robbe

Assembly and operating instructions
Notice de montage et de pilotage
Istruzioni di montaggio e d'uso
Instrucciones de montaje y manejo

Spirit L-16

No. S 3555

Specification

Main rotor diameter:	approx. 1200 mm
Tail rotor diameter:	approx. 255 mm
Length:	approx. 1170 mm
Height:	approx. 345 mm
Weight:	min. 2700 g

Introduction

The Spirit L-16 model helicopter you have purchased is a member of the robbe-Schlueter family of helicopter products.
The model is designed as a helicopter trainer, and can be assembled ready to fly in just a few hours.

Please follow the instructions in this section when assembling your Spirit L - 16.

The drawings corresponding to the numbered stages of construction can be found in the German instructions.

The tools and accessories required to complete the model are listed on the separate accessory sheet.

Notes on the radio control system:

All the pushrod lengths and servo output arm lengths assume the use of robbe / Futaba servos.
If you wish to use other makes of servo you may need to make allowance by adjusting the stated dimensions slightly.

The building instructions are grouped according to the helicopter's sub-assemblies, and are divided into Stages which follow on logically one to the next. Each sub-assembly is numbered, and corresponds to the bag of the same number in the kit.

An assembly drawing is included for each stage, showing how the parts fit together. Each drawing also includes a full-size key to the screws, washers and shim washers required for that stage, to help you identify these parts.

Each stage includes supplementary notes and tips which should be read carefully while you are assembling the model.

Replacement parts

It is vitally important that you use only genuine replacement parts when required. The Order Numbers are printed adjacent to each component illustrated in these building instructions.

Please store these building instructions in a safe place so that you can refer to them later when maintaining or repairing your model. The red Quality Control sheet and any other supplementary sheets in the kit should also be kept safely.

Please state the original Order No. when specifying replacement parts, as this avoids problems and delays in obtaining spares.

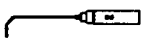
If you need to make a complaint or a claim under guarantee, it is essential to state the Control Number and include proof of purchase.

Replacement screws

The kit includes a replacement screw pack which you can use to replace any defective or lost items.

Notes on construction:

You will find three different symbols occurring repeatedly throughout these instructions:



1: Oil can
- Use synthetic oil (robbe No. 5531) at this location when the parts are assembled.

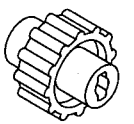
2: Grease gun
- Use grease (robbe No. 5532) at this locati on when the parts are assembled.

3: Loctite
- Use medium-strength thread-lock fluid (robbe No. 5074) at this location when the parts are assembled.

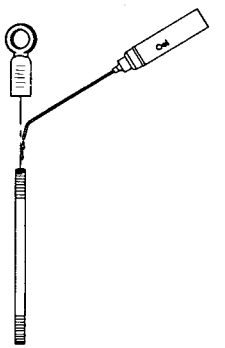
Before applying thread-lock fluid to threaded parts and screws, the surfaces must be de-greased.

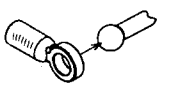
Tip: Loctite should always be applied very sparingly, otherwise excess fluid may penetrate ballraces or plain bearings and jam them. If in doubt, apply the fluid to the inside of the threaded hole.

Note: oil ball-links lightly before screwing them onto the pushrod. We recommend the use of our ball-link tool, No. S 5151.
When pressing ball-links onto linkage balls note that they have a "right way round": the embossed "Schlueter" name should be on the outside, as shown in the drawing.



S5151





How a model helicopter works:

A powered aircraft with a fixed wing and tail requires the thrust of the propeller to get it flying. The forward motion of the wing through the air produces lift; the model leaves the ground and flies.

In contrast, a helicopter requires no forward motion. The wing takes the form of an oversized propeller which rotates in the horizontal plane above the fuselage. That is why helicopters are also known as rotary-wing aircraft.

How lift is generated by the main rotor:

As with a fixed wing, the rotor blades feature an airfoil section and are set at a particular angle (pitch angle) relative to the airflow. The rotor generates lift when it rotates and passes through the air. As the rotational speed and pitch angle of the rotor blades rise, there comes a point where the lift, acting in the vertical direction, is greater than gravity. The helicopter then leaves the ground and climbs vertically.
If the lift generated by the rotor is the same as the helicopter's weight, the machine remains motionless in the air, i.e. it hovers. If the rotor's lift is reduced, the machine descends.

Torque compensation:

The power from the engine which is transmitted to the rotor head takes the form of a turning force, known as torque. The fuselage reacts to this force by tending to rotate in the opposite direction to the main rotor.

This yawing motion of the fuselage is unwanted, and must be eliminated. The compensation task is carried out by a small rotor mounted at the tail end of the fuselage. Like the main rotor, the blades of the tail rotor are profiled and set at a particular pitch angle, and therefore produce a lateral force. If the lateral force is equal to the torque reaction, it cancels out the helicopter's yawing tendency.

Controlling a model helicopter

The most important feature which differentiates a helicopter from a fixed-wing aircraft is that its power element - the main rotor - is also the essential control element.

The helicopter is controlled by varying the settings of both the main rotor and the tail rotor. The main rotor head includes what is known as an auxiliary rotor (flybar and paddles) which transfers the control movements to the main rotor itself.

The swashplate is a sub-assembly mounted on the main rotor shaft, or mast. It is capable of moving in all directions, and its purpose is to transfer mechanical control movements from the servos to the main rotor. The swashplate is actuated by the collective pitch, roll-axis and pitch-axis servos.

How the swashplate works:

Helicopters are capable of flying forward, backward and to both sides, and these movements are controlled by tilting the main rotor in the desired direction.
These movements are generated by varying the pitch angle of the rotor blades according to their momentary position in each cycle
= cyclic pitch control

To produce vertical movement in either direction the pitch angle of the rotor blades is varied simultaneously
= collective pitch control

Four primary functions have to be controlled:

- **Climb and descent: "collective pitch, throttle"**

  The pitch angle of both (all) blades is altered, and at the same time the throttle setting is changed to deliver the appropriate level of power to the rotor.

- **Roll: "roll-axis"**

  (movement around the longitudinal axis)
  The main rotor plane is tilted to right or left as required.

- **Pitch: "pitch-axis or forward / back cyclic"**

  (movement around the lateral axis)
  The main rotor plane is tilted forward or back as required.

- **Yaw: "tail rotor"**

  (movement around the vertical axis)
  The pitch of the tail rotor blades is altered as required.

Stage 1

1.1 Assembling the rotor shaft bracket, freewheel hub and main rotor shaft

- Fix the pre-assembled rotor shaft bracket S5247 to the chassis S5245 using the screws S4141 and washers S0001.
- Fix the pre-assembled freewheel hub S5248 to the 75-tooth gear S5237 using the washers S0001 and screws S4141.
- Slide the rotor shaft S5251 through the rotor shaft bracket from above, as far as the top edge of the chassis.
- Fit the crown gear S5236 in the chassis together with the shim washer S1585, and slide the rotor shaft down slightly through it.
- Install the gear S5237 with the freewheel and the shim washers S1585.
- Slide the rotor shaft down as far as the bottom edge.
- Rotate the rotor shaft so that the holes in the crown gear and the shaft line up. Fit the screw S0101 and washer S0009 to secure the crown gear.
- Press the swashplate guide S5290 into the upper servo mount S5286 and secure it with the screw S0014 and washer S0000.
- Fit the lower servo mount S5285 and the upper servo mount S5286 over the rotor shaft bracket.
- Fit the screws S0116 and washers S4366 and nuts S0009 to secure the servo mounts, but do not tighten them at this stage.
- Adjust the annular clamp S4286, shim washer S1585 and screw S0039 so that there is no axial play in the main rotor shaft.

1.2 Assembling the main gearbox

Tip: Loctite should always be applied very sparingly, otherwise excess fluid may penetrate ballraces or plain bearings and jam them. If in doubt, apply the fluid to the inside of the threaded hole.

- Press the 20-tooth pinion S5239 into the 60-tooth gear S5238, and place this assembly between the flanged bearings together with the spacer ring S5324.
- Fit the gearbox shaft S5256 through the flanged bearings and the gear assembly; the end with the machined flat must face down.

- Fix the 20-tooth pinion to the gearbox shaft using the grubscrew S0041. Ensure that the screw engages squarely on the machined flat.

- Press the ballraces S4303 into the bearing bracket S5253.
- Slide the coupling sleeve S5255 through the ballraces.

- Push the 14-tooth bevel gear S5235 onto the coupling sleeve as far as it will go, and secure it by tightening a grubscrew S0041 on the machined flat in the shaft.
- Install the tail rotor drive assembly in the chassis, and secure it with the washers S4366 and screws S0116. At the same time adjust the position of the bearing bracket in the slots so that the gears mesh correctly; they must rotate smoothly but without slop.

- Grease the complete gearbox.

Stage 2

2 Installing the electric motor

- Please read the instructions supplied with the electric motor before carrying out this stage.

- **Notes:** if you wish to use a motor other than the recommended unit, please note that alternative pinions with 12 to 20 teeth are available.

- **When selecting the retaining screws for the electric motor check that they do not exceed the permissible screw depth in the motor housing. The screws supplied are suitable for the recommended Kontronik motor.**

- Fix the motor mount S5322 to the motor using the screws S0030.
- Place this assembly in position and fix it to the chassis using the screws S0030 and washers S0001; do not tighten the screws at this stage.

- Fit the 16-tooth pinion S5252 on the shaft of the electric motor and tighten the grubscrew S0077 to secure it; ensure that the gears engage over their full width.

- Adjust the position of the electric motor to set the minimum possible meshing clearance between the gears.
- Tighten the screws which retain the electric motor.

Stage 3

3.1 Installing the front chassis structure and tail boom socket

- Place the front chassis structure in the chassis.

- Slide the tail boom socket S5262 and the clamping piece S5263 into the chassis as far as they will go, and tighten the retaining screws lightly.

- Fix this assembly to the chassis using the screws S0035, washers S0001 and self-locking nuts S0012.

3.2 Installing the battery supports

- The flight batteries can either be attached to the sides of the chassis or underneath it - see also pages 29 - 32. The remainder of these instructions show the side-mounted batteries.

- Fit the screws S0080, washers S0000 and nuts S0010 loosely on the battery supports.
- If you are side-mounting the batteries, attach the battery supports S5266 to the chassis using the screw S3074 and nut S0012 - view A.

- If you prefer to attach the batteries to the underside of the chassis, fix the front chassis structure to the chassis using the screws S0035, washers S0001 and self-locking nuts S0012 - view B.

Stage 4

4 Installing the skid landing gear

- Slide the nut S0012 into the channel in the front structure S5264.

- Screw the front spacer bracket S5270 and the rear spacer bracket S5269 to the chassis. Fit the screw S3074 and nut S0012.

- Fix the skid bars S5243 to the brackets using the screws and self-locking nuts shown.

- Slide the skids S5273 through the skid bars. Adjust the position of the skids so that their screw-holes are visible through the holes in the skid bars.

- Fit the screws S0046 to prevent the skids rotating.

- Glue the end-plugs S5268 in the skid ends.

- Allow the speed controller support plate S5265 to snap into the front chassis structure S5264.

Stage 5

5 Installing the swashplate guide and servos

- Set the three swashplate servos to centre from the transmitter.

- Most makes of servo are fitted with a splined output shaft. By rotating the servo output device in increments of approximately 90° you will be able to find a position which gives an exact right-angle relative to the servo case sides.

- Cut down the servo output devices as shown in the drawing.

- Screw the output arms on the servos.

- Fix the servos to the servo mounts using the fixings supplied with them. At the same time align the servo mounts and tighten the clamping screws fully.
- Screw the ball-links S0058 and clevises S0059 on the pushrods S0528, and set the 32 mm dimension as shown.

- Fit the swashplate onto the main rotor shaft and engage the driver pin in the swashplate guide.

- Press the ball-links onto the linkage balls on the swashplate.

- Connect the clevises to the servo output arms using the holes which give a lever length of 13.5 mm.

Stage 6

6.1 Assembling the collective pitch compensator

- Press the ballraces S5048 into the compensator levers S5319.

- Attach the 45° links S5292 to the levers using the pins S4269.
- Fix these assembles to the compensator hub S5291 using the screws S0080.

6.2 Installing the collective pitch compensator

- Slide the collective pitch compensator onto the main rotor shaft and press the 45° links onto the swashplate balls.

Stage 7

7.1 Assembling the main rotor head hub

- Press the ballraces S5044 into the main rotor head hub S5299.

- Slide the transverse shaft S5302 through the hub and tighten the retaining screws.

- Press the guide pins S3499 into the main rotor head hub as far as they will go.

7.2 Assembling the main rotor head

- Slip the blade pivot shaft S5301 through the hub S5299 and fit the remaining parts on each end as shown in the drawing.

- A second shim washer S02691 can be fitted if you prefer harder damping.

- **Note:** it is essential to fit the thrust bearings S5305 the right way round: the 6 mm I.D. washer should face the blade holder S5300.

7.3 Installing the mixer levers

- Attach the mixer levers S5315 to the blade holders using the screws S0031, washers S0001 and sleeves S4022. Tighten the screws just to the point where the mixer levers swivel freely, but without slop.

Stage 8

8.1 Installing the control ring and flybar

- Press the guide sleeves S4251 into both sides of the control ring S5294. Check that the holes for the screws S0041 line up correctly.

- Fit the control ring on the rotor head. At the same time grease the flybar S5282 lightly and slide it through the guide sleeves and the transverse shaft.

- Set the flybar exactly central and fit the grubscrews S0041; they should pass through the control ring and into the guide sleeves.
- Press the double-ended ball-links S5296 onto the linkage balls on the guide sleeves.

- Screw the inertia weights S5367 into the flybar paddles S5303 as far as they will go.

- Fix the inertia weights in the flybar channels using the grubscrews S0041. Check that the paddles are exactly parallel to each other and to the control ring S5294 before tightening the screws.

8.2 Installing the rotor head pushrods

- Fit the threaded rods S3409 into the forked pushrods S5293, and screw the ball-links S0058 on the threaded rods. Set the overall length as stated.

- Fit the forked pushrods over the flybar from the underside, and fix them to the mixer levers using the screws S4473 and self-locking nuts S0090.

- Press the double-ended ball-links S5296 onto the mixer levers.

- Make up the control pushrods from the ball-links S0058 and threaded rods S3409, and set them to the stated length. The ball-links must be offset at 90° to each other.

- Press the ball-links onto the inner linkage balls on the control ring.

8.3 Installing the main rotor head

- Fit the completed rotor head onto the main rotor shaft, engaging the guide pins in the hub of the collective pitch compensator.

- Connect the forked pushrods to the swashplate, and the control pushrods to the collective pitch compensator.
- Line up the holes in the main rotor head hub and the main rotor shaft. Fix the rotor head to the shaft using the screw S0069, washer S0001 and self-locking nut S0012.

Stage 9

9.1 Assembling the tail rotor gearbox

Tip: Loctite should always be applied very sparingly, otherwise excess fluid may penetrate ballraces or plain bearings and jam them. If in doubt, apply the fluid to the inside of the threaded hole.

- Press the inner ballrace S4303 into the front section of the tail rotor gearbox housing S5311.
- Fit the second ballrace S4303 and the sleeve S5325 onto the shaft of the coupling sleeve S5255.

- Press this assembly into the front section of the gearbox housing S5311.

- Fit one shim washer S4363.

- Fit the grubscrew S0041 into the bevel gear S0319 and slip it onto the shaft. Ensure that the grubscrew engages over the machined flat in the shaft. Press the bevel gear against its stop, and tighten the grubscrew through the hole in the gearbox housing using a 1.5 mm A/F allen key.

- Fit the grubscrews S0041 in the second bevel gear S0319 and the collet S0261.

- Install the shaft S4628, the ballraces S4303, the bevel gear S0319 and the collet S0261 (11 mm Ø). Press the collet against the outer ballrace as you tighten the screws in order to eliminate any axial play.
- Grease the gearbox and fit the gearbox housing cover S5312.

- The gearbox must rotate smoothly and freely, but without lost motion. You can adjust the gear meshing clearance if necessary by adding or removing the shim washers S4364.

9.2 Assembling the control bridge and actuating lever

- Attach the ball-links S3095 to the control bridge S4733, and slip this assembly onto the tail rotor shaft.

- Install the actuating lever S5313 as shown, pressing the ball-socket attached to the lever onto the linkage ball on the control bridge.

9.3 Assembling the tail rotor hub

- Slide the tail rotor hub S2693 onto the tail rotor shaft, set it flush on the outside, and tighten the grubscrew S0077 over the machined flat to secure it.
- Fit the remaining parts on the tail rotor hub as shown.
- Fit the tail rotor blade holders S4235 on the hub, and ensure that the threads of the retaining ring S4237 line up with the holes in the blade holders.
- Secure the blade holders using the countersunk screws S4293.
- Fit both tail rotor blades S5314 on the tail rotor balance shaft S1346 (not included in the kit) so that they can be balanced accurately.
- Support the rotor blades in the centre as shown in the sketch.
- The lighter blade will rise; apply adhesive tape to it until the rotor blades balance level.
- Fix the tail rotor blades S5314 to the tail rotor blade holders using the screws S4198 and nuts S0012; tighten the screws to the point where the blades can still just swivel freely.
- Connect the linkage balls on the blade holders to the ball-links.

Stage 10

10 Assembling the tail rotor drive shaft

- Fit the pins S0197 in the couplings (slider) S4739, set them central and tighten the grubscrews S0041 to secure them.
- Slide the coupling onto the drive shaft S5279 as far as it will go, and tighten the grubscrew S0077 over the machined flat to secure it.
- Slide the shaft through the bearings in the tail boom S5275.
- Fit the second coupling, pushing it in as far as it will go.

Stage 11

11.1 Installing the pushrod guide system and the tail rotor servo mount

- Assemble the pushrod guides from parts S5335, S5336, S0080, S0090 and S0000, and fit it on the tail boom.
- Slide the tail rotor servo mount S5337 onto the tail boom and fit the screw S0116, the washer S4366 and the self-locking nut S0009; do not tighten the screw at this stage.

11.2 Installing the tail boom and stabilisers

- Push the tail rotor gearbox into the tail boom as far as it will go. **Caution:** the slot at the front end of the tail boom must be on the left-hand side.
- Fix the vertical stabiliser S5332 to the tail boom together with the vertical stabiliser clamps S5334. Fix the tail rotor gearbox to the tail boom using the screws S0038, the washers S0001 and the nuts S0012.
- Fix the horizontal stabiliser S5329 to the tail boom using the screws S5340, the washers S4366, the clamps S5330 and 5331 and the self-locking nuts S0009. Do not tighten the screws at this stage.

11.3 Installing the tail boom

- Engage the drive shaft in the tail rotor gearbox by hand.
- Slide the prepared tail boom into the tail boom socket as far as it will go, taking care to engage the front coupling in the coupling sleeve in the chassis as you do so.
- Tighten the screws S5340 to clamp the tail boom in place.
- Fit the clamping screw S3370 and the nut S0009.
- Fix the tail boom braces S5280 to the upper servo mount using the bolts S5297.
- Adjust the position of the horizontal stabiliser so that the tail boom braces can be screwed to the upper horizontal stabiliser clamp S5330.
- Set the horizontal stabiliser parallel to the top surface of the chassis and tighten the retaining screws.

11.4 Installing the tail rotor servo and the tail rotor pushrod

- Attach the tail rotor servo to the tail boom socket and the tail rotor servo mount S5337 using the fixings supplied with the servo.
- Screw the tail rotor servo mount to the tail boom.
- Set the tail rotor servo to centre from the transmitter.
- Cut down the servo output device as shown in the sketch and screw it to the servo.
- Screw a clevis S0059 onto the tail rotor pushrod to a depth of about 7 mm.
- Slip the pushrod through the pushrod guides S5336 from the rear, and connect it to the tail rotor actuating lever.
- Screw a clevis on the front end of the tail rotor pushrod and set the pushrod to the stated length.
- Connect the clevis to the tail rotor servo output arm using a 13.5 mm lever length.
- Rotate the pushrod guides so that the pushrod runs in a perfectly straight line. Tighten the clamping screws.

Stage 12

12 Battery holder - side battery location

- Attach the front structure extensions S5306 and holders S5316 to the front structure.
- Screw the stand-off pillars S5339 in place as shown.
- Slide the aluminium tubes S5283 into the battery supports S5266, installing the battery locating pieces S5267 at the same time.
- Align the tubes S5283 and clamp them to the battery support.
- Secure the battery slide using the screws S0080, positioned to suit the batteries you are using.

Stage 13

13.1 Installing the receiving system

- Stick the receiver and gyro to the rear platform using the double-sided foam tape S5142.

- Fix the speed controller to the controller mounting plate using the double-sided foam tape S5142.

- **Before connecting and setting up the speed controller please read the instructions supplied with the unit.**

- Install the receiver aerial as shown in the sketch.

13.2 Installing the flight batteries

- Apply strips of Velcro tape S5132 to the battery locating pieces and the batteries.

- Press the batteries in position and secure them with the O-rings S5254.

Stage 14

14 Trimming and fitting the cabin

- Trim the rear edge of the cabin as shown.

- Drill 7.5 mm Ø holes at the points in the cabin marked with an "X".

- Mask out the glazed area of the cabin before painting the outside surfaces.

- Lightly sand the areas to be painted; sand the edges of the cabin smooth.

- When the paint has hardened fully cut out the decals and apply them to the model. The intended decal arrangement is shown in the picture on the title page of these instructions.

- Press the rubber grommets S4199 into the 7.5 mm Ø holes in the cabin, and press the cabin onto the cabin holders S5297.
- The cabin is attached at the front using the plastic screws S3078.

Stage 15

15.1 Battery holder: bottom battery mounting

- Slide the aluminium tubes S5283 into the front spacer bracket S5270.

- Install the rear battery locating pieces and one front battery locating piece S5267. Align the parts carefully. Screw the front locating piece to the front structure.

- Install the second front battery locating piece.

- Apply the double-sided foam tape 5014.

- Fix the batteries using the hook-and-loop tape S5132 and the rubber bands 9107.

15.2 Trimming the cabin

- Prepare the cabin as described in Stage 14.

- Trim the underside of the cabin to clear the battery packs.

Stage 16

16 Connecting the batteries

- Fit a matching plug system 4048 to the speed controller battery lead.

- The batteries are wired in series using the bridging connector 4069.

- Take great care to maintain correct polarity at all times when making up the wiring. Connecting the speed controller with reversed polarity will instantly ruin it.

Stage 17

17.1 Balancing the rotor blades

- Fit a single screw S0054 through the pivot holes of both main rotor blades S5234 and tighten a nut S0015 on the other end to hold them together.

- Support the assembled rotors in the exact centre.

- The lighter blade will now rise; apply coloured tape to the lighter tip until the blades balance exactly level.

17.2 Installing the main rotor blades

- Fix the rotor blades to the blade holders S5300 using the screws S0054 and self-locking nuts S0015.

- Tighten the screws S0054 just to the point where the rotor blades are still free to swivel in the blade holders.

- When transporting the model please note: swing both main rotor blades back and set them parallel to each other - don't allow them to overlap.

The Centre of Gravity

- The model's Centre of Gravity (CG) should be located at the front edge of the main rotor shaft. Adjust the position of the flight packs until the model balances correctly.

Setting up the radio control system

Basic requirement:

You need a radio control system designed for helicopter use. Connect the servos to the receiver in the sequence described in the operating instructions.

Procedure:

- Switch on the transmitter
- Select a vacant model memory
- Program the model memory to the "Heli" mixer type
- Set the swashplate mode to "HR 3"
- Activate the tail rotor mixer (Revo-Mix) if required by the gyro you are using
- Program the system for a right-hand rotation main rotor
- Set all transmitter sticks and trims to centre
- Do not activate any trim memories or freely programmable mixers
- Program throttle trim to idle trim (ATL - throttle trim active only at idle end of range)
- Switch on the receiving system (connect flight batteries to speed controller).

Setting up the servos for collective pitch

- Check the travel and direction of rotation of the swashplate servos.

- Move the collective pitch stick in the direction of collective pitch maximum: all three servos mounted below the swashplate should now move in the same direction and through the same distance, thereby raising the swashplate evenly, without tilting it at all.

Setting up the servos for roll and pitch-axis movements

- **Note:** with the HR3 actuation system the tilt of the swashplate corresponds to the direction of movement of the helicopter in the air.

- Check the direction of servo rotation.
- Apply a roll command to the right: the swashplate should tilt to the right as seen from the tail of the model.
- Use the servo reverse facility on your transmitter if any of the servos moves in the wrong direction.

- Apply a forward pitch (forward cyclic) command: the swashplate should tilt forward.
- Use the servo reverse facility on your transmitter if any of the servos moves in the wrong direction.

Setting up the tail rotor servo

Note:
Fold the tail rotor blades inward. When you move the tail rotor stick to the right, the top tail rotor blade should move to the right (towards the tail boom).
- Reverse the tail rotor servo if necessary.

Checking the direction of gyro effect

Kreiselwirkrichtungskontrolle = Checking direction of gyro effect

Set the gyro to maximum gain.
Swing the tail boom briskly to the right (i.e. the helicopter's nose moves to the left).

With the tail rotor blades folded inward, the tip of the top blade should move away from the tail boom ("Re").

Reverse the direction of gyro effect if necessary. If your gyro is a simple type without a reversing switch (e.g. G 200), invert the gyro element.

Final checks
When all the servos are at neutral, the output arms of all the servos should be horizontal.

At this setting the pitch angle of the main rotor blades should be +6°.

	Standard adj.	**3 D adj.**
Hovering:	approx. + 6°	approx. + 0°
Max. collective pitch:	approx. + 10°	approx. + 12°
Min. collective pitch:	approx. - 4°	approx. - 11°

Adjusting blade tracking

Einstellen Blattspurlauf = Adjusting blade tracking

When you first operate the model you will need to check and adjust the tracking of the main rotor blades.

Carefully open the throttle until the blades are spinning, and check the blade tracking from the side.

If the blades revolve at different heights when the rotor is at hover speed, you need either to increase the pitch angle of the lower blade B, or reduce the pitch angle of the higher blade A.

This adjustment is made by disconnecting the ball-link from the mixer lever to the swashplate, and adjusting it by 1 or 2 turns in the appropriate direction.

Maximum rotational speed of the main rotor head fitted with CFRP rotor blades: 1800 rpm.

General information on programming the radio control system

The settings described in the following section assume the use of the FX 18 radio control system, and the other recommended components (see separate Accessory Sheet)
If a model helicopter is to work efficiently it is essential that the basic mechanical adjustments are carried out accurately.

In the interests of safety remove the main and tail rotor blades before programming the speed controller and throttle system.

The next stage is to fine-tune the system programming; for this the following requirements must be fulfilled:
- The speed controller must be set up as described in the operating instructions.
- **Caution: if your speed controller offers a soft-start facity please be sure to activate it, as this prevents the main rotor blades folding together.**

- In the swashplate mixer menu (SWASH) the values for ROLL and PITCH-AXIS must be set to approx. 60-70%.

The first adjustment is the hover point.

The aim is that the helicopter should hover at the centre point of the collective pitch stick, corresponding to a main rotor blade pitch angle of +6°.

- Adjust the percentage values for swashplate mixer travel to obtain a range of collective pitch angles from -4° to +10°.

Diagram 1

Gas und Pitchkurve normal = Normal throttle and collective pitch curve
Gas = Throttle
Pitch = Collective pitch
Steuerknüppelweg = Stick travel
Servoweg = Servo travel

Setting the throttle and collective pitch curve for Idle Up 1 (GV-1)

If you have a 6-channel receiver it is possible to assign a fixed value to throttle in the throttle / collective pitch curve, as shown in the diagram above.

With a 7-channel (or more) receiver the speed controller can be assigned to a separate slider channel. For more details please read the instructions supplied with the speed controller.

Maximum rotational speed of the main rotor head fitted with CFRP rotor blades: 1800 rpm.

Tail rotor compensation (REVO)

Tail rotor compensation only needs to be activated if you are using a gyro which requires this.

The aim is to eliminate any tendency for the helicopter to yaw (swing to either side) when the model climbs or descends. This unwanted rotation is caused by variations in the torque generated by the rotor blades.

The basic requirement:

The helicopter must first be trimmed for a neutral hover, i.e. when hovering, the model should have no tendency to yaw.

Standard REVO value: 25%.
With the model at a steady hover, increase collective pitch briskly.

If the model yaws in the opposite direction to the direction of main rotor rotation, the value for tail rotor compensation (REVO) must be increased.

If the model yaws in the same direction as the direction of main rotor rotation, the value for tail rotor compensation (REVO) must be reduced.

Important:

After flying the model helicopter for the first time please take the trouble to check that all screwed joints are still tight; this applies in particular to the power train components and the rotor system.
All the following areas of the helicopter should be re-greased or oiled at intervals of two or three hours:
Main rotor shaft in the swashplate area,
Tail rotor shaft in the area of the tail rotor slider,
Main gearbox, tail rotor gearbox.

And one final tip

On no account attempt to fly your new model helicopter without enlisting the help of a good, experienced helicopter pilot. Many apparently difficult problems sort themselves out virtually by themselves if you can fall back on the experience of a competent helicopter pilot.

robbe Modellsport GmbH & Co. KG

We reserve the right to alter technical specifications

ORDER NO.	DESCRIPTION	QUANTITY SUPPLIED
S0000	WASHER, 2.2 / 5 X 0.3	20
S0001	WASHER, 3.2 / 7 X 0.5	20
S0002	WASHER, 4.3 / 9 X 0.8	20
S0009	SELF-LOCKING NUT, M2.5	10
S0010	HEXAGON NUT, M2	20
S0012	SELF-LOCKING NUT, M3	10
S0013	HEXAGON NUT, M4	10
S0015	SELF-LOCKING NUT, M4	5
S0029	MACHINE SCREW, M2 X 8	10
S0030	SOCKET-HEAD CAP SCREW, M3 X 8	2
S0031	SOCKET-HEAD CAP SCREW, M3 X 16	10
S0034	SOCKET-HEAD CAP SCREW, M4 X 16	2
S0035	SOCKET-HEAD CAP SCREW, M3 X 35	4
S0036	SOCKET-HEAD CAP SCREW, M3 X 20	4
S0037	SOCKET-HEAD CAP SCREW, M3 X 25	4
S0038	SOCKET-HEAD CAP SCREW, M3 X 30	4
S0039	SOCKET-HEAD CAP SCREW, M3 X 10	4
S0041	SOCKET-HEAD GRUBSCREW, M3 X 3	10
S0046	SOCKET-HEAD GRUBSCREW, M3 X 5	10
S0054	SOCKET-HEAD CAP SCREW, M4 X 24	4
S0058	BALL-LINK, EXCL. BALL	2
S0059	PLASTIC CLEVIS, M2	2
S0066	WASHER, 4.3 / 12 X 1	10
S0069	SOCKET-HEAD CAP SCREW, M3 X 17	4
S0071	SOCKET-HEAD COUNTERSUNK SCREW, M3 X 12	4
S0074	SOCKET-HEAD CAP SCREW, M2 X 14	2
S0077	GRUBSCREW, M4 X 5	2
S0080	SOCKET-HEAD CAP SCREW, M2 X 10	2
S0083	SOCKET-HEAD CAP SCREW, M4 X 12	2
S0090	SELF-LOCKING NUT, M2	5
S0101	SOCKET-HEAD CAP SCREW, M2.5 X 16	4
S0116	SOCKET-HEAD SCREW, M2.5 X 10	4
S0197	NEEDLE ROLLER, 2 X 11.8	1
S0212	BALLRACE, 8 X 16 X 5, ZZ	1
S0213	BALLRACE, 8 X 14 X 4	1
S0261	COLLET, 5 / 11 Ø X 5, M3	1
S0319	TAIL ROTOR GEAR, 20-TOOTH	1
S0528	PUSHROD, M2 X 8 / M2 X 8 X 44	1
S1585	SHIM WASHER, 8 X 13 X 0.5	2
S2693	TAIL ROTOR HUB	1
S3074	SOCKET-HEAD CAP SCREW, M3 X 60	1
S3078	PLASTIC SCREW, M4 X 10	10
S3095	BALL-LINK	2
S3198	SOCKET-HEAD CAP SCREW, M3 X 14	4
S3409	GRUBSCREW, M2 X 15	2
S3499	DOWEL PIN, 2 X 36	2

ORDER NO.	DESCRIPTION	QUANTITY SUPPLIED
S4022	SLEEVE, 4.8 X 3 X 9.7, BRASS	2
S4524	SHIM WASHER, 3 X 6 X 0.5	2
S4132	BALLRACE, 6 X 13 X 5, ZZ	1
S4141	SOCKET-HEAD CAP SCREW, M3 X 6	4
S4199	RUBBER GROMMET, 4 X 11	2
S4235	TAIL ROTOR BLADE HOLDER	2
S4237	RETAINING RING, 4.5 / 9 Ø X 4	2
S4251	GUIDE SLEEVE / BALL	1
S4269	NEEDLE ROLLER, 2 X 9.8	2
S4286	ANNULAR CLAMP, 8 / 18 Ø X7, ALUMINIUM	1
S4293	COUNTERSUNK SCREW, M2.5 X 4	4
S4303	BALLRACE, 5 X 13 X 4, ZZ	1
S4354	SOCKET-HEAD CAP SCREW, M2.5 X 6	6
S4364	SHIM WASHER 5X10X0.1	10
S4365	BALLRACE, 4 X 9 X 4, ZZ	1
S4366	WASHER, 2.7 X 6.5	20
S4473	FLAT-HEAD SCREW, M2 X 12	2
S4628	TAIL ROTOR SHAFT, RIGID	1
S4733	CONTROL BRIDGE, VARIABLE	1
S4739	SLIDER, 2.5 Ø X 5 X 22	1
S4816	WASHER, 6 Ø X 1, BRASS	1
S5044	BALLRACE, 3 X 8 X 4, ZZ	1
S5048	BALLRACE, 2 X 6 X 3, ZZ	1
S5132	VELCRO TAPE	1
S5142	DOUBLE-SIDED FOAM TAPE, 1.6 X 19 X 40	1
S5234	TWO-BLADE CFRP ROTOR BLADE SET	1
S5235	BEVEL GEAR, 14-TOOTH, M1	1
S5236	CROWN GEAR, 60-TOOTH, M1	1
S5237	GEAR, 75-TOOTH, M1	1
S5238	GEAR, 60 / 20-TOOTH, M1	1
S5239	PINION, 20-TOOTH, M1	1
S5240	BUILDING INSTRUCTIONS, SPIRIT L-16	1
S5241	DECAL SHEET, SPIRIT L-16	1
S5242	SPIRIT L-16 CABIN	1
S5243	PLASTIC SKID BAR, SPIRIT L-16	1
S5245	CHASSIS, SPIRIT L-16	1
S5246	BALLRACE, 4 X 12 X 4	1
S5247	ROTOR SHAFT BRACKET	1
S5248	FREEWHEEL HUB, SPIRIT L-16	1
S5250	BALLRACE, 8 X 16 X 5	1
S5251	MAIN ROTOR SHAFT, SPIRIT L-16	1
S5252	PINION, 16-TOOTH, M1	1
S5254	O-RING, I.D. 46 X 3	4
S5253	DRIVE SHAFT BEARING BRACKET, SPIRIT L-16	1
S5255	COUPLING SLEEVE, SPIRIT L-16	1
S5256	GEARBOX SHAFT, 4 Ø X 42	1
S5262	TAIL BOOM SOCKET	1
S5263	TAIL BOOM CLAMPING PIECE	1
S5264	FRONT CHASSIS STRUCTURE	1
S5265	SPEED CONTROLLER MOUNTING PLATE	1
S5266	BATTERY SUPPORT	1
S5267	BATTERY LOCATING PIECE	1
S5268	SKID END-PLUG	2
S5269	REAR SPACER BRACKET	1
S5270	FRONT SPACER BRACKET	1
S5273	SKID TUBE, 8 Ø X 347, ALUMINIUM	1
S5275	TAIL BOOM, 20 / 19 Ø X 670, ALUM., ASSEMBLED	1
S5279	DRIVE SHAFT, 2.5 Ø X 670	1
S5280	TAIL BOOM BRACE	1
S5281	PUSHROD, 1.8 Ø X M2 X 8 X 608	1
S5282	FLYBAR, 3 Ø X 350	1
S5283	ALUMINIUM TUBE, F54, 6 / 5 Ø X 210	1
S5285	LOWER SERVO MOUNT	1
S5286	UPPER SERVO MOUNT	1
S5287	SWASHPLATE, SPIRIT L16	1
S5290	SWASHPLATE GUIDE	1
S5291	COLLECTIVE PITCH COMPENSATOR HUB	1
S5292	LINK, 45° X 24	1
S5293	PLASTIC FORKED PUSHROD, SPIRIT L-16	1
S5294	CONTROL RING	1
S5296	DOUBLE-ENDED BALL-LINK, 4.8 / 8 Ø X 28	1
S5297	BOLT, M3 X 7	2
S5299	PLASTIC MAIN ROTOR HEAD HUB, SPIRIT L-16	1
S5300	MAIN ROTOR BLADE HOLDER	1
S5301	BLADE PIVOT SHAFT, 6 Ø X 80	1
S5302	TRANSVERSE SHAFT, 3 / 5 Ø X 38	1
S5303	FLYBAR PADDLE, L-16	1
S5305	THRUST BEARING, 6 / 12 Ø X 4.5	1
S5306	FRONT STRUCTURE EXTENSION	2
S5307	O-RING, I.D. 6 X 3	4
S5309	RETAINING RING	1
S5311	TAIL ROTOR GEARBOX HOUSING, FRONT	1
S5312	TAIL ROTOR GEARBOX HOUSING, REAR	1
S5313	TAIL ROTOR ACTUATING LEVER	1
S5314	TAIL ROTOR BLADE, PLASTIC	2
S5315	MIXER LEVER, SPIRIT L-16	1
S5316	HOLDER	2
S5319	COMPENSATOR LEVER, PLASTIC	1
S5322	MOTOR MOUNT, ALUMINIUM	1
S5324	SPACER RING, ALUMINIUM, 4.1 / 8 Ø X 2.3	1
S5325	BRASS TUBE, 6.0 / 5.1 Ø X 19	1
S5326	BRASS TUBE, 4.0 / 3.2 Ø X 12.75	1
S5329	HORIZONTAL STABILISER, PLASTIC, SPIRIT L-16	1
S5330	HORIZONTAL STABILISER CLAMP, TOP	1
S5332	VERTICAL STABILISER, PLASTIC, SPIRIT L-16	1
S5333	RETAINING WASHER, 3.1 / 12 Ø X 2, ALUMINIUM	1
S5334	VERTICAL STABILISER CLAMP	2
S5335	PUSHROD GUIDE, RING	1
S5336	PUSHROD GUIDE,	1
S5337	TAIL ROTOR SERVO MOUNT, 20 Ø	1
S5339	STAND-OFF PILLAR	2
S5340	SOCKET-HEAD CAP SCREW, M2.5 X 25	10
S5367	INERTIA WEIGHT	2
9107	RUBBER BANDS, 40 x 6 x 1	30
4048	CT-4 PLUG AND SOCKET	1 PAIR
4069	CT-4 BRIDGING PLUG	1
5014	DOUBLE-SIDED FOAM TAPE 3.2X19X1000	1