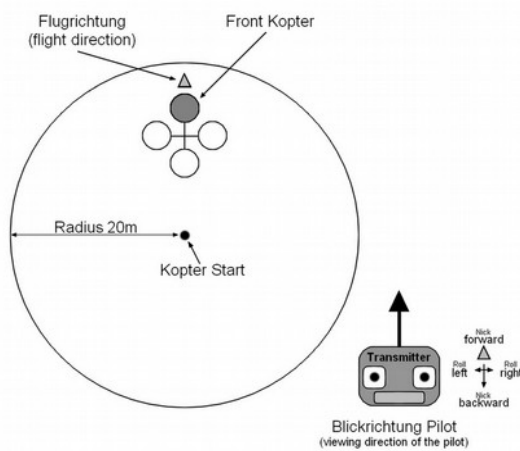
Function inside the 20-Meter radius around the starting point:

When the **ARF-MikroKopter** is inside of the 20-Meter radius around the starting point and always clearly visible, determine the front of the copter (rigger No.1) after switching on the function *CareFree*.

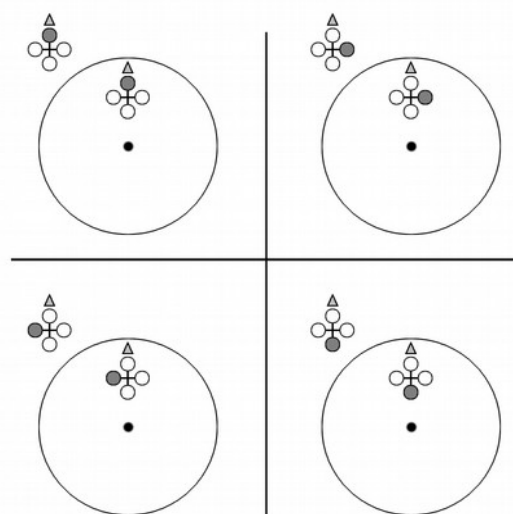
Point the front of the copter e.g. away from the pilot and when the function *CareFree* is activated the copter will fly away from the pilot and it doesn't matter where the front is if you move the „Nick“-Stick forwards.

Kopter fliegt innerhalb des 20mtr. Radius CareFree umschalten von "aus" auf "ein"

Kopter flies within the 20m radius
CareFree switching from "OFF" to "ON"



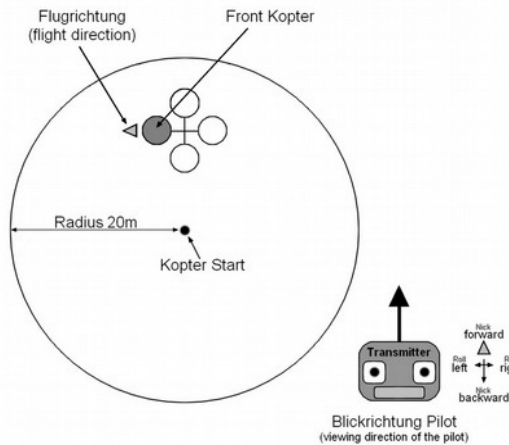
Kopter fliegt - CareFree ist "ein" Kopter flies - CareFree is "ON"



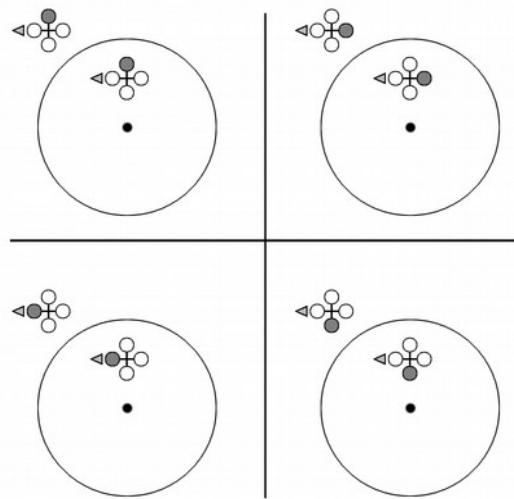
If the function *CareFree* will be disabled and the copter is inside the 20mtr radius (e.g. by 90°) and the function *CareFree* is enabled again, the new direction is the „front“. And it doesn't matter how the copter will be turned.

**Kopter fliegt innerhalb des 20mtr. Radius
CareFree umschalten von "aus" auf "ein"**

Kopter flies within the 20m radius
CareFree switching from "OFF" to "ON"



Kopter fliegt - CareFree ist "ein"
Kopter flies - CareFree is "ON"



If you switch „OFF“ the function the copter returns to the original control.

Function outside the 20-Meter radius around the starting point:

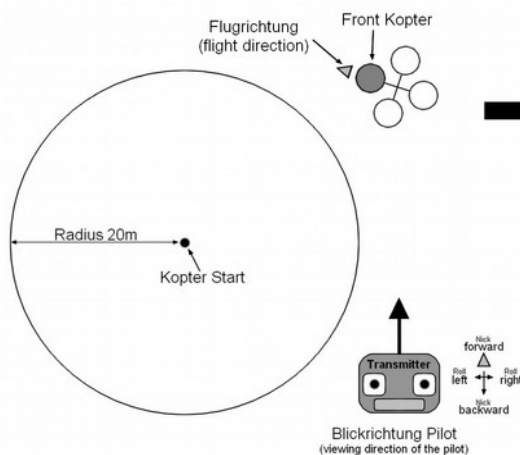
If the **ARF-MikroKopter** is outside the 20-Meter radius around the starting point, and can't be easily seen, it doesn't matter here which direction the front (rigger No.1) of the copter points.

Here now the current position of the **ARF-MikroKopter** and the starting point will be used.

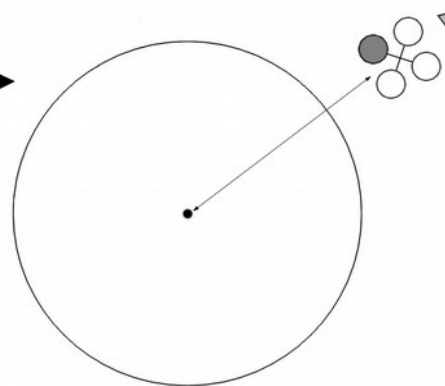
As soon as the function *CareFree* will be enabled, applies to the pilot (starting point) the averse side of the copter as „front“ and to the pilots (starting point) back-facing side as „backward“. If the „Nick“-Stick is moved forward the copter flies away from the pilot. Moving the „Nick“-Stick towards yourself the copter will fly to the pilot.

**Kopter fliegt außerhalb des 20mtr. Radius
CareFree umschalten von "aus" auf "ein"**

Kopter flies outside of the 20m radius
CareFree switching from "OFF" to "ON"



Kopter => Startpunkt = Flugrichtung "zurück"
Startpunkt => Kopter = Flugrichtung "vor"
Kopter => Starting point = Flight direction "backwards"
Starting point => Kopter = Flight direction "forward"



If you switch „OFF“ the function the copter returns to the original control.



The CareFree-Functions can be disturbed through solar storms or other influences in example magnetic interferences.

If you determine that the copter shows unusual behavior using the CareFree-function in that case switch OFF the CareFree-function **immediatly** and fly and land the copter manually. Otherwise the copter may cause a crash or is flying off.

FailSafe

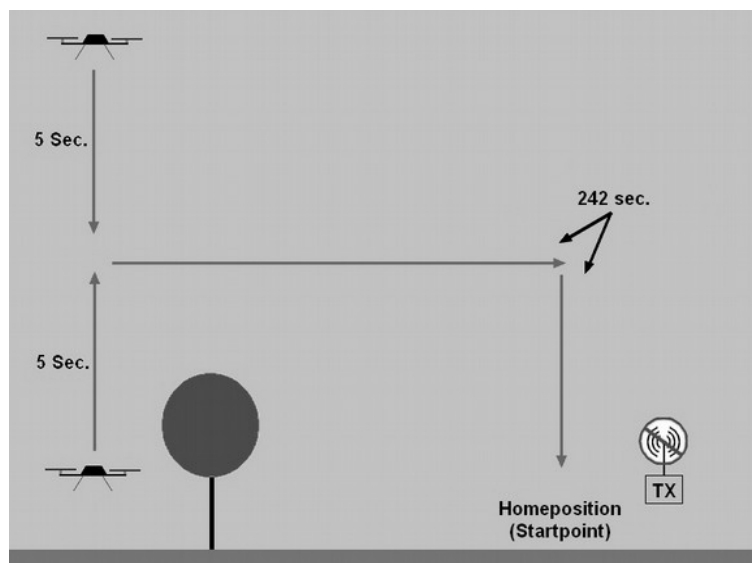
During an interruption / disturbance of the radio link between the transmitter and receiver the function *FailSafe* will automatically be activated. The purpose of this function is to bring the **ARF-MikroKopter**, in case of a lost receiving signal, back into the range of the transmitter to restore the receiver signal.

A reception failure can happen by exceeding the maximum range of the transmission path between the transmitter / receiver.

When the connection is re-established again after using *FailSafe*, the function will be automatically disabled and a control of the copter is possible again via the transmitter.

If you are unable to restore the reception (transmitter failure due to dead battery, etc.), the *FailSafe*-function will perform as follows:

- Transmitter failure =>
The **ARF-MikroKopter** will automatically switch the function FailSafe + PositionHold ON and climb / fall for 5 seconds to a pre-set „ComingHome-Height“.
- After the 5 seconds automatically the function "ComingHome" + Height regulator will be activated and the copter will fly into the direction of the home position (Starting point).
Info: If the set „ComingHome-Height“ is not reached in the first 5 seconds the copter will climb / fall to the pre-set height during the backflight.
- If the reception cannot be restored during the backflight the **ARF-MikroKopter** will fly back to the home position with the set time in the settings (max. 242 seconds). If the ARF-MikroKopter arrives at that point automatically begins the descent flight with a fixed and unchangable rate of descent.



If there is a too much distance / height to the home position and can not be reached within the 242 seconds it automatically switches to „emergency gas“. Here the ARF-MikroKopter will not continue to fly to the starting position (home position) but goes at the current position with a pre-set emergency gas into de descent flight. The availability of nthis emergency gas is another 24 seconds. After that the motors will switch off automatically.

Set the ComingHome Height for FailSafe

The „ComingHome Height“ can be done in the settings and in the window „**EasySetup**“ by yourself. Here you need to enter the height in which the copter will fly back in case of a reception failure (see Pg. 20).



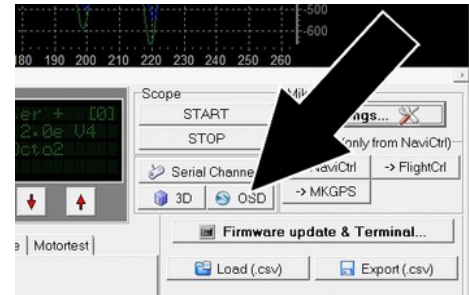
This height will be also taken if during a manual flight the function ComingHome will be activated.

The ComingHome Height helps to prevent not to fly into obstacles such as trees, houses etc. during the automatic return flight.

WayPoint Flight

With the **ARF-MikroKopter** and the MikroKopter-Tool WayPoints can be set anywhere on the map and then flown automatically. Here now the Bluetooth-Set is used.

The WayPoint program can be opened after a „Click“ on the button „OSD“ in the KopterTool.



The WayPoint program „OSD“ opens:

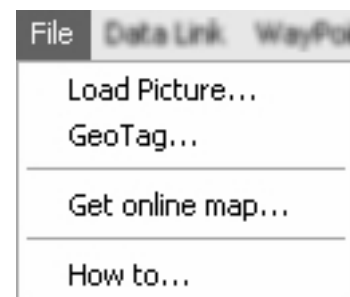


Is the ARF-MikroKopter switched ON, all telemetry data will be displayed via the Bluetooth set in the upper field of the „OSD“. These will show battery voltage, number of received satellites, set functions, height etc.

The field below in the „OSD“ is still empty. Here a map of the flight field can be displayed. That can be done with the „OSD“ via

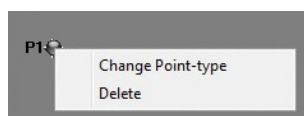
File > Get map online ...

and be chosen and saved.

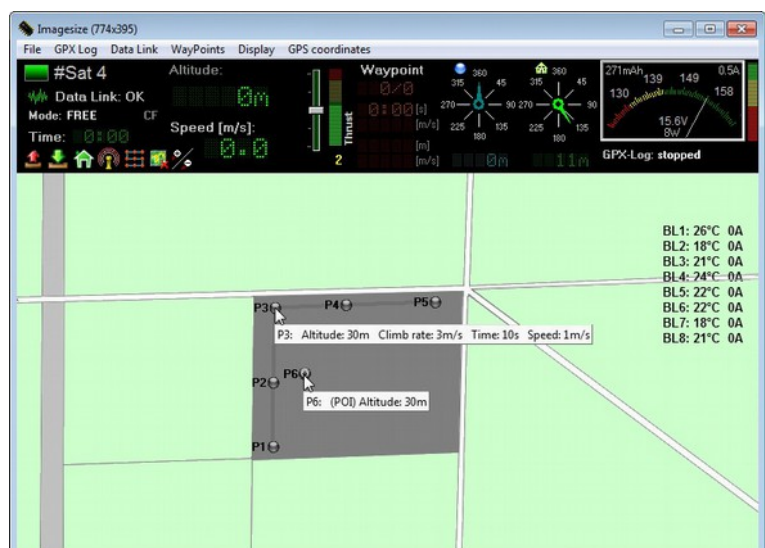


The saved map sections can be loaded into the WayPoint program via *Load image...* . You can store now Into this map any WayPoint with a „right click“ of the mouse.

With a „Right click“ of the mouse on a WayPoint in the map you can change that WayPoint into a *Point of interest* (POI) . In that way several WayPoints can be changed into POI.



While the WayPoints are being flown the camera can be focused on those POI.



If a WayPoint or POI is set, another window opens up so that the set WayPoints and POI can be changed afterwards. Each WayPoint can be changed individually and if multiple POI are set each WayPoint can be set as a different viewing direction to the POI.

5 waypoints in Mission Plan												
Waypoint-List Waypoint												
	Nr.	Time	Radius	WP-Event	Climb rate	Altitude	Heading	Speed	CAM-Nick	Prefix	Latitude	Longitude
	1	10	10	0	30	30	180	10	90	P	53.2847961	7.4838677
	2	10	10	0	30	30	180	10	90	P	53.285147	7.4838751
	3	--	--	--	--	30	--	--	--	--	53.2853681	7.4841252
	4	10	10	0	30	30	180	10	90	P	53.2855027	7.4845373
	5	10	10	0	30	30	180	10	90	P	53.2855075	7.4852509
	6	10	10	0	30	30	180	10	90	P	53.2855027	7.4852677

Are all WayPoints / POI set, those can be transferred to the **ARF-MikroKopter**.
The ARF-MikroKopter needs to be switched on and it must have a connection via the Bluetooth-Set.

Transfer the WayPoints / POI by a „Click“ on the upward pointed red arrow.

For each transferred WayPoint / POI the ARF-MikroKopter will confirm it with a „beep“.

Are the WayPoints / POI tranferred to the copter you can start the copter.

To start the WayPoint flight proceed as follows:

- All switches at the transmitter should be „OFF“.
- Start ARF-MikroKopter and hover on a position.
- On the transmitter activate the function „Hold Height“.
- On the transmitter activate the function „PositionHold“.

The ARF-MikroKopter will now hold a fixed position in the air.

- On the transmitter activate the function „CareFree“.
(Here the camera mounts point into the set direction(s)).
- On the transmitter change the switch for „LANC-Ctrl + WP-Trigger“ to middle position.
(This is the automatic that the camera will trigger during a waypoint fly.)
- On the transmitter activate the function „ComingHome“.

By switching the switch to the function „ComingHome“ the copter automatically start to the first WayPoint. After reaching that point and with the set waiting time the flight continues to the next WayPoint.
Has been a POI set as the view direction, the copter will align to that POI by flying to the next WayPoint. Was there no new view direction set for the next WayPoint the current alignment will be maintained.

When the ARF-MikroKopter reaches the last WayPoint, the copter will stop there.

To get the ARF-MikroKopter back to the starting point all functions like (Hold Height, CareFree, ComingHome) need to be deactivated to manually fly back the copter.

If you want to fly the same WayPoints again you must land the copter and switch OFF the motors. After a restart of the motors you can proceed from the beginning.



Transferred WayPoints are not stored in the ARF-MikroKopter. As soon as the power supply has been disconnected the transferred WayPoints are deleted.



A transfer of the WayPoints to the ARF-MikroKopter is also possible during the flight. In that way you can transfer new assigned WayPoints during the flight. Up to 100 WayPoints can be transferred at the same time.



As long as there is a connection to the Bluetooth-Set (range is limited) the telemetry data as well as the current position of the ARF-MikroKopter will be displayed in the „OSD“.

More information about the WayPoint flight and further settings you can get on the following website:
<http://mikrokopter.de/ucwiki/MikroKopterTool-OSD>



Acoustic signals – LED displays

After switching ON the **ARF-MikroKopter** the connected modules will start initialization.

- The BL-Ctrl (Motor regulator) checks on the individual connected motor
- The FlightCtrl checks the connected electronic

The initialization is signaled by certain beeps the copter.

After the initialization is successfully done the green LED on all electronic modules should light. On the MK-GPS an additional blue LED lights will start blinking with a successful Satfix.

A red LED will blink on the FlightCtrl, NaviCtrl or the BL-Ctrl if an error occurs.

Those errors can be displayed with the HoTT transmitter or read on the KopterTool.

If after the review of the ARF MikroKopter and after re-connecting the battery an error message continues to appear, please contact our support (ARF-Support@HiSystems.de).

The Initialization:

After connecting the battery the initialization begins:

- A short „beep“ via the buzzer of the **ARF-MikroKopter**
- Each motor will be tested individually and one after the other through the appropriate BL-Ctrl. Here each motor gives a „tone interval“ and the appropriate motor moves for a short time.
- After that, a long „beep“ will sound from the buzzer of the **ARF-MikroKopter**, followed by 4 short beeps.
- After a short break a last „beep“ will sound and the initialization is finished.

If you missed it to turn on the transmitter you will hear, after the initialization, tone intervals of short and long tones. If the transmitter will be turned on, the warning signal stops.

This warning signal you will also hear during a reception failure.

Low voltage warning:

The undervoltage alarm occurs in three steps. The warning threshold can thereby be customized and set:

1. When the battery reaches the first warning threshold, the buzzer of your copter will beep the whole time. Also the front LED is flashing and the Graupner HoTT Transmitter is giving you a warning message.
2. If the battery reaches the second warning threshold, the copter will automatically fly back to the Home Position.
3. And if the battery reaches the third warning threshold, the copter will automatically land.

Signaling the battery warning, the **ARF-MikroKopter** should be landed immediately and the battery should be charged or changed.

Switching the functions:

- GPS-Functions (PositionHold / ComingHome)
 - Each time you switch between the functions the copter will confirm with a short „beep“.
 - INFO: If there is no Satfix yet and you switch to the function *PositionHold* or *ComingHome* a short „beep“ will sound in second intervals. That stops, if there is a Satfix. A Satfix will be signaled with a longer „beep“.
- CareFree
 - After switching on this function it will be confirmed with a short „beep“.
- Height regulator
 - If the height regulator is switched on you will hear via the buzzer of the **ARF-MikroKopter** a continuously tone interval.

Voice output:

A voice output of the telemetry data and the switch process of height, PositionHold, ComingHome and CareFree will be provided via the Graupner HoTT MX-20 / MC-32 transmitter. The MC-32 uses here a built-in loudspeaker. For the MX-20 you need to connect an external loudspeaker.

Installation of the optional accessories

Optionally, various accessories can be purchased for the **ARF-MikroKopter**. This includes for example a transmitter with receiver, a camera mount, a mechanical cable release or a programmable remote with zoom function for different camera models, and more.

The connection of these optional accessories is described below:

Transmitter/Receiver MX-20 / MC-20 / MC-32

The optional HoTT transmitter / receiver is already set. The transmitter can be used directly after the receiver is connected.

Ch.	Assignment in the KopterTool	Functions	Switch MX-20 (Mode2)	Switch MC-20 (Mode2)	Switch MC-32 (Mode2)
1	Gas	Control throttle	Control sticks left	Control sticks left	Control sticks left
2	Roll	Control roll	Control stick right	Control stick right	Control stick right
3	Nick	Control nick	Control stick right	Control stick right	Control stick right
4	Yaw	Control yaw	Control stick left	Control stick left	Control stick left
5	Ch5	Function HoldHeight	SW 3	SW 7	(right) SW 3
6	Ch6	Function GPS (PositionHold / ComingHome)	CTRL 10	SW 5/6	(right) SW 6
7	Poti3	Camera Zoom	CTRL6	Slider right	Slider right
8	Ch8	Function CareFree	SW 2	SW 9	(left) SW 4
9	Poti5	Camera tilt (Nick)	CTRL 7	Slider left	Slider left
10	Poti6	Camera tilt (Roll)	CTRL 8	Potentiometer	Potentiometer
11	Poti7	Trigger camera - ModSp.1 (LANC - ModSp.2)	SW 9 (CTRL9)	SW 8	(right) SW 8
12	Ch12	Function Motor-Safety switch & Voice output	SW 1	SW 14	(left) SW 7
13	Ch13	Auto Start / Land	n/a	n/a	(right) SW1
14	Ch14	-	n/a	n/a	-
15	Ch15	-	n/a	n/a	-
16	Ch16	-	n/a	n/a	-



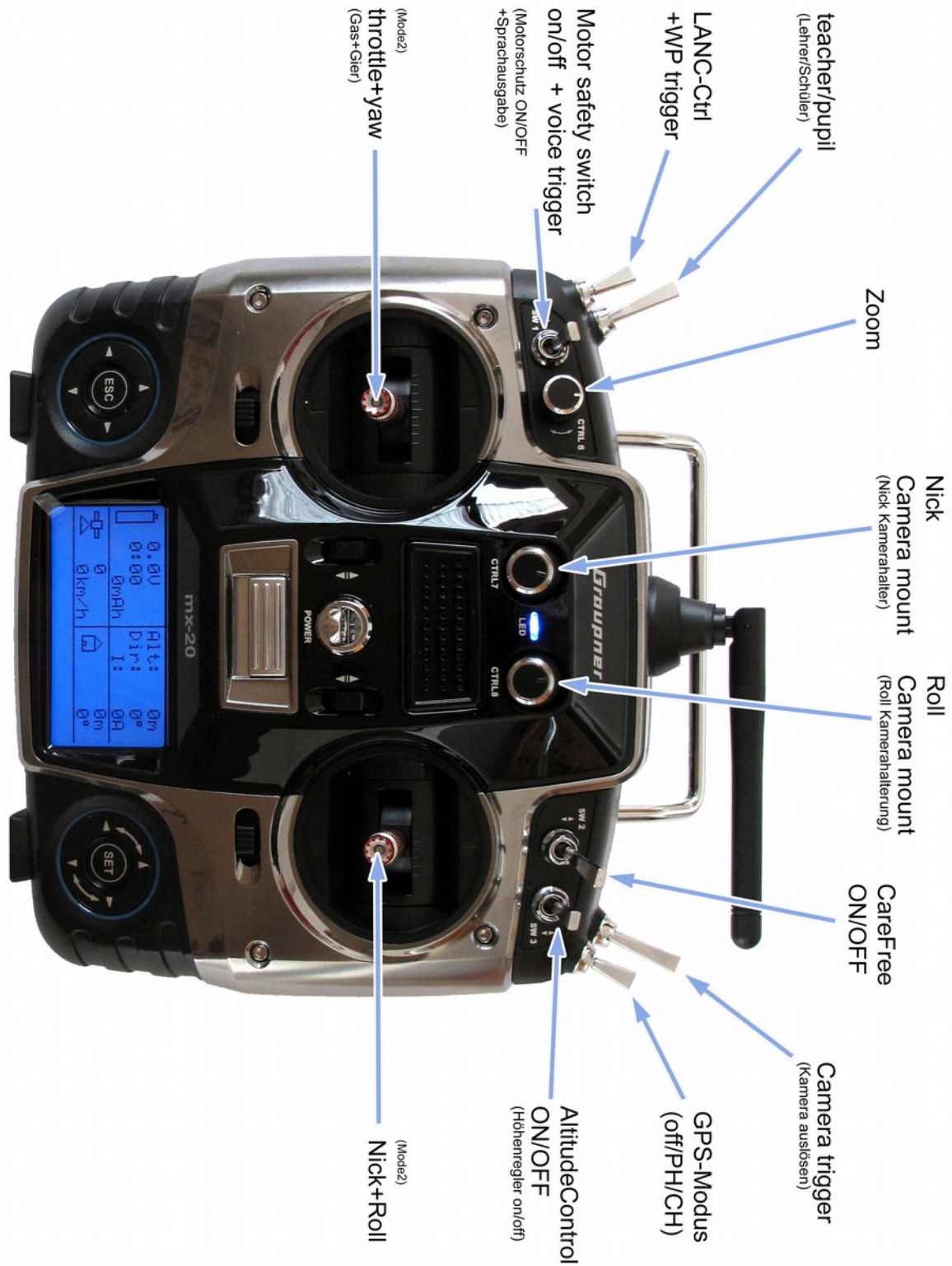
If a HoTT transmitter has been ordered to the **ARF-MikroKopter** it contains these a matching model memory. In that model memory channel 11 is set for a push button (trigger) and also for a 3-way switch (LANC-Ctrl + Automatic).



The sticks of all transmitters can buy are set to "neutralized". A spring will hold here the Sticks in the middle position. As a beginner, you should change the "throttle" stick to "non-neutralized". How to set this is described in the manual of the transmitter.

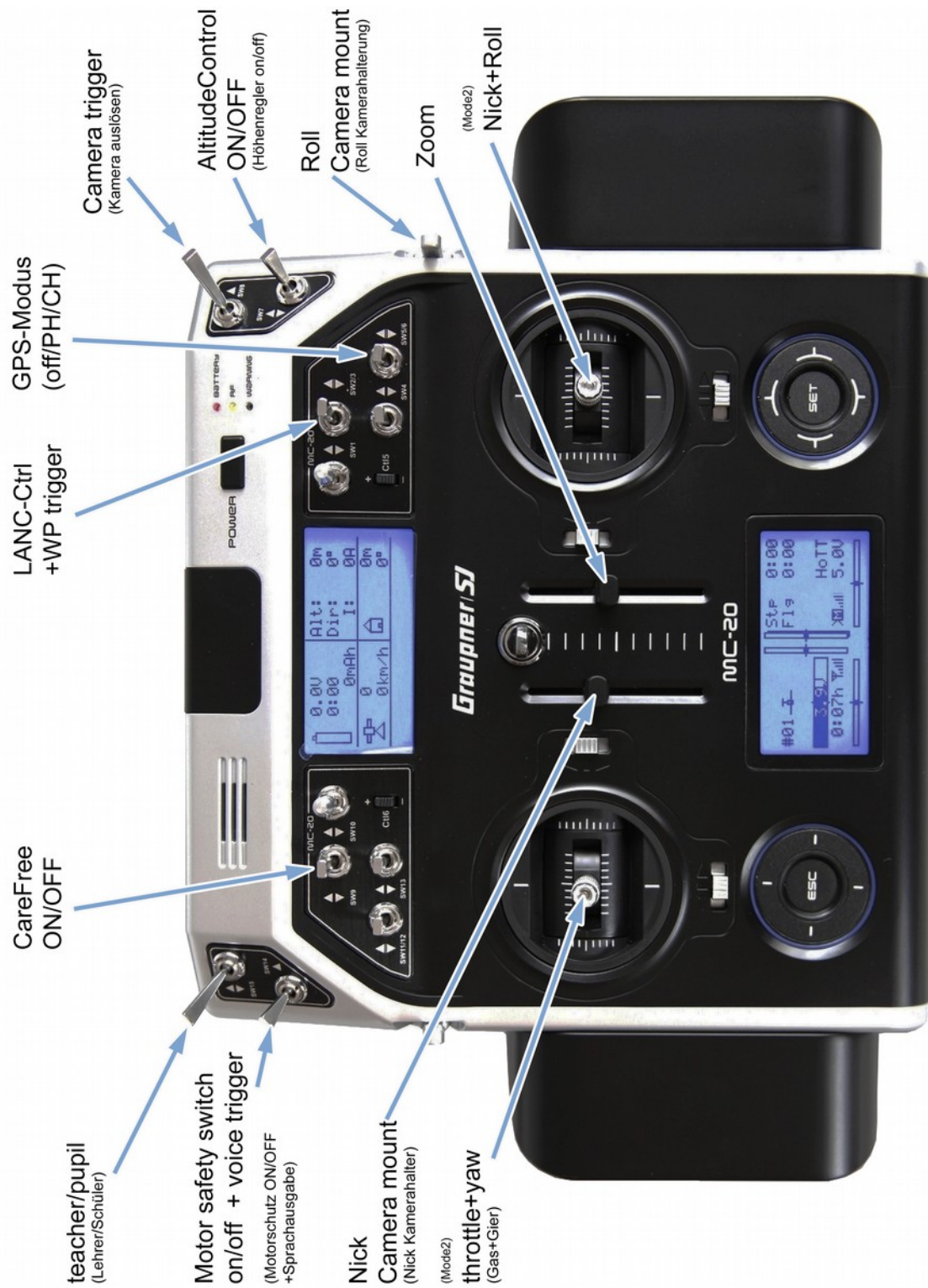
Transmitter assignment: Graupner MX-20

Assignment:



Transmitter assignment: Graupner MC-20

Assignment:



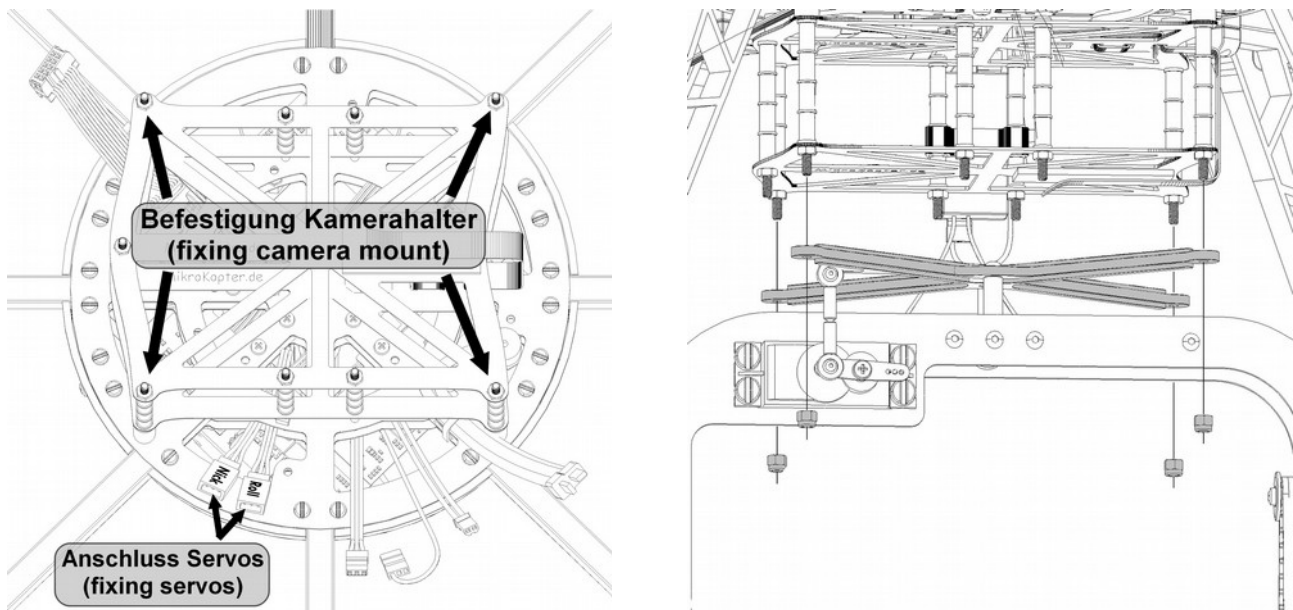
Transmitter assignment: Graupner MC-32

Assignment:



Mounting the camera mount

The camera mount SLR1 or SLR2 needs to be mounted to the four edge-screws of the battery holder.

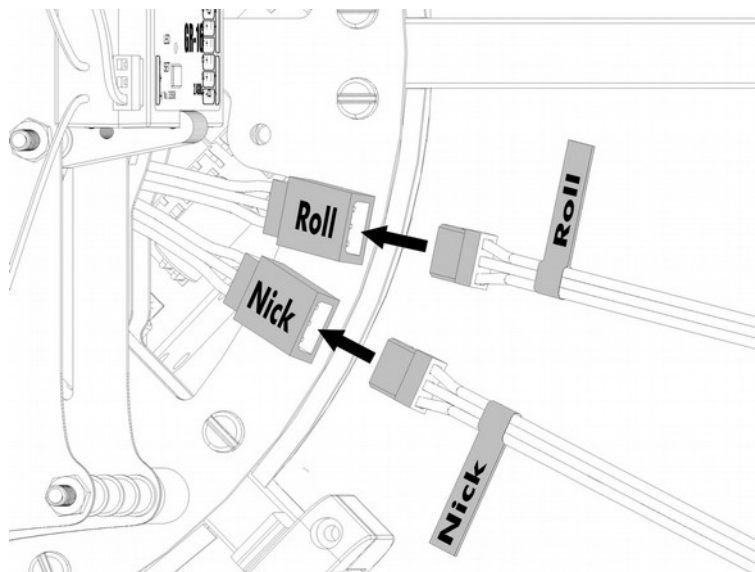


For the control of the two servos on the camera mount, located at the bottom of the **ARF-MikroKopter**, there are two couplings, labeled with „R“ (Roll) and „N“ (Nick).

Here the appropriate servo plug of the camera mount will be inserted.



Make sure that the plugs are connected right in polarity!

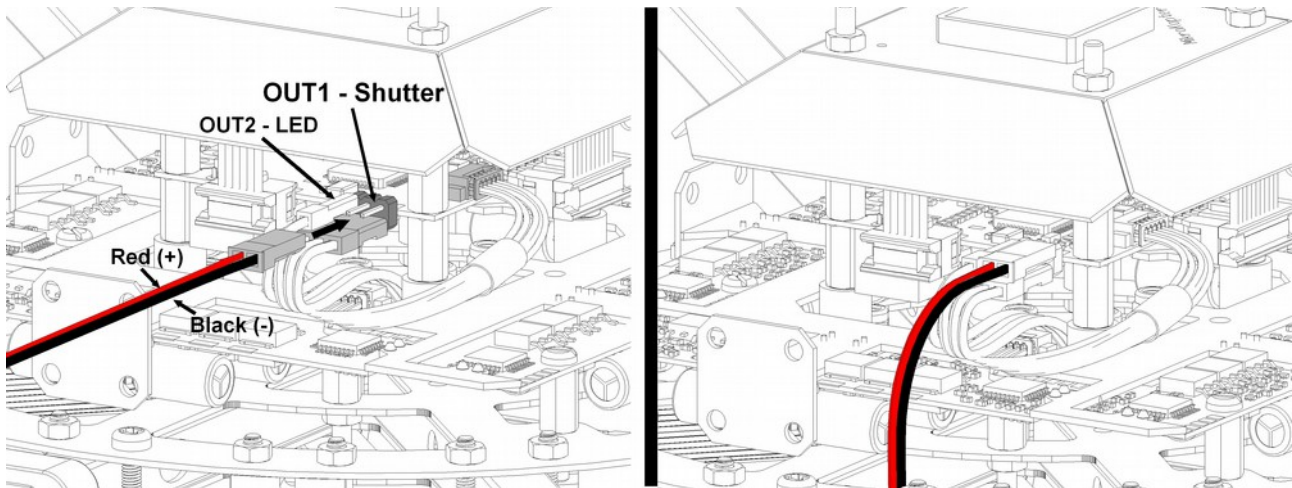


Camera trigger - Shuttercable

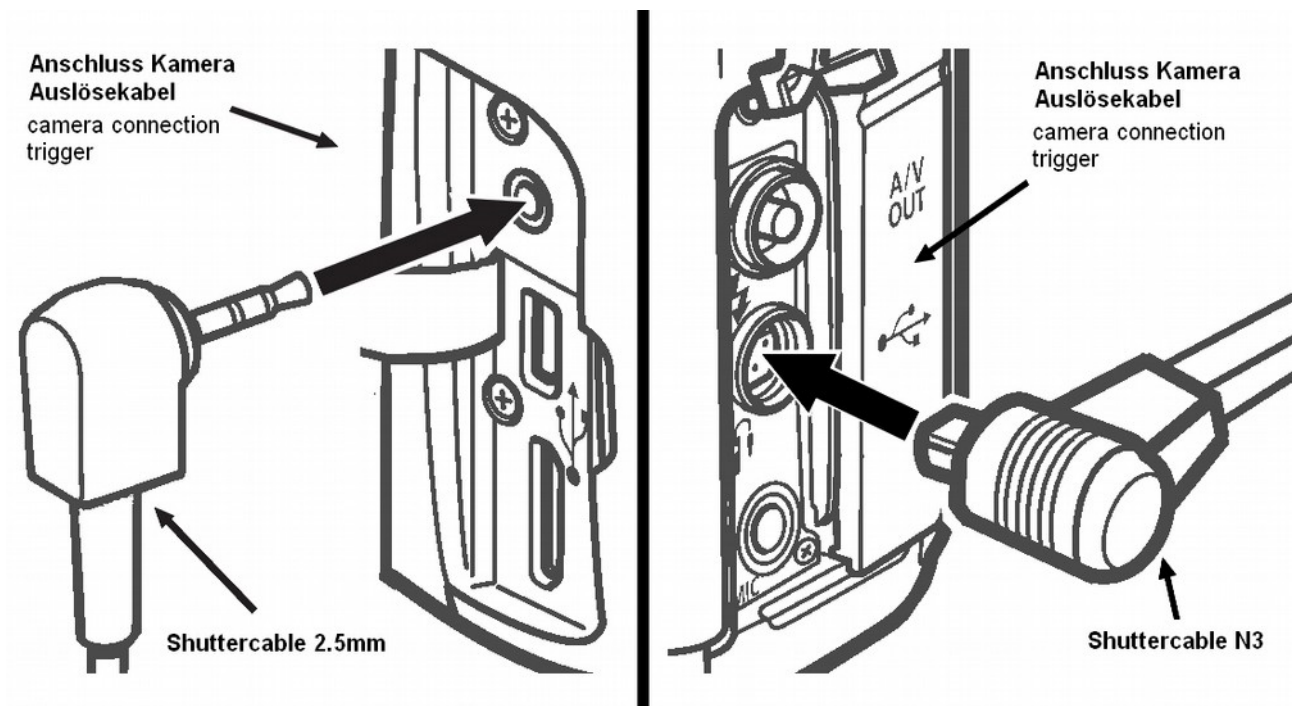
The Shuttercable can be ordered with a 2.5 mm jack or a N3 connector.

Using the Shuttercable, an attached camera can be triggered manually by the transmitter or automatically via the FlightCtrl (e.g. during WayPoint flight).

The Shuttercable is connected with the BEC-coupling to the prepared switch output „Out2“ of the FlightCtrl and will be moved down and out through the Centerplates to the camera mount.



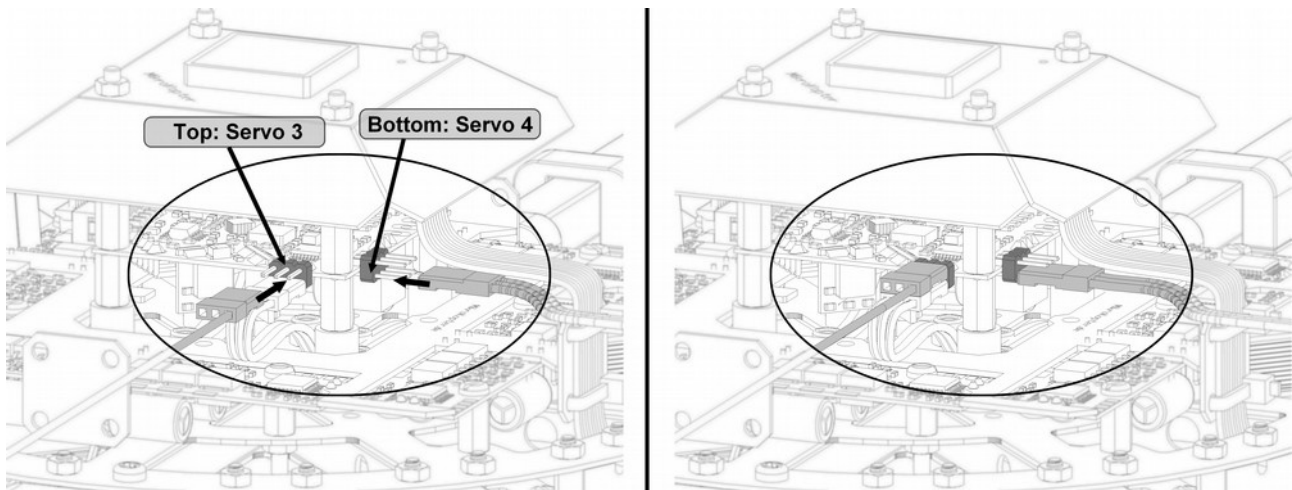
The 2,5mm jack / N3-connector needs to be connected to the appropriate socket of the camera.



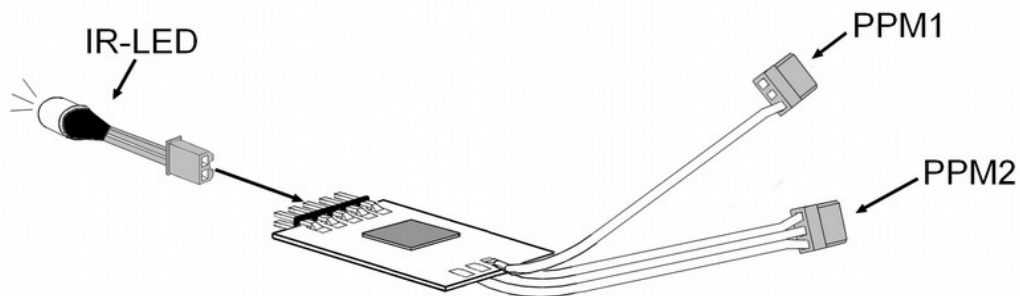
Camera trigger – IR-Ctrl / LANC

To trigger or control a camera / video camera with IR-receiver or LANC, the IR-Ctrl can be used. IR-Ctrl may either be purchased with an IR sensor or a LANC terminal. This allows to send a total of 4 control commands to the used camera / video camera.

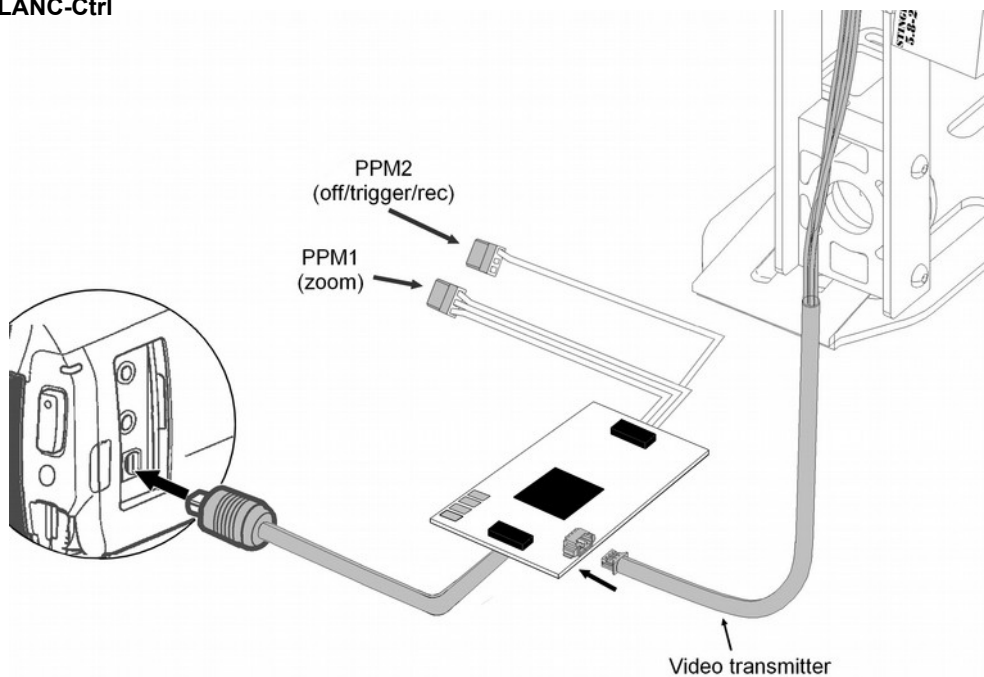
The connection to the FlightCtrl of both versions is identical.



Connection IR-Ctrl



Connection LANC-Ctrl



Installation of the video transmitter

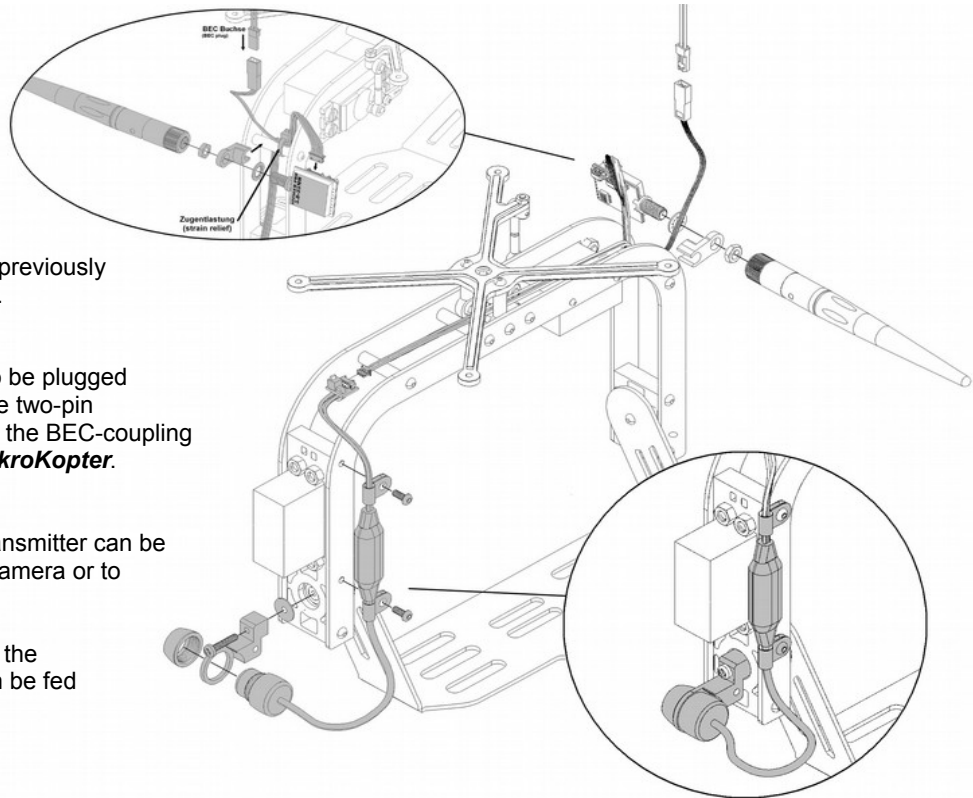
On the **ARF-MikroKopter** the appropriate video transmitter „NANO Stinger“, can be attached directly to the camera mount SLR1/2. For this purpose a suitable clip for the video transmitter is included.

Step 1:

The cable for the video transmitter for strain relief is attached to the camera mount with a cable tie.

Step 2:

The video transmitter is with the clip and with the antenna is attached to the carrier of the camera mount.



ATTENTION:

Do not damage or crush the previously attached cable on the carrier.

Step 3:

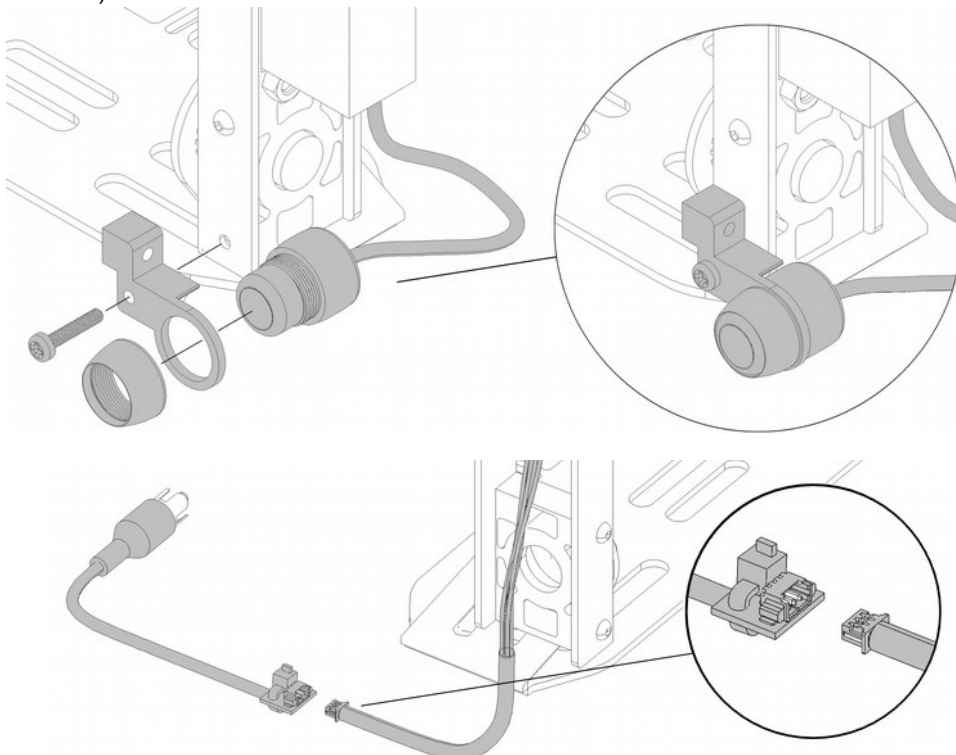
The wide connector needs to be plugged into the video transmitter. The two-pin BEC-connector is plugged to the BEC-coupling on the bottom of the **ARF-MikroKopter**.

Step 4:

The three-pin cable of the transmitter can be connected now to the Mini-Camera or to the Cinch-Molex Adapter.

Via the Cinch-Molex Adapter the video signal (Composite) can be fed from a camera/video camera to the video transmitter.

The Mini-Camera can be installed to the camera mount and be either movable (pictured above) or rigid (pictured below).

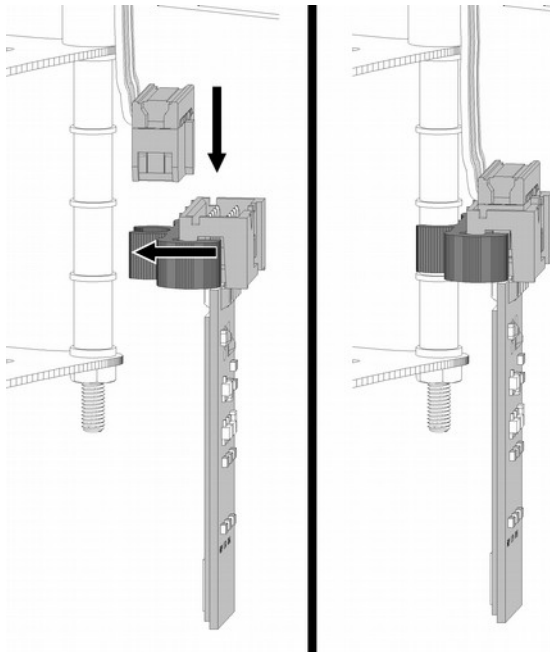
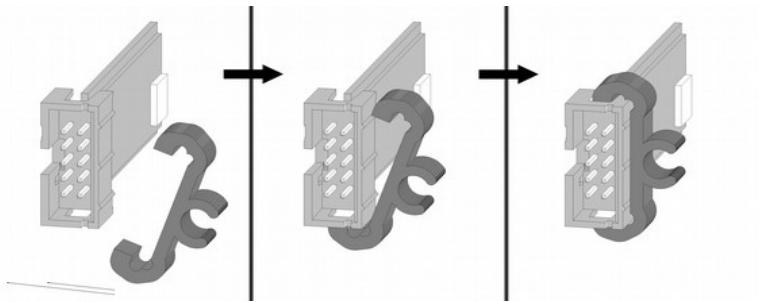


Connection Bluetooth-Set / Wi.232-Set

For wireless transmission of the telemetry data and for WayPoint flights the Bluetooth-Set or the Wi.232-Set can be used on the **ARF-MikroKopter**.

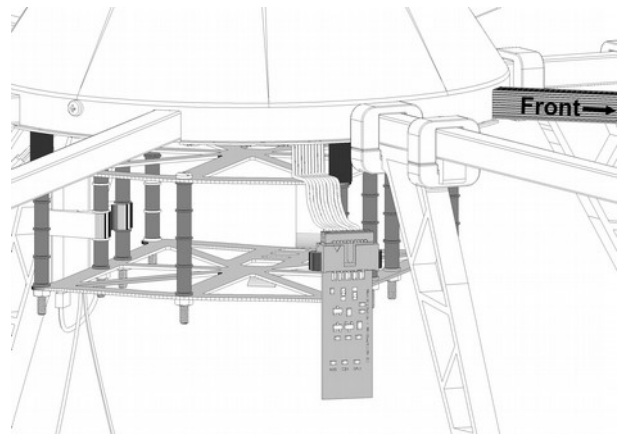
Step 1

The retaining clip will be pressed with a little pressure into the recesses of the Module.



Step 2

The Module is connected with the 10-pin connection cable to the bottom of the **ARF-MikroKopter** and hooked up to the LiPo holder.



Step 3

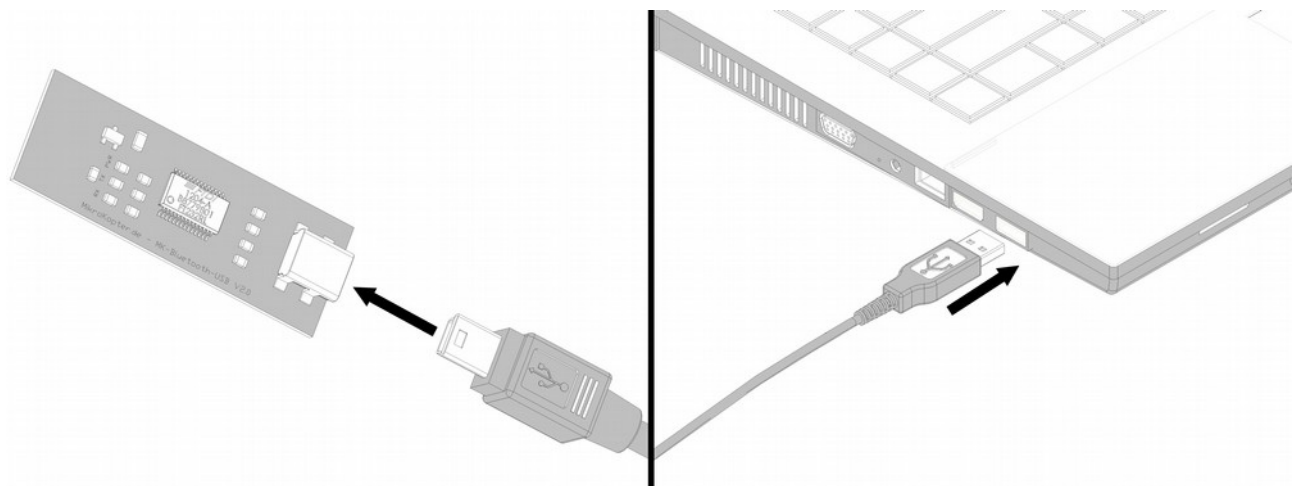
Connect the USB Module to the PC / Laptop

Now the module on the Windows PC should be automatically detected and the appropriate drivers should be found online and installed. For this procedure an internet connection is necessary and the installation can take a few minutes.



If the automatic installation of the Windows drivers fail, the COM port driver (VirtualComport VCP) can be downloaded here and installed manually:

<http://www.ftdichip.com/Drivers/VCP.htm>



Kopter-Pilot + CAM-Operator

If you will control the copter and the camera separated, you can use a second transmitter. If you already use a Graupner HoTT Transmitter you can easily bind a second one. If you then use the Teacher/Pupil Switch (see page 45), the functions of the camera are on the second transmitter.



The optional HoTT transmitter are already equipped with the required model memories.

- model select 1: ARF-OktoXL
- model select 2: CamOperator

The first transmitter use still the model select 1: *ARF-OktoXL*

And the second, to control the camera, use the model select 2: *CamOperator*.

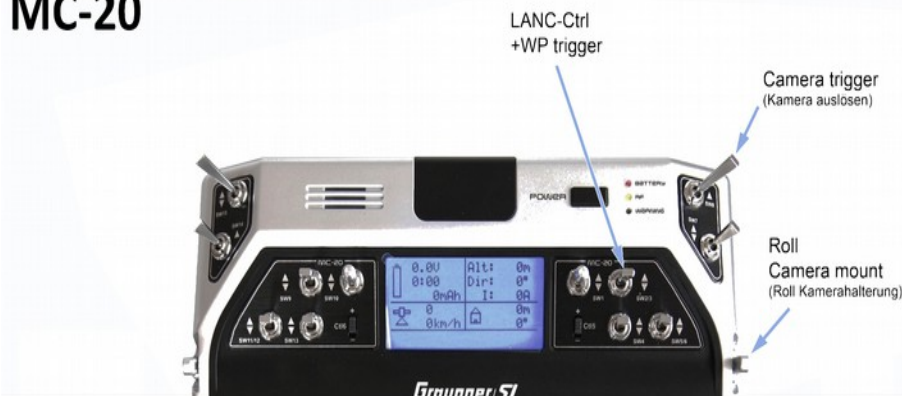
(How to chose the model select – please see manual of the transmitter)

This functions are then on the second Transmitter: „Kamera trigger“, „LANC+WP-Trigger“ and „Roll Camera-Mount“

MX-20



MC-20



MC-32



The controlling for the Camera-Nick and the Zoom are on the Sticks:

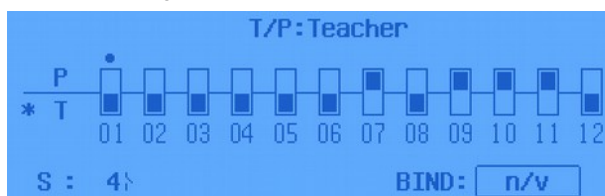


This is perfect to control the functions much more accurately and "soft".

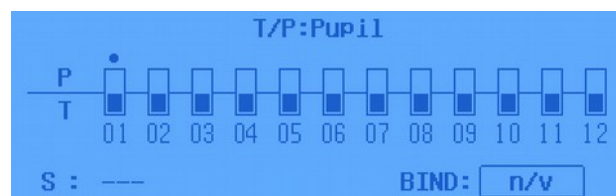
Transmitter bind

To use both transmitters together you have to bind them together. Here you can see how:

- Switch main transmitter and Copter (receiver) ON
- On the main transmitter select the model memory *ARF-Okto*
- In the second transmitter select the model memory *CamOperator*
- Change on both transmitters to *Teacher / Pupil* and select „BIND“

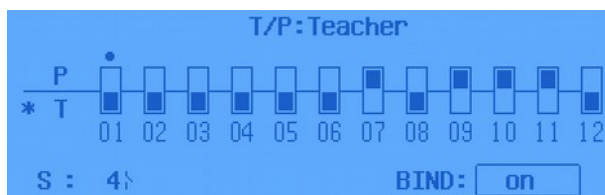


Main transmitter (control Copter)

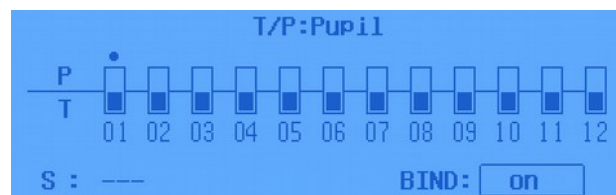


Second transmitter (control Camera)

- Press „SET“ on both transmitter – The transmitters will bind and you see an „on“ behind „BIND“.



Main transmitter (control Copter)



Second transmitter (control Camera)

Press „ESC“ (on both transmitters) to go back to the main window. Ready.

Choose Setting 5

With the second transmitter you can control the camera nick with the left stick. With the spring the stick is always centered. The function is:

- Stick centered => camera mount hold the position
- Stick up / down => camera mount goes up / down.

For this we have to choose Parameterset 5 (Setting 5).

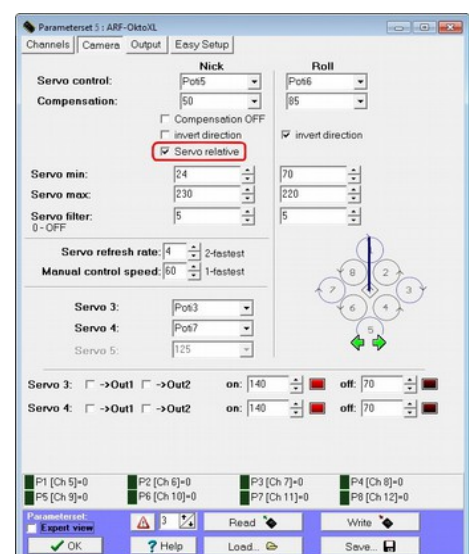
In this Parameterset (Setting) we have activated the function „Servo relativ“.

You can select the Parameterset (Setting) with your main transmitter:

- move the right stick to the right
 - (Roll to the right)
- and
- move the left stick in the upper left corner
 - (throttle up + yaw left)

The copter beep's now for 5 times and the Parameterset 5 is activ.

(See also „Parameterset“ Page 27)



Maintenance

You as the user / pilot of the **ARF-MikroKopter** must ensure a proper operation of this aircraft. To ensure a proper function of the ARF-MikroKopter a review and regular maintenance of the copter is absolutely necessary before every flight.

A review / maintenance of the copter should include:

- Checking on the ARF-MikroKopter for damages. This includes:
 - the frame
 - all cables
 - all motors
 - all propeller
 - the antenna of the receiver
 - as well as the complete electronic
- Checking the tightness of
 - Rigger
 - Motors
 - Propeller
 - and all screws (motors, frame, etc.)
- Function / Smooth running of the motors
- Check all connections for correct and proper fit
- Check all soldered cables for proper contact
- Function of the transmitter
- MicroSD-Card is insert into the NaviCtrl.
 - On the card the copter will log the whole telemetry data during flight. This can help to find a problem – if there was a problem.

Cleaning the ARF-MikroKopter

After the flight operation the ARF-MikroKopter should be checked for possible contamination (e.g. gras, dust, etc.). Use for cleaning the copter (except electronics), a soft, dry or slightly damp cloth. The electronics should be cleaned with a soft brush. Avoid getting water on the electronics and the battery.

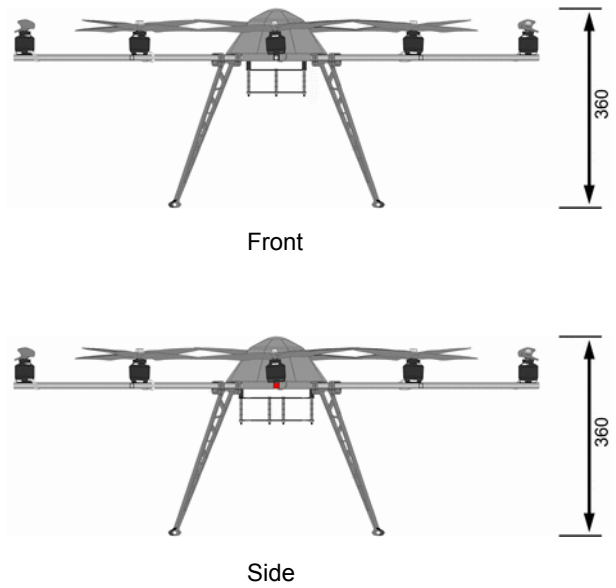
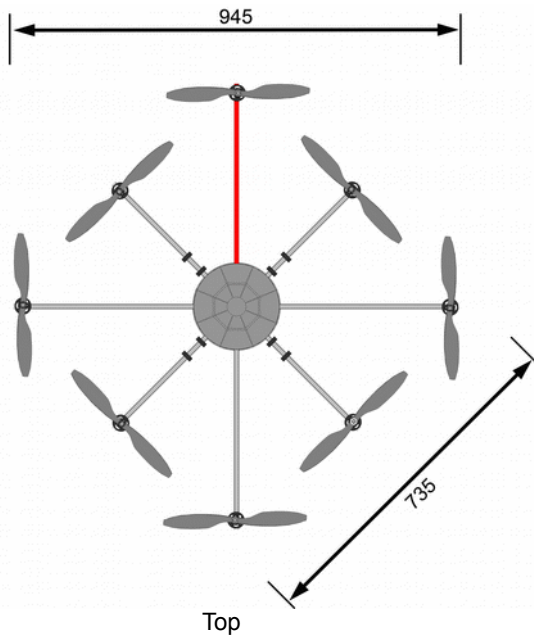


It should be avoided to start on sandy / dusty surfaces. Particles can get into the motor and cause damage.

Technical Data ARF-OktoXL

- Manufacturer
 - HiSystems GmbH
- Model:
 - ARF-MikroKopter OktoXL
- Drive:
 - Electro drive
 - Voltage- / Current consumption: 14,8V / max. 100A (Motor MK3638)
 - 8 individually controlled Brushless Motors
 - Motor MK3638 (Manufacturer: Danlions)
 - Propeller: Size 12" - pitch 3.8 or 4.5
 - max. Engine speed: 8200 rpm (MK3638 with 12" Propellers)
- Control:
 - Control via a suitable RC-transmitter and receiver with either PPM-Sum signal or S.BUS
- Weights:
 - ARF-MikroKopter (without battery/payload) = 2050g
 - Battery 4S/5000 = 520g
 - recommended max. payload = 2500g
- Allowable maximum total weight = 5000g
- Size:
 - 735x735x360 (W x L x H)
- Flight times: 8 - 41 minutes. Depending on the payload and battery choice.
- Range:
 - Flight radius = depends on the used transmitter/receiver being used
(Range Graupner MX-20/MC-32 with receiver GR-16 = 4km (acc. to manufacturer))
 - Radius for WayPoint Flights / FollowMe = Basic version 500m Radius, depending on the license.
- Altitude: up to 5000m over sea level
- Use- / Temperature range: -5°C to +35°C (+23F to +95F)
 - Batteries lose power quicker in cold weather.
The flight time can be reduced accordingly.
- Recommended max. Wind speed: 2-3 Beaufort
 - Copter is Airworthy up to 6 Beaufort (requires advanced flight skills)
- Serial number => see bottom of ARF OktoXL
- Security features:
 - FailSafe (see page: 41)
 - Battery warning (3 Steps) (see page: 44)
 - Motor redundancy. Also if a motor or propeller fails, the UAV can still be safely flown and landed.
 - Redundancy flight control (Optional) (see page: Fehler: Referenz nicht gefunden)

Dimensions / View ARF-OktoXL:



Noise measurement report:

Noise measurement point:

MP1 = 45°
MP2 = 90°
MP3 = 135°

Distance to the reference point:
= 25 Meter

Position above the ground:
ARF-OktoXL = 1m
Microphone = 1m

Reference point:
= 

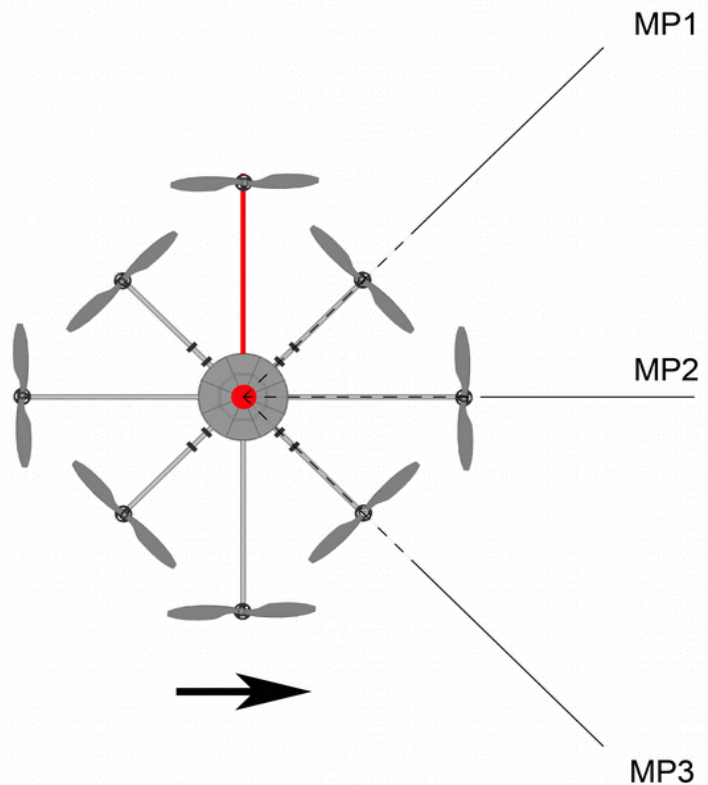
Wind direction:
= 

Level (float):
MP1 = 50dB(A)
MP2 = 50dB(A)
MP3 = 50dB(A)
arithmetic mean = 50dB(A)

Level (full throttle):
MP1 = 58dB(A)
MP2 = 58dB(A)
MP3 = 58dB(A)
arithmetic mean = 58dB(A)

Measurement conditions:

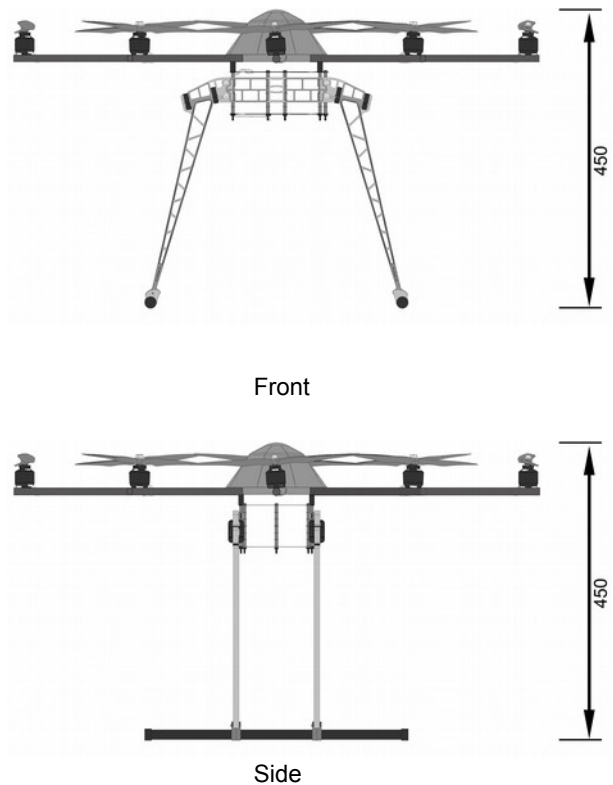
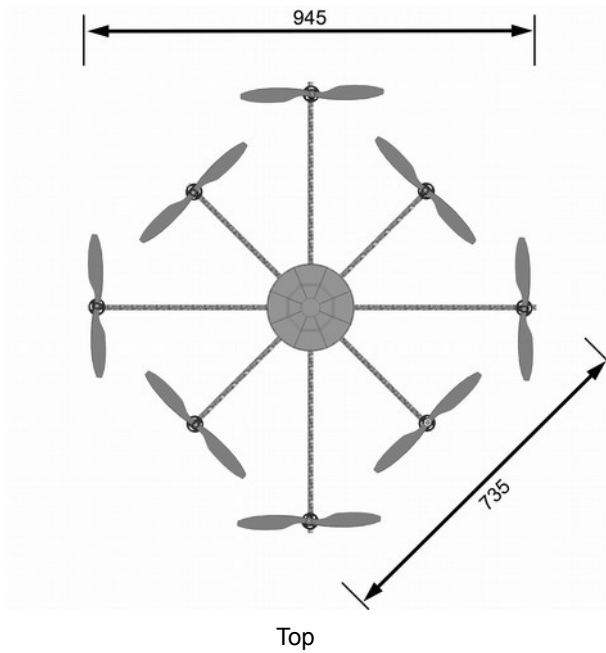
The measurements took place on a short cut grass floor (120mx90m).
Temperature: 13,7°C
Wind speed: 1,8 m/s
Level measurement: Peaktech Level Meter (calibrated)
Maximum permissible engine speed: See „Technical Data ARF-OktoXL“ > “Drive“.



Technical Data ARF-OktoXL 6S12

- Manufacturer
 - HiSystems GmbH
- Model:
 - ARF-MikroKopter OktoXL 6S12
- Drive:
 - Electro drive
 - Voltage- / Current consumption: 22,2V / max. 120A (Motor MK3644)
 - 8 individually controlled Brushless Motors
 - Motor MK3644 (Manufacturer: Danlions)
 - Propeller: Size 12" - pitch 3.8 or 4.5
 - max. Engine speed: 8600 rpm (MK3644 with 12" Propellers)
- Control:
 - Control via a suitable RC-transmitter and receiver with either PPM-Sum signal or S.BUS
- Weights:
 - ARF-MikroKopter (without battery/payload) = 2600g
 - Battery 6S/4500 = 750g
 - recommended max. payload = 4000g
- Allowable maximum total weight = 5000g
- Size:
 - 735x735x450 (W x L x H)
- Flight times: 8 - 41 minutes. Depending on the payload and battery choice.
- Range:
 - Flight radius = depends on the used transmitter/receiver being used
(Range Graupner MX-20/MC-32 with receiver GR-16 = 4km (acc. to manufacturer))
 - Radius for WayPoint Flights / FollowMe = Basic version 500m Radius, depending on the license.
- Altitude: up to 5000m over sea level
- Use- / Temperature range: -5°C to +35°C (+23F to +95F)
 - Batteries lose power quicker in cold weather.
The flight time can be reduced accordingly.
- Recommended max. Wind speed: 2-3 Beaufort
 - Copter is Airworthy up to 6 Beaufort (requires advanced flight skills)
- Serial number => see bottom of ARF OktoXL 6S12
- Security features:
 - FailSafe (see page: 41)
 - Battery warning (3 Steps) (see page: 44)
 - Motor redundancy. Also if a motor or propeller fails, the UAV can still be safely flown and landed.
 - Redundancy flight control (Optional) (see page: Fehler: Referenz nicht gefunden)

Dimensions / View ARF-OktoXL:



Noise measurement report:

Noise measurement point:

MP1 = 45°
MP2 = 90°
MP3 = 135°

Distance to the reference point:

= 25 Meter

Position above the ground:

ARF-OktoXL = 1m
Microphone = 1m

Reference point:



Wind direction:



Level (float):

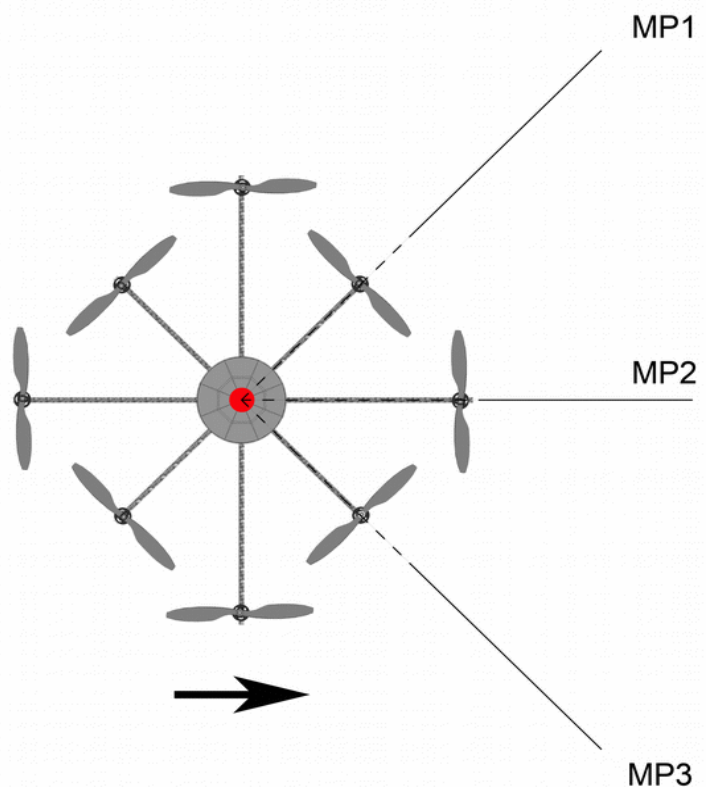
MP1 = 50dB(A)
MP2 = 50dB(A)
MP3 = 50dB(A)
arithmetic mean = 50dB(A)

Level (full throttle):

MP1 = 58dB(A)
MP2 = 58dB(A)
MP3 = 58dB(A)
arithmetic mean = 58dB(A)

Measurement conditions:

The measurements took place on a short cut grass floor (120mx90m).
Temperature: 13,7°C
Wind speed: 1,8 m/s
Level measurement: Peaktech Level Meter (calibrated)
Maximum permissible engine speed: See „Technical Data ARF-OktoXL“ > “Drive“.



Delivery

The delivery of the **ARF-MikroKopter** consists of:

Elektronik:

- FlightCtrl V2.5
- NaviCtrl V2.1
- MKGPS V2.1 incl. GPS Shield 1.1
- XL-Powerboard with BL-Ctrl V3

ARF-Frame:

- CFK-Centerplate
- Aluminum-Rigger (Alu/CFK Rigger (6S12))
- One motor per rigger
- Lighting on 3 riggers
- Landing gear
- LiPo-Holder CFK
- Cover/hood (2x black / 1x transparent/clear)
 - Propeller EPP1245 (8x Left / 8x Right) (for training flights)
 - Propeller CFK 12x3,8 (4x Left / 4x Right) (for flights with payload)

Other:

- Programming adapter MK-USB
- One BEC-connector (for external supply – e.g. a video transmitter)
 - 1x Y-Anschlusskabel für 2 LiPos
 - 4x LiPo (14,8V/4S/5000/20C)
- or
- 4x LiPo (22,2V/6S/4500/20C) (ARF-OktoXL 6S12)

License

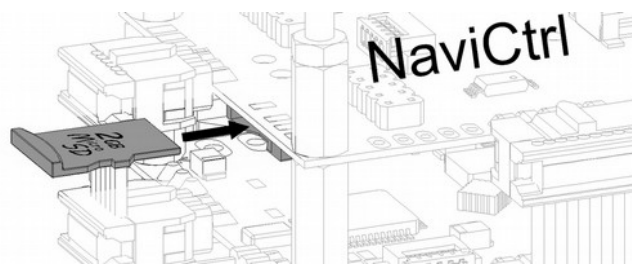
The **ARF MikroKopter** is already equipped with the required license for commercial use.

A Micro SD-Card is already inserted into the NaviCtrl and contains your personal license file and the license number. With the license additional functions are usable with the copter:

- Greater range of 500mtr. For the WayPoint flight / FollowMe-Flight
- Greater FailSafe-time (max. 247 Seconds)
- Transfer of up to 100 WayPoints to the NaviCtrl
- Adjustable maximum height (depending on the Rise permit different)
- Adjustable maximum flight range (depending on the Rise permit different)
- Adjustable "Fail sink-radius" (depending on the Rise permission differently - for example, in France required)

To use these functions the Micro SD-card with the license file need to be inserted into the NaviCtrl. The license is automatically copied to the NaviCtrl and safed (since software version V2.06).

The Micro SD-card stay into the NaviCtrl to record the telemetry data in a LOG file.



To read the data on the Micro SD-card you need the MikroKopter-Tool. With the Button "SD-Card" you can read the information's on the card. In the folder "LOG" you will find the telemetry data of each flight. This can help in case of a problem with the copter.

The file "*license.in*" is the license file for the licensees. Do NOT clear or change this file.

Depending on the flight permit additional requirements such as a maximum altitude or a limited flight range may be necessary. In order that those "limits" cannot be flown it can be fixed on the SD card. In that way the copter will stay in the limits.

Example:

We will use a **max Altitude of 150m** and a **max Range up to 300m** around the place where we start the Copter. If the Copter will fly over this max. Range (because strong Wind, fault etc.) the copter should land automatically if he reach the second "**Fail Sink-Radius**". This should be at **350m**.

For this we change in the settings this values:

- | | |
|---------------------------|--------------------------|
| > Setting > „Altitude“: | Max. Altitude => 150 |
| > Setting > „NaviCtrl 2“: | Max. Flying Range => 300 |
| > Setting > „NaviCtrl 2“: | Descend range => 350 |

INFO: When the maximum flight range is exceeded, the copter will automatically switch to "Coming Home".

If it must be ensured that the Copter must go down automatically when a certain radius is exceeded (this is e.g. the case in France), the "Maximum flight range" should be a little bit smaller for safety. In addition, the maximum allowed radius is entered under "Descend range". This ensures that the UAV ideally always automatically remains within the smaller radius. If the copter still (storm, disturbance by external influences) reach the outer radius, for any reason, it will be there automatically comes down with a preset emergency gas.



If you use the ARF-MikroKopter for commercial purposes you must be insured accordingly and you may need a permit from your Aviation Administration. When you apply for the permit you will typically need the proof of liability insurance, the technical data and the purpose of the ARF-MikroKopter as well as the name / address of the applicant and also the pilot.

Troubleshooting

Problem:

You can not start the Motors

Source:

- Compass is not calibrated. (Page 35)
- Gyros are not calibrated. (Page 35)
- The motor safety switch hasn't been pressed at the same time with „Gas-Stick“ down + „Yaw-Stick“ to the right.
- Battery is not connected.
- Transmitter is not switched ON.
- Wrong model memory on the transmitter has been chosen.

You can start the Motors, but you can not give throttle.

- Height sensor not switched OFF during start.
- In the settings was clicked „Avoid Start without GPS Fix “ and there is no Satfix.
- Battery is not charged.

The Copter is beeping every second

- There is no Satfix and the GPS-Mode switches on the transmitter are on „PositionHold“ or „ComingHome“.

The Copter is beeping fast

- The battery is empty and need to be charged.
- The transmitter has been switched OFF.

The Transmitter is beeping

- The copter is not connected with the battery.
- The battery from the transmitter need to be charged.

The Copter fly's very “sluggish”

- Carrying a large payload on the copter.

The Copter fly's in circles or doesn't hold the position perfect with activated function “PositionHold”

- Reflections from buildings / trees disrupt the GPS.
Solution = Flying higher.
- You fly several hundred miles away from their home position. Solution = recalibrate compass.
- During a solar storms, the GPS reception is bad. Deactivate all GPS functions and fly manually fly.

Error Codes

If an error in the ARF-MikroKopter occur, it is displayed in the display of HoTT transmitter or via the KopterTool.

Error1 "FC not compatible "

Source: The FlightControl Software is not compatible to the Software-Version of the NaviControl.

Remedy: Software-Update

Error2 "MK3Mag not compatible "

Source: The MK3Mag Software is not compatible to the Software-Version of the NaviControl.

Remedy: Software-Update.

Error3 "no FC communication "

Source: NaviControl has no communication to the FlightCtrl

Remedy: Check supplied power and the connection (6-pole AND 10-pole ribbon cable) and the soldered pin-headers.

Error4 "no MK3Mag communication "

Source: Die NaviControl hat keine Kommunikation zum MK3Mag.

Remedy: Check connection. The green LED on the MK3Mag must light or flash

Error5 "no GPS communication "

Source: NaviControl has no communication to the GPS.

Remedy: Check connection. The green LED of the MKGPS must light or flash.
Using the latest MK-GPS-Modul update if necessary the NC-Firmware (min. 0.26g).

Error6 "bad compass value"

Source: Compass value is invalid.

Remedy: Calibrate the compass new.

Error7 "RC Signal lost "

Source: No reception (Beep tone: lost receiving signal).

Remedy: Switch ON transmitter.
Check cable to receiver.
Bind transmitter or check channel
Check Receiver-Setting via KopterTool

Error8 "FC spi rx error "

Source: NaviControl has no SPI communication to the Flight Control.

Remedy: Check SPI connection (6-pole AND 10-pole ribbon cable) and the soldered pin-headers.

Error9 "ERR: no NC communication"

Source: FC reports that the communication to the NC has been suddenly interrupted.
Beep tone: Failure communication between FC and NC.

Remedy: Check ribbon cable to NC.

Error10 "ERR: FC Nick Gyro"

Source: The analog sensor signal of the Nick-Gyro is during calibration of the sensors outside the tolerance (between 150 and 850).
(Value is shown in the virtual display of the KopterTool in bars)

Remedy: Calibrate new - MK must stand still.
Check solder joints to the Gyro.
Flight Control 1.x -> check test points and if necessary adjust new. Eventually change Gyro.

Error11 "ERR: FC Roll Gyro"

Source: The analog sensor signal of the Roll-Gyro is during calibration of the sensors outside the tolerance (between 150 and 850).
(Value is shown in the virtual display of the KopterTool in bars)

Remedy: Calibrate new - MK must stand still.
Check solder joints to the Gyro.
Flight Control 1.x -> Check test points and if necessary adjust new. Eventually change Gyro.

Error12 "ERR: FC Yaw Gyro"

Source: The analog sensor signal of the Yaw-Gyro is during calibration of the sensors outside the tolerance (between 150 and 850).

Remedy: Calibrate new - MK must stand still
Check solder joints to the Gyro.
Flight Control 1.x -> Check test points and if necessary adjust new. Eventually change Gyro.

Error13 "ERR: FC Nick ACC"

Source: The analog sensor signal of the Nick- acceleration sensor was during ACC-Calibration outside of the tolerance (between 300 and 750).
(Value is shown in the virtual display of the KopterTool in bars)

Remedy: Calibrate ACC new - MK must stand still and in balance
Check solder joints to the sensor.

Error14 "ERR: FC Roll ACC"

Source: The analog sensor signal of the Nick- acceleration sensor was during ACC-Calibration outside of the tolerance (between 300 and 750)
(Value is shown in the virtual display of the KopterTool in bars)

Remedy: Calibrate ACC new - MK must stand still and in balance.
Check solder joints to the sensor.

Error15 "ERR: FC Z-ACC"

Source: The analog sensor signal of the Z-acceleration sensor was during ACC-Calibration outside of the tolerance (between 512 and 850)
(Value is shown in the virtual display of the KopterTool in bars)

Remedy: Calibrate ACC new - MK must stand still and in balance.
FlightControl must be installed in the right way -> Processor is pointing upwards.
Check solder joints to the sensor.

Error16 "ERR: Pressure sensor"

Source: The analog sensor signal of the pressure sensor was during calibration out of the tolerance.
Evtl. the copter is also outside the air pressure measure range.

Remedy: Check solder joints to the sensor.
Deactivate height sensor in the settings

Error17 "ERR: FC I2C"

Source: The I2C-Bus to the BI-Ctrls is disturbed.

Remedy: Check power supply of the Brushless-Controller.
Check wiring of the I2C-Bus (C and D right connected?).
Check addressing of the Brushless-Controller.
Disconnect I2C Bus of each BL-Controller to determine the defective BL-Controller.

Error18 "ERR: BI Missing"

Source: BL-Controller hasn't been found but must be present according to the mixer table

Remedy: Check power supply of the Brushless-Controller.
Check addressing of the Brushless-Controller.
Check mixer table.

Error19 "Mixer Error"

Source: More BL-Controller are connected to the I2C-Bus than expected.

Remedy: Check mixer table. Eventually a Quadro Setting is chosen for a HexaKopter..

Error20 "FC: Carefree Error"

Source: The funktion CareFree is activated but no valid compass value is coming from the NaviCtrl.
Beep tone: compass failure during flight.

Remedy: Check connection between FlightCtrl and NaviCtrl.
Calibrate compass.

Error21 "ERR: GPS lost"

Source: Lost GPS-signal during flight or reception of less than 4 satellites.

Remedy: Wait for a new Satfix.

Error22 "ERR: Magnet Error"

Source: The magnet strenght of the compass sensor deviates by 15% from the calibration value.

Remedy: Eliminate magnetic interferences (power cables, buzzer etc.) .
Calibrate the compass new.

Error23 "Motor restart"

Source: A BL-Controller tries to restart a motor.
Evtl. motor blocked or broken cable.

Remedy: Remove interruption to the motor and/or change the defective motor.

Error24 "BL Limitation"

Source: A BL-Controller goes into the power limitation. Either over-current or over-temperature.

Remedy: Reduce take-off weight of the copter.

Error25 "Waypoint range"

Source: The flown WayPoint is outside of the range and will be not reached.

Remedy: Set WayPoints new inside the flight range.

Error26 "ERR:No SD-Card"

Source: In the settings the option "No flight without SD-Card" is activated and no Micro SD-Card is inserted in the NaviCtrl.

Remedy: Insert Micro SD-Karte into the NaviCtrl.

Error27 "ERR:SD Logging aborted"

Source: In the settings is the option "No flight without SD-Card" activated and the logging has been aborted.

Remedy: Contact problems to the Micro SD-Card or defective Micro SD-Card.

Error28 "ERR:Flying range!"

Source: On the Micro SD-Card is to the file "SETTINGS.INI" the parameter "MAX_FLYING_RANGE" set (e.g. MAX_FLYING_RANGE = 100) and the set range (100=100m) is exceeded.

Remedy: Deactivate on the Micro SD-Card in the file "SETTINGS.INI" the parameter "MAX_FLYING_RANGE" (MAX_FLYING_RANGE = 0) or enlarge the desired range.

Error29 "ERR:Max Altitude"

Source: On the Micro SD-Card is in the file "SETTINGS.INI" the parameter "MAX_FLYING_ALT" set (e.g. MAX_FLYING_ALT = 100) and the set height (100=100m) will be exceeded.

Info: When using a commercial license with the NC the MK is set for further 10m "Emergency gas" to return to fall in the allowed range.

Remedy: On the Micro SD-Card deactivate in the file "SETTINGS.INI" the parameter "MAX_FLYING_ALT" (MAX_FLYING_ALT = 0) or enlarge to the desired height.

Error30 "No GPS Fix"

Source: At the start there is no GPS Satfix and in the parameters of KopterTool the option "No start without GPS fix" is activated

Remedy: Wait for Satfix or deactivate the option "No Start without GPS-Fix".

Error0 "No Error"

No error

ErrorCodes of the FlightControl
(If no NC is connected)

HardwareError 1:1

Source: Problems with the sensor: Gyro Nick

Remedy: Change faulty sensor.

HardwareError 1:2

Source: Problems with the sensor: Gyro Roll

Remedy: Change faulty sensor.

HardwareError 1:4

Source: Problems with the sensor: Gyro Yaw

Remedy: Change faulty sensor.

HardwareError 1:8

Source: Problems with the sensor: ACC Nick

Remedy: Change faulty sensor.

HardwareError 1:16

Source: Problems with the sensor: ACC Roll

Remedy: Change faulty sensor.

HardwareError 1:32

Source: Problems with the sensor: ACC Z

Remedy: Change faulty sensor.

HardwareError 1:64

Source: Problems with the air pressure sensor

Remedy: Change faulty sensor.

HardwareError 1:128

Source: Problems with the compass or CareFree

Remedy: Deactivate the function „CareFree control“

Disposal

General

A disposal of individual parts or the ARF-Kopter after end of its life must be done in accordance with applicable law.

Batteries

Disposing batteries in household waste is prohibited. Used or defective batteries can be given e.g. free of charge at your community or anywhere, where you can buy batteries / accumulators.



Impressum

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HiSystems GmbH
Flachsmeerstr.2
D-26802 Moormerland

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V4 - Stand 06/14

Additional for approval in Austria:

Reliability analysis for ARF-OktoXL + ARF-OktoXL 6S12:

(Appendix F Austro Control)

Point 1: Failure of Transmitter

(see page 41)

If the connection between Transmitter and Receiver is lost, the ARF-OktoKopter will note this and activate automatically the function "FailSafe". Then the Copter will fly first to the set altitude and fly back to the place where you have start the copter and land there.

Here you can find an example video who shows the function: <https://vimeo.com/32788915>

Point 2: Receiver failure

See point 1.

Point 3: Faulty data connection

See point 1.

Addition to Point 1,2,3:

If you use a redundant System with a second FlightCtrl (Flight control - Point7), the receiver is connected with an little electronic to both FlightCtrl on the Copter. So if the Master FlightCtrl fail, the Slave FlightCtrl will automatically takes over and also control the receiver.

Point 4: Engine failure.

If a Motor fails the electronic will automatically detect and correct this.

In addition the Pilot is informed by the telemetry. E.g. by voice output "error engine".

Also if a Motor fails you can fly the Copter further.

Point 5: Short circuit

- Prevention of a short circuit: Under the cap the electronic is protect against rain or outside influences.
- Short circuit on an engine: The BL-Ctrl will detect this automatically and switch off this faulty motor.
- Short circuit in a motor controller: The motor controllers are protected by a defined conductor (shunt) and will be automatically disconnected from the circuit.
- Short circuit in the control electronics: The control electronics are designed redundantly (see point 7)
- If you use a camera under the copter, it will use his own power supply. So this will not disturb the copter.

Point 6: Failure of the Power supply

There are 2 LiPo's separately connected to the power board. If one LiPo fails the second will take over the Power supply. A drop in voltage is automatically detected and signaled by the telemetry.

Added security and safety in three steps:

First step (e.g. 30% residual capacity):

- The pilot is informed by telemetry: voice message "Undervoltage".
- The MikroKopter will send an acoustic signal.
- The LEDs under the Copter are flashing.
- Normally now the Pilot have 1-2 minutes time to land the Copter manually.

Second step (e.g. 20% residual capacity):

- The MikroKopter flies automatically back to the Home position..

Third Step (e.g. 10% residual capacity):

- The MikroKopter will land automatically. This will safe the Copter from a crash.

Point 7: Fault / failure of the attitude controller
(INFO: Special equipment for ARF OktoXL + 6S12)

The FlightCtrl is twice under the MikroKopter. So if the Master FlightCtrl fails, the second Slave FlightCtrl will automatically takes over.

(See Example: <http://www.youtube.com/watch?v=IvrMn4AEAD0&feature=youtu.be>).

Functional principle of the redundant flight control system:

- The second Slave FlightCtrl is connected to all Motor controllers with a serial connection.
- The redundant bus is decoupled by resistance (for each Motor controller), so that a single faulty controller can not shut down the system..
- The Motor controller note the second Slave FlightCtrl and showing in the Telemetry during flight the symbol „R“.
- If there is a problem with the first Master FlightCtrl or the Master FlightCtrl fails, the second Slave FlightCtrl will automatically control the Motor controllers.
- Normally you will not note that the second Slave FlightCtrl takes over the controlling. The Copter flies further like before.
- This will also work if e.g. the Master FlightCtrl makes a reset.

Point 8: Fault / failure in the GNSS

The number of satellites is monitored and displayed via telemetry.

The strength and inclination of the earth's magnetic field is also measured and used as the monitoring of the compass signal.

A stand-alone unit (NaviCtrl) is responsible for the GPS navigation. If this fails the FlightCtrl will automatically note this and switch to manual controlling. The Pilot will get a note about this via telemetry.

More safety function before starting:

The pilot will be informed during degraded earth's magnetic field or no GPS signal and can not start the MikroKopter.

More safety function in flight:

If the navigation system fails during flight, or the GPS / compass are disturbed (solar storms, GPS shadowing, etc.), the MikroKopter will automatically switch to manual mode and inform the pilot via the telemetry on the transmitter. For example, by voice: "Error GPS"

In addition, the pilot can always turn off the GPS mode on the transmitter and control the MikroKopter manually.

Point 9: Fault / failure in the telemetry

The telemetry transmission is not relevant to the flight of the copter. If the telemetry transfer fails the Copter can still fly safe with the same flight characteristics.

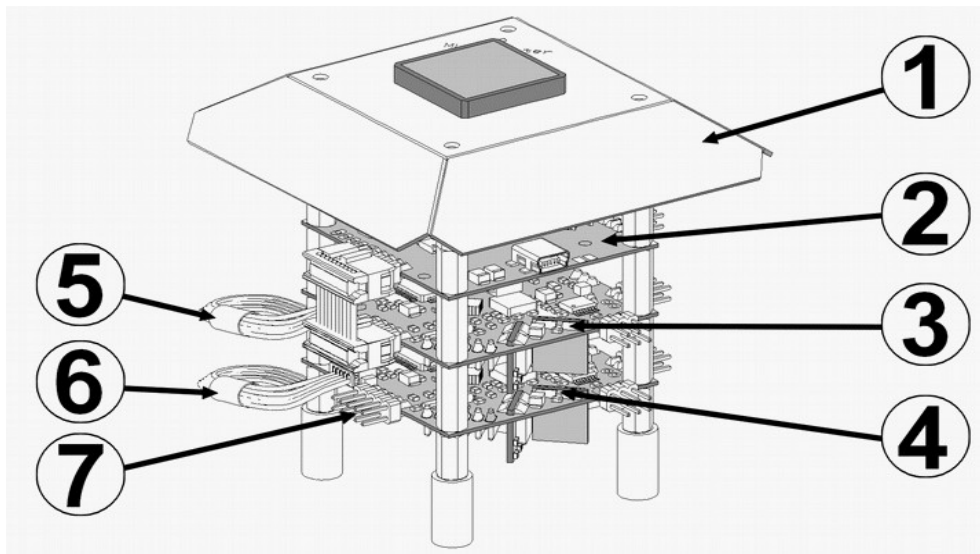
Point 10: Thermal overload the battery

There are two LiPo's connected to the Copter. If one fails the second will power the Copter.

If there is an overloading the battery will show an undervoltage. Then the mechanisms described under point 6 will grab.

Redundant connections FlightCtrl:

- 1 => MK-GPS
- 2 => NaviCtrl
- 3 => Master FlightCtrl
- 4 => Slave FlightCtrl
- 5 => Power supply Master FlightCtrl
- 6 => Power supply Slave FlightCtrl
- 7 => Connection serial UART controlling BL-Ctrl (+connection MK-USB for e.g. a Software update)



A ARF-MikroKopter include redundant system is already set and tested. If you make an software update yourself, take care that you have the same settings on both FlightCtrl.
The right Software for the Master and Slave FlightCtrl you can find here:
<http://www.mikrokoetter.de/ucwiki/Redundant>