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REV03-191001-IB

Instruction manual

ECO16

Order-No. 67900 without motor
Order-No. 67902 with brushless motor

ECO16 - made by Ikarus. Our great and extensive experience in designing helicopters, in combination with carefully choosen materials makes this helicopter (which can get assembled easily) to a real entertaining pleasure.

ECO16

ECO - the electric helicopter is designed and developed in germany. Years of experience assisted in producing this helicopter.

Energy **eco**nomics is the most sensible subject in creating a helicopter with an electric motor. 12-20 cell batteries and charging equipment is available at very favorable conditions so this had been the target we had to reach. The basic design is extremely lightweight though still very solid. The special chassis eliminates weight-consuming screws and parts. Ball bearings on all moving parts reduce the overall friction in the mechanical section. Various pinions are available to adopt the transmission and the tailrotors speed to the motor and to the flyers habits. A belt drives the tailrotor with hardly any loss of power. The special mechanical mixer allows the use of a standard 4 channel r/c without electronic mixing facilities. Those who tend to use an advanced electronic r/c-system can easily use a 4 x 90° swashplate program with 3 servos, eliminating even the weight of the mixer. The steering is designed to be strong and very efficient. Flying the **ECO** means first class **eco**nomics and professional flying potential - for the beginner as well as for the 3D ambitious. A wide variety of tuning parts for even less weight or more performance is available in your hobby store. Ask your dealer for IKARUS parts.

Check yourself! Which other helicopter offers:

- extremly lightweight Frame
- suitable motors from 8,000 to 24,000 rpm.
- 12 different gear ratios for the main rotor.
- 3 different gear ratios for the tail rotor.
- 12-20 cells battery range.
- Ball bearings throughout the drive section.
- 5 ch electronic R/C with 90° CPM-program or
- ordinary 4 ch R/C to use with mechanic mixer.
- from calm hovering to hot aerobatics.
- very quiet in use.

This **ECO** is:

very **eco**nomic
easy to build and understand
easy to fly and ...

...simply the right choice!

ECO16 the economical helicopter

The Introduction

1. Many thanks ...

... for your purchase. This product is checked and carefully packed in our facilities. Anyhow, please check immediately at your end and make sure that this kit is complete and undamaged. You will understand that we cannot accept any claim arising to a later date.

2. Care ...

... is a very sensitive subject for this high performance helicopter. Assembled and flown by skilled hands it offers fun and satisfaction. Anyhow, it is not a toy and therefore shall be operated with care and responsibility. We have to reject any claim arising from inexperienced use or misuse at all.
Helicopters are subject to various physical rules which can turn your hobby to success as well as a full crash. Our job has been to develop and supply a high performance model. The helicopter in your hands now is the result of experience, tests and trial. The assembly now is your part. We wrote this manual to assist you in any way. Please follow the steps exactly, have a look at the measurements and follow them exactly as written down.

Therefore: Please assemble the model as carefully as possible. If doubts are arising please have a break, think twice or ask an experienced modeler for assistance. It will pay off!

The parts are packed as required in the steps. Start reading this manual completely and get familiar with the system. Open the bag of need only and leave the unused material aside. Use small cups and carefully assemble step by step, bag by bag.

3. Warranty:

We guarantee that this product is free of factory defects in material and workmanship for a period of 120 days from date of purchase. This warranty does not cover defects from misuse. By the act of using this model the user accepts all resulting liability.

4. You will need: (not included in this kit!)

Item	Order No.	Description
The motor:	70103	Aero Maxx 30 - 3 - modern power technique. Brushless, therefore maintenance - free and with an high efficiency.
The speed controller- V90 or The speed cotroller V65	702012	V90 - High performance motor controller for brushless motors, 90A max., 7-17 cells.
	702014	V65 - High performance motor controller for brushless motors, 65A max.,12-24 cells
The R/C-System:	173504 (35 MHz) 174004 (40 MHz)	Lexors Nova 4 - Standard 4-channel R/C transmitter using 4 Micro-Servos and a Y-connector to the speed controler or 5 Channel computerised R/C with mixing facilities and 4x90° swashplate program.
Gyrosystem:	720613	ProfiGyro - With only 24g our top model, with heading lock and automatical fade out, has an unusual light weight -at the same time the ProfiGyro is very precise and has a low energy consumption. Suitable for professionals and beginners as well.
	720615 720654	The MiniGyro and the extremely small MicroGyro are also suitable, with a very good gyro effect, but with less functions.
Battery:		use NiCad with 2 x NC Pack 8 /10 cell 1700 - 2400 mAh
	721052	8 cells,3000 mAh,NiMH
	721053	10 cells,3000mAh,NiMH
Connectors:	3-1635	The gold plated system offers a very low resistance, is free from corrosion and is temperature resistant.

5. Dimensions:

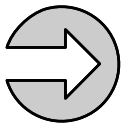
6. Materials used:

To assemble this model you will need:

- Hobby knife
- Sander
- Screwdriver (Phillips #1 and small slotted)
- Hex wrench 1x1.5 mm - 2x2 mm - 1x2.5 mm
- Needle nose pliers
- Bladegauge, Order No. 603445
- Nut driver 4mm - 4.5 mm - 5 mm - 5.5 mm
- Bowls for small parts
- Cyano glue
- Screwlock, Order No. 320006

7. Abbreviations:

To make the manual clearly and short we shall use certain abbreviations as follows:



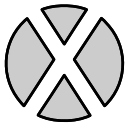
Your special attention is required!

Use cyano glue!

Assemble the shown quantity!

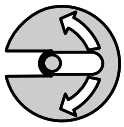
Assemble the left side the same way as the right side.

Use some oil.



Use screw lock as shown.

The part shown is not included in this kit.

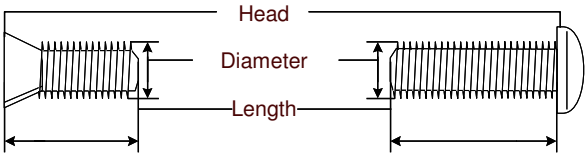


The subject is shown in true scale.

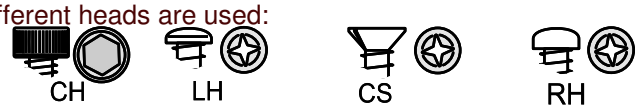
The part has to move easily without any friction.

8. Screws:

Most screws in this kit have metric threads and are described in the following way:



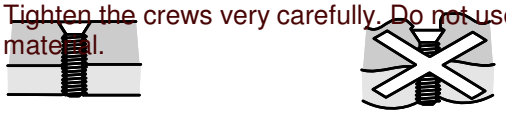
Different heads are used:



Caphead (CH), Lenshead (LH), Countersunk (CS), Roundhead (RH), phillips or slotted types

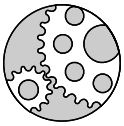
M4x20 mm CH means 4 mm metric thread, 20 mm length with a cap head.

Tighten the crews very carefully. Do not use too much force and avoid damaging the material.



Basics

Depending on the version you intend to assemble, some steps are for the mechanical mixer only, some other are necessary only if used with a 5 ch microcomputer radio.
The particular steps are marked with

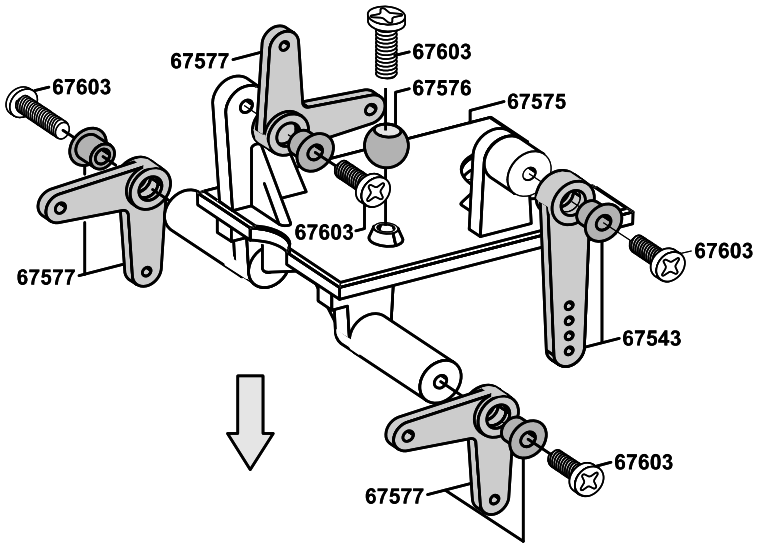
 For the mechanical mixer version only!

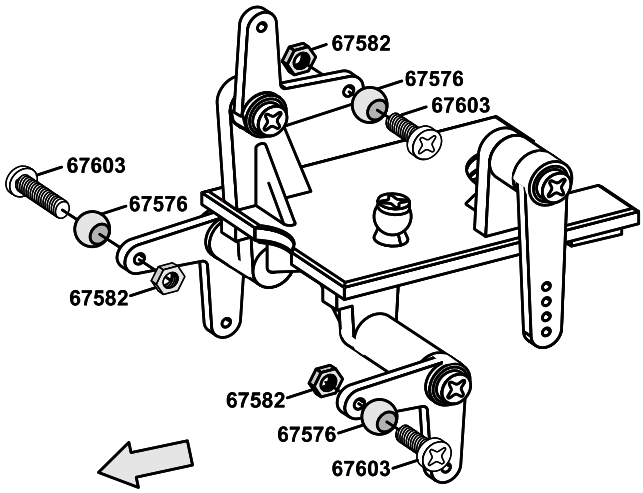
 For the microcomputer version only!

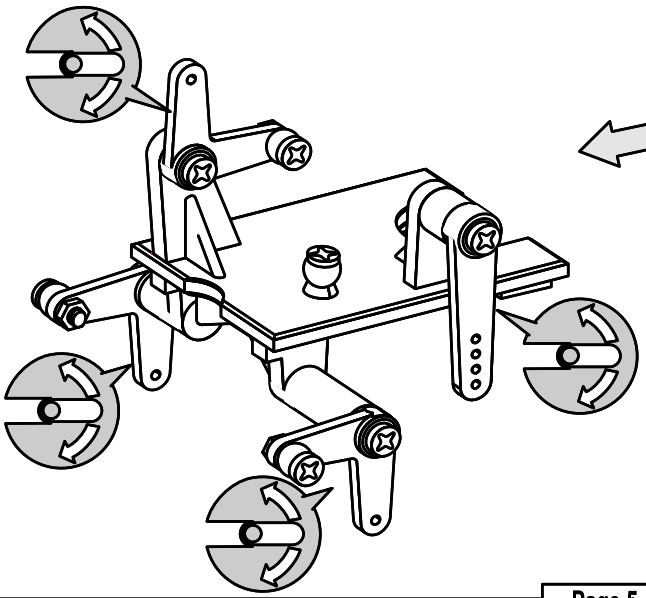
You have to decide now which version you will build. You will always be able to change the layout of your helicopter but mayor reconstruction will be neccessary.
Let's start with the assembly.Take the specific parts out of the packing and assemble them according to the shown graphics. Please pay attention to the pictograms relating to play,lubricant etc.

The mechanical mixer

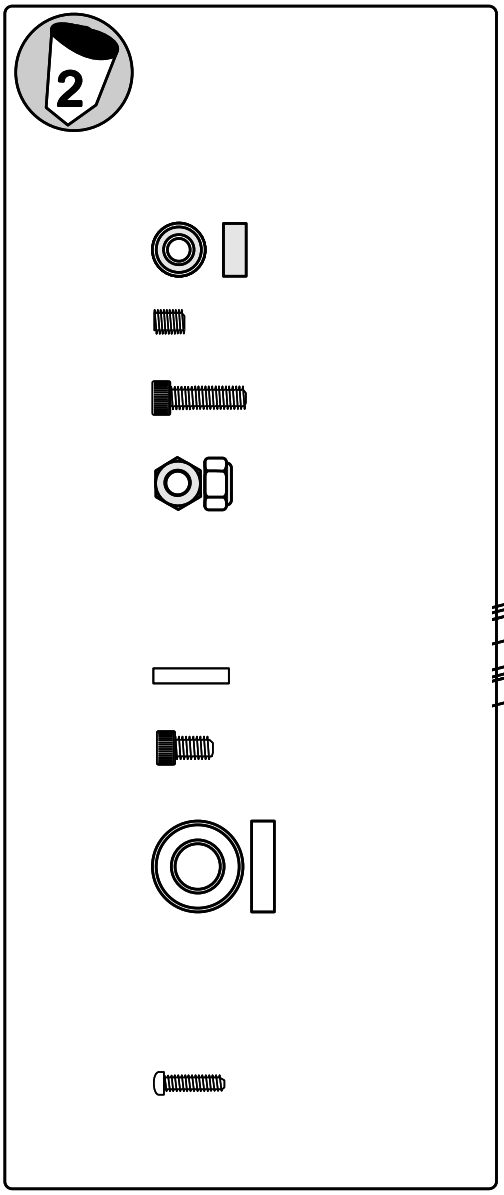
1x 67575 Mixer body
3x 67577 90° Lever with bushing
1x 67543 Tailrotor lever with bushing
4x 67576 Ball, brass
3x 67582 2 mm Nut
8x 67603 mm LH Screw







The main frame



Tuning Parts are available for the part numbers marked in grey.

Fasten the set screw on the flat.

Avoid friction here!

Tighten slightly.

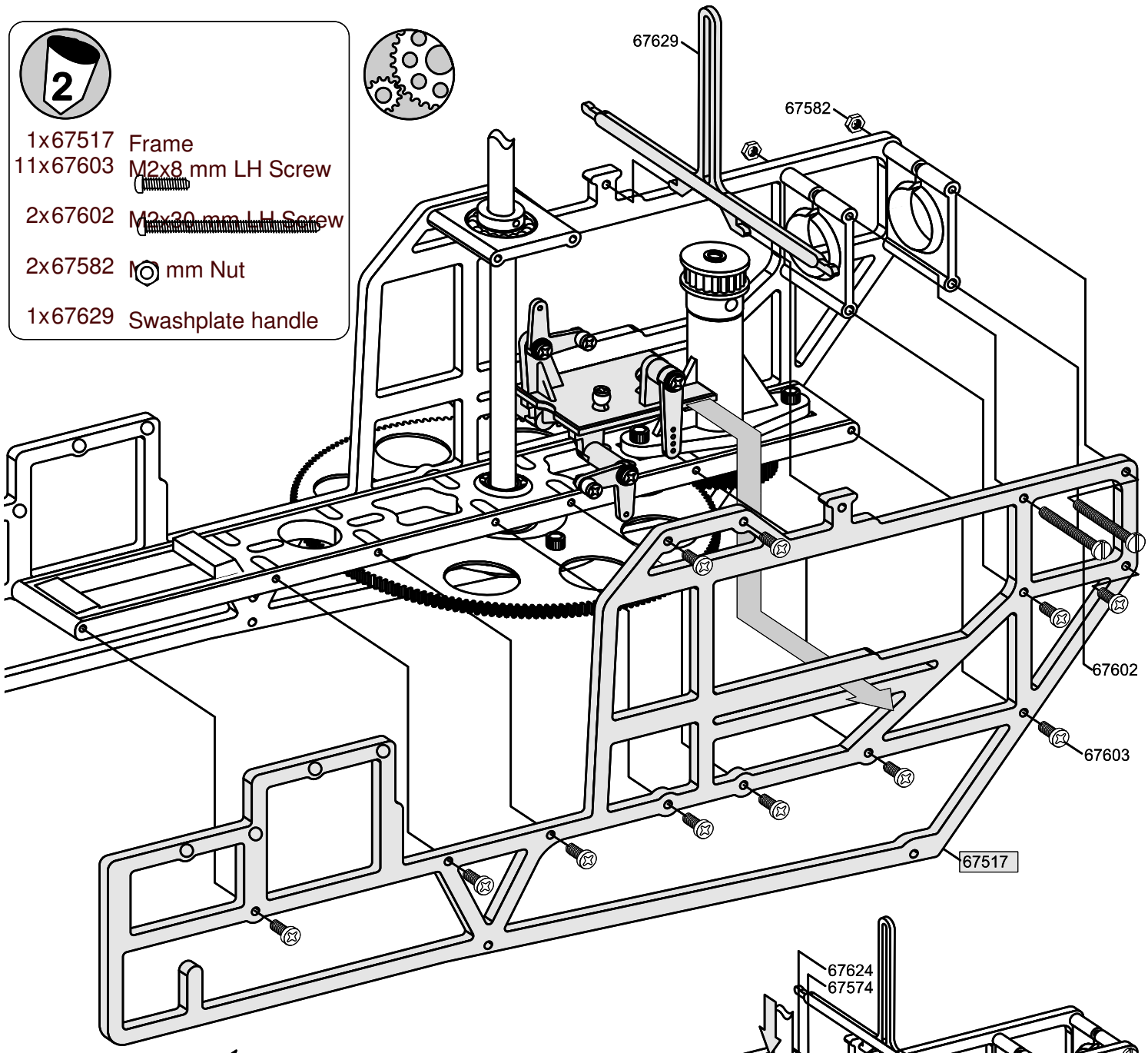
Downwards

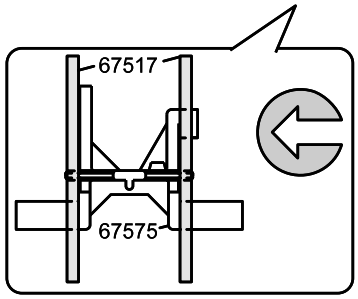
67702
67574
67567
67604
67572
67535
67640
67581
67567
67556
67574
67580
67594* 40Z
67570
67536
Fasten the set screw on the flat.
67585*
67625
67624
67570
67521
Tighten the stopper temporarily only. It will be adjusted later.
67625
67556
67585*
Bottom view
Attention: Pin 67625 has to disappear completely in the notch !
67624
67574
67570
67521
67603
67540
67517*
67603

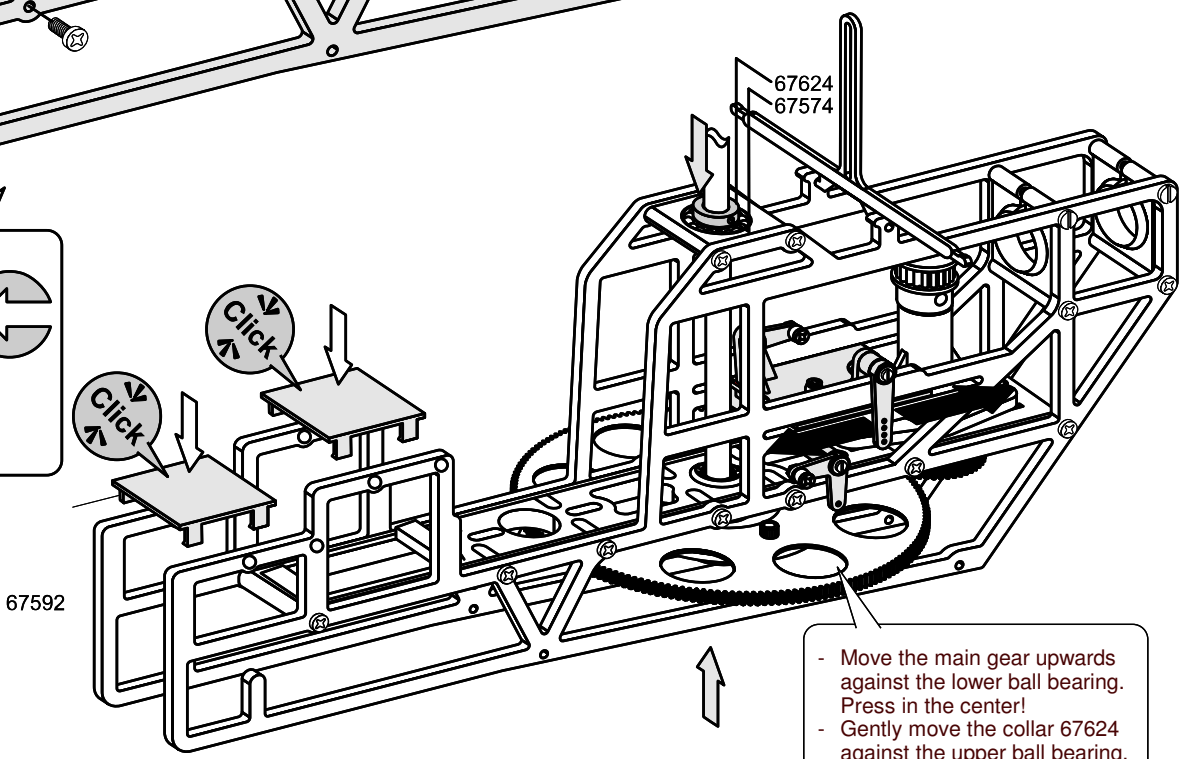
The main frame

2

1x67517 Frame
11x67603 M2x8 mm LH Screw
2x67602 M2x30 mm LH Screw
2x67582 M3 mm Nut
1x67629 Swashplate handle







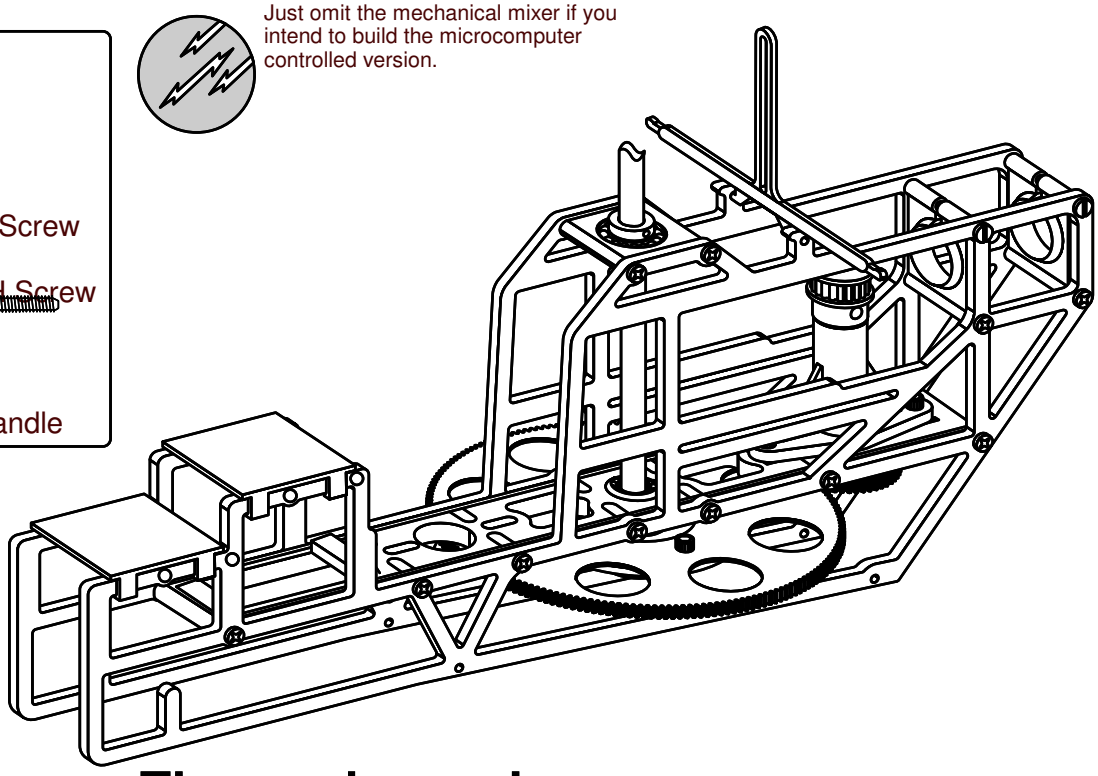
- Move the main gear upwards against the lower ball bearing. Press in the center!
- Gently move the collar 67624 against the upper ball bearing.
- Tighten the M3x4 mm set screw 67574.

The main frame with electronical mixer

2

1x 67517 Frame
11x 67603 M2x8 mm LH Screw
2x 67602 M2x30 mm LH Screw
2x 67582 M3 mm Nut
1x 67629 Swashplate handle

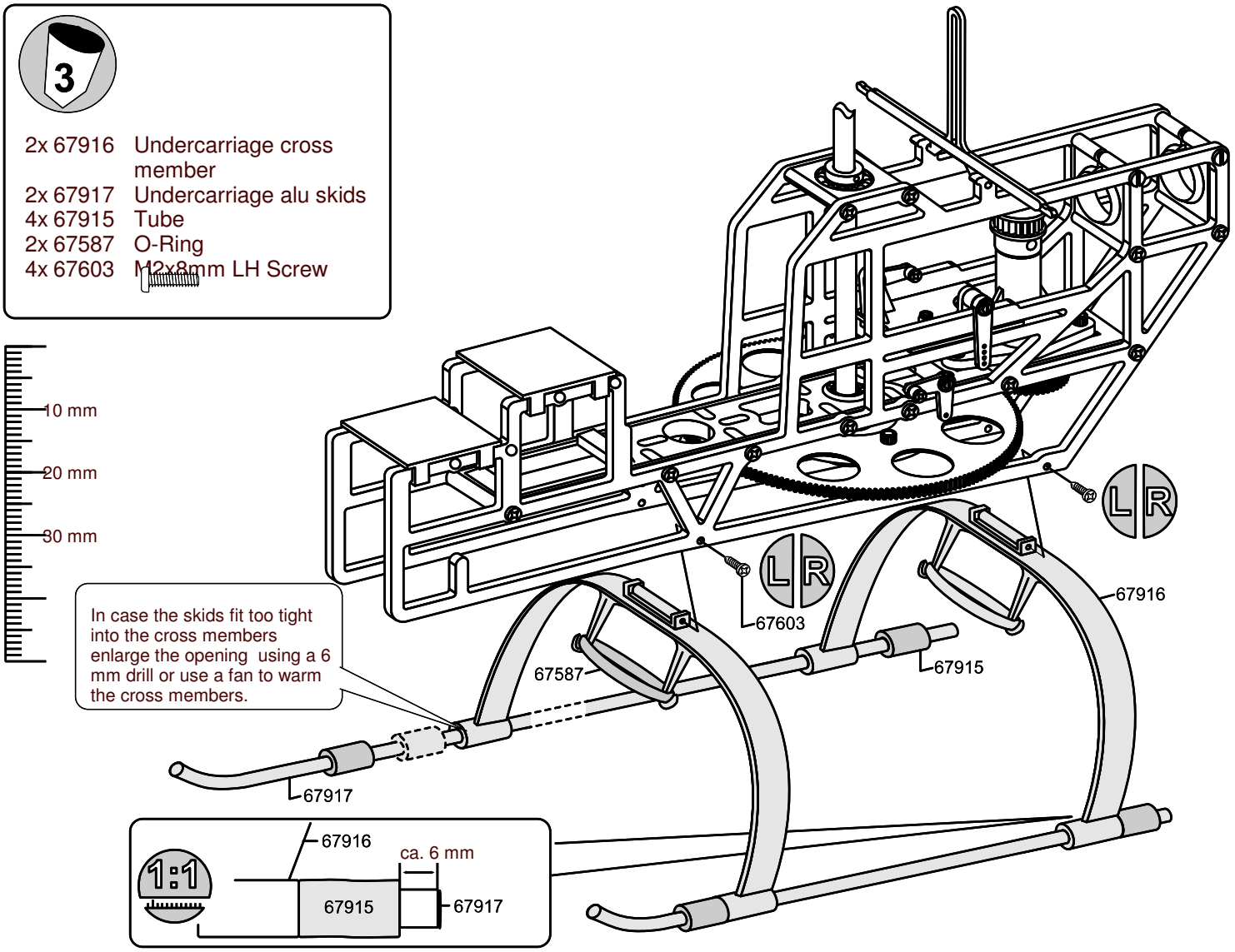
Just omit the mechanical mixer if you intend to build the microcomputer controlled version.



The undercarriage

3

2x 67916 Undercarriage cross member
2x 67917 Undercarriage alu skids
4x 67915 Tube
2x 67587 O-Ring
4x 67603 M2x8mm LH Screw



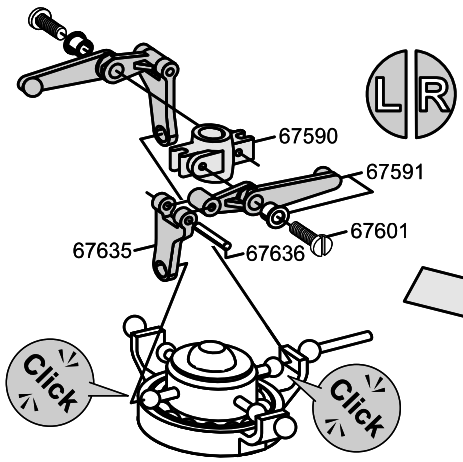
The collective pitch compensator

4

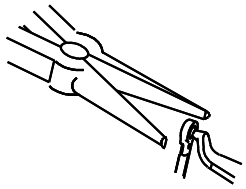
Collective pitch compensator

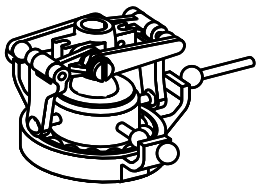
1x 67590 center hub
2x 67591 arm with bushing
2x 67635 Y- arm
2x 67601 M2x12 mm LH Screw

2x 67636 Shaft (Y- Arm)
1x 67701 Swashplate complete



The ball clips 67635 are supposed to move without play, but stilll easily. If those are difficult to move, press the clip on the top of the ball carefully with flat nosed pliers together. Please start with less pressure, check then the movableness ; press again until you can swivel the clip easily.

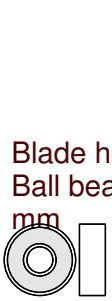


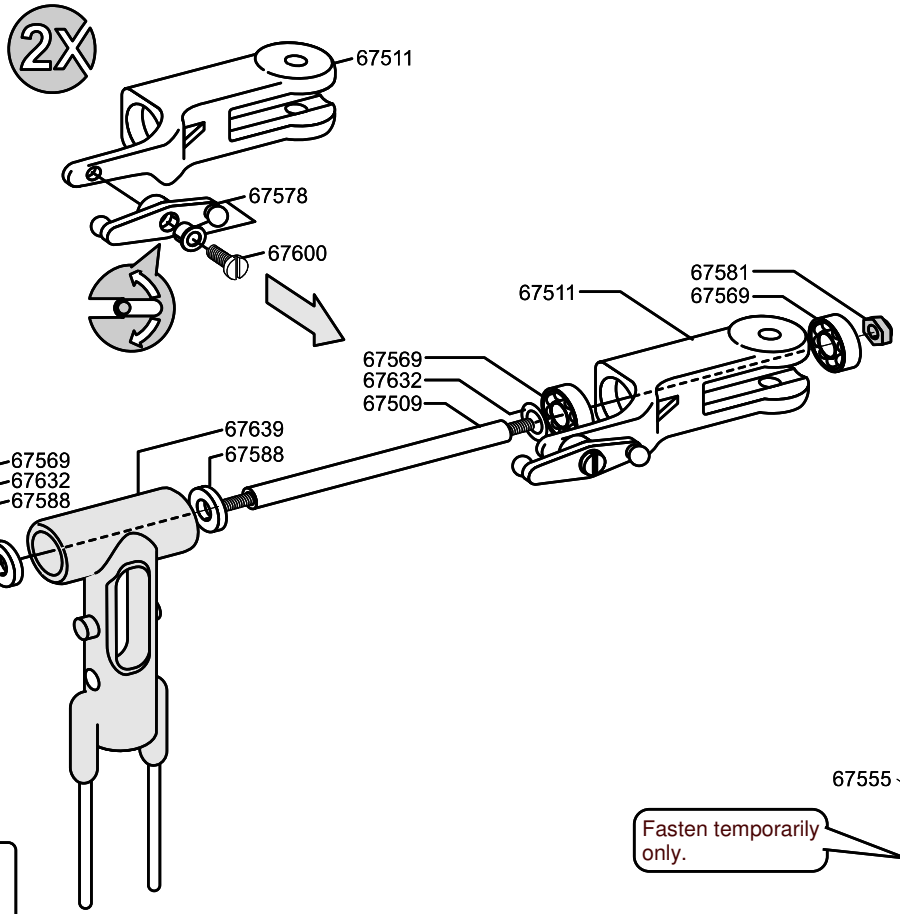


The rotor head

5

2x 67511 Blade holder
4x 67569 Ball bearing 4x11x4 mm



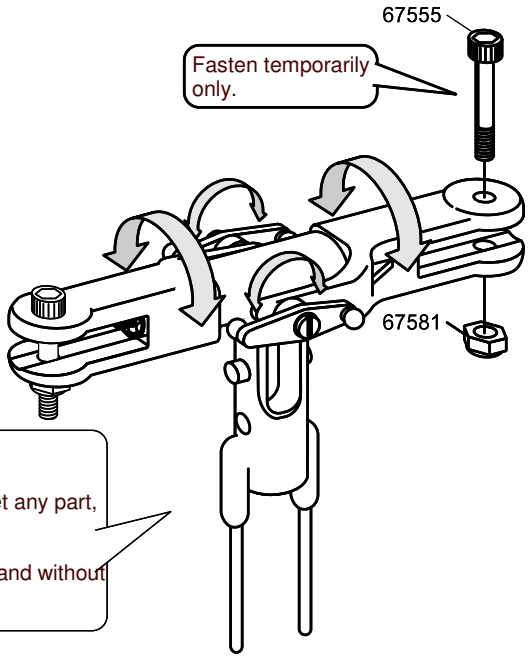


2x 67632

1x 67509 Washer 4 mm
2x 67588
2x 67578
2x 67600 Blade shaft
O-Ring
1x 67639 Mixerlever with bushing
2x 67555 M2x10 mm LK Screw

Rotor center unit
4x 67581 M3x25mmCH Screw

2x M3mm nyloc nut



Please check very carefully:

Make sure that you did not forget any part, especially the washers?

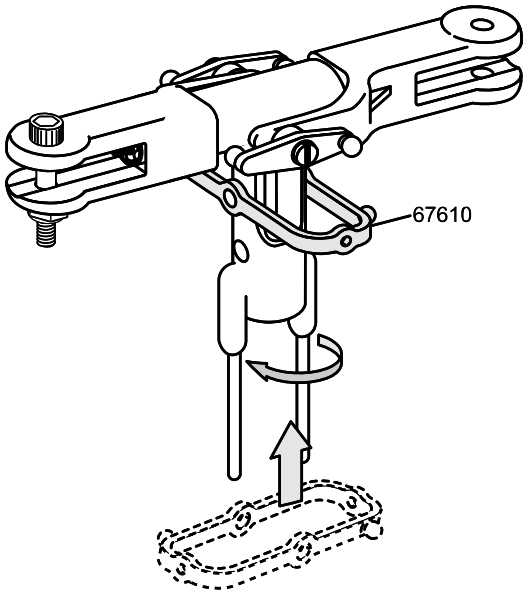
The Blade holders move gently and without friction?

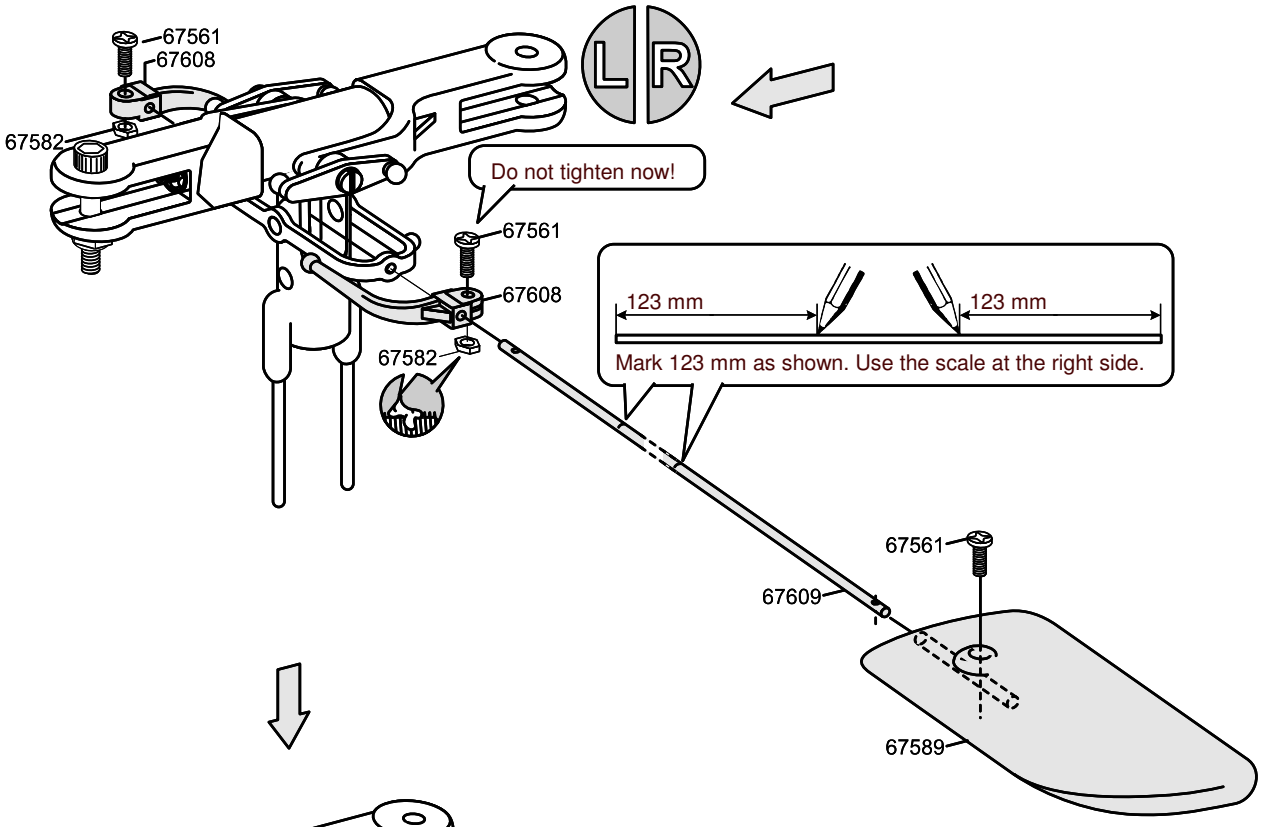
The rotor head

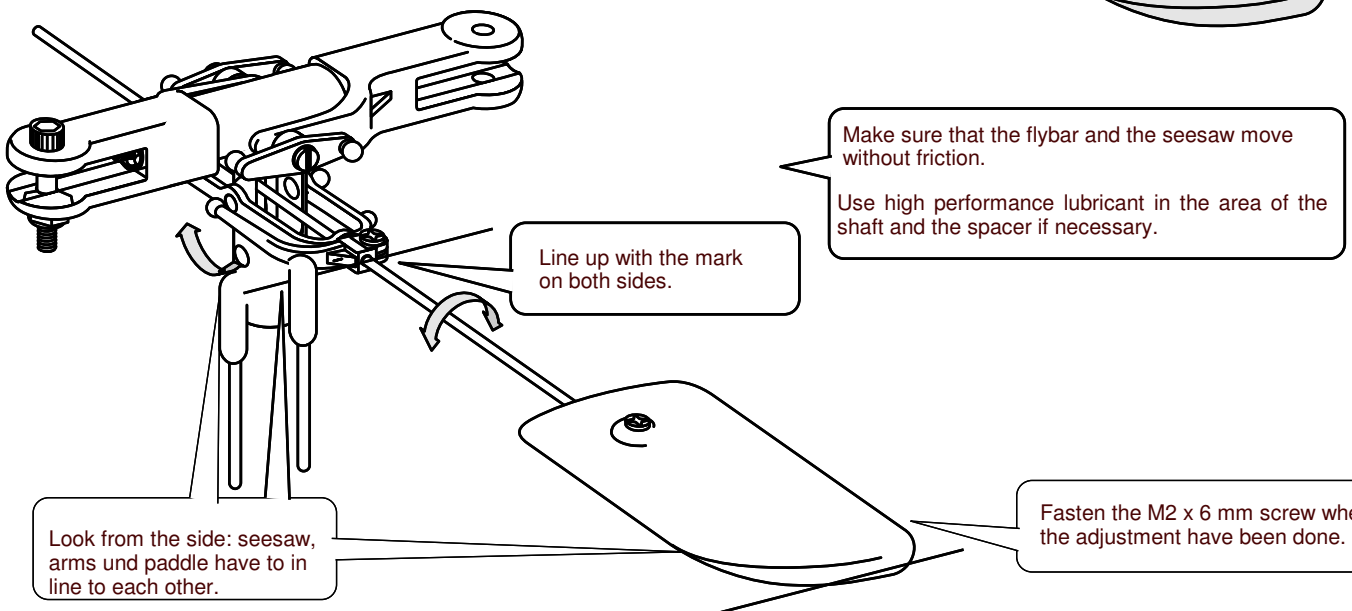
5

1x 67610 Flybar Seesaw
2x 67608 Seesaw Lever
1x 67609 Flybar
2x 67589 Paddle
4x 67561 M2x6 mm LH Screw

2x 67582 M2 mm Nut







The complete rotor head

5

1x 67599 M2x16 mm CH Screw

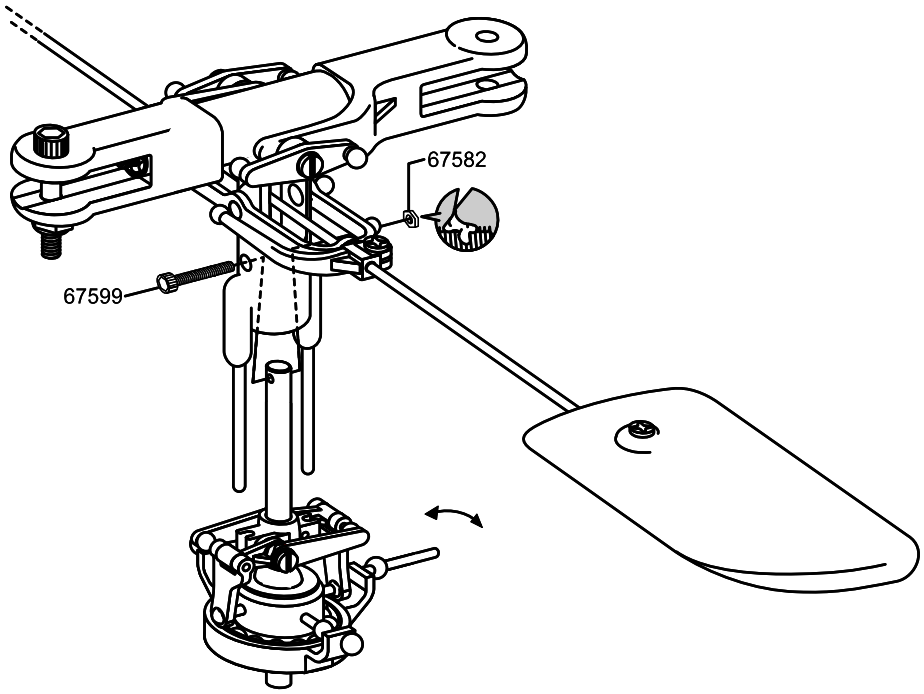
1x 67582 M2 mm Nut

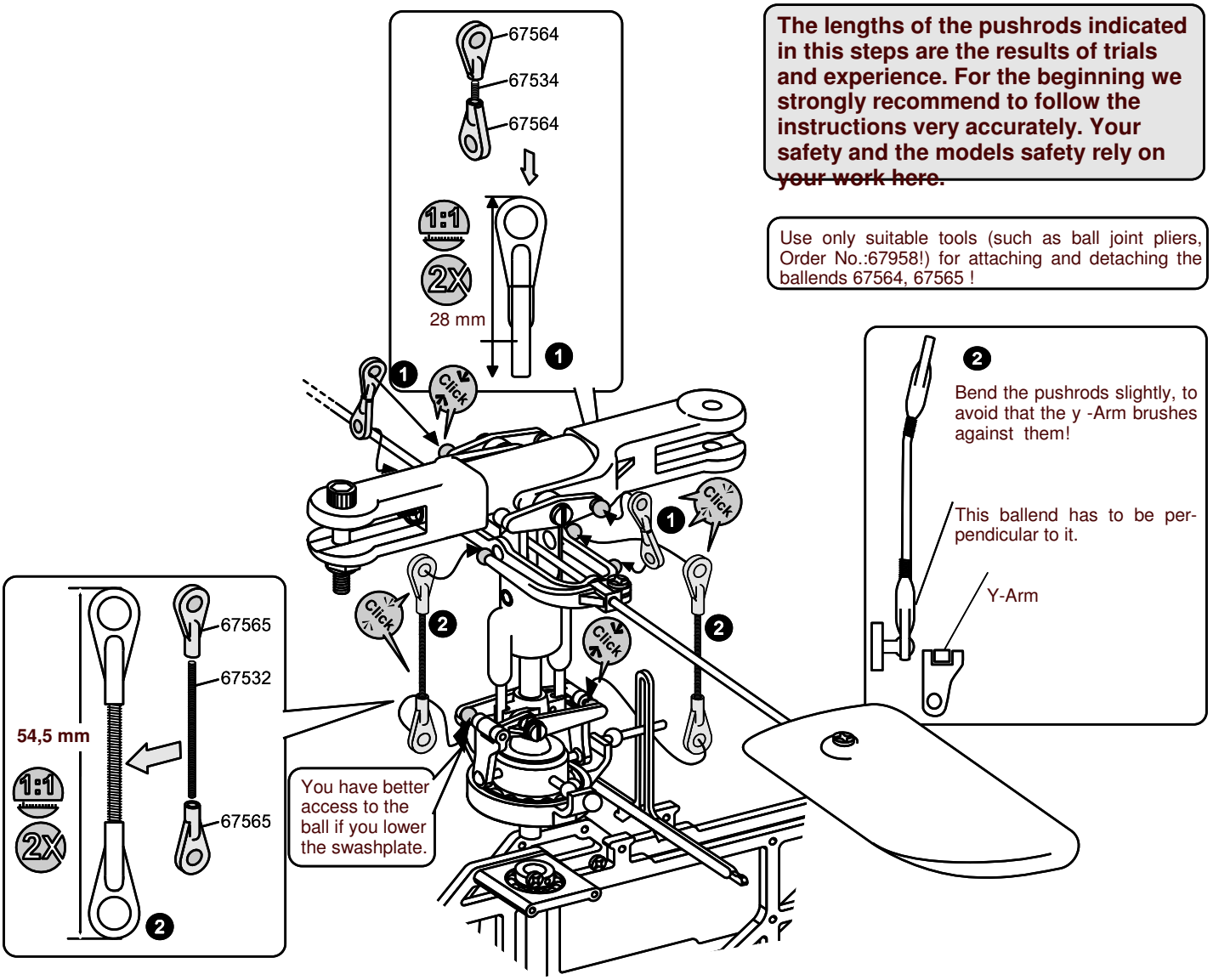
4x 67564 Ballend, short

2x 67534 M2x3 mm Threaded rod

4x 67565 Ballend, long

2x M2x33 mm Threaded





The lengths of the pushrods indicated in this steps are the results of trials and experience. For the beginning we strongly recommend to follow the instructions very accurately. Your safety and the models safety rely on your work here.

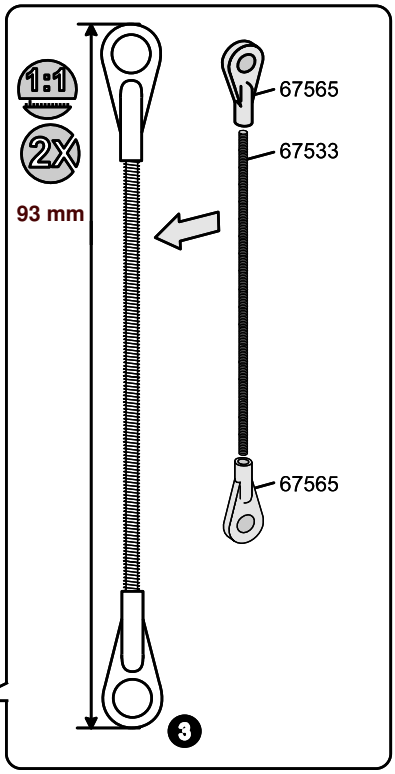
Use only suitable tools (such as ball joint pliers, Order No.:67958!) for attaching and detaching the ballends 67564, 67565 !

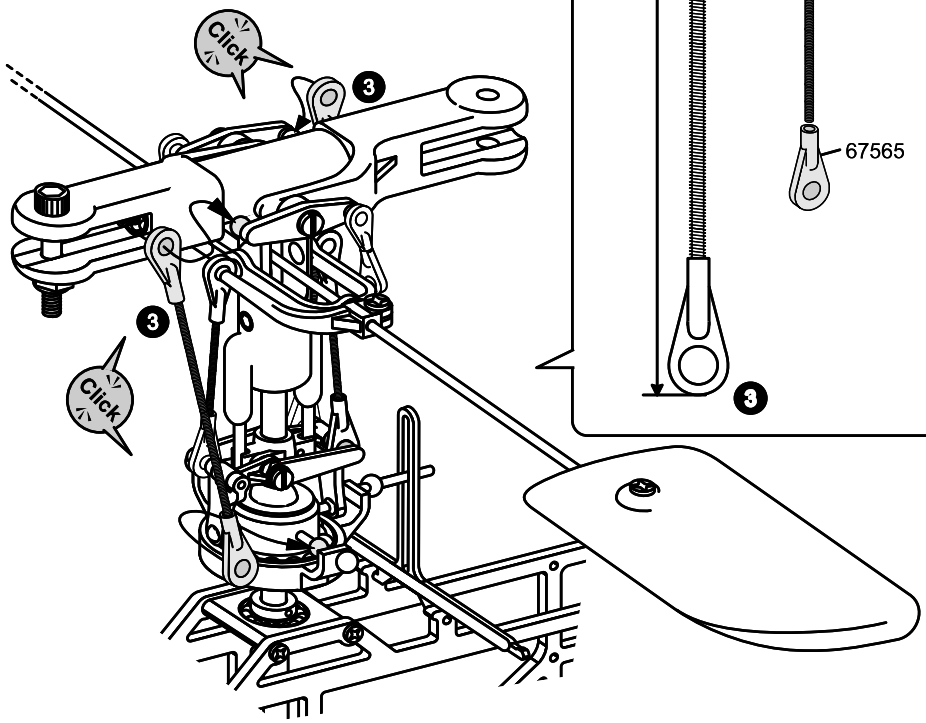
The complete rotor head

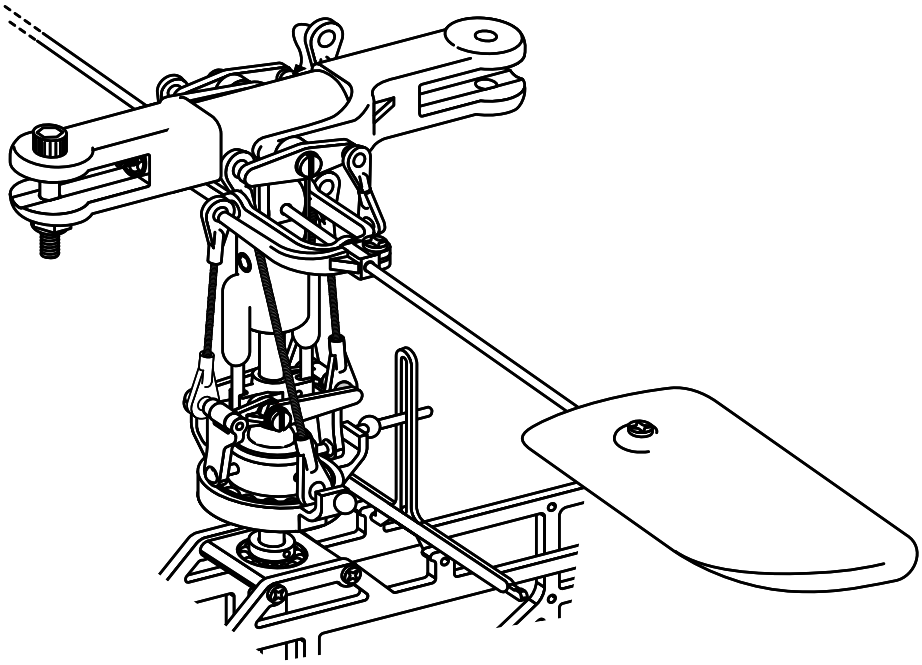
5

4x 67565 Ballend, long

2x 67533 M2x72 mm Threaded rod







Have a break here.

- Check all linkages for gentle and easy movements.
- Check again the exact length as indicated.

Avoid friction in the pitch compensator, in the mixer levers and in the flybar.

Please keep in mind: Unnecessary friction causes increased energy consumption and reduces your flight time. Besides, friction reduces the control response.

Make it a good rule to check all linkages after each flight, especially after each hard landing.

The tail rotor

6

2x 67542 Blade holder
1x 67549 Hub
2x 67576 Ball
2x 67566 Ball bearing 2x6x3 mm

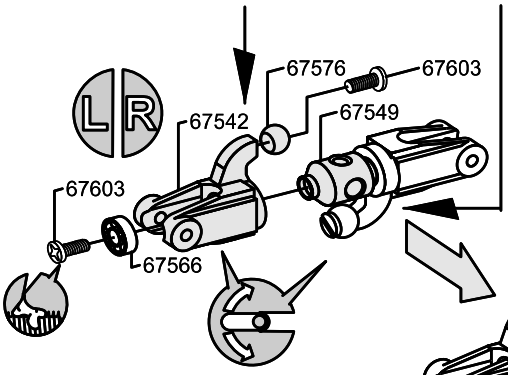
2x 67603 M3x8 mm LK Screw

1x 67550 Tail rotor shaft
2x 67574 M3x4 mm set screw
2x 67564 Bushing short

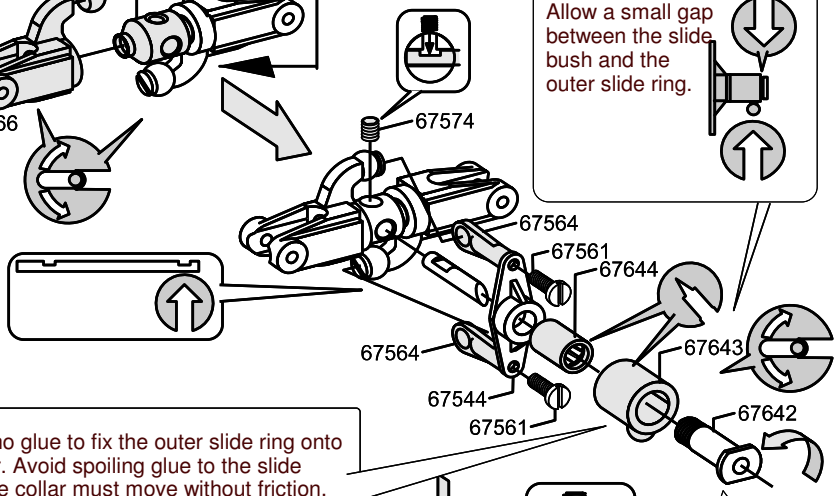
4x 67561 M2x6 mm LK Screw

1x 67544 Tail pitch plate
1x 67538 Collar
1x 67545 Outer slide ring
1x 67537 Slide bush
1x 67702 Pulley
2x 67571 Ball bearing 3x7x3 mm

1x 67548 Housing
1x 67920 Belt
1x 67919 Tailpipe
1x 67606 Vertical fin
1x 67546 Spacer
67541 Pitch lever
Washer 2 mm
M2x14 mm CH Screw



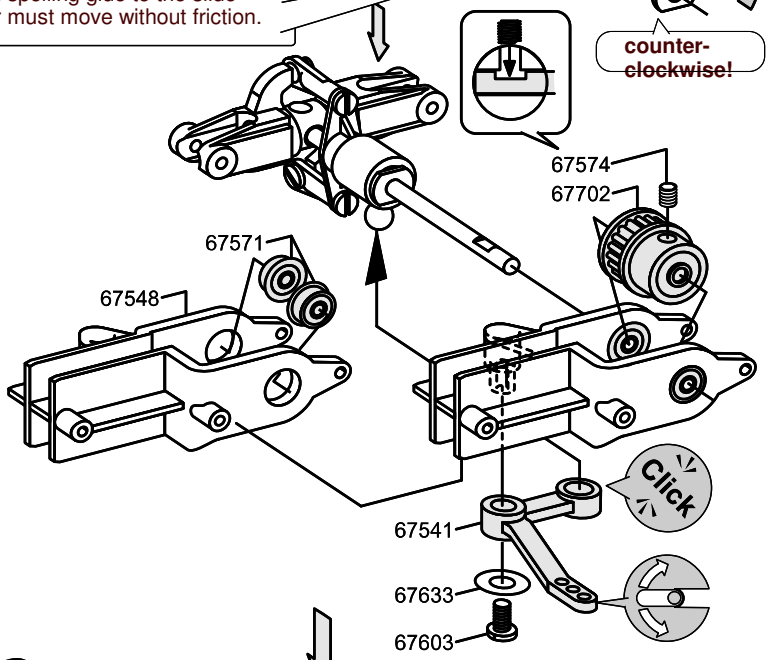
Please watch out for the alignment of the pushrods,while you are assembling.

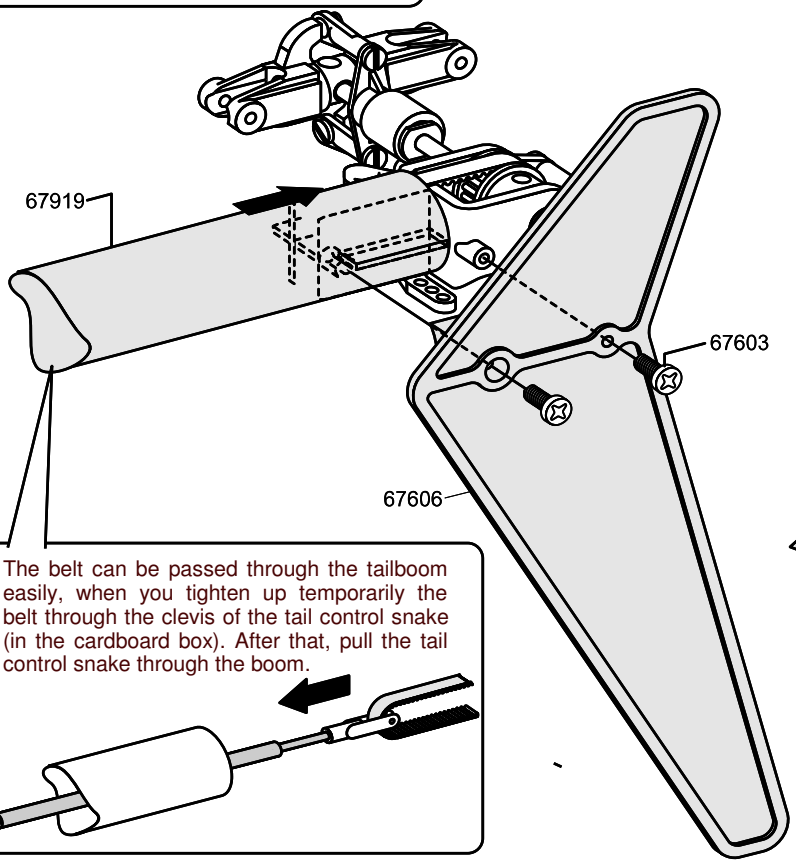


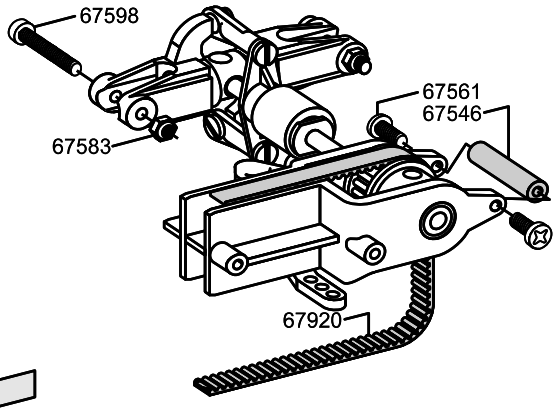
Allow a small gap between the slide bush and the outer slide ring.

Use cyano glue to fix the outer slide ring onto the collar. Avoid spoiling glue to the slide bush. The collar must move without friction.

counter-clockwise!





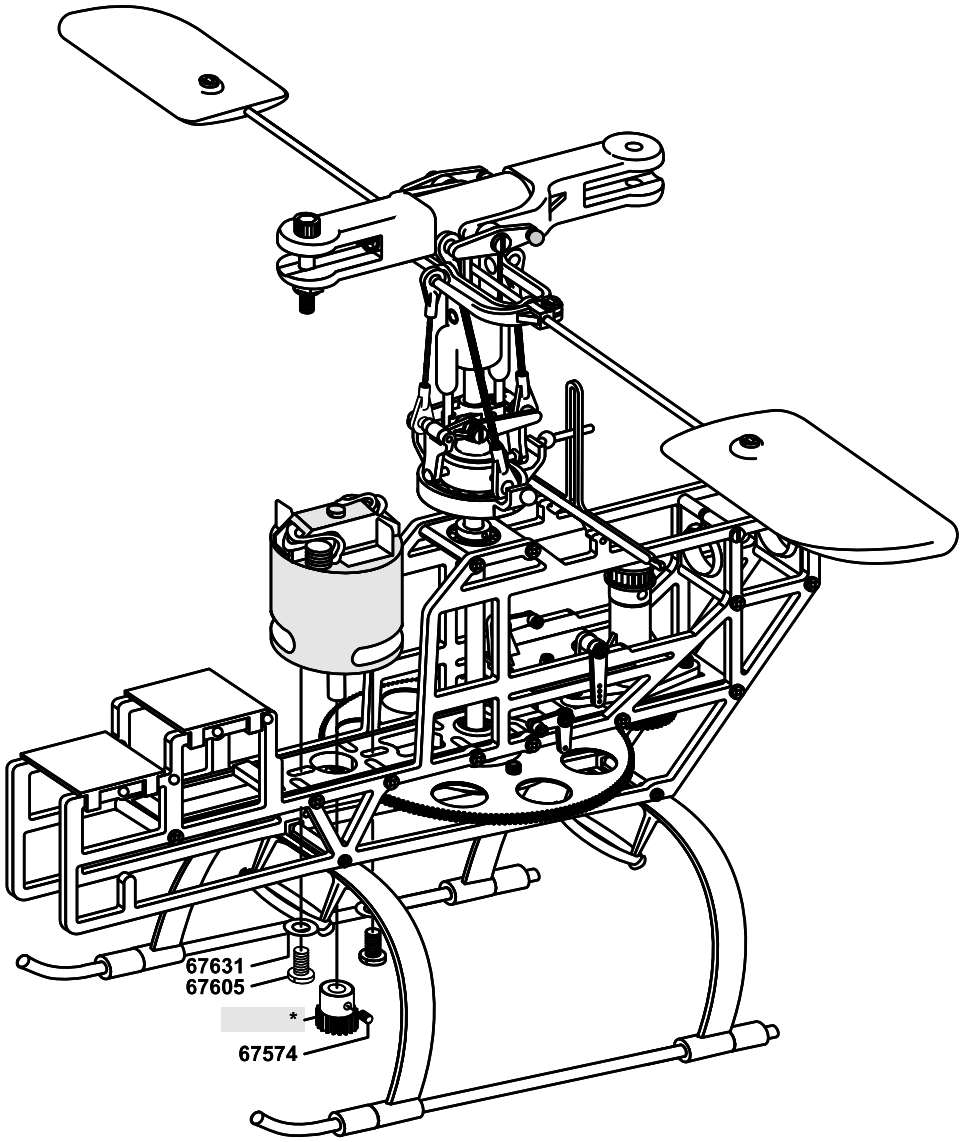


The belt can be passed through the tailboom easily, when you tighten up temporarily the belt through the clevis of the tail control snake (in the cardboard box). After that, pull the tail control snake through the boom.

The motor

6.1

1x 70103 Motor (not included in Kit No.: 67900)
2x 67605 M3x8 mm CH Screw
2x 67631 Washer 3 mm
1x 67608 Pinion 10 T
1x 67574 3x4 mm set screw



*)
Please keep in mind:
You have to use different pinions regarding the used motor or the number of used battery cells. (See page 28 and the following ones).Follow the operating instructions of the motor and keep close to the described features of the

Gear Meshing

Gear meshing is a rather sensitive subject. Wrong adjustments cause high friction and unnecessary wear and tear whereas the correct adjustment is very simple.

Loosen the motor screws.

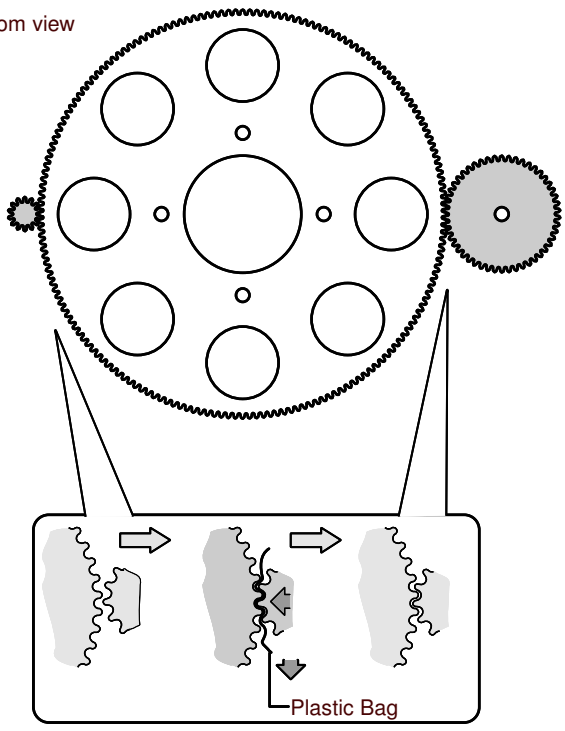
Put an unused part bag between pinion and main gear.

Move the motor with the pinion against the main gear and tighten the screws.

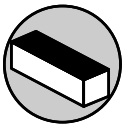
Remove the plastic bag.

Adjust the meshing in the same way at the taildrive gear.

Bottom view

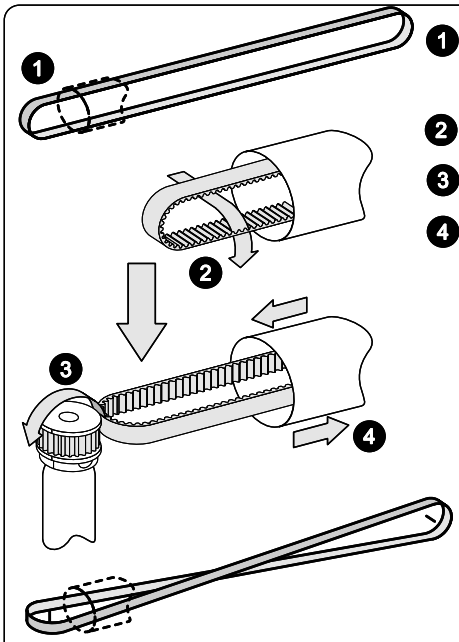


The tail boom



1x 67919 Tailpipe

Properly adjust the belts tension. Remember, too much friction costs energy. Energy is flight time and flight performance!

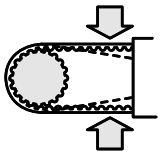


1. Make sure that the belt runs straight in the tailboom.

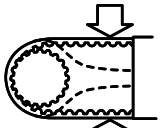
   Insert the tailboom into the frame.
2. Twist the belt by 90° to the left!
3. Pull the belt over the pulley.
4. Pull the tailboom backwards, adjust the belts tension and tighten the M2 x 30 mm screws.

The belts tension:

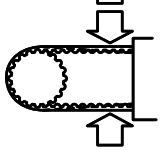
If you can compress the belt by abt. 5 mm the tension is just right.

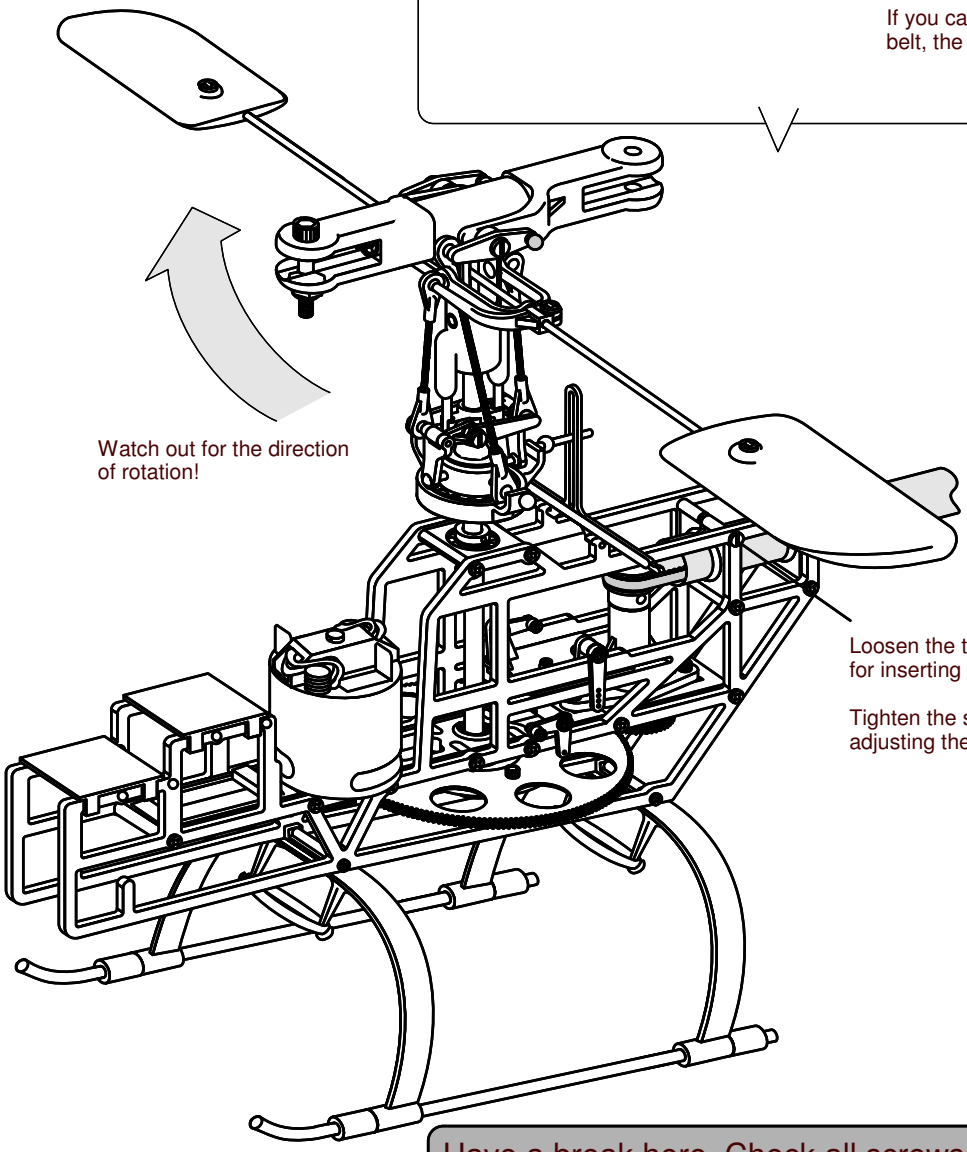


If you can compress the belt completely, the tension is low.



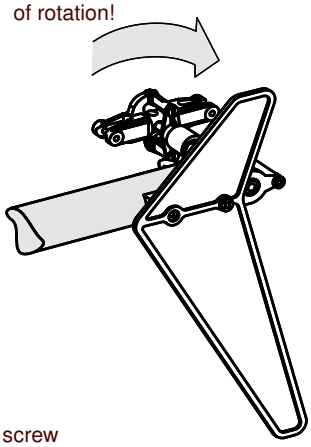
If you can hardly compress the belt, the tension is too tight.





Watch out for the direction of rotation!

Watch out for the direction of rotation!



Loosen the two M2 x 30 mm screw for inserting the tailpipe.

Tighten the screws again after adjusting the belt tension.

Have a break here. Check all screws and check the moving parts for easy operation. Pay special attention to the levers of both rotors and the gear meshing of the central drive unit. Don't forget to use screw-lock on certain marked parts. Do not underestimate the belt drive! Once it is properly adjusted it moves with hardly any friction. Misadjustment can cause a lot of damage and is a waste of energy.

The servos for mechanical mixing

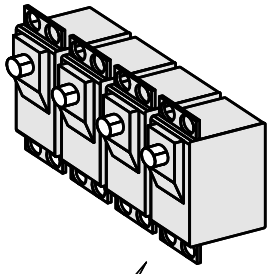
Carefully select the components of your r/c-equipment in view of quality and weight. Keep in mind:

⇨ **Saving 1 g of weight gives you 1 s more flight time!**

⇨ **Using unsuitable components can cause serious damage!**

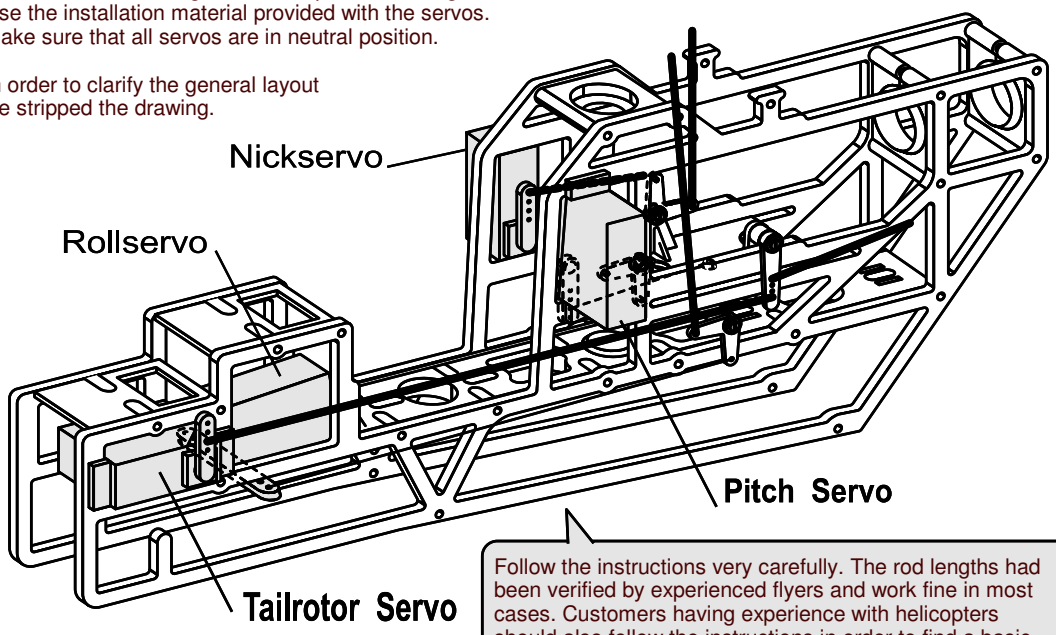
If you have the choice, choose the more sophisticated equipment.
Connect the components as suggested by the manufacturer.
Use the rubber servo grommets to prevent damage from vibration.
Use the installation material provided with the servos.
Make sure that all servos are in neutral position.

In order to clarify the general layout
we stripped the drawing.



Make sure that all servos are in neutral position.
Use the rubber servo grommets to prevent damage from vibration.

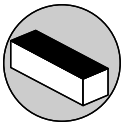
Attention: Never turn the servos manually. The gear unit of the servos is not constructed



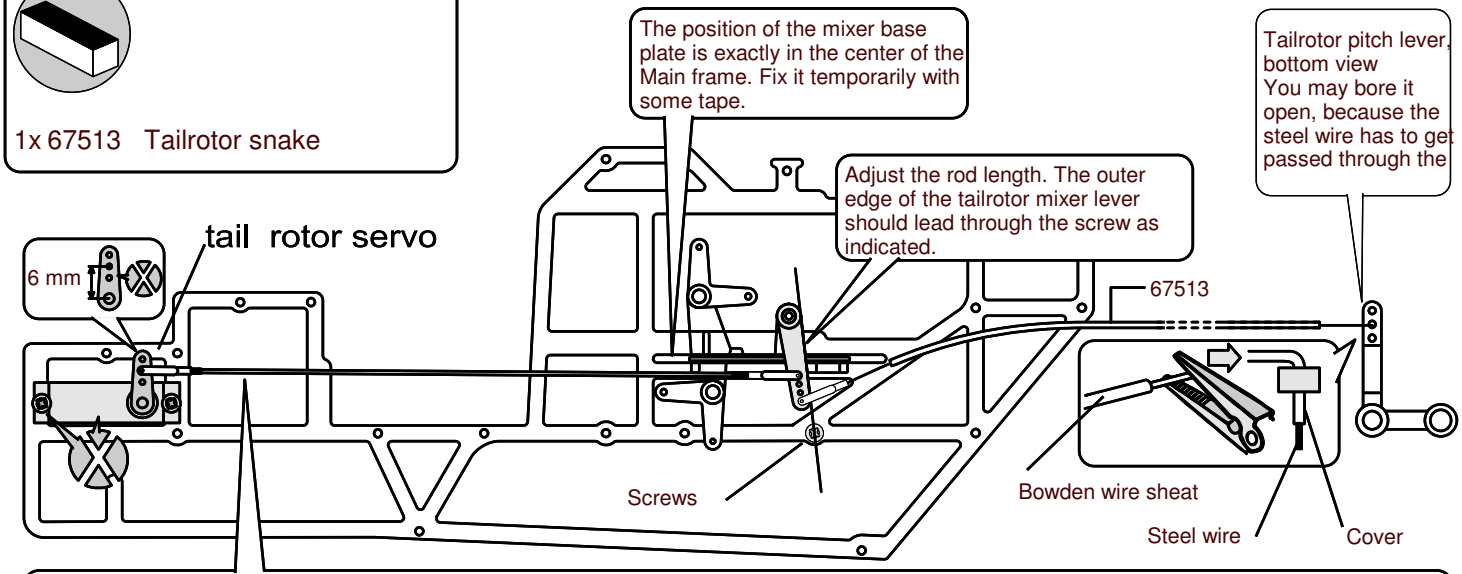
Follow the instructions very carefully. The rod lengths had been verified by experienced flyers and work fine in most cases. Customers having experience with helicopters should also follow the instructions in order to find a basic adjustment.

The tail rotor servo

1x 67526 Tie rod M2x160 mm
2x 67523 Quick link



1x 67513 Tailrotor snake

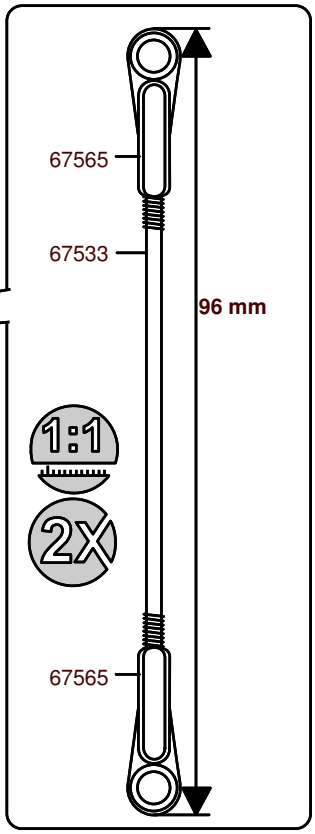


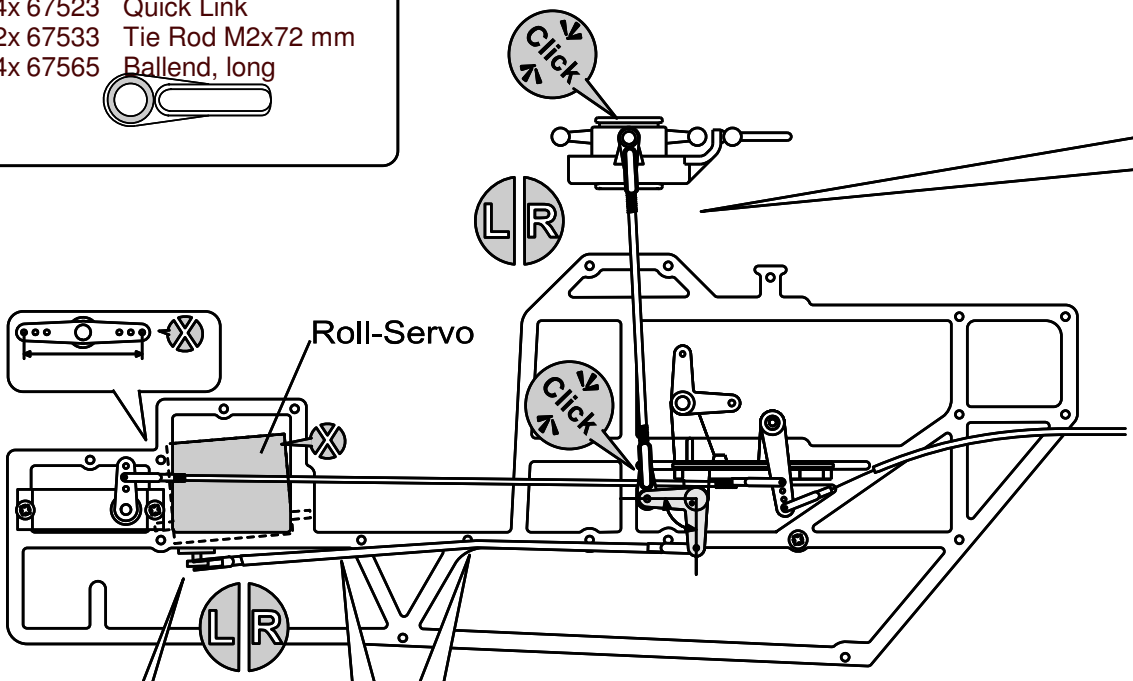
The servos for mechanical mixing

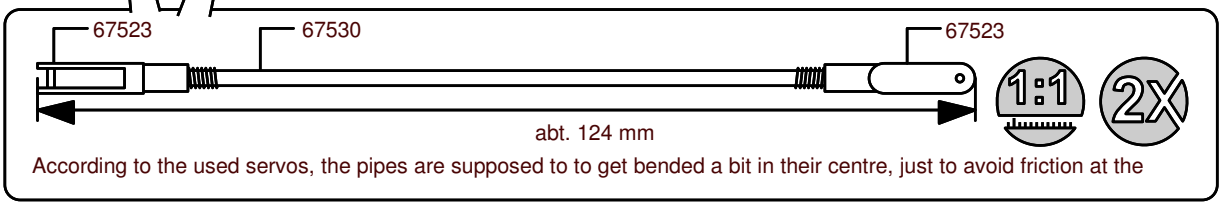
The aileron servo

7

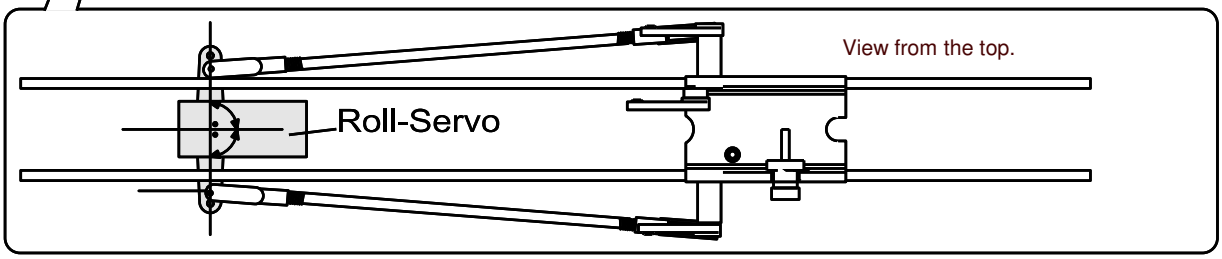
2x 67530 Tie Rod M2x99 mm
4x 67523 Quick Link
2x 67533 Tie Rod M2x72 mm
4x 67565 Ballend, long



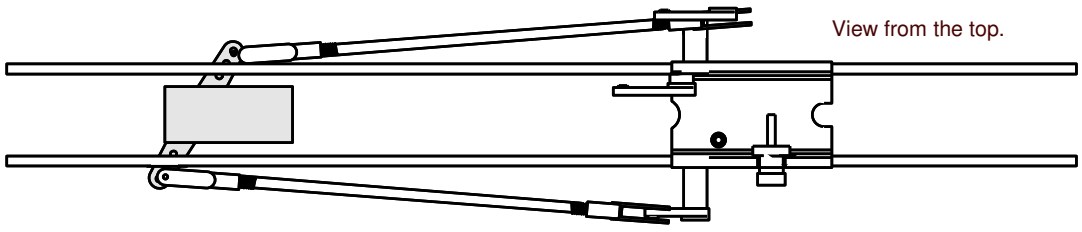




According to the used servos, the pipes are supposed to to get bended a bit in their centre, just to avoid friction at the



According to the used servos,the pipes are supposed to get bended abit in their centre.



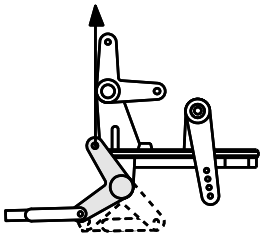
Make sure that you have a basic adjustmenst as indicated above.

If the Servo turns to the right, the left 90° lever moves the aileron rod upwards. The right 90° lever pulls the aileron rod downwards.

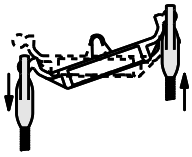
The swashplate tips to the right so the helicopter starts rolling to the right side.

In order to obtain equal steering response to both sides, the adjustments have to be done as shown.

View from the left side.



View from the front.



The servos for mechanical mixing

The elevator servo

7

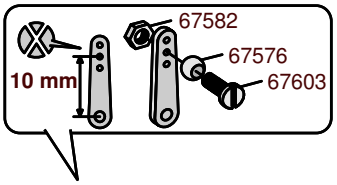
1x 67527 Tie Rod M2x12 mm
1x 67523 Quick Link
2x 67520 Servospacer 3 or 5 mm
1x 67564 Ballend, short

1x 67531 Tie Rod M2x52 mm
2x 67565 Ballend, long

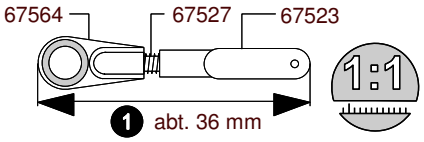
1x 67576 Ball

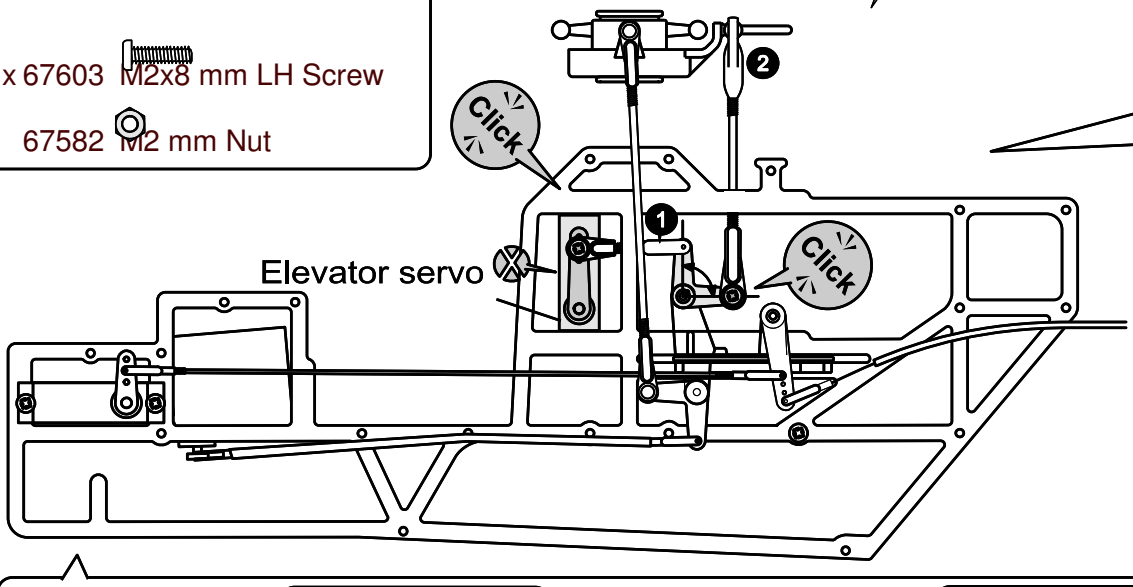
1x 67603 M2x8 mm LH Screw

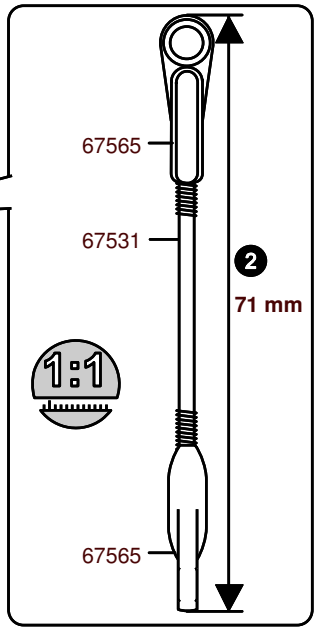
67582 M2 mm Nut

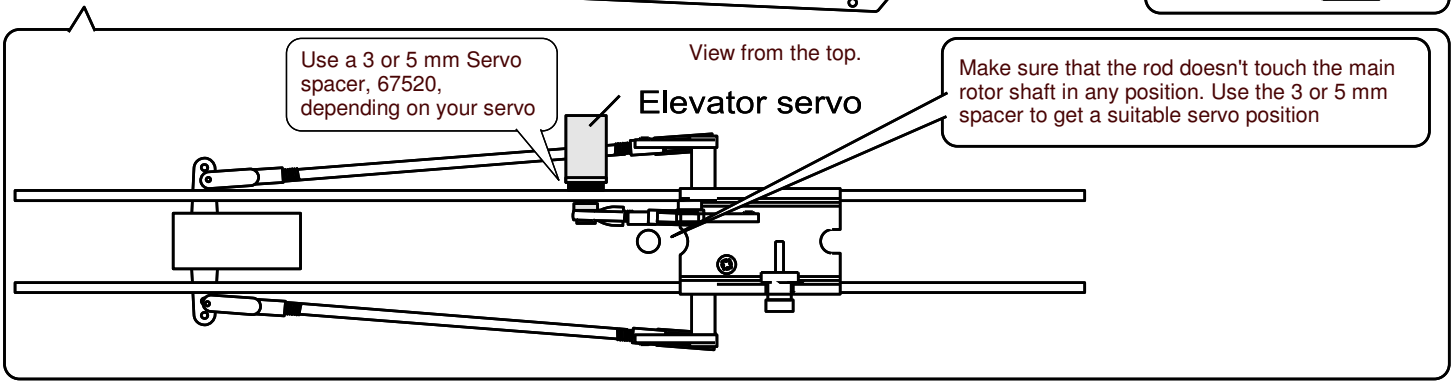


The length may vary according to the final servo position. Make sure that the mixer base plate is exactly in the center of the main frame and the 90° lever is at a right angle.









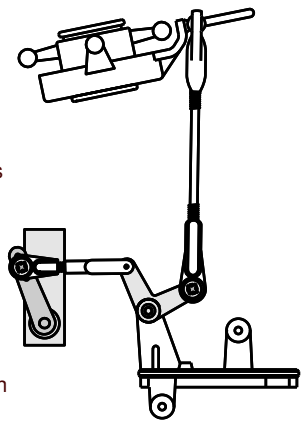
Make sure that you have a basic adjustmenst as indicated above.

If the servo turns to the front, the left 90° lever moves the elevator rod upwards.

The swashplate tips to the front so the helicopter starts to bend the nose downwards

In order to obtain equal steering response to both sides, the adjustments have to be done as shown.

Keep in mind that the pitch servo shall be installed oposite the elevator servo so there should be some space left. Use either the 3 mm or 5 mm Servo spacer to adjust for the correct offset of the servos and keep in mind that the rod never touches the main rotor shaft.



The servos for mechanical mixing
The pitch servo

7

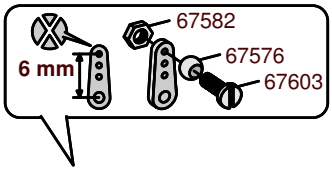
1x 67527 Tie rod M2x12 mm
1x 67523 Quick link
2x 67520 Servospacer 3 or 5 mm
1x 67564 Ballend, short

1x 67533 Tie Rod M2x52 mm
2x 67565 Ballend, long

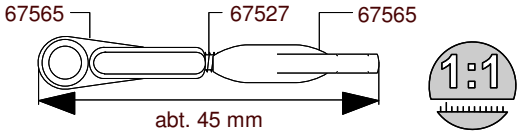
1x 67576 Ball

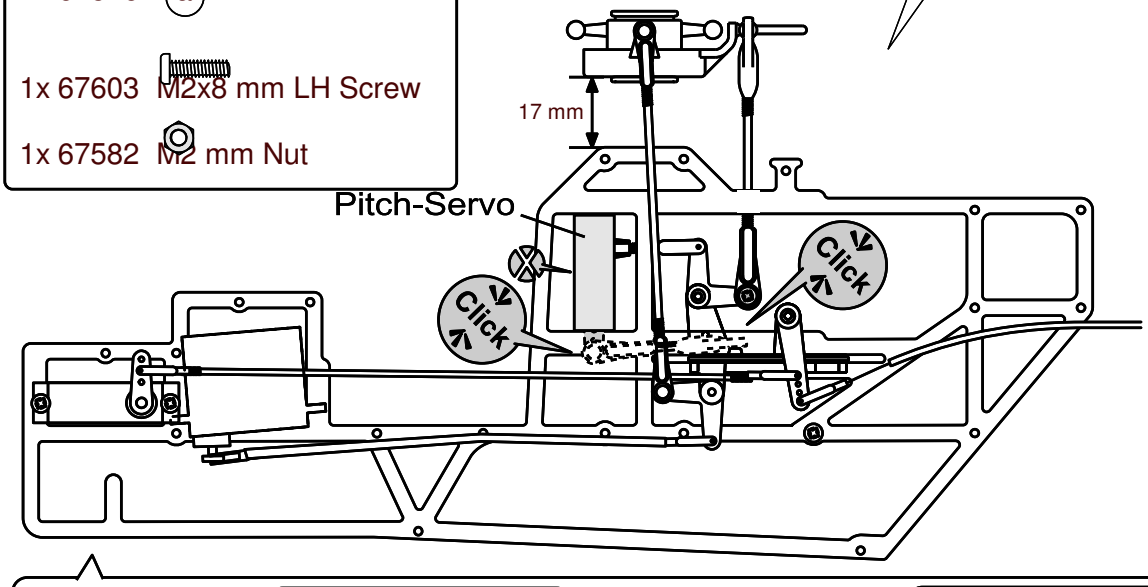
1x 67603 M2x8 mm LH Screw

1x 67582 M2 mm Nut



The length may vary according to the final servo position. Make sure that the mixer base plate is exactly in the center of the main frame and the 90° levers are at a right angle.

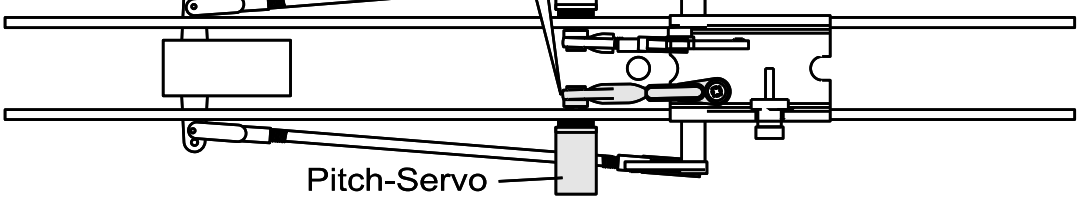




Use a 3 or 5 mm Servo spacer, 67520, depending on your servo

View from the top.

Make sure that the rod doesn't touch the main rotor shaft in any position. Use the 3 or 5 mm spacer to get a suitable servo position

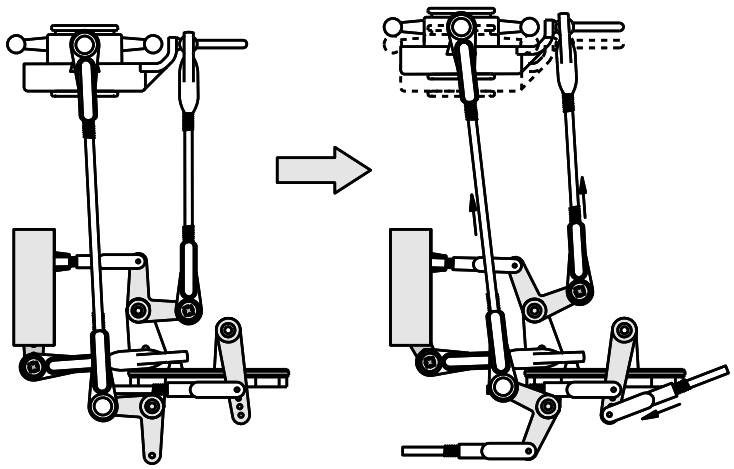


You will see now how the mixer works:

The pitch servo moves the base plate backwards. The elevator, aileron and tailrotor servo remain unchanged. The 90° levers "translate" the horizontal movement of the ground plate in vertical movement of the tie rods to the swashplate. The swashplate wards and increases the pitch value of the manrotor. At the same time, the mixer lever for the tailrotor pulls the tailrotor snake giving increased pitch to the tailrotor blades.
The system is simple but effective. It allows you to use a standard 4 -Channel R/C. With a Y-connector the pitch signal is relayed to the speed controller. Increasing pitch will automatically increase the motor rpm.

max. pitch	+9°
hoover pitch	+5° until +6°
min. pitch	-1° until -2°

Our speed controller Heli 4000 (No.:720667) is already installed with an exact throttle curve.



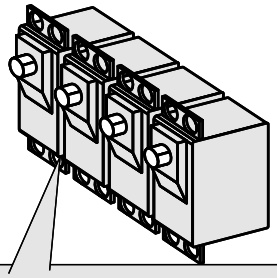
The servos for electronical mixing

Carefully select the components of your r/c equipment in view of quality and weight. Keep in mind:

⇨ **Saving 1 g of weight gives you 1 s more flight time!**

⇨ **Using unsuitable components can cause serious damage to helicopter!**

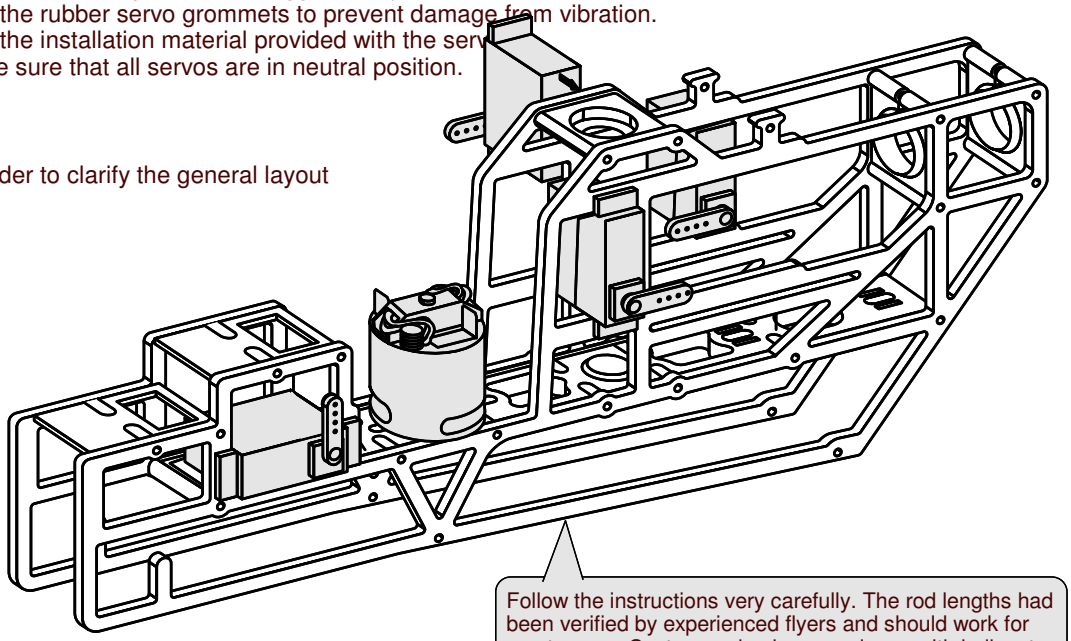
If you have the choice, choose the more sophisticated equipment.
Connect the components as suggested by the manufacturer.
Use the rubber servo grommets to prevent damage from vibration.
Use the installation material provided with the serv
Make sure that all servos are in neutral position.



Make sure that all servos are in neutral position.
Use the rubber servo grommets to prevent damage from vibration.

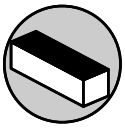
Attention: Never turn the servos manually. The gear unit of the servos is not constructed for this kind of actions.

In order to clarify the general layout

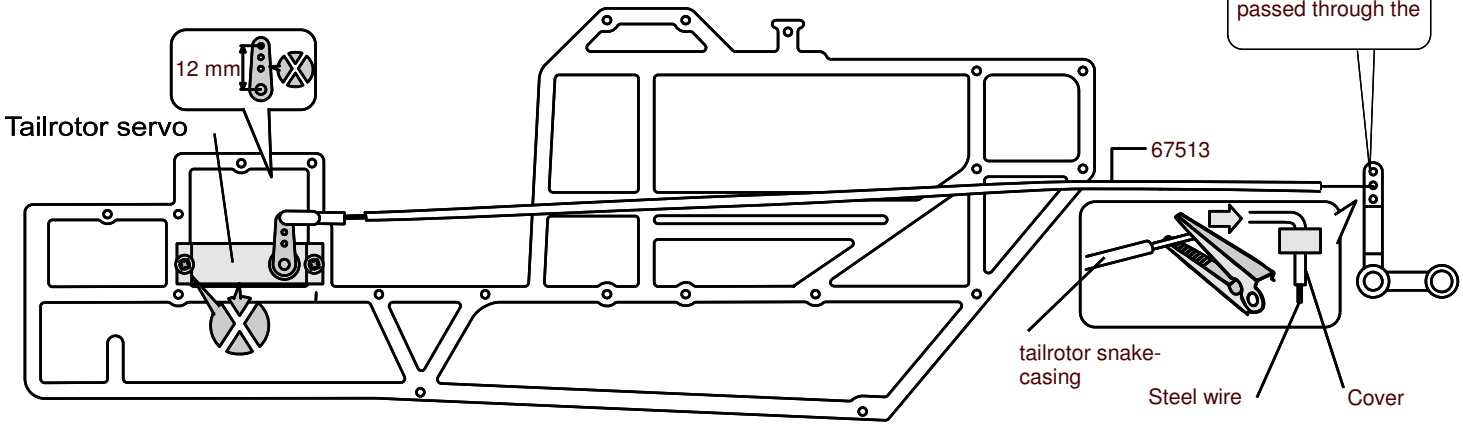


Follow the instructions very carefully. The rod lengths had been verified by experienced flyers and should work for most cases. Customers having experience with helicopters should also follow the instructions in order to find a basic adjustment.

The tail rotor servo



1x 67513 Tailrotor snake

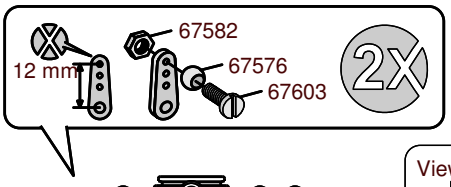


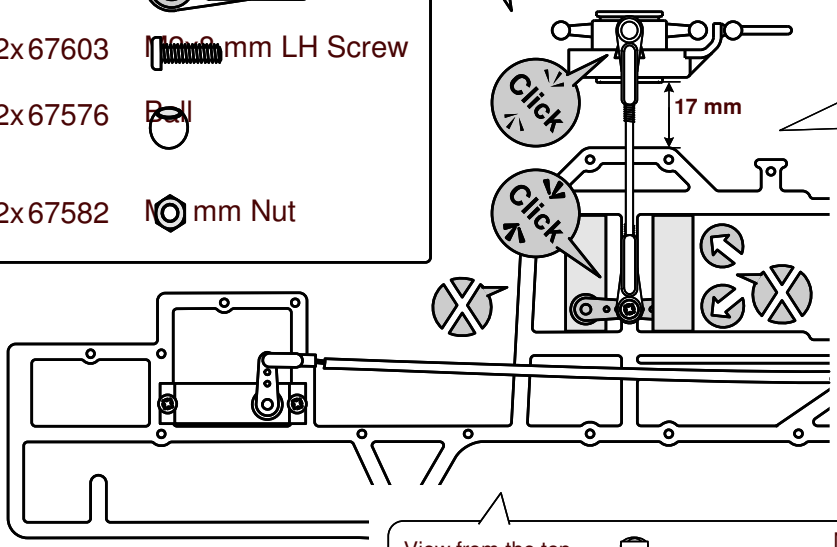
The servos for electronical mixing

The aileron servos

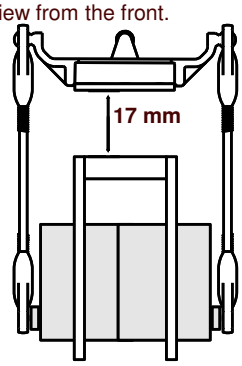
7

2x 67533 Tie rod M2x72 mm
4x 67565 Ballend, long
2x 67603 M2x8 mm LH Screw
2x 67576 Ball
2x 67582 M2 mm Nut



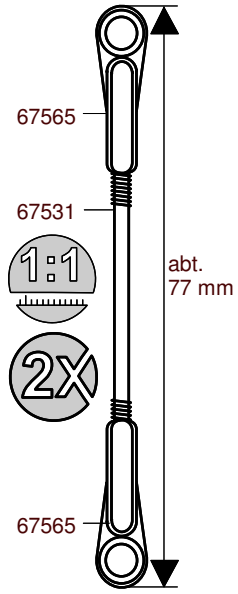


View from the front.

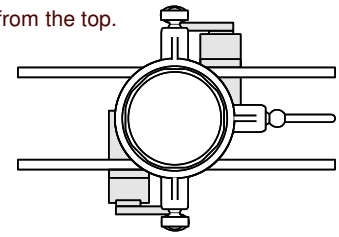


The rods length may vary according to the servo used. In neutral position the swashplate should be 17 mm above the upper bearing plate.

Shorten the 72 mm rod down to 52 mm.



View from the top.



Make sure that both rods have the same length and the swashplate is exactly parallel to the upper bearing plate.

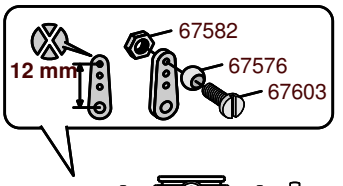
Possible difficulties may arise from the servo mounting. Therefore please make sure that you mount both servos in the same way. Either you centralise them in the main frame or they may rest against the upper or lower bracket.

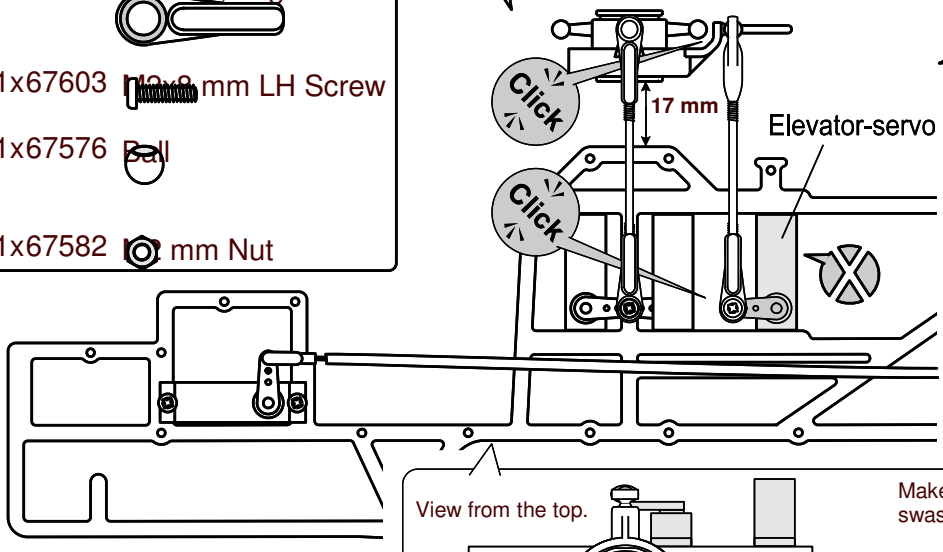
The more straight the rods are the better steering response you will obtain.

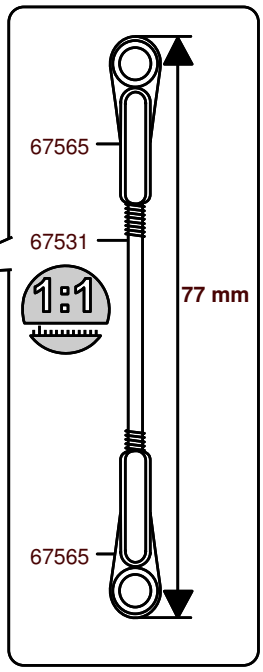
The elevator servo

7

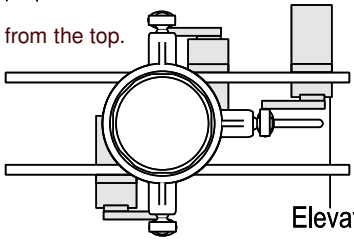
1x 67531 Tie rod M2x52 mm
2x 67565 Ballend, large
1x 67603 M2x8 mm LH Screw
1x 67576 Ball
1x 67582 M2 mm Nut







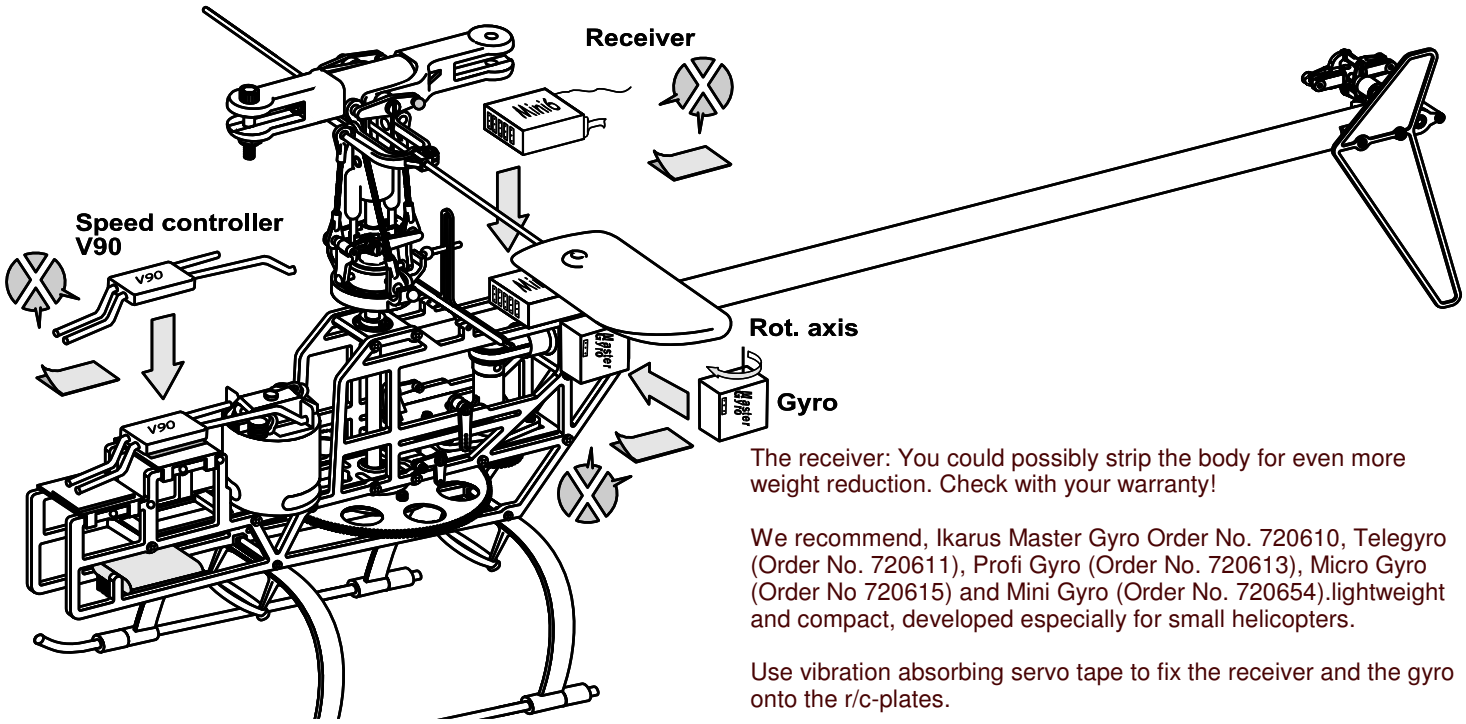
View from the top.



Make sure that the rod has the same length and the swashplate is exactly parallel to the upper bearing plate.

Possible difficulties may arise from the servo mounting. Therefore please make sure that you mount the servos in the same way. Either you centralise them in the main frame or they may rest against the upper or lower bracket. The more straight the rods are the better steering response you will obtain.

The Receiver, Speed Controller and Gyro



Keep the wires as short as possible!

Use 2,5 mm² silicon insulated wire to the motor and to the battery.

Secure the wires against heat and moving parts.

Keep the motor and battery wires away from the antenna and the receiver.

Avoid connectors between the controller and the

The receiver: You could possibly strip the body for even more weight reduction. Check with your warranty!

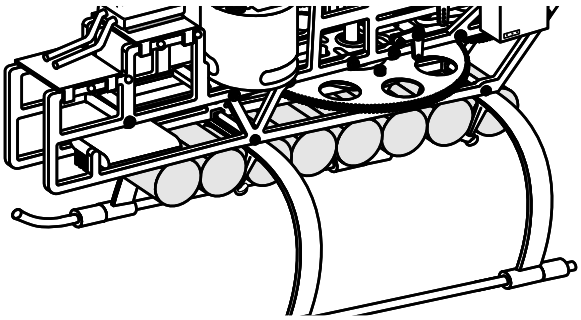
We recommend, Ikarus Master Gyro Order No. 720610, Telegyro (Order No. 720611), Profi Gyro (Order No. 720613), Micro Gyro (Order No 720615) and Mini Gyro (Order No. 720654).lightweight and compact, developed especially for small helicopters.

Use vibration absorbing servo tape to fix the receiver and the gyro onto the r/c-plates.

The speed controller V90 is a microcomputer based system that can easily be adapted to any R/C-System. The motor starts only after certain procedures on the transmitter. The Controler V90 fits perfectly well into the main frame and allows short wiring to the battery and to the motor.

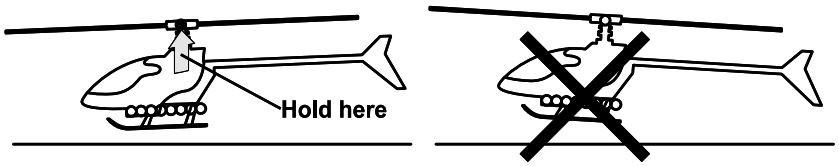
When working on the helicopter with a battery connected accidents may happen due to unexpected motor start. When working on the helicopter please always remove the motor

Batteries

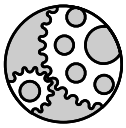


Insert the battery into the undercarriage and adjust the center of gravity.

Hold the helicopter at the flybar. The helicopters nose should drop down a little. Adjust by moving the battery to



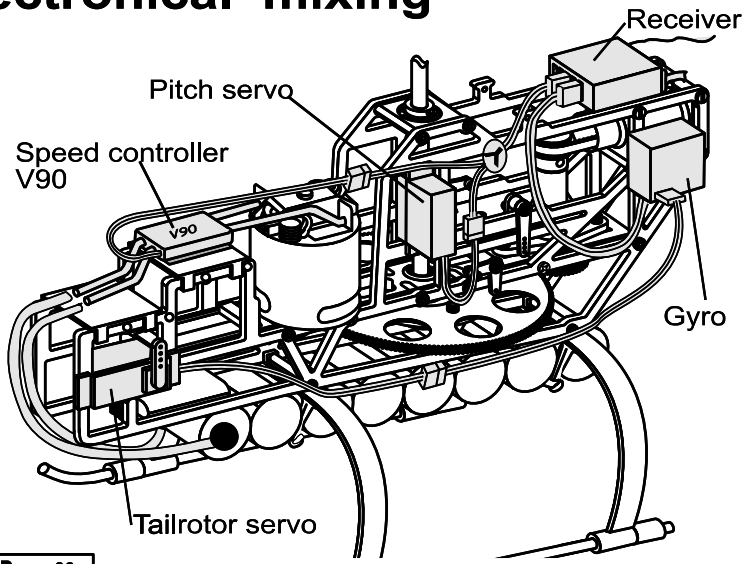
V-Cable with electronical mixing



Use an Y-Adapter cable with electronical mixing.

Plug the end of the cable in the output of the receiver. Now connect both of the ends of the Y-Adapter cable with the speed controller and the pitch servo.

You may have to extend the connection cable of the tailrotor servo with an additional extension piece.



Hints for R/C adjustment with electronical mixing

Select a program for 4 x 90° swashplate steering. Depending on the R/C-System one of the servo position is not covered. It is mostly 0°, so

Aileron, right side is at 90° position

Elevator, rear, is at 180° position

Aileron, left side, is at 270° position

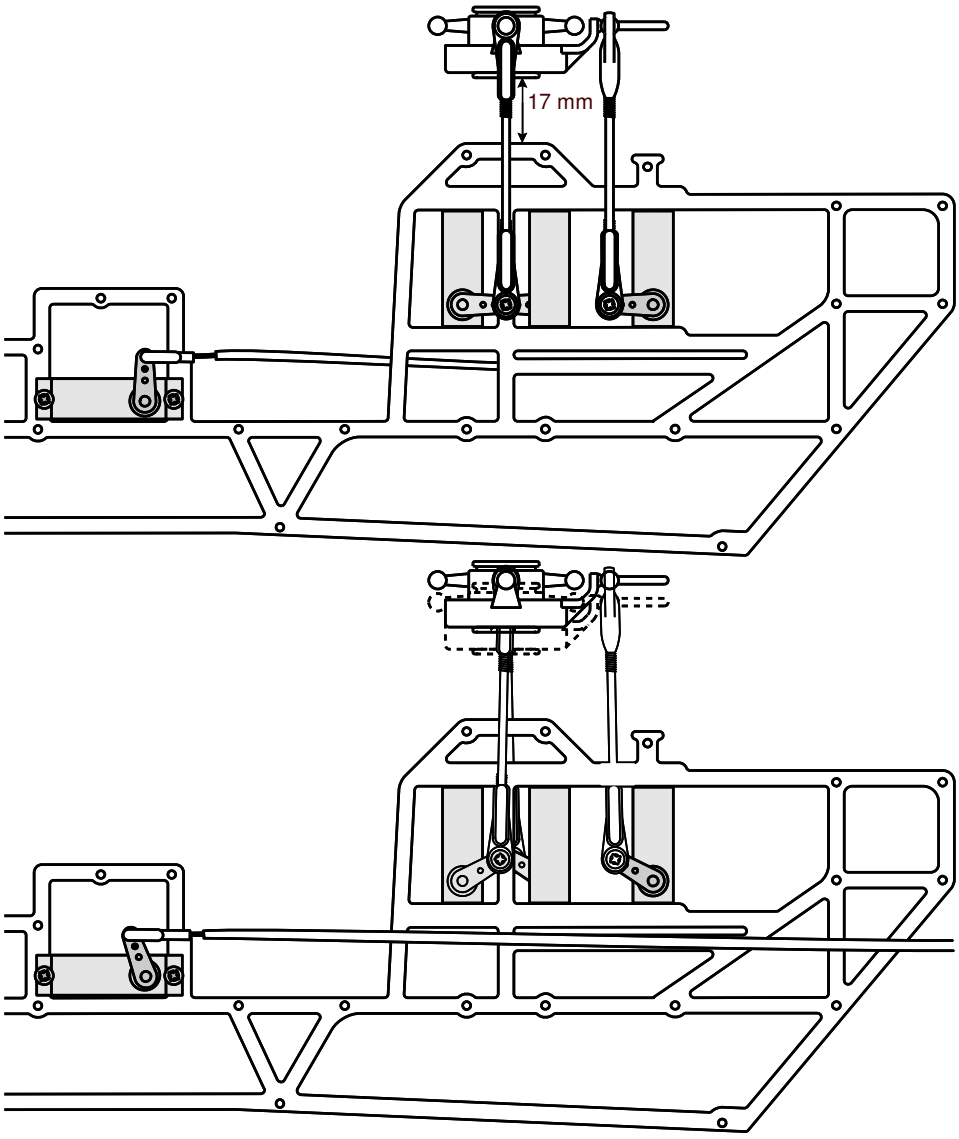
Due to the way of mounting the servos, the elevator servo has to be reversed. We strongly recommend the following values for the first flight attempts:

max. pitch	+9°
hoover- pitch	+5° until +6°
min. pitch	-1° until -2°

Increasing pitch should move the swashplate straight upwards.

Make sure that the servo travel on these servos is exactly the same. You may limit the travel down or upwards. Check the ultimate swashplate position and reduce the travel step by step. Adjust for the same limits on all three servos.

As a general rule, the pitch travel should increase the tailrotor servo by 30% for increasing the pitch value, 20% for decreasing the pitch value. On certain r/c-systems this value may have to be reversed. Please check your manual for details



Tracking the main rotor blades

It is essential for the flying culture that the rotor blades both move on one track. Mark one blade with red tape at the tip. You can check the tracking by operating the helicopter near lifting speed and watching the moving rotor directly from the side.

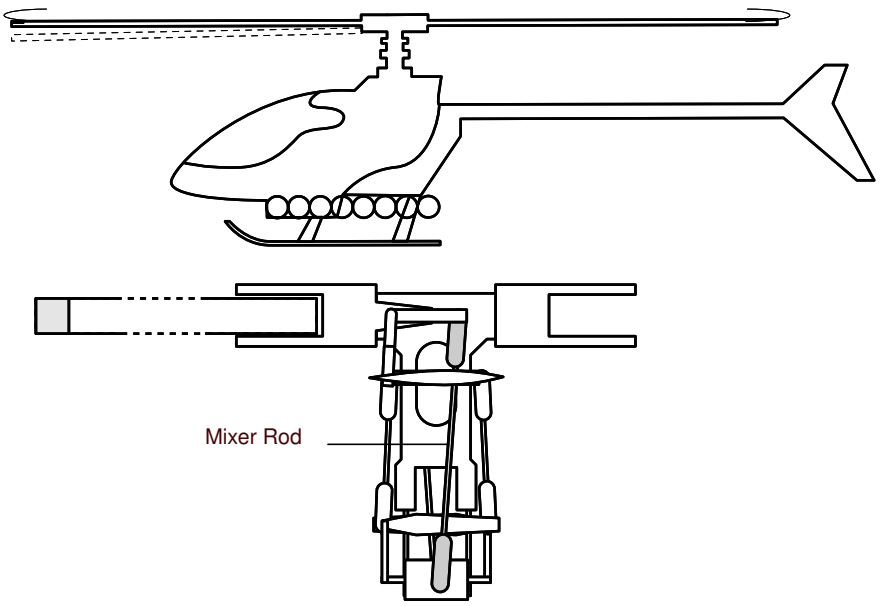
If you see 2 blade tip levels, adjustment is necessary.

If you see the red mark on top, the marked blade mixer rod should be shortened.

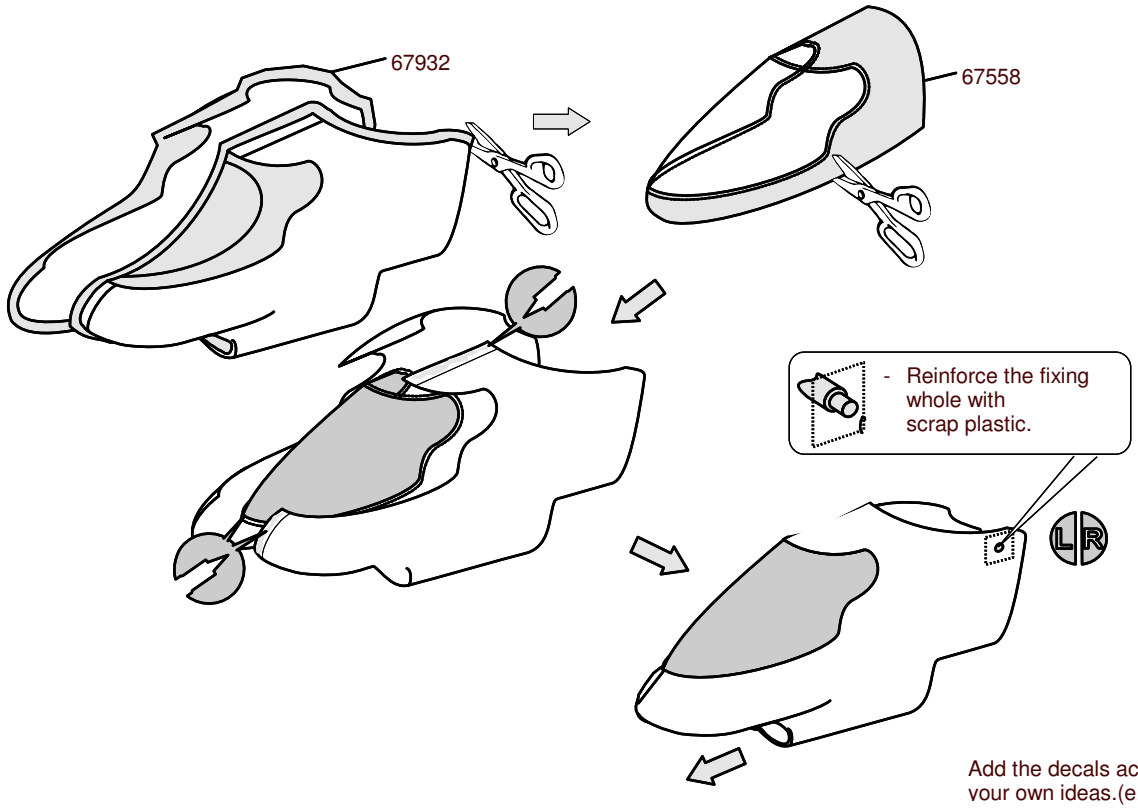
If you see the red mark under the unmarked blade, the marked blade mixer rod should be enlengthed.

Adjust until you see one level of blade tips only.

Be aware of general safety regulations. Make this adjustment at the airfield only. Wear eye protectors. Keep a safety distance of at least 10 ft. Wait until the rotor comes to a complete stop. Protect the helicopter against undesired motor start. Work at the rotor with disconnected battery only.

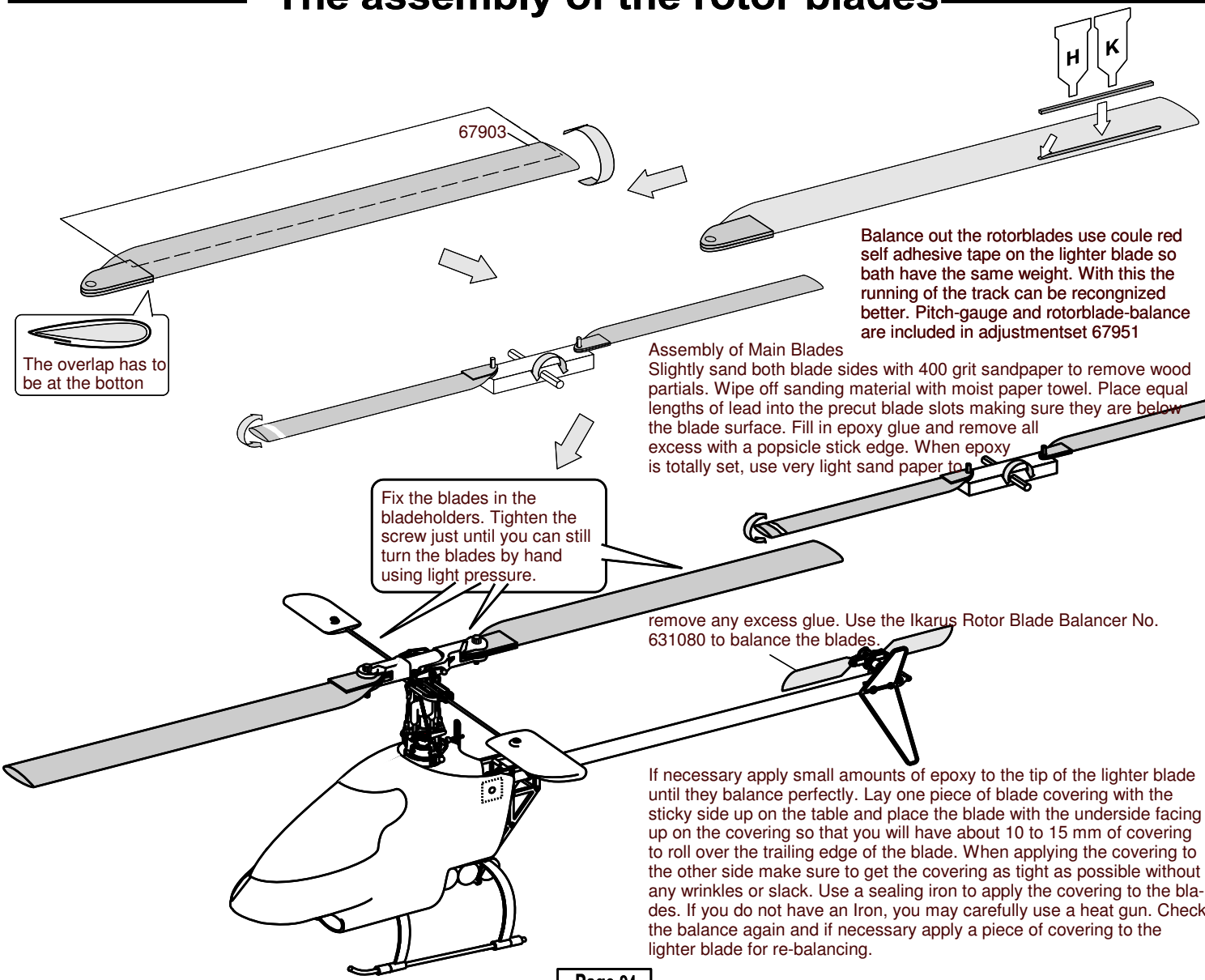


Completing the helicopter



Add the decals according to your own ideas.(e.g. 67818)

The assembly of the rotor blades



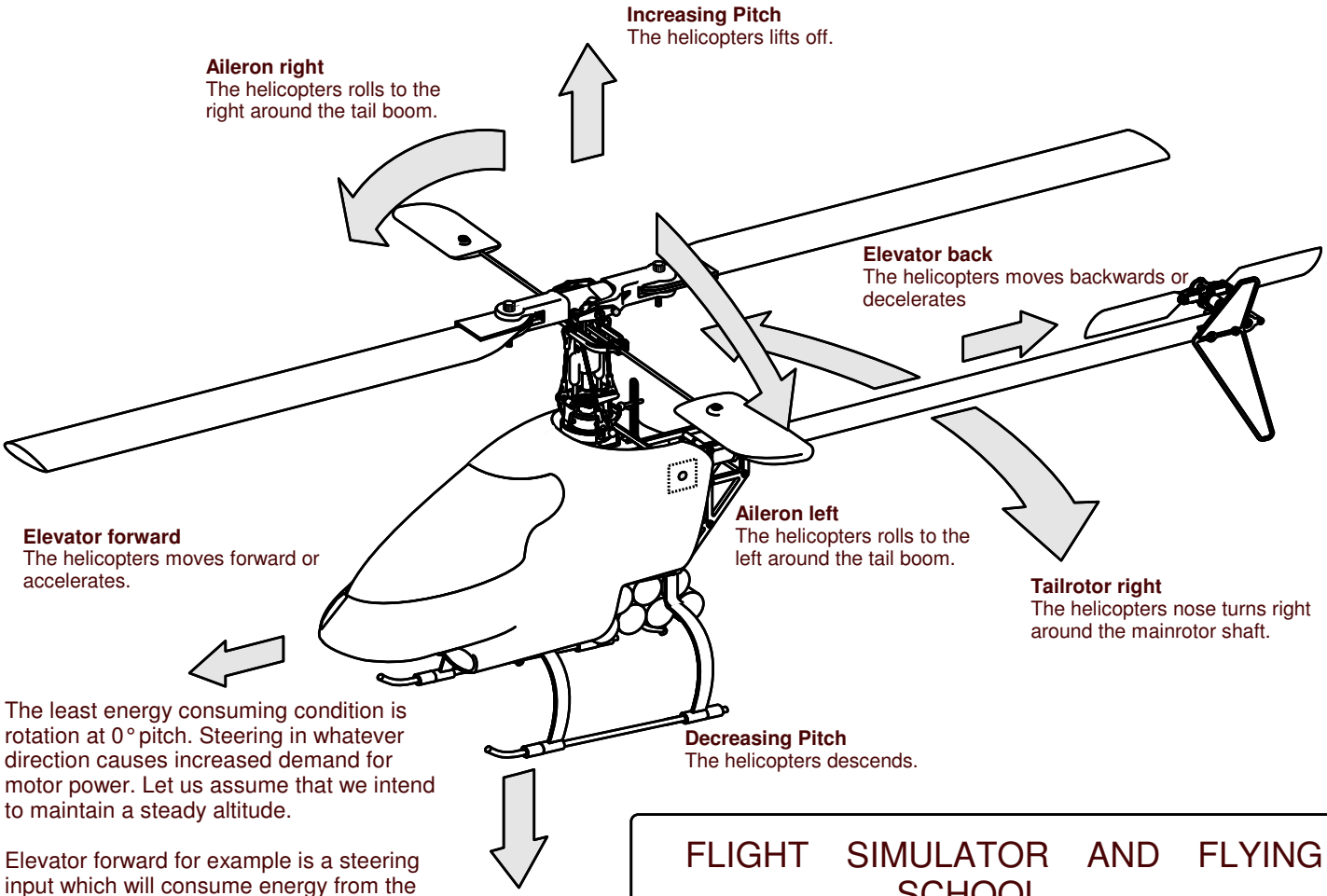
Balance out the rotorblades use coule red self adhesive tape on the lighter blade so bath have the same weight. With this the running of the track can be recongnized better. Pitch-gauge and rotorblade-balance are included in adjustmentset 67951

Assembly of Main Blades
Slightly sand both blade sides with 400 grit sandpaper to remove wood partials. Wipe off sanding material with moist paper towel. Place equal lengths of lead into the precut blade slots making sure they are below the blade surface. Fill in epoxy glue and remove all excess with a popsicle stick edge. When epoxy is totally set, use very light sand paper to remove any excess glue. Use the Ikarus Rotor Blade Balancer No. 631080 to balance the blades.

If necessary apply small amounts of epoxy to the tip of the lighter blade until they balance perfectly. Lay one piece of blade covering with the sticky side up on the table and place the blade with the underside facing up on the covering so that you will have about 10 to 15 mm of covering to roll over the trailing edge of the blade. When applying the covering to the other side make sure to get the covering as tight as possible without any wrinkles or slack. Use a sealing iron to apply the covering to the blades. If you do not have an Iron, you may carefully use a heat gun. Check the balance again and if necessary apply a piece of covering to the lighter blade for re-balancing.

Steering the helicopter

The transmitter setup may vary according to the flyers habits. Please adapt this drawing to your favorite layout. Talking about "left" and "right" refers to the helicopters nose seen from the top.



The least energy consuming condition is rotation at 0° pitch. Steering in whatever direction causes increased demand for motor power. Let us assume that we intend to maintain a steady altitude.

Elevator forward for example is a steering input which will consume energy from the previous hovering level. The helicopter will move forward but at the same time the helicopter descends. To compensate this effect a little increased pitch and motor speed is required. Once you become familiar with the helicopter this will not be a problem anymore.

The same applies for any steering except for tailrotor left. A mainrotor that turns right will automatically force the helicopters nose to turn left. Giving a steering command to

Make it a good rule to execute a pre- and post - flight check on the complete helicopter. Check especially for the correct steering response. Transmitter input "right" should be "Nose right" on the helicopter. Unnecessary in - flight confusion should be avoided.

Check every rod and linkage for easy operation and safe seating. Check the screws and nuts. Have an eye on the motors condition, especially the collector and the carbons. Be aware of possible wire damage due to heat, bad solders or mechanical damage. Check the blades for possible damage.

Remember: Safety is the first concern, fun the second! It is not only your

FLIGHT SIMULATOR AND FLYING SCHOOL

Flying a model helicopter is a fascinating and challenging hobby. Besides your own flying experiences which you will make, you will always have the possibility to ask for professional help and advice.

The IKARUS model helicopter and model plane school does exist since over 20 years and offers a well-balanced training programme for every level of knowledge and experience. You will get educated and advised by professional flight instructors in comfortable courses, which will last normally one week. And your family will enjoy the trip too, because the Black Forest offers an attractive environment and surrounding, which is a perfect background for multiple recreational activitie. By dialing the number 0049-(0)7402-929190, you will get to know more details.

To achieve and gain additional skills and experience in the days before and after practising with your model plane, we alternatively offer you our flight simulators. Those are also a great opportunity for beginners to get familiar with flying a model planes. The Flight Simulators are unusual efficient, with an outstanding, realistic simulation and an appealing graphic representation. Apart from that the price is extremely low compared with the convincing quality and the performance of the product.

Order-No.	Item
31010	EasyFly, Game-Commander-Version (separate transmitter case)
31065	EasyFly, Interface cable version (for connecting with your own transmitter\ with trainer jack)
31042	Aerofly, Interface cable version(for connecting with your own transmitter\with trainer jack)
31050	Aerofly Professional, Interface cable version (for connecting with your own transmitter\with trainer jack)

NEVER	get near the helicopter with the main rotor rotating. Have a good safety distance. Ask spectators to clear the scene and have at least 35 ft distance.
NEVER	ignore the local regulations for operating airplanes and helicopters. They come from experience and good human thinking. Ask your local authorities or hobby store for details.
NEVER	fly helicopters near crowds, playgrounds, streets, railway lines, airports etc.
NEVER	start with unsafe or doubtful equipment.
NEVER	start if you don't feel confident with your equipment, your location or your capabilities.

ALWAYS	ask an experienced flyer for assistance.
ALWAYS	have an eye on wind conditions and changes.
ALWAYS	look for a wide and clear operating area. You may need the space!
ALWAYS	keep in mind: Safety and life first! Loosing your helicopter costs you some money, loosing an arm costs your health!
ALWAYS	check your helicopter for broken, damaged or loose parts.
ALWAYS	maintain the helicopter, the batteries and the charger.
ALWAYS	think about your co - flyers and the environment you are guest in.

This hobby calls for wide areas, fair and sportive thinking. Therefore, keep the airfield clean, don't leave any waste behind and be careful with natural resources. Batteries can easily be recycled. Ask your hobby store or waste handling companies for details. Don't throw worn batteries away. Always be careful with heat. Hot batteries or motors could cause serious damage.

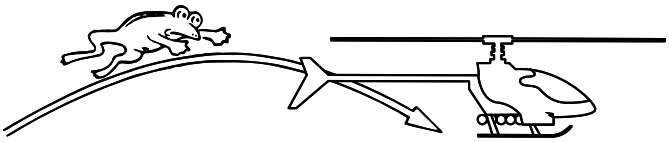
First flying

The full secret of flying helicopters is not only skill but practice. What normally causes a crash is the wrong command at the wrong time. Therefore, keep practicing. Fly as much as possible. Start with easy operations until you are familiar with the transmitter inputs and the helicopters reaction.

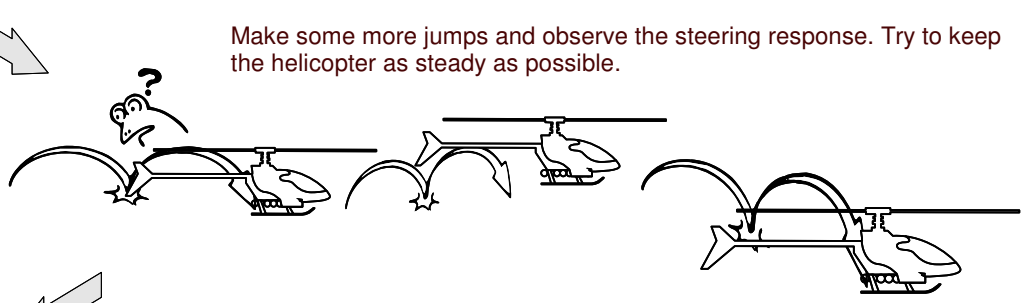
Keep in mind:

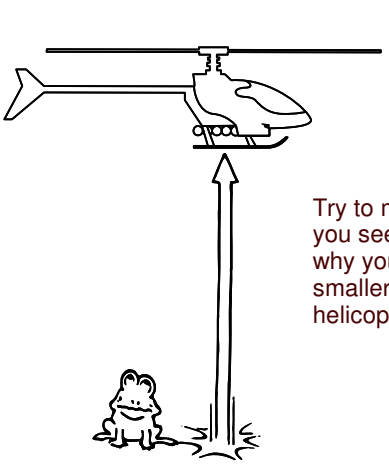
- Take your time, don't panic.
- A helicopter leaving you turns right if you steer right. A helicopter coming to you steers right as well but from your position it is left!
- Even the best pilot had to learn first.

Start the engine.
Increase the pitch.
Observe the tailrotor. If the helicopters starts turning to one direction compensate with the transmitter trimming.
Increase the pitch and make a small jump.
Observe the intention to roll to one direction. Compensate here

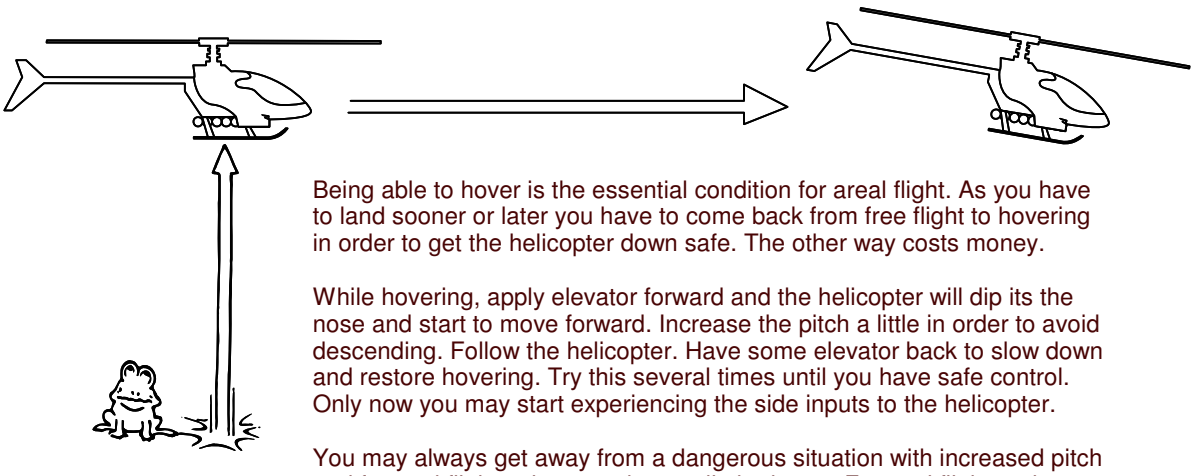


Make some more jumps and observe the steering response. Try to keep the helicopter as steady as possible.





Try to maintain altitude for some time. You now practice first hovering. If you see the helicopter starts to move in one direction just follow it (that's why you need a wide area). Compensate and try to keep the "used " area smaller every time you try. After some time you will be able to keep the helicopter in abt. 20 x 20 ft. That is fine for the beginning.



Being able to hover is the essential condition for areal flight. As you have to land sooner or later you have to come back from free flight to hovering in order to get the helicopter down safe. The other way costs money.

While hovering, apply elevator forward and the helicopter will dip its the nose and start to move forward. Increase the pitch a little in order to avoid descending. Follow the helicopter. Have some elevator back to slow down and restore hovering. Try this several times until you have safe control. Only now you may start experiencing the side inputs to the helicopter.

You may always get away from a dangerous situation with increased pitch and forward flight unless you have a limited area. Forward flight and

Transmission and batteries

Finding the correct gear ratio is a rather delicate subject and needs some experience and trials. Assuming that the motor has its best efficiency at a certain, specific speed, it must be your aim to operate the motor in this specific range. Here efficiency means best energy economics at best power output. In practice it is not very efficient to operate a motor at 50% speed with high energy consumption as it would perform better at 70% speed at even lower consumption.

Let us discuss the following example:

You have a motor with nominal 25,000 rpm . The efficient speed would be abt. 17,500 rpm being abt. 70%, depending on the motor's quality.

The target speed of the main rotor is abt. 1,300 rpm so we have to find the proper gear ratio.

Various pinions are available from your IKARUS dealer. Let us do some calculation:

17,500
---------- = 13.46
1,300

The 13 t pinion would offer the longer -, the 14 t pinion the shorter transmission. Select the shorter one in order to compensate possible deviations on the motor.

Another example. You have a very powerful motor that runs 12,000 rpm only, effective 9,500 rpm. To get the same mainrotor speed, a pinion of 24 t will do.

There are other factors that may influence your decision: If you go for hot aerobatics, 1,500 rpm mainrotor speed are interesting. To obtain 1,500 rpm with the 17,500 rpm motor the 15 t pinion should be the best.

It is never easy to estimate the efficient speed of your motor. Consider 70% of the nominal speed as a good value to start with and select a pinion in the range. If you have doubts, go for the smaller pinion.

Your experience ...	Help:
... that the motor does not run freely.	Try 2 tooth less on the pinion.
... that the motor runs free but the helicopter seems to be slow in response.	Try 1 teeth more on the pinion.
... that the motor and the battery are very hot after the flight.	2 tooth less on the pinion are possible.
... that the motor and the battery are rather cool after the	1 tooth more on the pinion is possible.

TOO MUCH HEAT IS A SIGN OF POOR ENERGY ECONOMICS. ENERGY TRANSFERRED TO HEAT WILL NOT BE TRANSFERRED TO FLIGHT TIME AND FLIGHT

The batteries

The battery is the second sensible source of energy economics. NiCad-batteries offer very good efficiency and performance data - if treated well. The fun with NiCad cells is that they allow high energy input while charging and very high output if required. In car racing these cells often have more than 100 A output.

To get a good performance you should have an eye on the charging. NiCad cells tend to remind certain states of discharging which may influence the capacity. The so called "Memory Effect" may damage your cell if not treated correctly. Let us have some first remarks here:

- Charge your batteries just before you intend to start.
- Discharge your batteries correctly after use.
- Use a suitable charger to improve the batteries lifetime and performance.

In detail: 12-20 cell packs are available in any hobby shop. If you have the choice use selected or matched types. Remove the shrink folio for better ventilation. Use silicon or

The most forgotten feature about NiCad cells is DISCHARGING. In order to avoid the Memory Effect and increase the lifetime of the battery pack it is highly recommended to discharge the battery completely after use.

Use a 30 Ohm/10-15 VA ceramic resistor, available from your hobby or electronic shop for 6 h on the complete pack or 5 Ohm/1 VA for 24 h on the single cell and discharge until both, the resistor and the battery are back to normal temperature. It may not be practical to discharge the packs after each use but you should do so at least after 3 charging periods. Watch the electric model car racers for their charging and discharging equipment. They usually have the best stuff.

Watch for the recommendation of the manufacturer. Avoid overcharging as poisonous gas may escape from the cells. Do not dump NiCad batteries, do not expose them to hot sunlight or throw them into fire. Never open the cells. Handle damaged cells with care and wear eyeprotectors and gloves. Damaged and worn cells can be recycled and should be treated properly.

Brushless motors

Motor type	Aeromaxx 15-4	Aeromaxx 15-5	Aeromaxx 30-3	Aeromaxx30-4
Order Number	70101	70102	70103	70104
No load speed per volt	1900	1530	1280	960
Nominal speed per volt	1500*	1200*	1000*	760*
Length without shaft	45	45	57	57
Diameter in millimetre	40	40	40	40
Shaft diameter in millimetre	5	5	5	5
Weight (in gramme)	180	180	280	280
Optimized for number of cells (helicopter)	8 bis 12	8 bis 12	12 bis 16	16 bis 20
Optimized for number of cells (airplane)	6 bis 8	8 bis 12	8 bis 12	10 bis 14
Recommended number of cells	7	10	10	12
Propellor for recommended cells	9 x 5	10 x 5	11 x 5	11 x 6

Pinions for brushless motors

Pinions in the helicopter ECO 8 und ECO 16

Motor type	cells	pinions
Aeromaxx 15-4	8	18
Aeromaxx 15-4	10	16
Aeromaxx 15-4	12	14
Aeromaxx 15-5	8	19
Aeromaxx 15-5	10	17
Aeromaxx 15-5	12	16
Aeromaxx 30-3	12	16
Aeromaxx 30-3	16	14
Aeromaxx 30-4	16	15
Aeromaxx 30-4	20	13

Pinions for brush motors

Pinions in the helicopter ECO 8

Motor type	cells	pinions	flight time	reaction
Performance	8	12	10	good-natured
Perfomance	8	11	11	good-natured
Performance	10	10	13	acrobatic flying
Performance	10	11	12	acrobatic
flyingPerformance		12	10	14 acrobatic
flying				
Sport	6	17	8	good-natured
Sport	7	13	9	lively
Sport	7	14	8	agile
Sport	8	10	10	agile
Power	7-8	12		
Power	8-10	10		
pinion in ECOlite				
Sport	6	17	5	good-natured
Sport	7	16	6	lively
Sport	7	15	7	lively
Sport	8	14	7	agile