item no. 1599

212

Assembly & Operation

Manual
Parts List

Please read the following building instructions and safety warnings carefully BEFORE commencing with assembly of kit and installation of technical equipment.
Please also refer to the safety guidelines on page 45.

WARNING!
During the charging period all batteries must be removed from the hull. NEVER charge the batteries within the hull as most regular lead batteries gas while being charged. Insufficient air circulation during the charging period may lead to a serious EXPLOSION!

Please adhere to your country's safety guidelines during construction and operation of this item.

We are not liable for any personal injury or damage of any kind resulting with the assembly and/or use of our products as we are neither able to delegate nor verify the assembly and/or use of these items.

We reserve the right to alter technical specifications.

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This symbol indicates that after the service life of this electrical device has ended it must be disposed separately from domestic refuse at your communal waste collection.

Since the completion of the first boat U31, the class 212 has enjoyed increasing popularity, both in the original and in the model. With this kit, we would like to open up this technically demanding area of model shipbuilding to the less experienced model builder, but also offer incentives for experienced submariners to acquire this model. First of all, a short construction time with manageable technical resources is a basic prerequisite for such a concept. Furthermore, in terms of performance and safety, it should be in no way inferior to the larger models in our submarine fleet. The result is this 212 - compact, easy to handle and with a piston tank.

The hull is made of 3 mm thick ABS, the hull ridge with sail, rudders, skegs and service hatch are made of resin. The hull consists of three parts, front, center and rear section and is manufactured complete with bayonet lock and aft bulkhead. The required bolts (for mounting the Tech Rack©) and all connections for the piston tank, pressure switch and breather tube are already glued into the end bulkhead.

A 2-component adhesive, referred to as "2K" in the following text, is recommended for gluing the tail section to the center section and all other joints on the hull. When bonding all components, ensure that the surfaces to be bonded are thoroughly cleaned with white spirit or universal thinner.

Less stressed bonding can be carried out with CA adhesive (cyanoacrylate, RAPID CA medium viscosity Art. No. 96040), generally known as superglue.

Dive Set with Piston Tank and CompactTankSwitch CTS2
The 212 is equipped with a piston tank type HA500-123 with automatic end position cut-off and Hall sensor for proportional control. The cut-off ensures that the piston tank stops automatically as soon as the cylinder is completely filled or emptied. The Hall sensor control allows sensitive trimming of the submerged model.The piston tank and the corresponding CTS2 compact tank controller form a compact unit without complex and vulnerable wiring. On the transmitter side, a proportional slider should be used to control the CTS2. Alternatively, the CTS2 or the piston tank can also be operated without a Hall sensor and therefore not proportionally. In this case, the control can be carried out via a stick or 3-position switch (on/off/on).

CTS2 offers four independently operating fail-safe devices:
• low battery monitor
• loss of transmitter signal
• loss of receiver signal
• automatic resurfacing if model dives below approx. 1.8 m (via pressure switch)

If R/C signal is lost due to excessive depth, failure of transmitter or receiver signal or any other circumstances CTS2 will automatically switch the piston tank to bail. The pressure switch limits operational depth to approx. 1.8 meters (6 ft). If the model dives below this level, the CTS2 will automatically switch to the "resurface" and empty the piston tank. The model will then resurface unless the dive mode is still activated. Otherwise, with dive mode still activated the model will emerge to a depth above 1.8 meters after which the tank will start filling again (and so on). Furthermore, the pressure switch acts as a second safety device. Should the overpressure which builds-up within the hull while submerging (by filling the tank) be lost due to a leakage, the dive mode will be terminated. In this case, the yellow LED blinks steadily and the system does not allow the model to dive again until this has been corrected. If voltage drops below a preset value (factory setting approx. 9V for 12V operation) the piston tank is automatically switched to empty. Low voltage will be indicated by lighting of the red LED on CTS2.
Good receiver signal is indicated by the green LED on CTS2. If receiver battery or receiver itself fails CTS2 will switch the piston tank also automatically to bail. The fail safe function also comes into action if transmitter signal is lost.

Conning Tower Mechanism operating principle
for retracting and extending the periscope, radar, snorkel and antennas (optional item no. 1599-1A). Filling the piston tank creates an overpressure which remains in the hull. The model now submerges. This overpressure sets a mechanism in motion that allows the extension devices mounted on a slide to retract into the sail when the piston tank is approx. 80% full. When the piston tank is emptied, the pressure is reduced until the pressure is fully equalized. The model emerges again and the devices extend again. With the appropriate trim, it is therefore also possible to drive to periscope depth with the devices extended, only with dynamic diving at approx. 70% flooding of the piston tank.The conning tower mechanism also has a safety and warning function. If there is a loss of pressure during the dive, the devices extend. This is a clearly visible indication of a leak so that you can react immediately and check the boat for a possible leak.The construction description is divided into three main parts A, B and C. Part A describes the construction of the technical framework, i.e. the interior of the model known as Tech Rack©. Part B is devoted to the work on the hull, part C to the leak test and basic trim. Part D briefly explains finishing and paintwork. This final part also contains further information on initial commissioning and subsequent maintenance.

Please also refer to the part listing at the end of this text. This listing is sorted by part group. The separately held packing list is sorted by pack numbers.

Further items required/recommended to complete this model:
• Conning Tower Mechanism for retraction of periscope, radar and antennas, item no. 1599-1
• Wire and Connector Set, item no. 1599-99
• Battery Pack High-Power NiMH 12V/3500mAh + Receiver Battery NiMH 4,8V/3000mAh, item no. 5556
• Boat Stand made of Polycarbonate, aluminum and stainless steel, item no. 1599-Z
• Pitch Controller DLx2 for X-rudders, item no. 1573
• Reverse Drive Detection BL (no BEC), item no. 8454
• Electronic Speed Controller Brushless 30A, Art.-Nr. 3751
• Servo DS-238 MG BB, item no. 9377 (only this servo will fit, requires 2)

Adhesives and lubricants:
• Epoxydkleber (2K), z. B. UHU Endfest 300
• Rapid CA Superglue medium viscosity, item no. 96040

• Q-Lube, high-performance adhesive lubricant, item no. 9705
• Silicone Grease, item no. 9710

Operating a model submarine under water requires relatively good R/C equipment. 40 MHz is the legal frequency for submarine, boat and surface models in the European Union. In the USA the frequency to use is 75 MHz.

PLEASE NOTE: 2.4 GHz radios do not qualify for model submarines as this frequency band does not penetrate water.

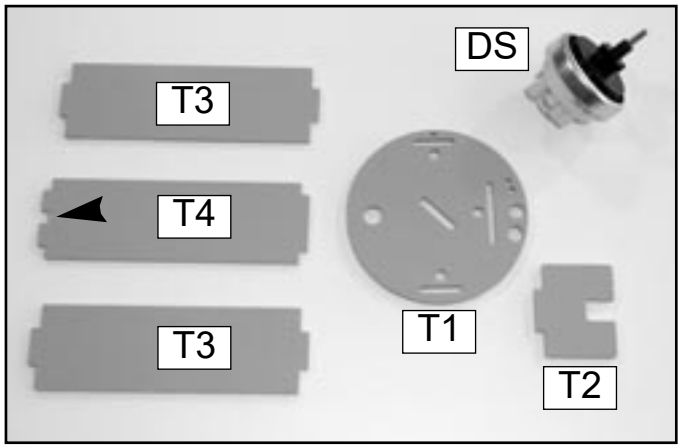
The receiver used for this 212 should have horizontal servo socket pins. Attenuation and reflection of radio waves on and beneath water surface is quite strong posing quite a challenge to the receiver. Important is safe behavior especially at range limits.

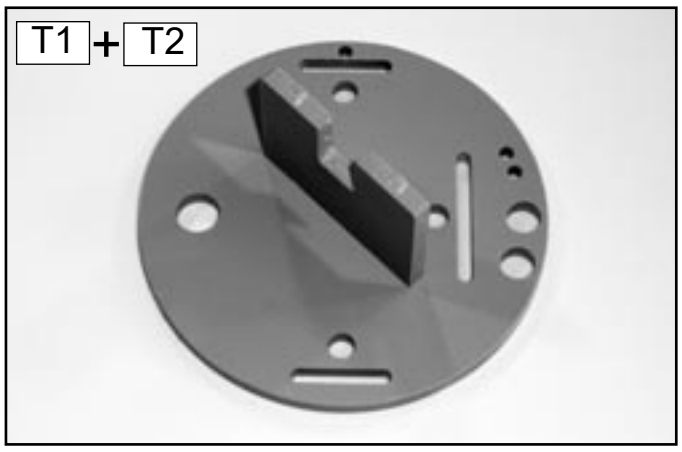
Part A

The Tech Rack© is constructed from milled plastic parts, brass rods and the piston tank. This frame is divided into four sections. Firstly, the battery compartment, which holds the two main batteries and the receiver battery. The mounting for the pressure switch is located at the bow. Secondly, the piston tank with CTS switch unit, which is already fitted with the corresponding bulkheads at the factory. Thirdly, the so-called control center, on the top of which the receiver is mounted and which accommodates the socket. Fourthly, the servo block, consisting of two frames and the mounting plate for the speed controller. After assembly, the battery compartment and piston tank form a single unit, which can be divided into two individual sections by loosening three screws in the front piston tank bulkhead. The piston tank and control panel should only be joined together at an advanced stage of construction so that it is less difficult to join the Tech Rack© and hull.

A stand is particularly useful for working on the hull. A custom-fit stand made of Makrolon®, aluminum and stainless steel is available as an accessory (kit, item no. 1599-Z). However, to protect this stand from soiling during construction, it should be covered with a film and cloth. Alternatively, you can make your own stand from wood.

Another useful option is the socket with central plug, which is located in the so-called central unit of the boat. By plugging in or unplugging the plug, all of the boat's consumers are connected to or disconnected from the batteries. The socket also serves as a charging socket through which both battery packs can be charged (separately). The cable and plug set required for this is available as an accessory under item no. 1599-99.





1. Battery Compartment
1.1 Assemble compartment from two side parts T3, one bottom part T4 and bow bulkhead T1. Cut-out in bottom part lies against pre-fitted bulk head of Piston Tank (for clearance of screw in end cap of tank).

NOTE: Assemble parts DRY - DO NOT GLUE. Verify correct arrangement and orientation of bow bulk head.

1.2 Glue with medium viscosity CA (item no. 96040). Apply glue on front face of side parts as well as on bottom part. Remove excess glue IMMEDIATELY with pointed blade.

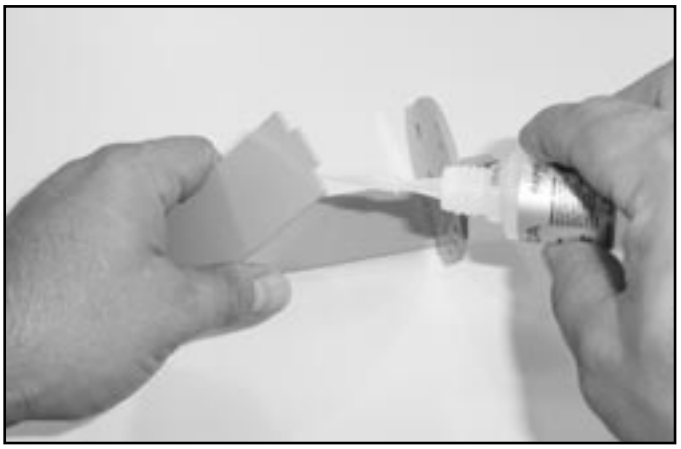
1.3 Glue carrier T2 (for Pressure Switch) to bow bulk head.

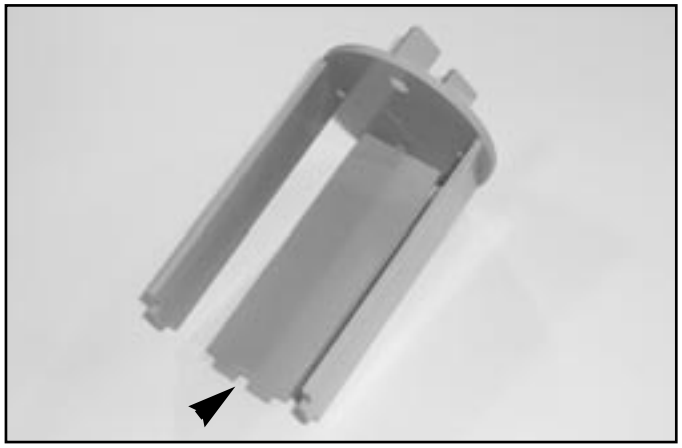
1.4 Glue completed section against pre-fitted bulk head of Piston Tank.

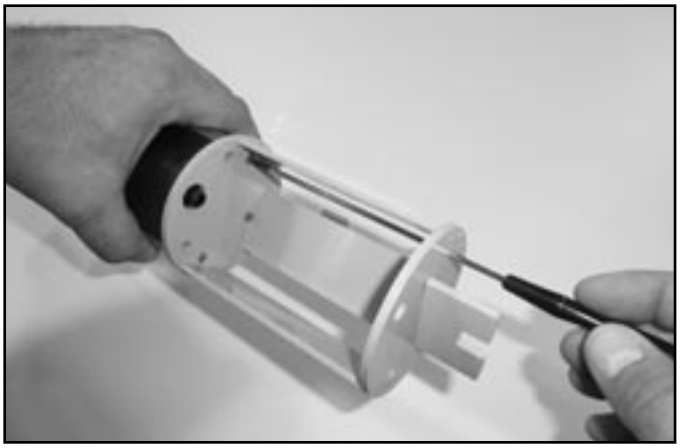
NOTE: Apply CA very sparingly to avoid gluing of bulk head to end cap of Piston Tank. Otherwise parting of section and disassembly of Piston Tank will become difficult or even impossible.

1.5 Push Pressure Switch in carrier T2 and check for good fit.

1.6 Accessibility of screws in Piston Tank bulk head is given by three corresponding holes in bow bulk head (see picture).



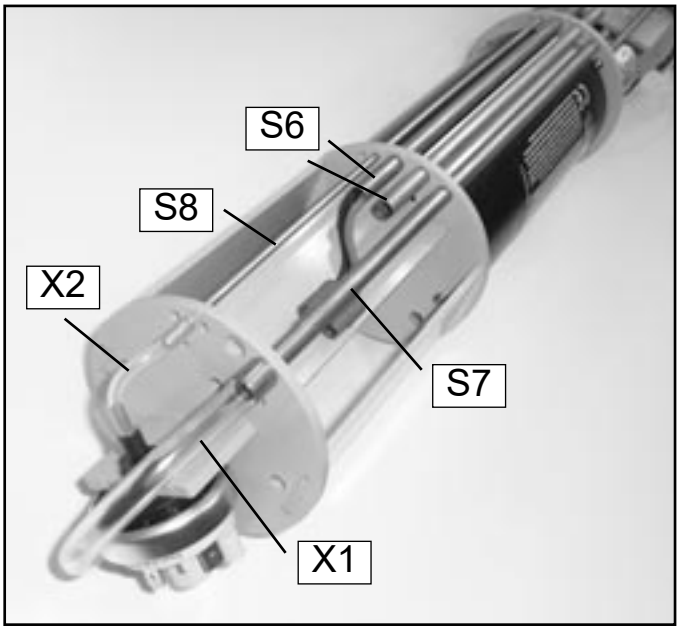




2. Installation of Cables and Tubes
2.1 Insert three brass tubes, outer dia. 7 mm, which are two parts S6 with length 249 mm and one part S7 with length 332 mm into the bores of both Piston Tank bulk heads as shown.

2. 2 Insert brass tube S8, outer dia. 3 mm, length 332 mm, into the corresponding bores of both Piston Tank bulk heads as well as bow bulk head. This tube connects to Pressure Switch via silicone tubing X2; cut to length of approx. 48 mm. Push both ends of tubing about 6 mm onto Pressure Switch and brass tube S8.

2.3 Cut PVC tubing X1, outer dia. 9 mm, to 275 mm length. Push onto nozzle in back plate of Piston Tank. Feed tubing through upper bore of bow bulk head down to brass tube S7. Push end of tubing about 8 mm onto brass tube.



3. Mounting and Connection of CTS2 to Piston Tank

3.1 Before mounting CTS2 to Piston Tank, make up cables connecting motor poles to tags of micro switches from wires, yellow and violet (each. about 120 mm long) as well as blade receptacles and heat shrink tube supplied with CTS. Skin each wire end and tin coat with soldering iron. Crimp one receptacle onto each wire. Cut heat shrink tube supplied in half (to about 20 mm), push over receptacles and shrink with heat gun (about 130°C). Solder other wire end directly onto connection tag of motor.

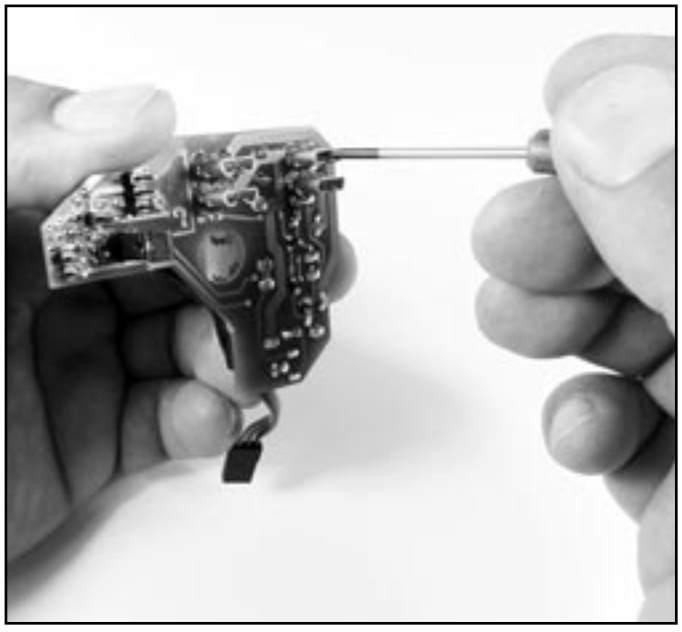
3.2 Connection is made as illustrated.
Yellow to micro switch S2, tag 1 and "+" pole of motor.
Violet to micro switch S1, tag 1 and counter-pole of motor.

3.3 Install wires accurately around spindle and motor.

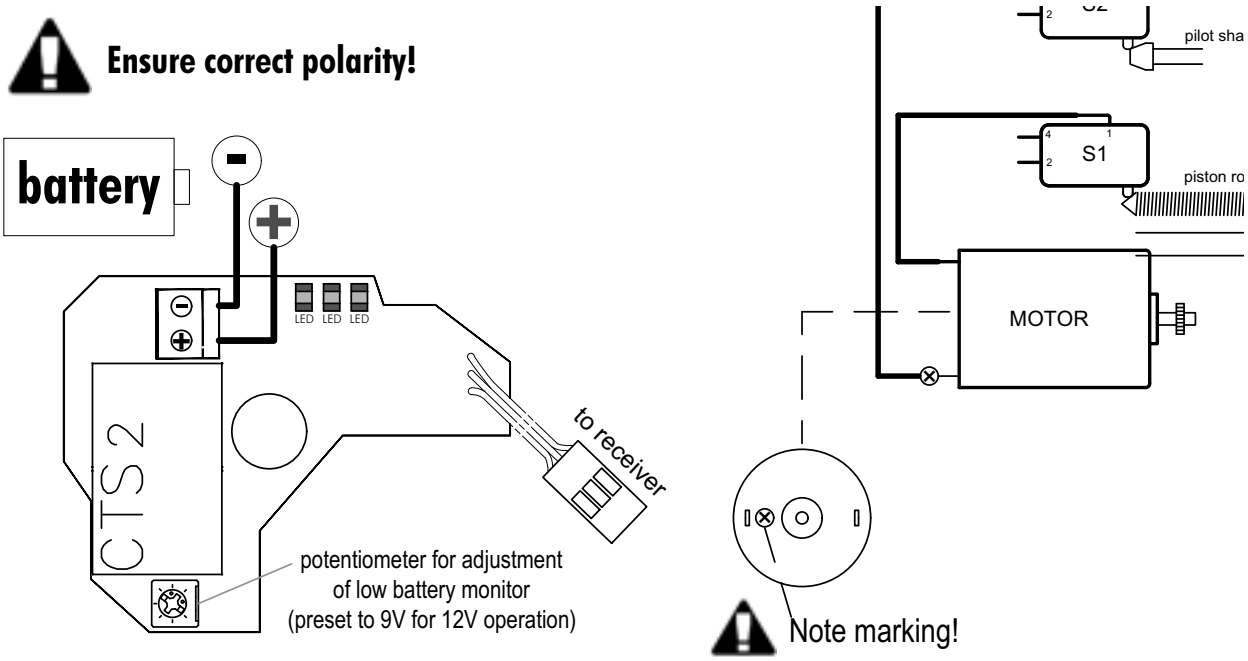
3.4 Coat contact tags of micro switches with contact spray in order to prevent oxidation.
3.5 Before sliding CTS2 onto micro switches, slightly press contact tags 2 and 4 of each piston tank together so that the tags lie parallel to one another. This will facilitate fitting of the unit. CAREFULLY widen the blade receptacles (pre-soldered to CTS2's back side) with a small screwdriver.

3.6 Slide receptacles of CTS2 CAREFULLY onto the micro switches. This will require some pressure but must be done with GREAT CARE to avoid damaging the circuit board.

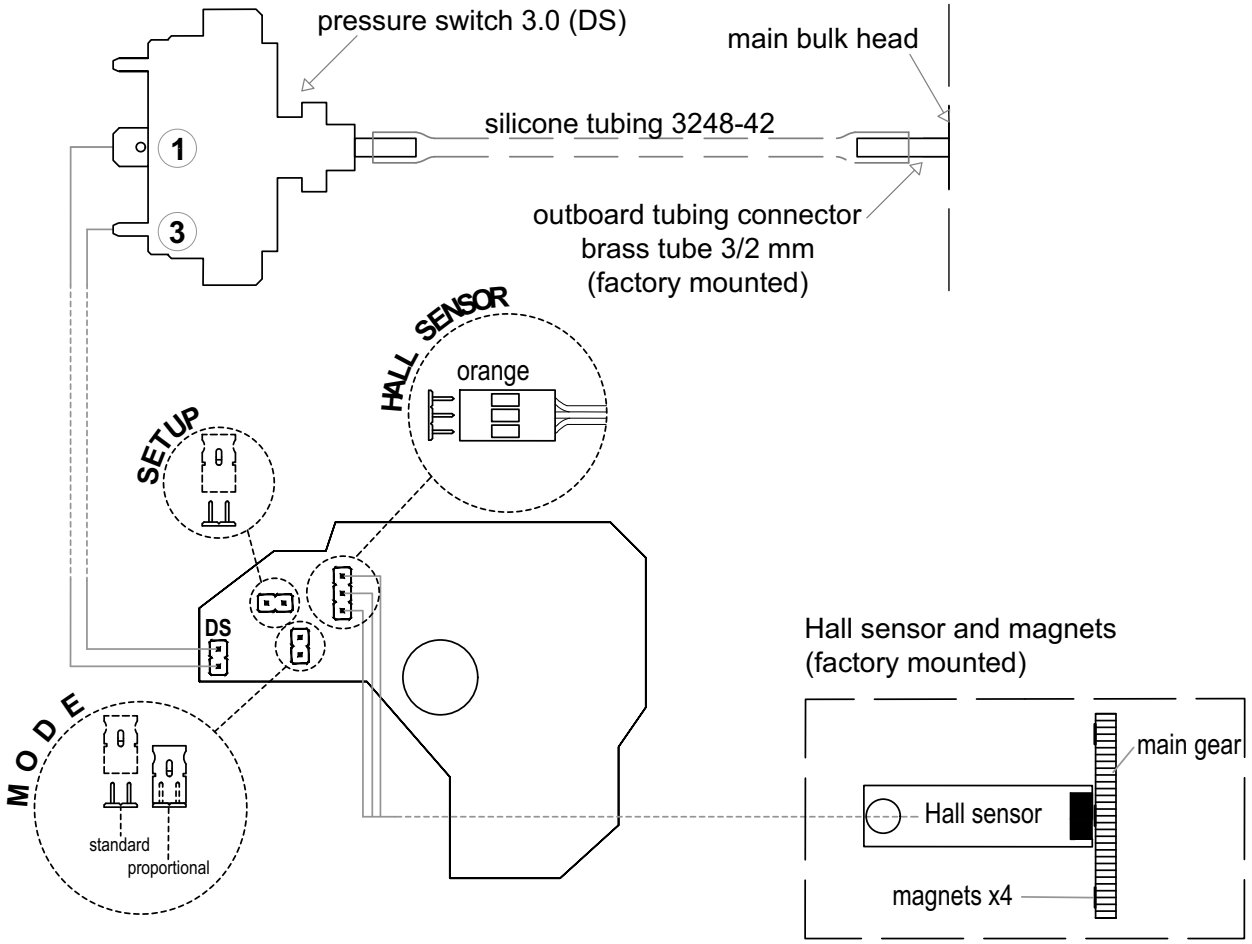
3.7 Align the CTS2 to the Piston Tank so that the spindle of the piston tank is more or less centered to the hole in the CTS. Move the spindle slightly outwards by turning the gear wheel. The protective tube S5, which is later inserted into the central unit, engages in the bore of the CTS and aligns it.



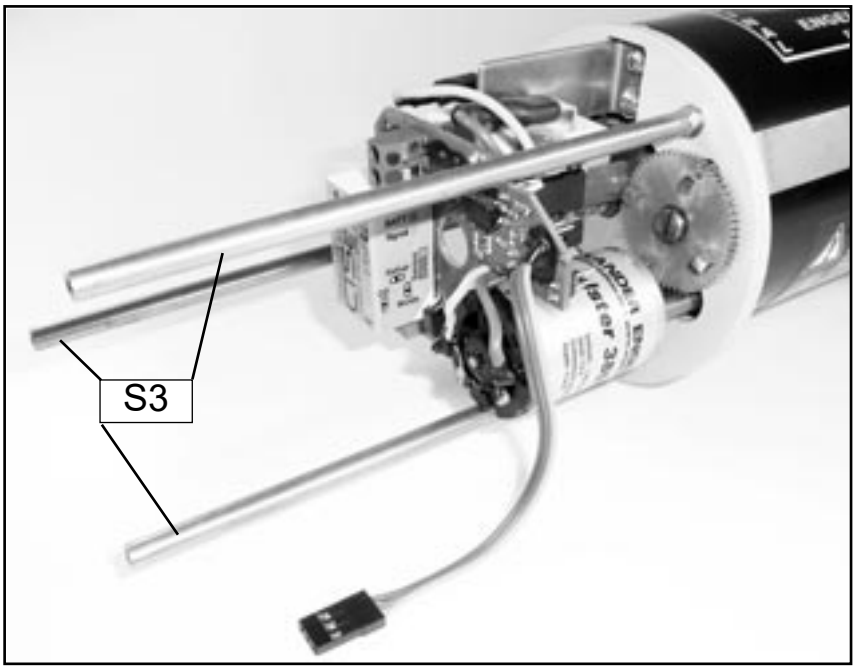
Anschlüsse VORDERSEITE



Anschlüsse RÜCKSEITE

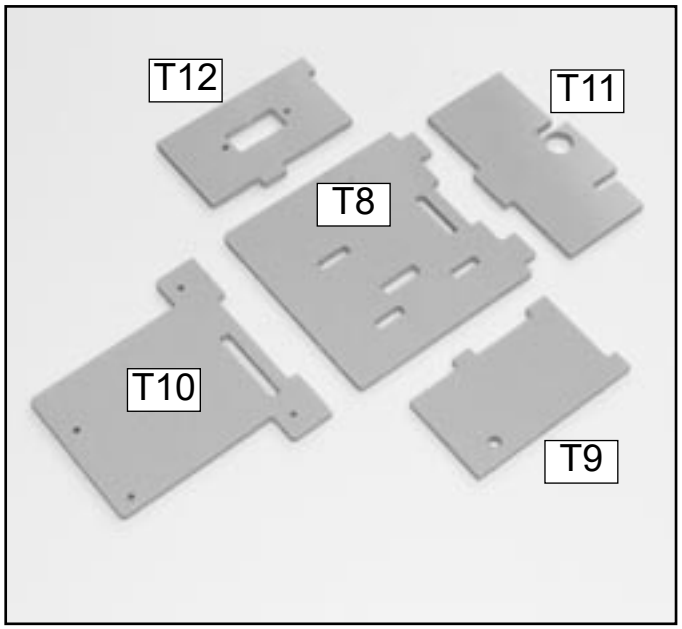


3.9 Screw 3 brass bars S3, length 124 mm, on piston tank and tighten by hand only.



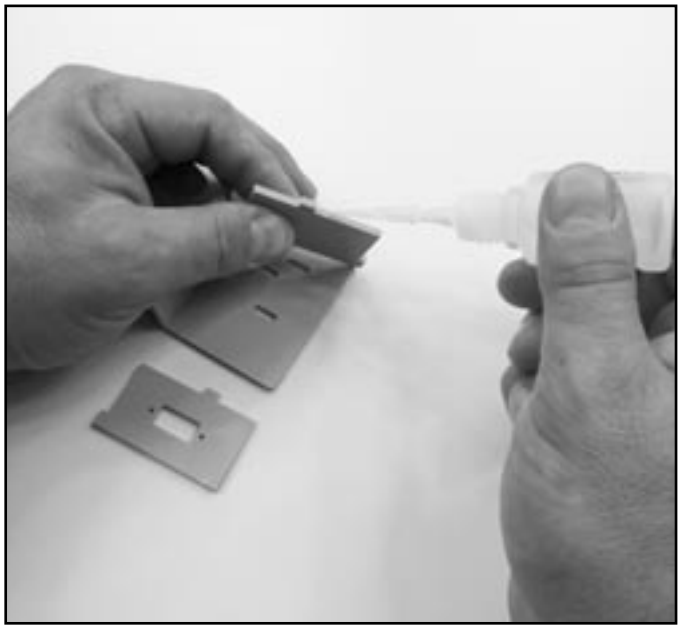
4. Centre Section

4.1 Remove parts from milled sheet and sand down fillets. A small side cutter without bevel is recommended for removing the parts so that the bars can be almost completely cut off. Trimming is then very easy and, above all, clean using a flat file.

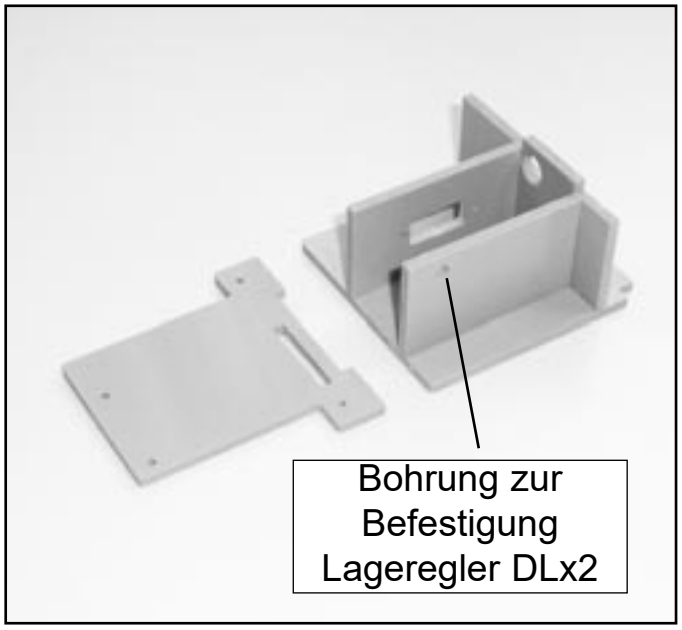


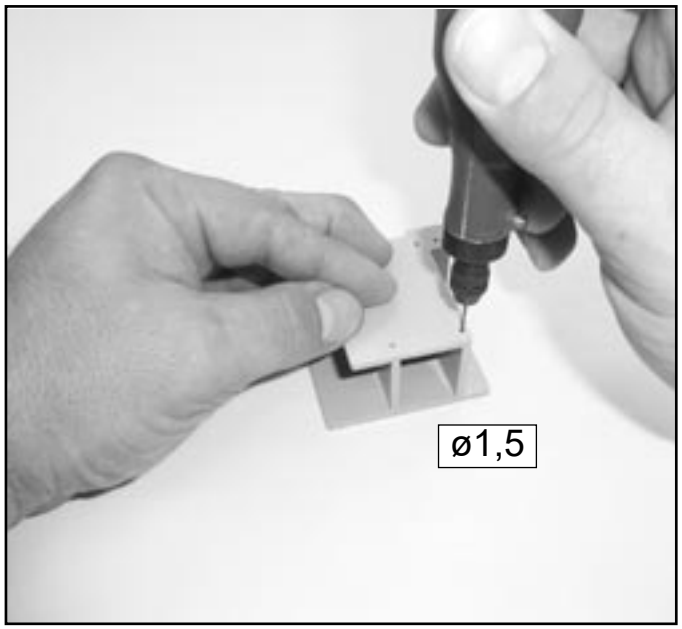
4.2 Assemble centre section, commencing with back part T11 onto bottom plate T8. Ensure right angle by placing one side part against back part and bottom. Glue T11 onto T8 with cyano (medium viscosity, item no. 96040).

4.3 Add side parts T9 and T12 with cyano.



4.4 The basic body of the centre section is now almost completed. The top cover is to be kept detachable.

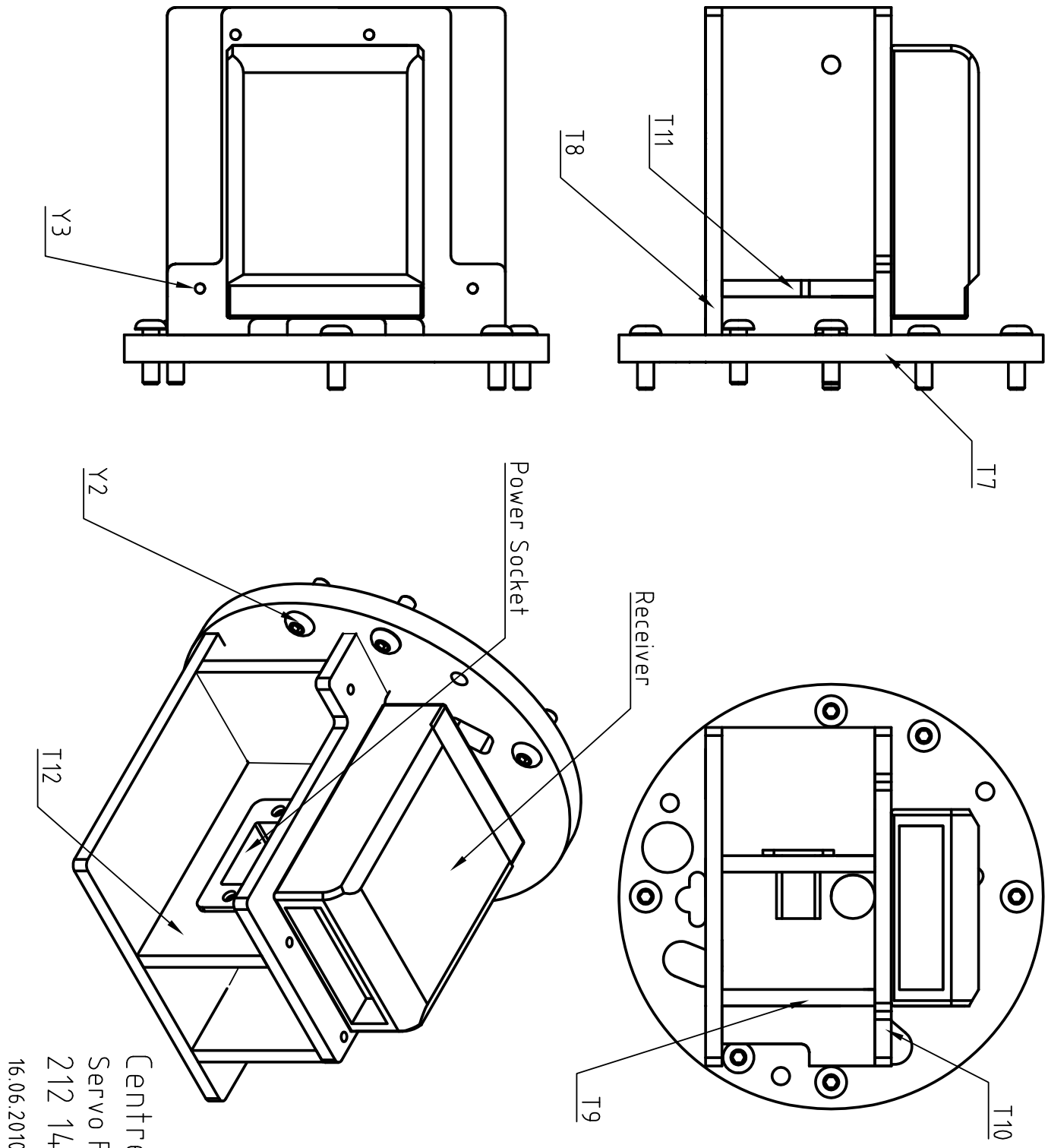




4.5 Place top cover T10 onto assembly, align accordingly and copy bores onto back and side parts. Drill with 1.5 mm bit, about 5 mm deep. For drilling a mini drill such as Proxxon or Dremel is recommended.

4.6 Countersink all four bores in top cover T10 (diameter 5 mm at 90 degree angle). Use reamer or, if not at hand, a matching drill bit. Top cover is fastened with four countersunk self-tapping screws 2.2x6.5 mm - DO NOT GLUE!

4.7 Prior to final assembly purpose-made power socket must be installed into opening of the centre section's right-hand side part (seen from aft to bow). This building sequence is described in chapter 9.


Y3
T8
T11
T7
Y2
Power Socket
Receiver
T12
T9
T10
Centre Section
Servo FS 500
212 148
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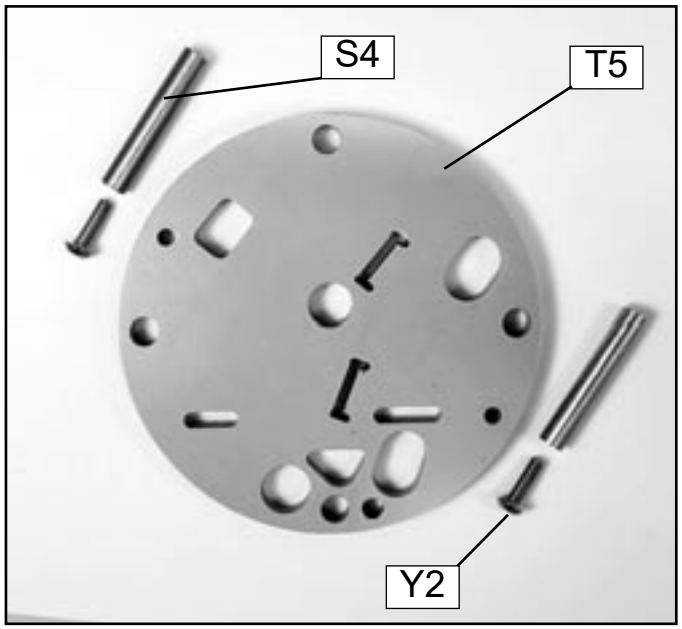
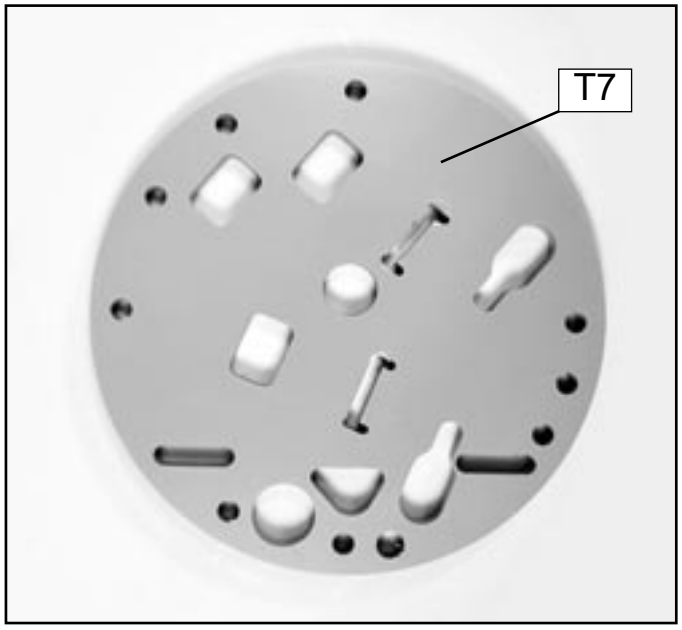
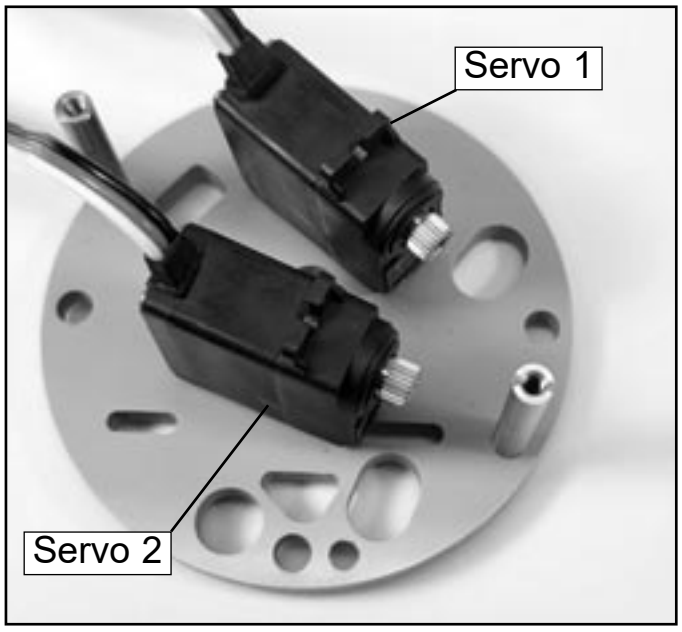


5. Servo Block

5.1 Firstly, sand down remaining fillets from outer diameter of servo bulk heads T5 and T7. Trim T5 to fit snugly through inner bayonet lock ring R4. Bulk head should just fit into the ring; not too loose. Slightly chamfer outer edges of all bulk heads so that these are left without sharp edges.

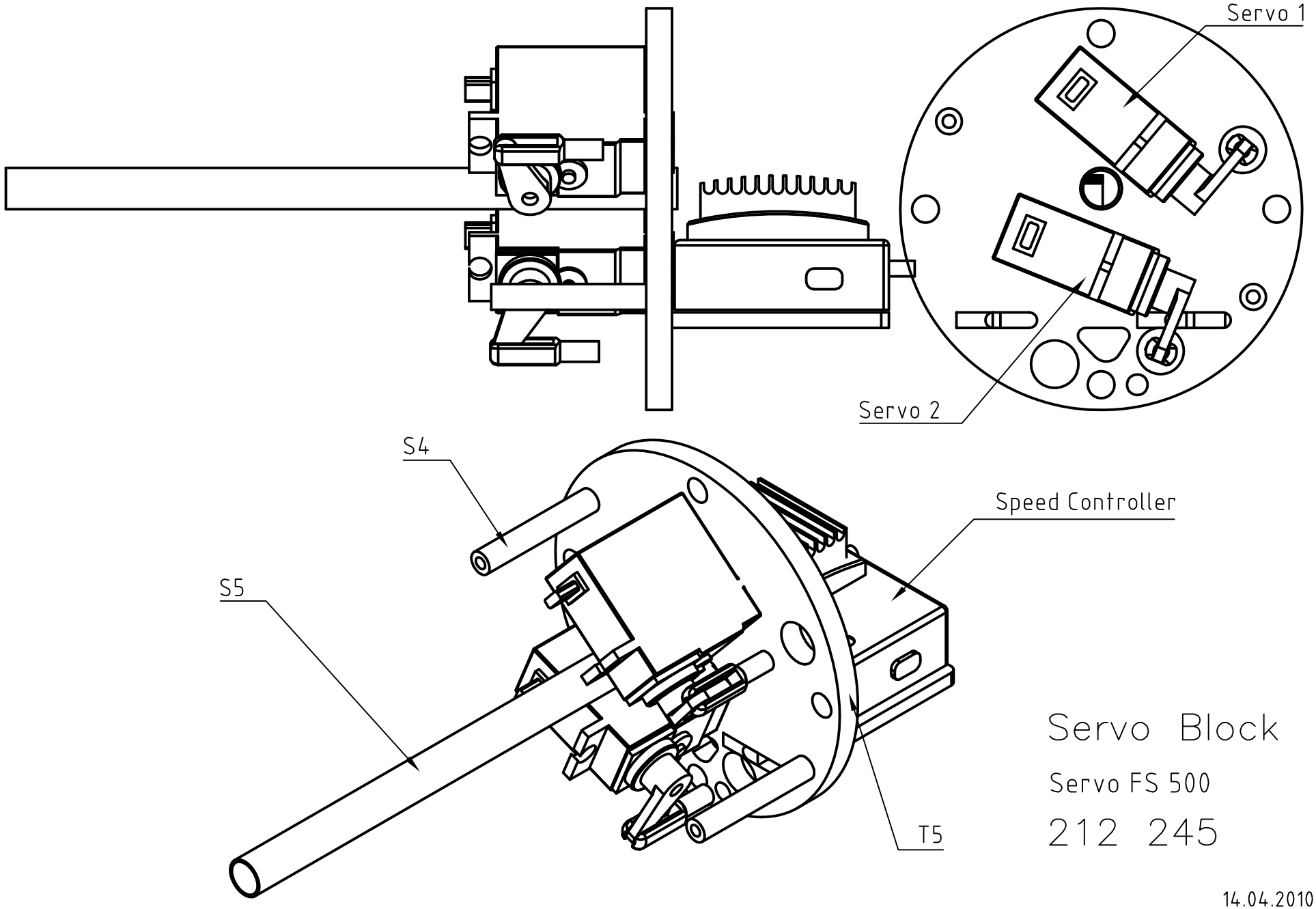


5.2 Fit two brass bars S4, length 30 mm, with screws Y2 (allen head) to bulk head T5.



5.3 Glue mounting plate T6 for speed controller against back side of T5.

NOTE: Bulk heads accept exclusively servo type DS-238 MG BB (item no. 9377).



Servo Block

Servo FS 500

212 245

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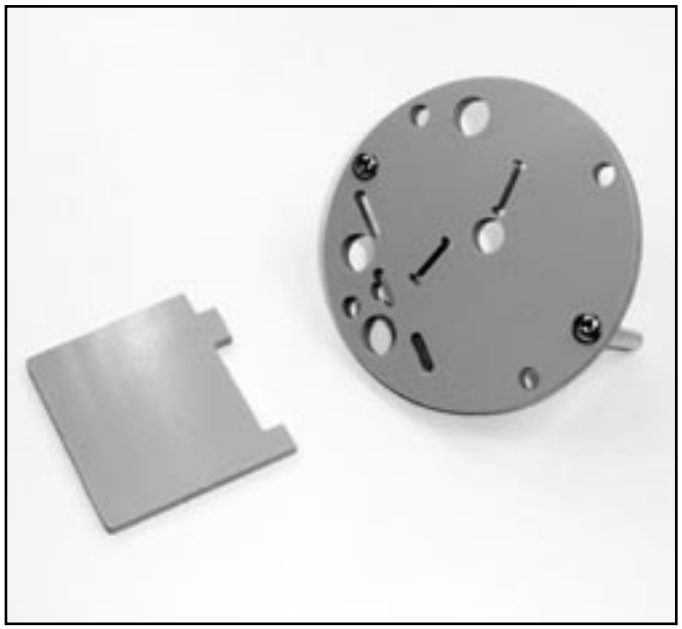
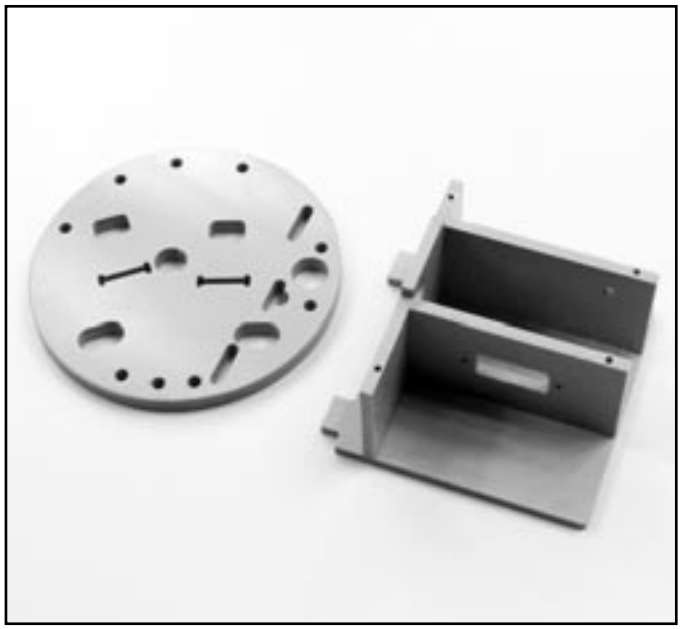
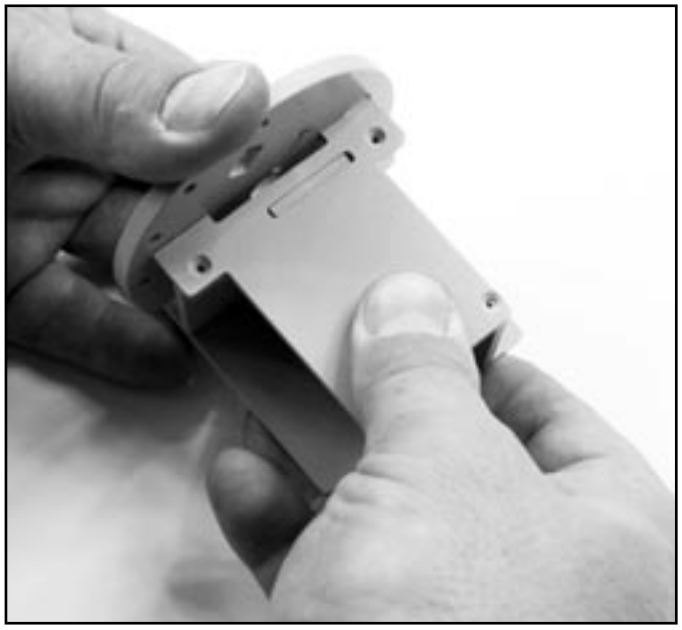


5.4 Glue mounting plate T6 accepting speed controller against back side of servo bulk head T5 with cyano (medium viscosity, item no. 96040). Remove servos beforehand.



5.5 Glue Central Section against bulk head T7.



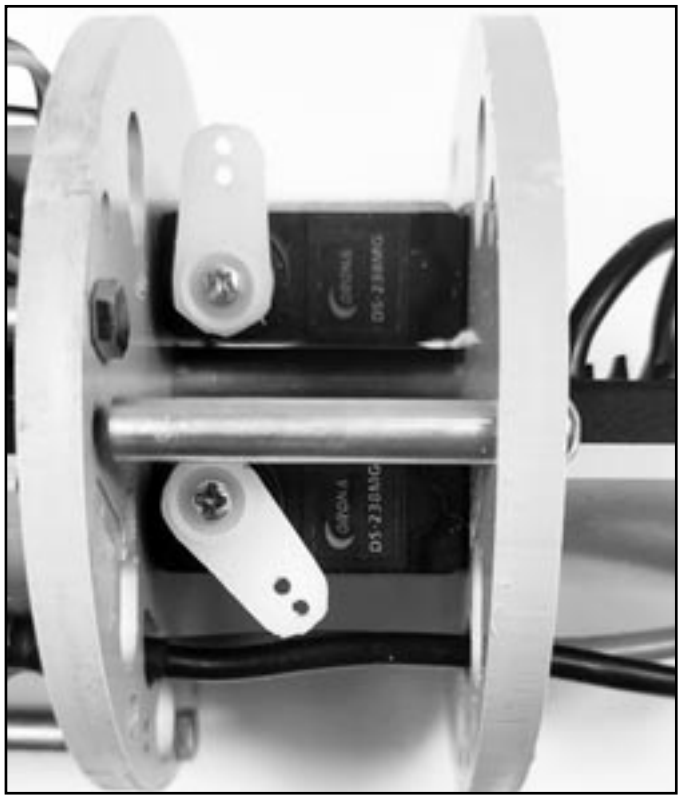
NOTE: Top cover is not fastened, yet, but only placed onto Central Section to ensure right angle.

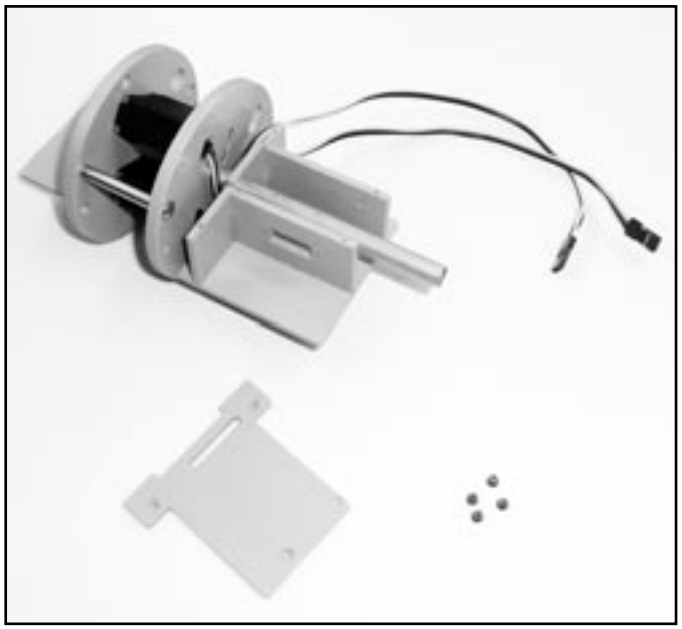
5.6 Push tube S5 through centre bore of servo bulk heads T5 and T7 so that S5 ends flush with back side of T5. Tube S5 will later accept protruding piston rod when tank is filled thereby protecting adjacent wires and components. DO NOT GLUE tube S5!

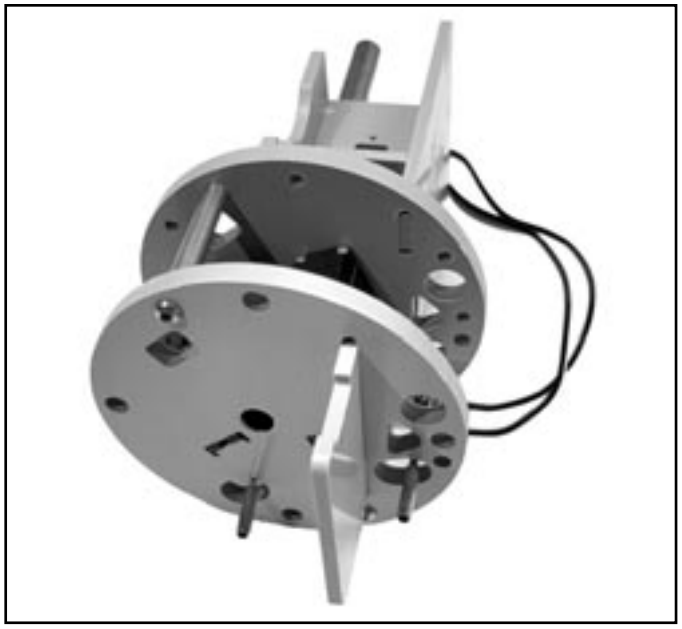
5.7 Top Cover is to be fastened after center section has been fitted with power socket and supply cables.

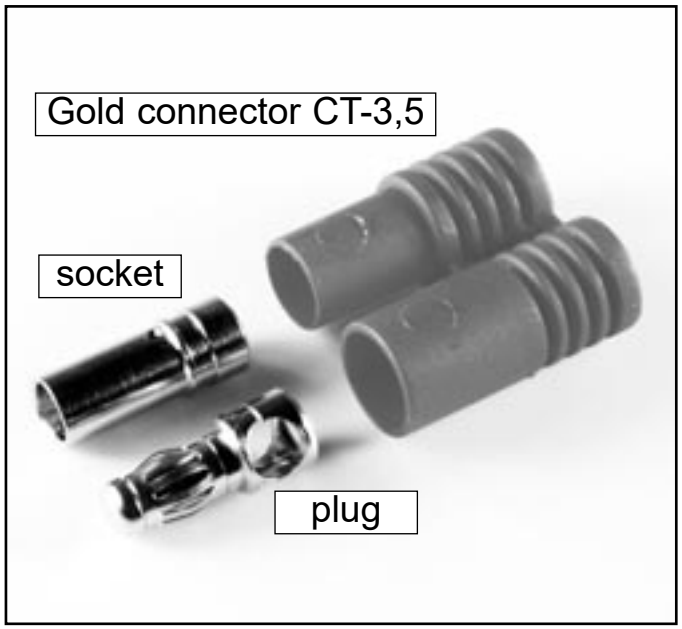
5.8 If Dual Pitch Control DLx2 (optional, item no. 1573) is used, mount DLx2 now on portside of central section (screw and nut are supplied with DLx). Pass both servo leads to DLx2 and plug-in accordingly. The two-core wire with red JST connector (included in optional cable and connector set, item no. 1599-99) should also be plugged onto the two pin row for automatic pitch reverse on DLx2. Pass the two wire leads through both servo bulk heads beneath the mounting plate for the electronic speed controller (ESC). Leave sufficient wire lengths in order to facilitate joining of Tech Rack© and main bulk head. This will also require connection of speed controller (ESC) to motor. Cable for automatic pitch reverse will also have to be soldered to connectors leading from ESC to motor.

5.9 The picture below shows the basic setting of the servo levers for servo 1 (top) and servo 2 (bottom). This may need to be adjusted in order to achieve identical control surface deflections in both directions.









6. Main Drive Battery and Arrangement of Wire Leads

6.1 The main drive battery consists of two individual packs with 5 cells each (size Sub-C) and a capacity of 3500 mAh. Each pack adds up to 6 Volt (5x 1.2 Volt). In order to acquire the necessary on-board voltage of 12 Volt the two packs must be switched in row.

6.2 Parting of the fully wired Tech Rack sections requires insertion of several connectors. Cable and connector set no. 1599-99 includes two pair of plugs and sockets 3.5 mm, one pair with and one without housing. For the receiver power line there are also two pair of plugs, and again one pair with and one without housing.

6.3 The two main drive battery packs stand on portside (left, seen from aft to bow) and in centre position. The receiver battey pack is placed starboard. Protruding wire leads always face towards the aft.

6.4 Cut positive wire lead (red) of one main battery pack (5554) to a length of 50 mm. Cut negative wire lead (black) of second main battery pack to a length of 30 mm. Skin both leads by about 5-7 mm.

6.5 Push a piece of heat shrink tube 4.8 x 20 mm onto the longer (red) wire lead. Join formerly skinned wire ends and solder together. Leave to cool down.

6.6 Place heat shrink tube over the soldered joint and shrink with heat gun (>90°C). This serial connection of battery packs results in a nominal voltage of 12 Volt.

6.7 Cut the remaining wire leads to a length of 150 and respectively 170 mm. The centrally positioned pack is left with the 20 mm longer wire lead.

NOTE: Cut one wire at a time - risk of SHORT CIRCUIT!

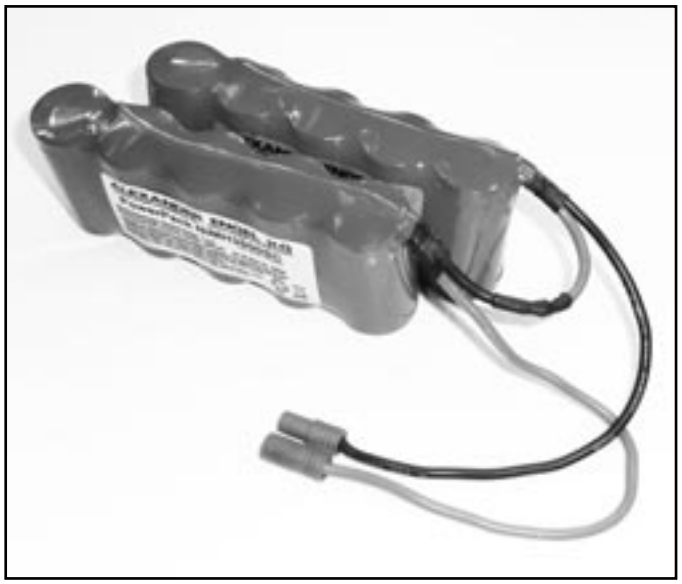
6.8 Strip insulation of both wires by about 3 mm and tin-plate with soldering iron. Melt some soldering tin in both plugs and sockets type CT-3.5. Push red housing onto both wire leads. Ribbing of the housing lies towards battery packs. Solder plug to positive lead (red), socket contact to negative (black) lead.

6.9 Solder leads, leave to cool and press connectors into housings. Housings fit snugly between water tube of Piston Tank and bottom plate of battery compartment.

6.10 The remaining lengths of wires are used as extension leads from this connector towards the power socket at Centre Section. Determine cable length required, measured from CT-3.5 connector through cable guiding tube S6, ending just below switch unit CTS (approx. 350 mm). Cut accordingly.

6.11 Strip insulation of wires by about 3 mm and tin-plate. Solder contacts with housing in accordance to CT-3.5 connector formerly fitted to main battery packs. Solder 3.5 mm socket and plug (supplied without housing) to wire ends below CTS. These connectors are insulated with heat shrink tube 4 x 8 mm.

6.12 Remaining length of wires are fitted with socket and plug 3.5 mm, again without housing. Ensure correct pairing of connectors. These two wire leads will be soldered to the power socket within the Centre Section at a later stage.



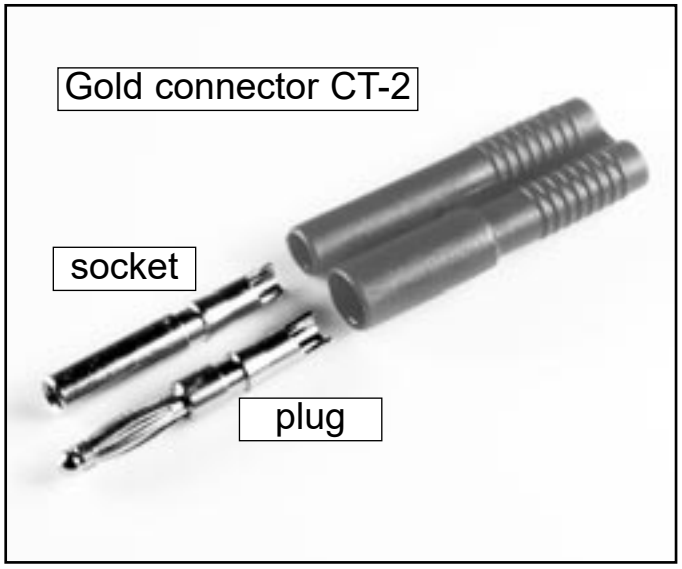
7. Receiver Battery and Arrangement of Wire Leads with Pressure Switch Cable

7.1 Place receiver battery pack (5528), consisting of 4 cells type Sub-C (4.8 Volt), on portside of battery compartment.

7.2 Determine required wire length from battery pack to underside of battery compartment (approx. 100 mm) and cut accordingly. Remaining wires with connector will be needed at a later stage.

NOTE: Cut one wire at a time - risk of SHORT CIRCUIT!

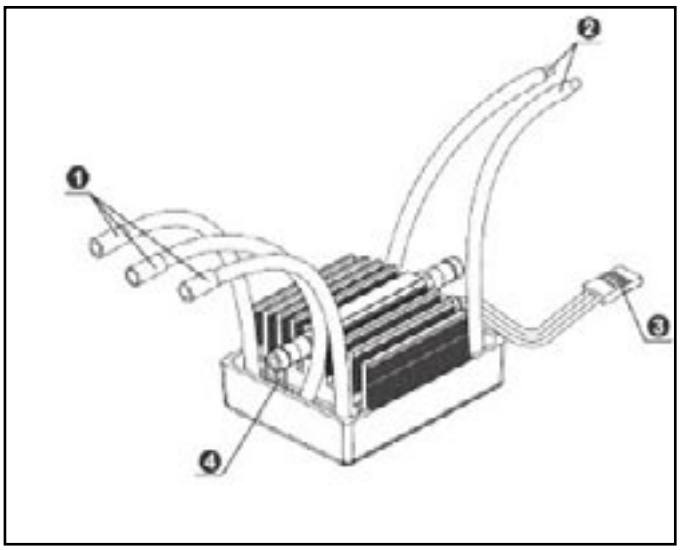
7.3 Strip insulation of wires by about 2-3 mm, tin-plate and solder to connector CT-2 with housing. Solder positive (red) lead to plug, negative (black) to socket.



7.4 Extend receiver battery lead with silicone wire 0.5 sqmm (cross section), approx. wire length 300 mm. Wire leads for receiver power are passed through second guiding tube S6, together with cable connecting CTS to Pressure Switch (PS). Red JST connector connects to two-pole pin row on lower back side of CTS.

7.5 As for the main power leads, wire ends towards receiver battery are fitted with CT-2 connectors with housing. 2 mm connectors below CTS are fitted without housing and insulated with heat shrink tube 3.2 mm. Fit connectors to remaining cable lengths accordingly and insulate in the same manner.

7.6 Feed connection leads for DS through bow bulk head and solder to contacts 1 and 3 of PS. Polarity is irrelevant here. Wires can be fastened with a piece of spiral cable wrap (also included in 1599-99) alongside Piston Tank tubing.



8. Electronic Speed Controller (ESC)

8.12 As the R/C system aboard is powered by a receiver battery the BEC (Battery Eliminating Circuit) system provided by the ESC remains unused.

8.13 If Automatic Reverse Drive Detection BL (item no. 8454, included in BrushlessPower Set, item no. 3780) the BEC is already internally deactivated by this device. In this case the red wire lead does not have to be removed from the plug connecting to the receiver.

8.14 The Automatic Reverse Drive Detection is designed to work in combination with the DLx2 and a BRUSHLESS motor. It reverses automatically the pitch of the dive planes when the main drive motor switches to reverse. Just plug the device between receiver and speed controller and connect the two other ports to DLx2. The two wires with red connector are plugged into the DLx2 at pins „Motor + -“.

8.15 Feed the receiver connecting plug [3] through the triangular openings of servo bulk heads T5 and T7. The Automatic Reverse Drive Detection BL is placed just beneath the Centre Section.

8.16 The two power leads red and black [2] are already fitted with gold bullet connectors (3.5 mm). Their two counterparts are pushed onto the pre-soldered and insulated connectors. These will be required at a later stage when setting up all the power lines.

8.17 The three motor connection leads are to be fitted to the ESC motor cables [1] as illustrated. This corresponds to RIGHT turn of motor shaft (seen from aft to bow).

8.18 DO NOT exchange ESC battery connection (black/red). Red corresponds to +positive+ polarity, black corresponds to -negative- polarity.

8.19 The ESC can be fixed onto the back plate of the Tech Rack© with the self adhesive pad supplied.

8.20 The ESC’s water cooling [4] remains unused.

9. Power Socket
Applies to optional cable and connector set, item no. 1599-99.

9.1 This socket is located within the Central Section, fitted in a frame to an opening in the side of that section. The socket feeds power from the main drive and receiver battery to the model's electric and electronic components. Furthermore, the socket allows easy charging of all battery packs at a single central point.

9.2 Feed wires coming from main drive and receiver battery through slot in bottom plate T8 as well as cut-out in the side part. Cut wires to length. Strip insulation of wires by about 4 mm and tin-plate with soldering iron.

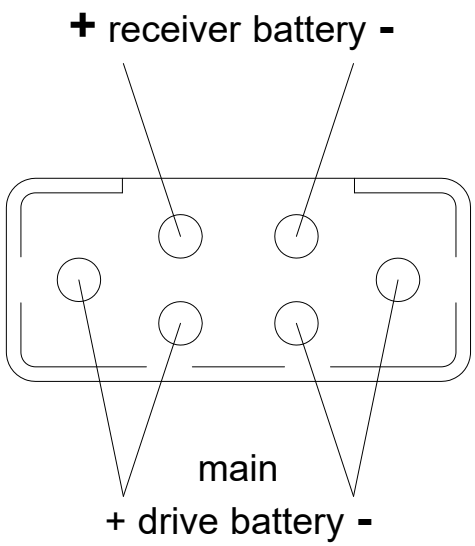
9.3 Push MPX style socket (green, with pin contacts) into frame (black) and retain with a small drop of CA (medium viscosity, item no. 96040). Place the shorter strain relief circuit board (11 mm) onto the contact pins protruding the back side of the socket. Apply tin solder. Solder wire ends to circuit board according to drawing. Avoid excessive build-up of heat to avoid distortion of frame and socket.

9.4 Verify all contacts with continuity tester for required and possibly unintended bridging of contact pins.

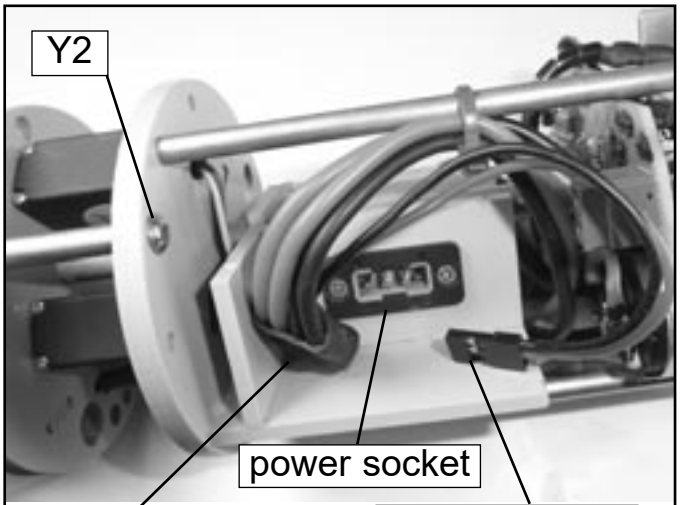
9.5 Place frame into cut-out and secure fasten with countersunk self-tapping screws 2.2 x 6.5 mm.

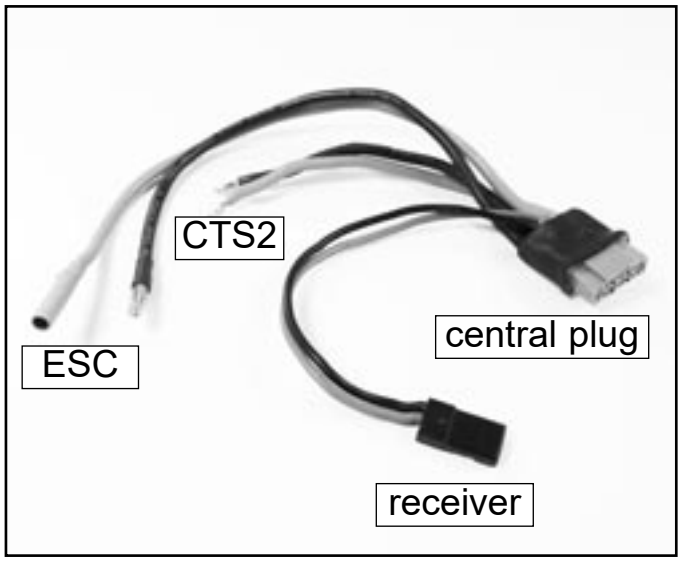
9.6 Push brass guiding tube S5 into through bore in back part T11 of Central Section as well as both servo bulk heads, ending flush with back side of T5.

Assignment of socket pins (example)



High-Amp MPX Connector with Frame and Strain Relief Circuit Board





10. Central Plug
Applies to optional cable and connector set, item no. 1599-99.

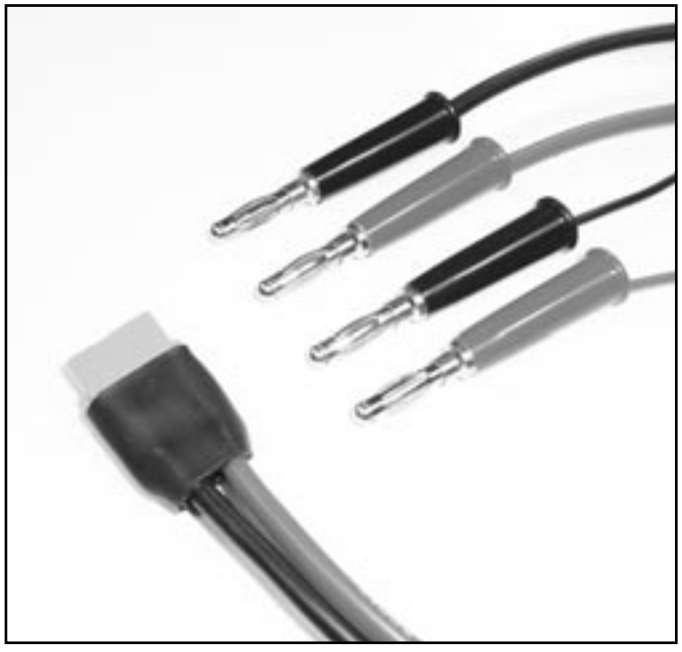
10.1 Solder strain relief circuit board (short, 11 mm) to MPX style plug (green, with socket contacts). Apply tin solder to bridge contacts in accordance with power socket.

10.2 Prepare three pair of wires: 1.) Wire with plug remaining from receiver battery, strip insulation by about 4 mm and tin-plate. 2.) Extension of power supply leads for ESC, cable cross section 1.5 sqmm, fitted with connectors 3 mm and insulated with heat shrink tube 4.8 mm. 3.) Power leads for CTS, cable cross section 1.5 sqmm, strip insulation by about 4 mm and tin-plate.

10.3 Solder wires (according to assignment of power lines at power socket) to strain relief circuit board.

10.4 Verify all contacts with continuity tester for required and possibly unintended bridging of contact pins.

10.5 Cut glue lined heat shrink tube dia. 16 mm in half (approx. 16 mm), push over circuit board up to the green casing of the plug and shrink with heat gun. Avoid excessive build-up of heat to avoid distortion of plug.



11. Charge Lead
Applies to optional cable and connector set, item no. 1599-99.

11.1 Charge leads are made from 1 m long silicone leads, cable cross section 1.5 sqmm for main drive battery, 0.5 sqmm for receiver battery.

11.2 Unscrew plastic handles of bunch plugs, push onto leads, strip insulation by about 3 mm and solder to plug.

11.3 Solder strain relief circuit board (long, 15 mm) to second MPX style plug (green, with socket contacts). Strip insulation of wire ends by about 4 mm and solder to circuit board according to assignment of socket pins.

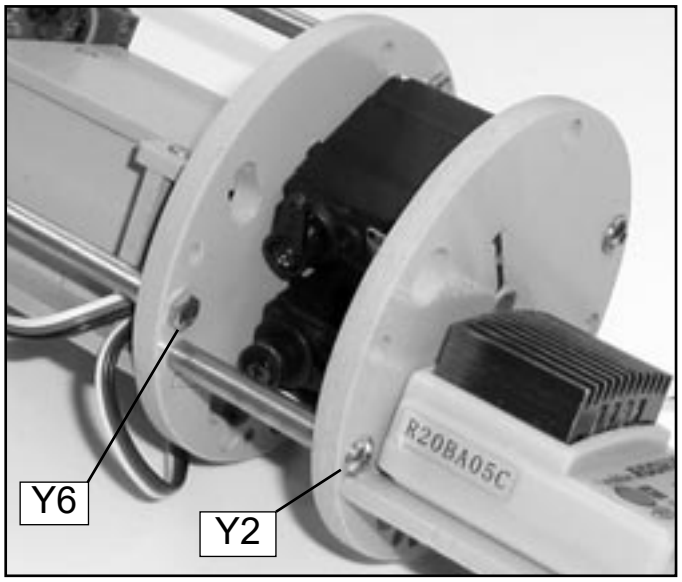
11.4 Push second half of glue lined heat shrink tube dia. 16 mm over circuit board up to the green casing of the plug and shrink with heat gun. Avoid excessive build-up of heat to avoid distortion of plug.

PLEASE NOTE: When charging battery packs FIRST connect bunch plugs to charger and THEN push central plug into power socket. Otherwise you risk a SHORT CIRCUIT!

12. Joining of Servo Block/Center Section and Piston Tank
12.1 Place the three bars, formerly screwed to the Piston Tank's bulk head, against the corresponding bores in servo bulk head T7 and fasten with hexagonal screws Y6.

12.2 Plug wire leads connected to power socket into extensions below CTS. Ensure that all connections are properly insulated.

12.3 The Tech Rack can be put aside until merged with hull.



13. Servo Arms
The recommended servo DS-238 MG BB (item no. 9377) is supplied with several servo levers. The two-arm lever is used for the 212, but one arm is cut off. The remaining arm is shortened after the second hole. It is best to cut it off with a side cutter and then file the corners round. Drill the holes to 1.5 mm.The servo arms are only fitted after the servos have been adjusted.

Part B

WORK ON THE HULL

14. Rudder System at Stern

14.1 First glue the four skegs (rudder base) to the rear of the hull using 2-K. The exact positions are determined by the recesses and holes in the stern.

14.2 The procedure is as follows:

➜ Insert the rudder shaft bearing L4 from the outside into the respective skeg BUT not completely - just allow the shaft bearing to protrude outwards by approx. 3 mm.

➜ First attach only two opposite skegs. To do this, apply some 2K to the gluing surface of the skeg and ensure that no adhesive gets into the shaft bearing.

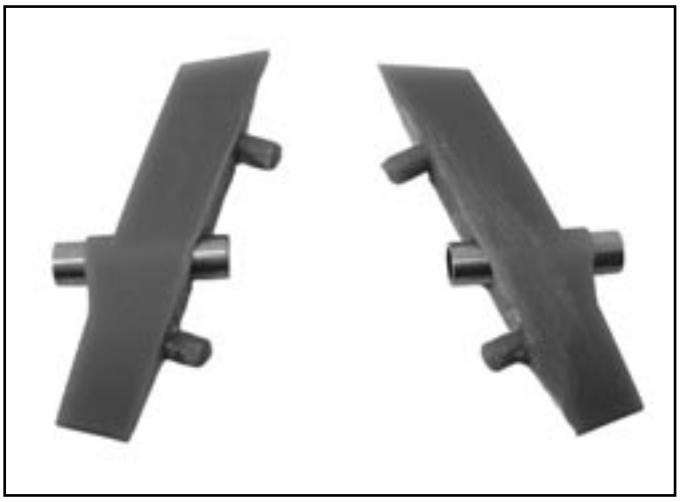
➜ Place the skeg against the hull, press on and then slide in the shaft bearing flush with the outer edge of the skeg.

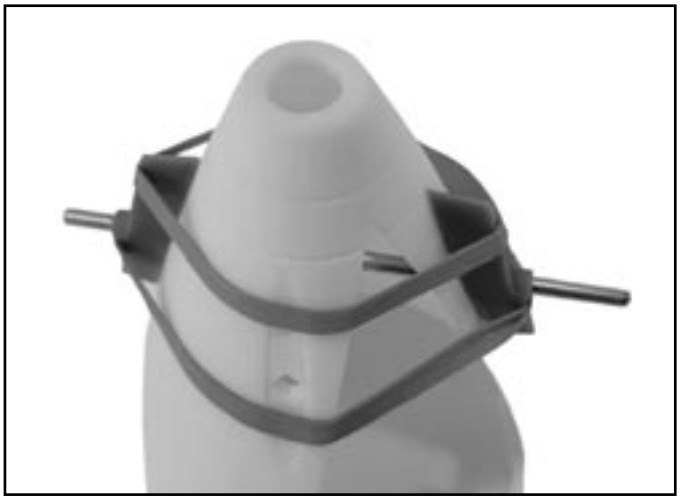
➜ Use rudder shaft L8 (for tower rudder) as an aid to maintaining the alignment of the respective pair of shaft bearings.

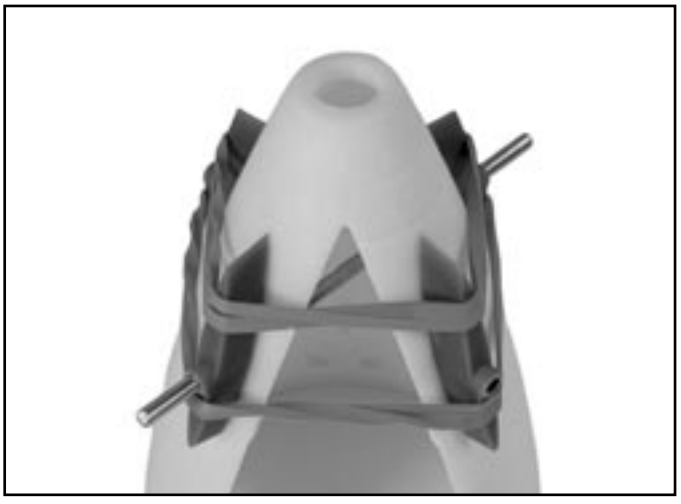
➜ Remove excess adhesive with a blade or similar. Wipe with spirit. Then fix with rubber bands.

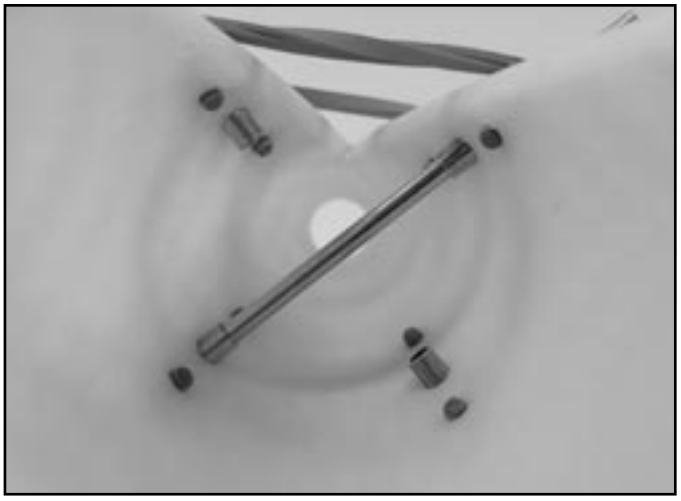
➜ Glue the pins and tube inside the hull with 2K.

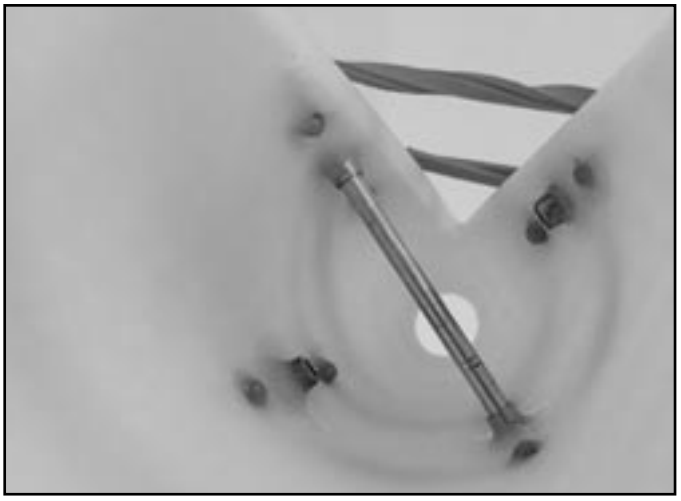
➜ After drying, repeat with the second pair of skegs.











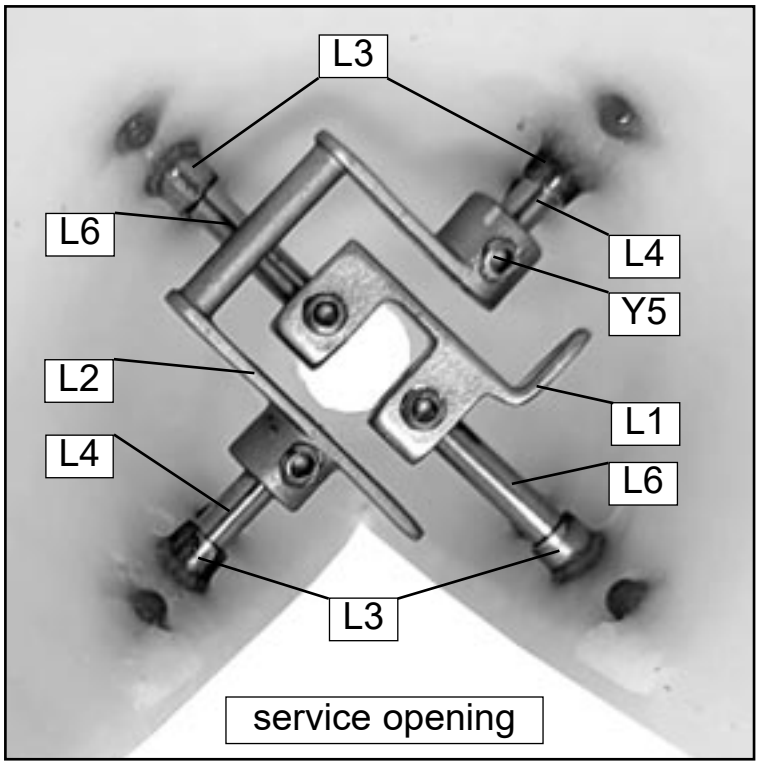
15. X-Rudder

15.1 Insert the rudder shafts L4 or L6 into the four rear rudders. To do this, allow medium viscosity CA to run into the hole in the rudder. A maximum of two drops per rudder is sufficient! Immediately push the rudder shaft in as far as it will go. Wipe off excess CA immediately with a lint-free cloth.

15.2 Allow to dry for approx. 10 minutes and connect the two rudders with longer shafts using steering lever L1.

15.3 Initially only loosely tighten grub screws Y5. The exact positioning of the two steering levers can only be carried out at point [19.9].

15.4 Connect the second pair of rudders with shorter axles using steering lever L2. L2 must be at 45° to axle L6. See from point [19.4].



The main drive must be fitted before attaching the shaft bearing A8. The installation of the drive is initially only temporary and only serves to adjust the steering levers.

16. Main Drive

16.1 Press the shaft seal A7 into the neck of the motor mount A2. The spiral spring is on the inside.

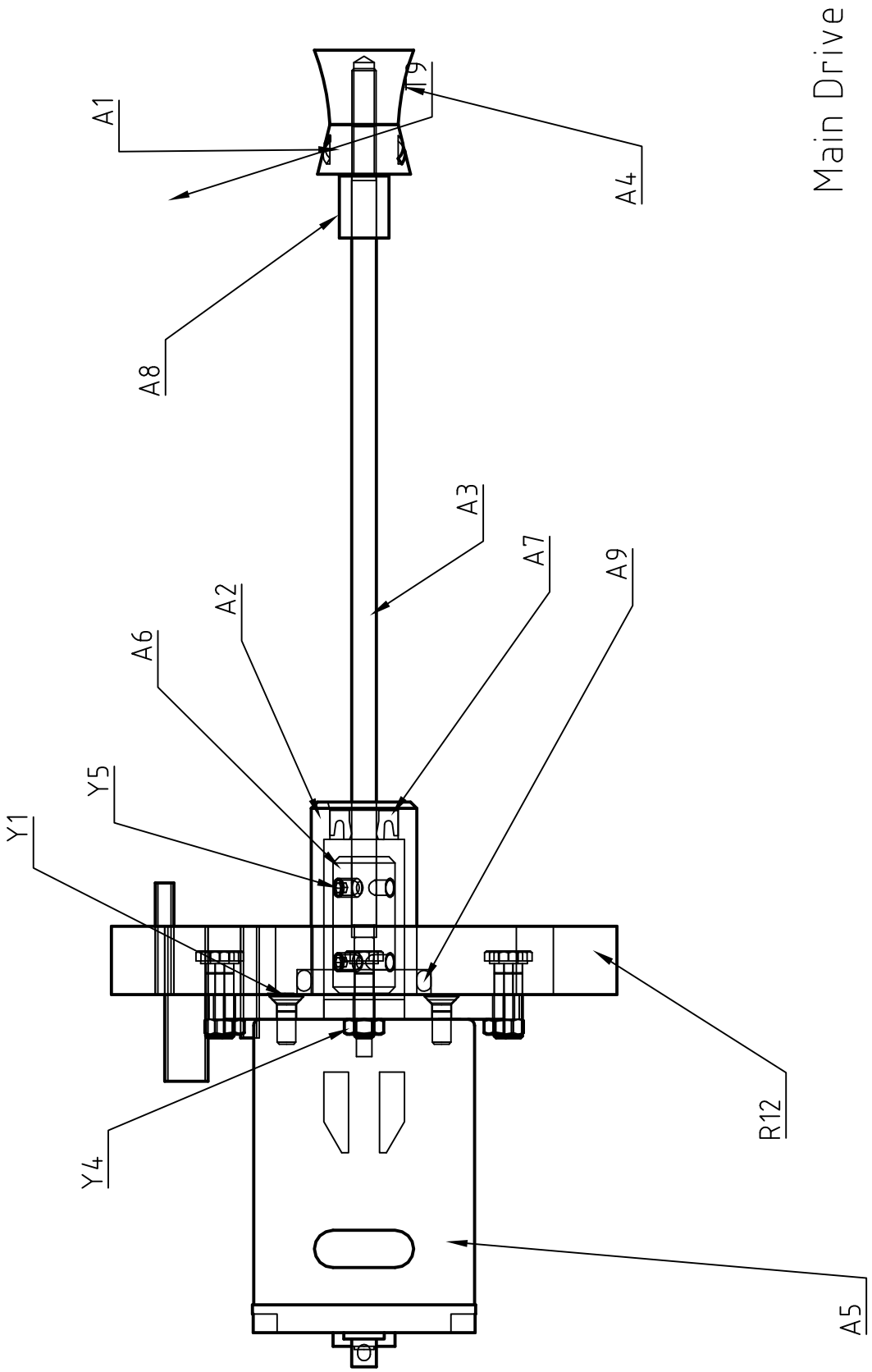
16.2 CAREFULLY insert the propeller shaft A3 with the blunt end into the shaft seal. The shaft seal and the shaft end should first be greased with Q-Lube adhesive lubricant (part no. 9705).

CAUTION: Do not push the propeller shaft with the threaded end through the shaft seal! Otherwise the sealing lip of the ring will be damaged!

16.3 Connect the motor shaft and propeller shaft with the coupling A6 and grub screws Y5 and fasten the motor to the motor mount A2 with two countersunk screws Y1.

16.4 Push the O-ring A9 onto the neck of the motor mount and rub in well with silicone grease (item no. 9710). Then insert the motor mount into the end bulkhead and screw tight with four nuts Y4.

Do not allow shaft seals to run dry! Otherwise the sealing lip will wear very quickly and leak. To test the drive unit, apply a drop of oil directly to the shaft on the sealing lip of the sealing ring.



17. Prop Shaft Bearing
Before the tail section is glued to the center section of the hull, the shaft bearing and the fork connections, push rods and bellows are fitted first. The kit includes tools for fixing the tail section to the center section.

17.1 First place the tail section on the hull center section. Guide the drive already attached to the center section with the propeller shaft through the steering levers.

17.2 The propeller shaft now protrudes from the hole in the rear of the hull.

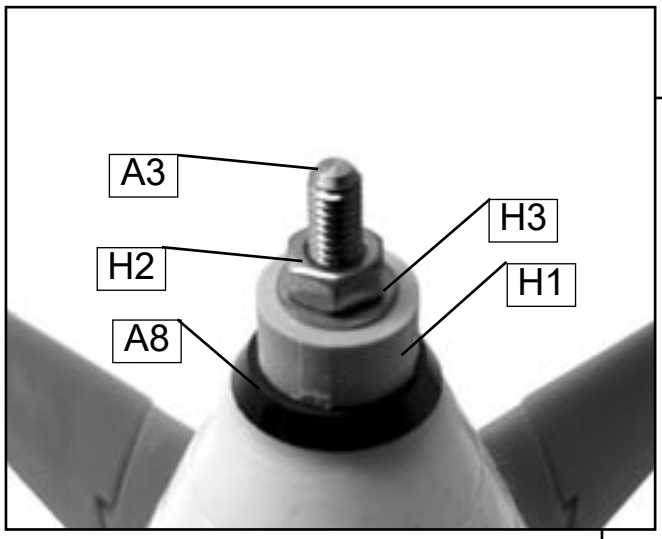
17.3 The bore is dimensioned so that the shaft bearing has radial play in the bore. This allows the propeller shaft to be precisely aligned.

17.4 Apply a generous amount of 2K to the adhesive surface of the shaft bearing and push it into the tail section.

17.5 Slide on bushing H1 and washer H3 and screw on nut H2 loosely at first.

17.6 The propeller shaft must rotate easily!

17.7 Then tighten nut H2 and allow the bonding to dry completely.



18. Clevises (plastic)
The clevises in the flooded area are made of plastic as metal clevises would corrode after a short time after being exposed to water.

18.1 Assemble the rudder linkages from parts L9 - L13 as shown. Pay attention to dimension 21!

18.2 Lightly roughen part L11 beforehand to ensure a better adhesive bond.

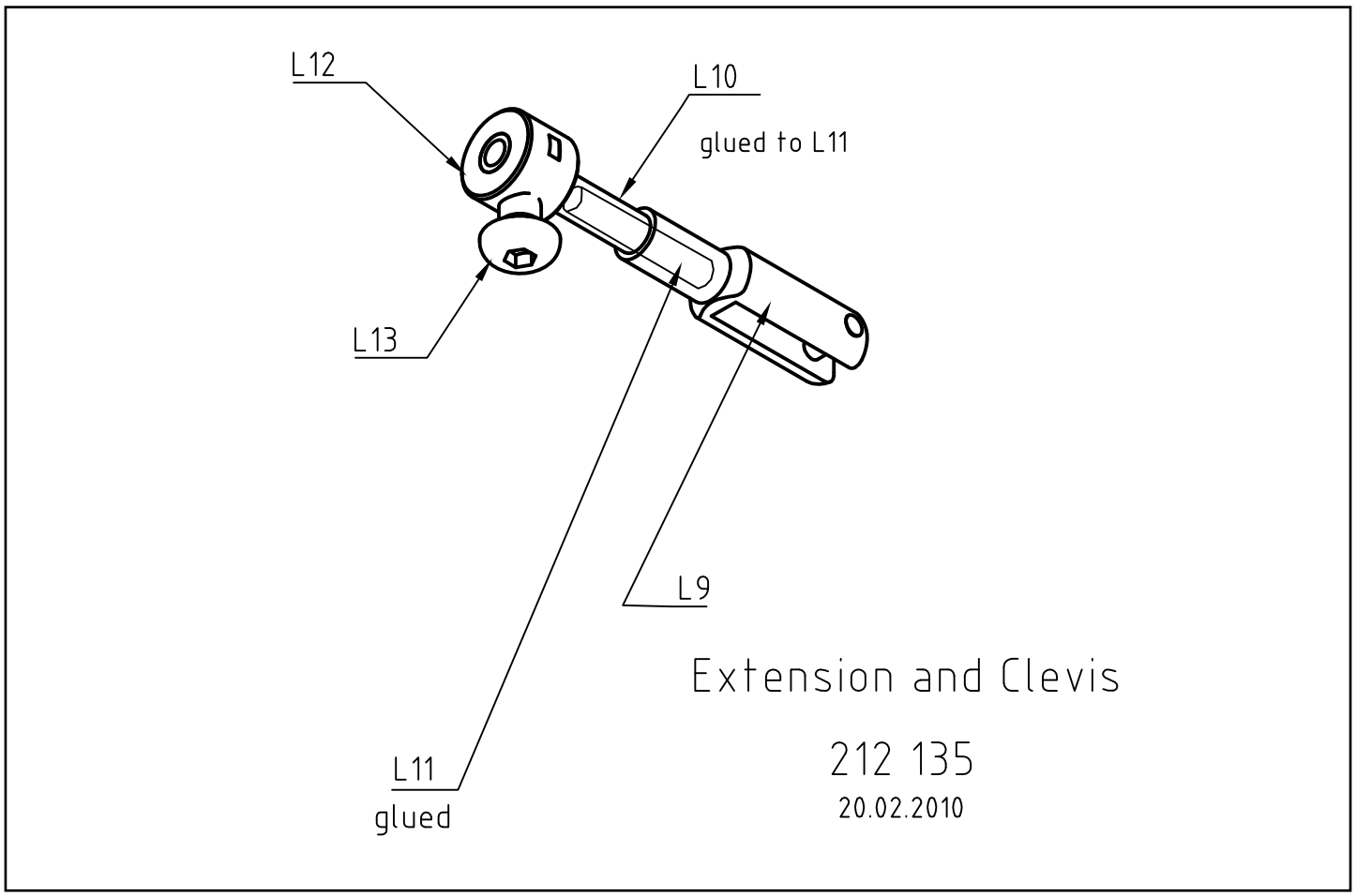
18.3 Run a small drop of CA adhesive into the front of tube L10 and insert rod L11.

18.4 Glue rod L11 into fork connection L9 with medium viscosity CA.

18.5 Fit set collar L12 with screw L13 and push onto L10.

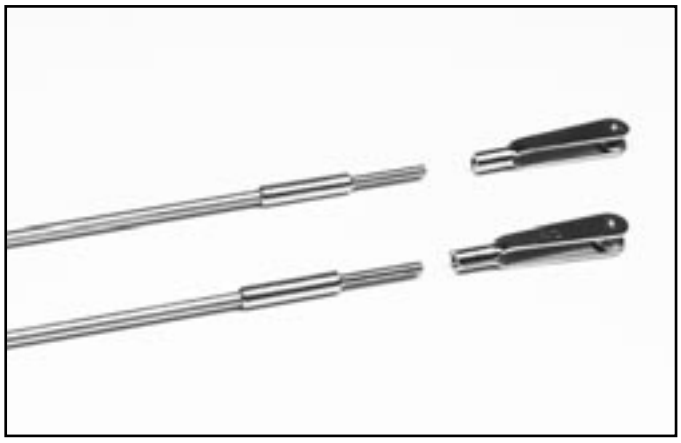
18.6 Snap fork connection L9 into the respective rudder yoke.

Push rod S1 is later inserted into tube L10 and secured by tightening L12.



19. Push Rods

19.1 Solder or glue a solder sleeve L15 to one end of the push rods S1-1 and S1-2 (e.g. with superglue, art. no. 96040).



19.2 A steel clevis L16 is then screwed onto each of the solder sleeves up to approx. 2 mm in front of the threaded end of the solder sleeve. This should later correspond approximately to the servo position in neutral.

19.3 The other end of the linkage is filed round with a file so that no sharp edge remains.

19.4 The standard value for the basic setting of the rudder linkage is: Screw the clevis onto the solder sleeve up to approx. 3 mm.

The two push rods are different lengths! The shorter push rod S1-1 is used to link the smaller (inner) rudder yoke L1, the longer rod S1-2 operates the larger (outer) yoke L2.

19.5 Carefully insert the rods from the inside through the rod bushings and the bellows. The bellows must not be damaged under any circumstances! Start with the rear push rod S1-1.

19.6 In order to be able to insert the push rods into the guide tubes of the clevises, the rods must be angled slightly. The bend should be made approx. 30 mm before the rear end of the rod. To do this, mark the position accordingly, grip the rod at the marking with needle-nose pliers and then carefully bend the rod in the desired direction with two fingers.

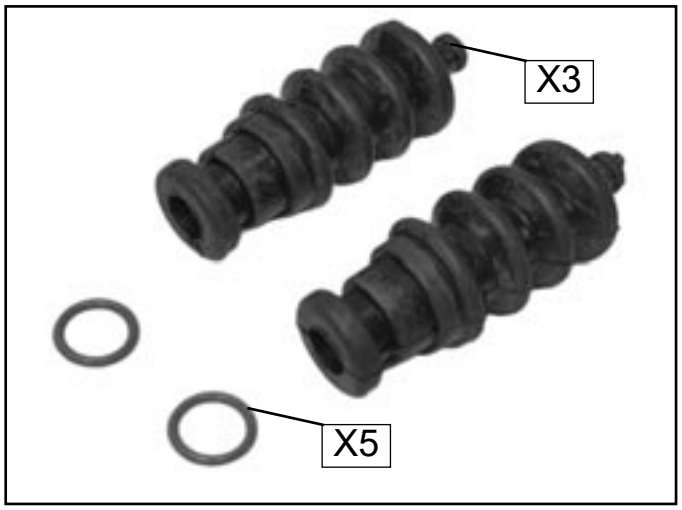
19.7 It is now advantageous that the tail section is not yet glued to the center section of the hull.

19.8 The bend must never be too close to the end bulkhead, otherwise the control travel will be affected, which in turn will have a very negative effect on the control behavior and the servo.

Screws L13 (on the adjusting rings) are only tightened after the tail section has been glued to the center section.

19.9 Fine adjustment of rudder yokes L1 and L2 ensures that the propeller shaft runs more or less centrally through steering lever L1. The shaft must not touch L1. The rudder deflections should be the same in both directions.

20. Bellows
Slide bellows X3 together with O-ring X5 ungreased (dry) onto the rod bushings. The O-ring serves to additionally secure the bellows on the bushing.



21. Bonding Rear and Center Section
These two parts must be glued using 2K. Make sure that all bonding surfaces are thoroughly cleaned with spirit beforehand. The tools for mounting the shaft bearing (for the propeller shaft) are now removed again. The tail and center sections are now detached from each other again.

21.1 Apply 2-component adhesive to both bonding surfaces and push the tail and center sections together.

21.2 Fix the rear and middle sections together again using the same tools as when fitting the shaft bearing (point 17).

21.3 Tighten nut H2 well.

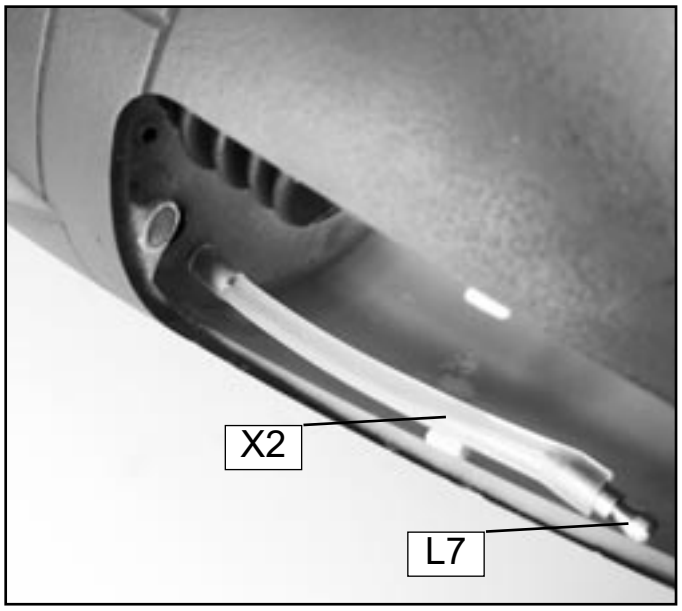
21.4 Use a blunt object to remove any adhesive emerging from the seam and, if necessary, carefully wipe it off with spirit. However, the adhesive seam should remain filled with adhesive.

21.5 Allow the bond to cure completely. As a rule, the drying time is at least 12 hours.

22. Breather Tube and Seal Plug
This breather will prove helpful when checking for leaks or for equalization of internal pressure in case of leakage. Furthermore, if the bayonet lock ring cannot be opened due to large difference in air/water temperature (and a resulting negative pressure caused thereby within the hull) just open the breather to equalize pressure. The lock ring can then be opened again easily.

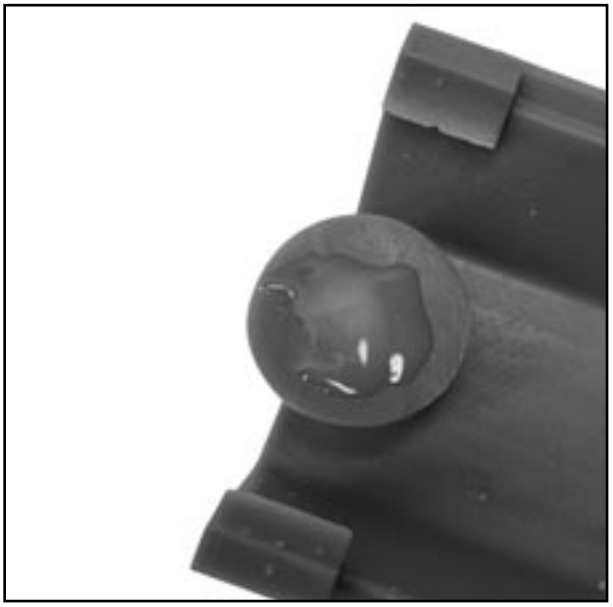
22.1 Cut a 5 cm long piece of silicone tubing X2. Push this tube onto the brass tube protruding the back side of the main bulk head.

22.2 Close tubing with seal plug L7.



23. Hull Ridge

is attached to the front hull section R1 with two Y7 screws and thus remains removable. The front screw block on the front part of the hull is already fitted at the factory. The rear bracket R12 for the hull ridge must still be glued on to ensure a (more or less) seamless transition between the two hull ridge sections. However, the hull ridge tends to be approx. 1 mm longer than required. This is indicated by an "overbite" at the bow. This deliberate excess length allows the hull ridge to be adapted exactly to the optimum mounting dimension. For this purpose, the rear end of the hull ridge can be sanded flat on a piece of sandpaper (120 grit) to the required dimension. The mounting height can be adjusted by sanding the ring-shaped attachment surfaces on the underside of the hull ridge.

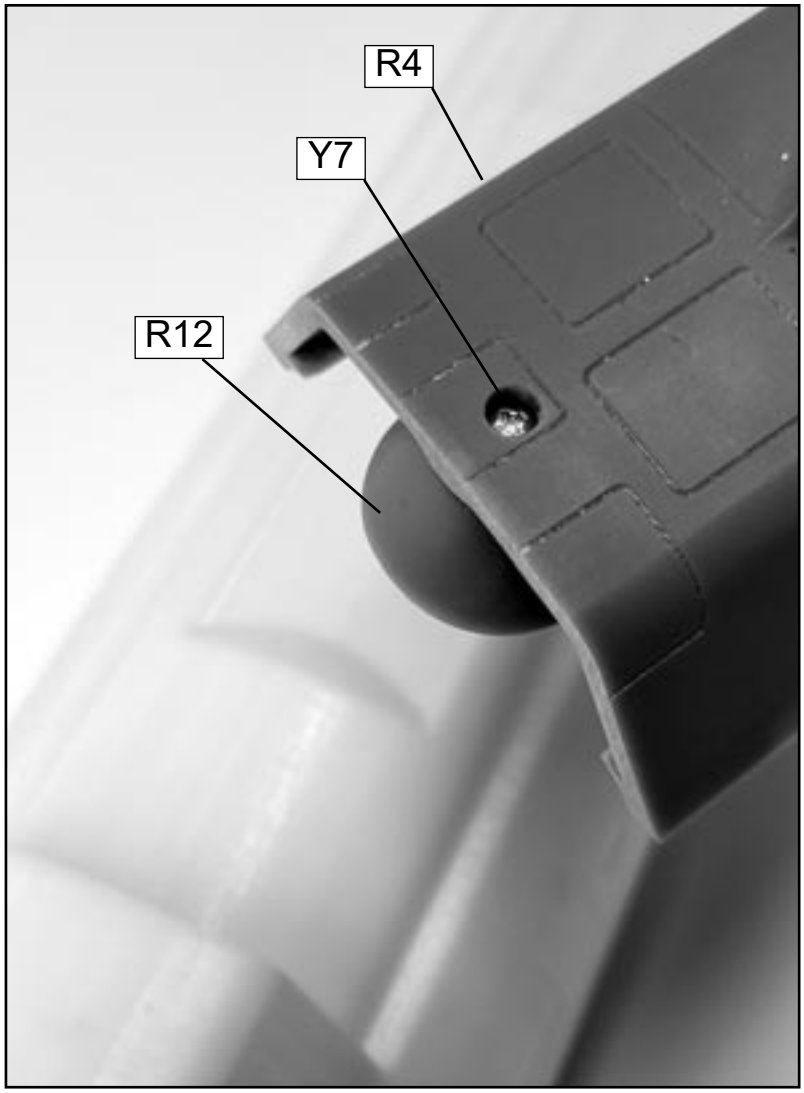


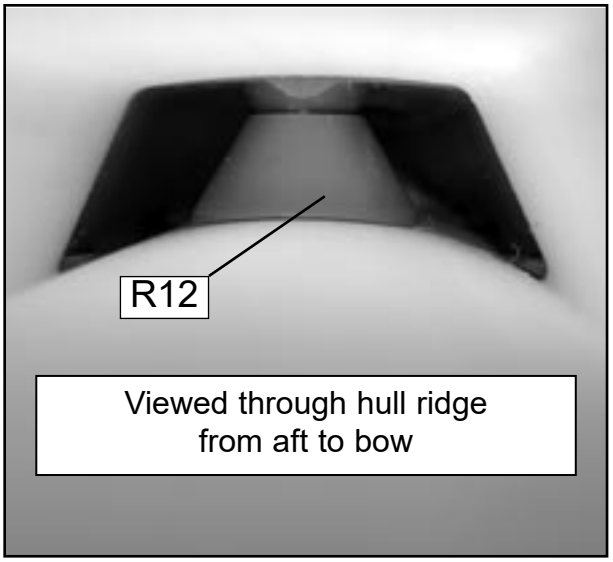
23.1 Then drill out the rear bracket R12 to ø 1.7 mm and fasten it to the tower back R4 with screw Y7.

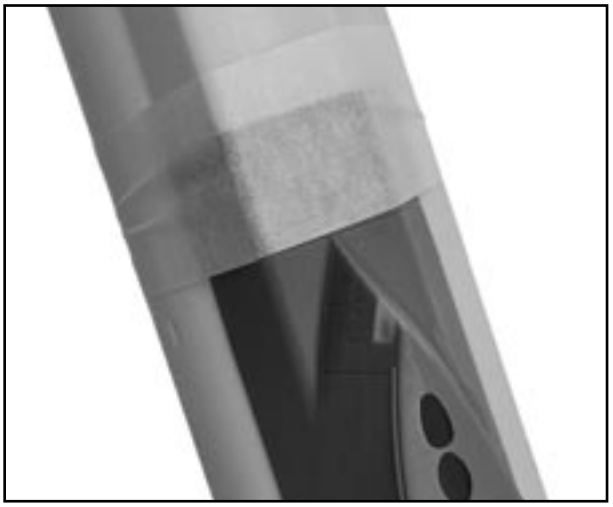
23.2 Apply a generous amount of 2K to the underside of bracket R12, position it on the front part of the hull and align it accordingly. Secure with adhesive tape.

23.3 Drill the hole for the front attachment with a 1.7 mm dia. drill bit and also secure with screw Y7.

The maximum drilling depth must not exceed 6 mm!







24. Sail
The sail needs to be fitted with dive planes, position lights and windows. The planes should be pre-assembled before the model is painted. The position lights and windows should only be fitted after the model has been painted. However, the sequence of this assembly work is anticipated.

The holes for the sail dive planes axle L8 are reamed to fit. The sail planes are not linkable. Shaft L8 is only inserted through the two opposite holes and should only hold the rudders in position by friction - even when the model is moving forward. This "fixation" is provided when using the optional Conning Tower Mechanism (1599-1A), as the mechanism itself guides the shaft and clamps it to a certain extent. Without the mechanism, however, this can only be the case to a limited extent.

To make the windows, the kit includes a small sheet of transparent PET with a paper cutting template. The two starboard/port frames are made of black, self-adhesive film and are included in package 2. These frames are (of course) only attached after painting.

24.1 Glue only one of the tower planes firmly to the tower rudder axle L8. Simply stick the other plane in place. Otherwise it will no longer be possible to fit or remove the conning tower mechanism (1599-1A).

24.2 Paint the three position lights R9 accordingly before gluing (with CA and after painting!):
1. starboard (right) GREEN
2. port (left) RED
3. stern (rear) WHITE

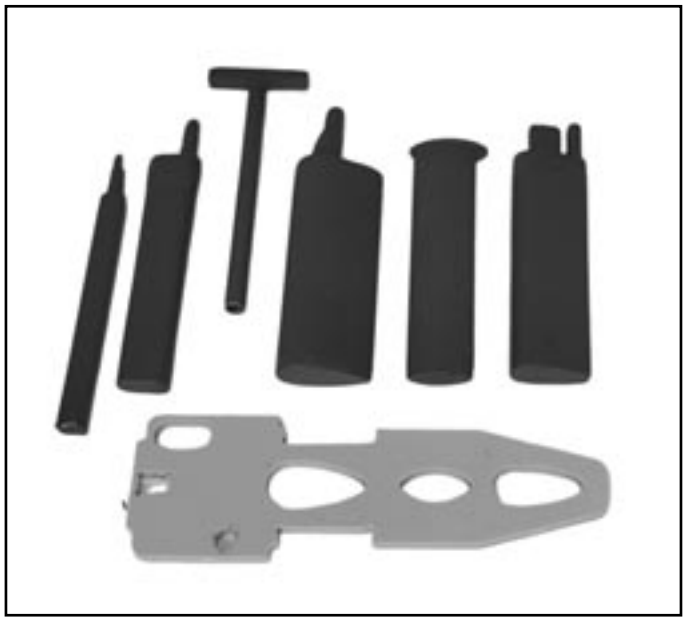
24.3 Cut the window from the provided transparent PET D2 using the paper template. Good, sharp scissors are absolutely sufficient for this. Cut out generously! In other words, stay just outside the edge of the paper template. It is better to adjust it slightly than to cut it too small from the beginning.

24.4 Do NOT use CA (superglue) to glue the windows! Otherwise the windows will become blind. Suitable adhesives are UV-curing adhesives or appropriate instant adhesives.

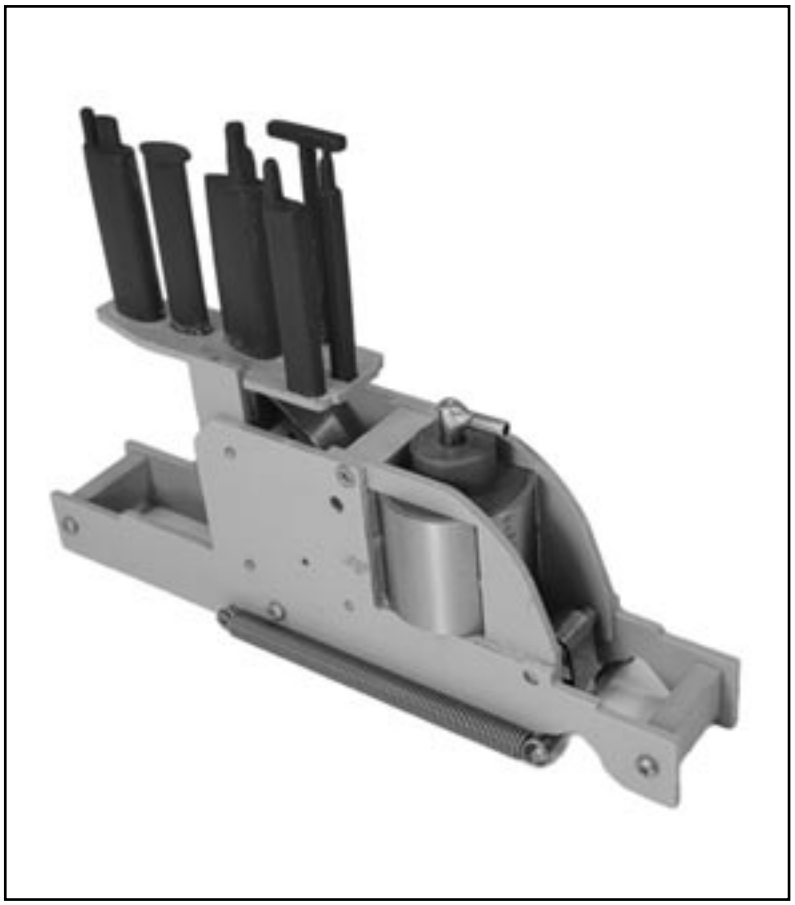
25. Periscopes and Antennas
As an alternative to the optional Conning Tower Mechanism the kit includes the extension units for permanent installation in the sail.

25.1 Glue the periscopes and antennas onto mounting plate R21 in their respective positions.

25.2 Then slide this assembly into the sail and glue it in place. Silicone is recommended for this, which can also be cut open again to remove the extension units if necessary.



26. Conning Tower Mechanism (optional)
The tower mechanism is available as an accessory and comes fully assembled.

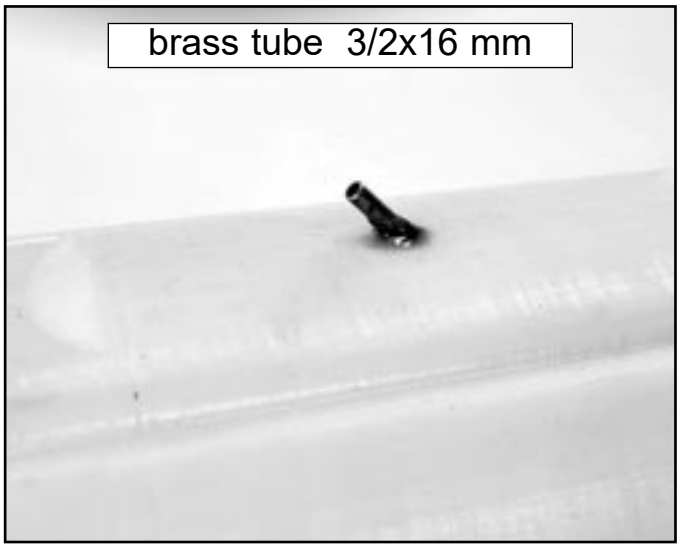


26.1 The axle that connects the two planes on the sail is used to fix the sail mechanism. Glue only one of the tower planes R5 firmly to the tower rudder axle L8. The other plane is simply plugged in. As the bores for the rudder axis may be different check beforehand which bore fits better and glue the smoother-running plane. Leave the other for "dry" assembly. If both planes fit too easily on the shaft, a knurl can also be pressed onto the shaft end with a coarser flat file so that the rudder is held securely but remains removable.

26.2 The mechanism must not be GREASED under any circumstances! Furthermore, no mechanical components may be painted.

26.3 If the model, and therefore the conning tower mechanism, is not moved for a certain period of time it may not function at first. Storage may cause the sealing ring to stick slightly inside the cylinder of the mechanism. If this occurs, the free movement can be restored by carefully pushing down and pulling out the slide by hand.

26.4 To operate the mechanics, a breather in the form of a brass tube ø 3 mm glued into the top of the hull is required. This tube is connected to the elbow connector located on the top of the cylinder of the mechanism using a silicone hose. The brass tube and hose are included with the mechanism.



26.5 Drill a dia. 3 mm hole at an angle of approx. 45° in the upper hull, measured approx. 370 mm from rear edge of the front hull to bow. Glue in the brass tube dia. 3/2x16 mm with 2K and leave to set.

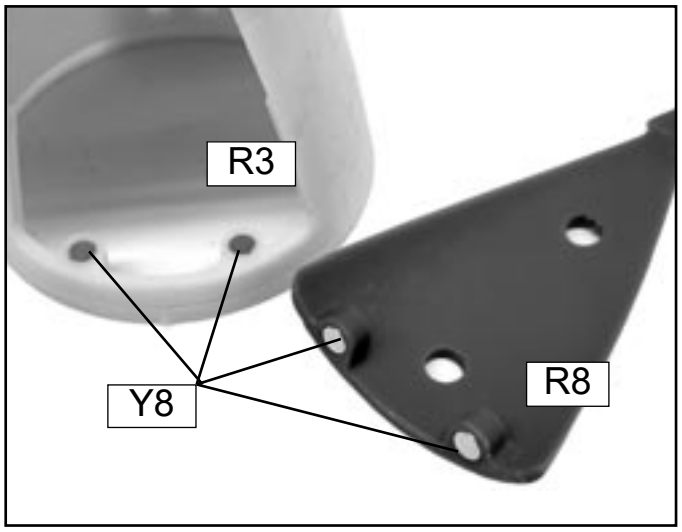
26.6 It is IMPERATIVE to ensure that the tube does not protrude more than 1 mm on the INSIDE and that there is NO excessive glue built-up within. Otherwise there is a risk that the insertion of the Tech Rack© will prove difficult or become even impossible.

In the shipping packaging, the Conning Tower Mechanism (item no. 1599-1A) is held in the 'retracted' position with a locking pin.This transport lock must be removed before installing the mechanism in the sail.

27. Service Hatch
Magnets are used to lock the service hatch R8 in the rear of the hull. The magnets Y8 are gold-plated and therefore protected against corrosion.

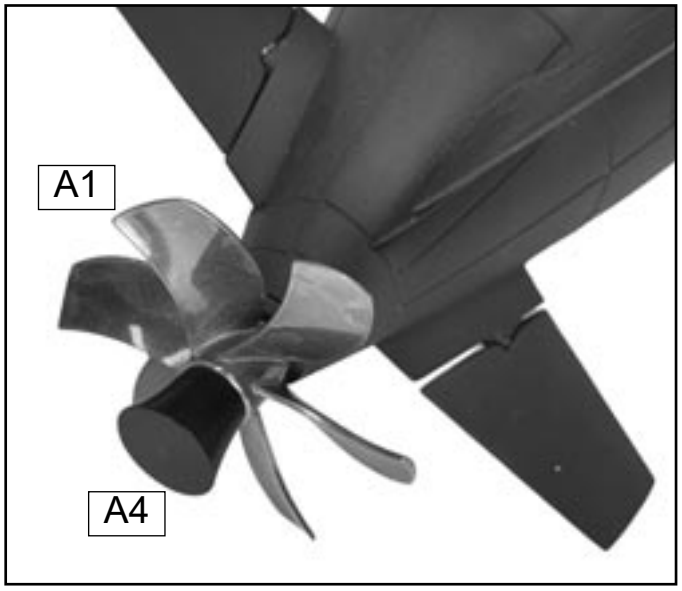
27.1 Glue two Y8 magnets each in the service hatch R8 and in the tail section R3 with CA.

27.2 Ensure correct polarity of the magnets - the magnets must ATTRACT each other!



28. Propeller and Spinner
28.1 Screw the propeller onto the shaft to a distance of slightly less than 1 mm from the hull.

28.2 Screw on the plastic spinner A4 and lock it with the propeller. It is not usually necessary to additionally secure the screw with adhesive.



29. Receiver, Servos and Pitch Contoller

29.1 The receiver should have horizontal servo socket pins. We scan-receiver RP8DI (item no. 9465). Attach receiver (Rx) on top cover of Centre Section, either with double-sided tape or Velcro® (hook-and-loop tape). Insert antenna wire into guiding tube S9 (made of white, flexible plastic). A piece of thin steel or brass wire or any stiff material with a maximum diameter 1.5 mm and a length of more than 1 m will prove helpful. Push this wire all the way through the guide tube, attach the antenna with a small drop of CA just to the blunt end of the wire and pull wire back slowly. If necessary, apply a drop of CA activator beforehand (item no. 96200) to strengthen the bond.

29.2 Plug speed controller (ESC) into receiver (Rx). Connect wires of main drive motor and ESC. Turn Transmitter (Tx) on. Switch on Rx and main drive simply by pushing central plug into power socket. Check if motor actually turns in the correct direction. Seen from aft to bow, prop shaft must turn clockwise in forward mode. ESC should not be operated "forward" if actually in reverse mode; otherwise ESC might suffer damage. Instead, reverse wiring between ESC and drive motor (e.g. blue-on-white, white-on-blue). Please refer to separate manual of ESC for specific setup procedure.

29.3 Remove top cover from center section and fasten pitch controller with screw M3x16 mm and nut M3 (supplied with DLx2) in position. When using DLx2 ensure that cable connecting to motor for automatic pitch reverse is plugged onto the pins marked + and - on DLx2. Cable with black seam is connected to pin marked as - (negative) on DLx2. Plug both connection leads of DLx2 into the corresponding channels of receiver. Connect servos to DLx2. Servo mounted to top is “Servo 1”, bottom servo is “Servo 2”. Place Tech Rack© on even keel (meaning piston tank sits horizontally) and press “Neutral” button on DLx2. Servos will then travel to their neutral position.

29.4 Servo travel must be reduced to 60% so that rudder yokes do not conflict at full throw with prop shaft. DLx2 will ignore any servo travel settings given by the transmitter. Therefore, servo travel can be limited directly on DLx2.

29.5 Adjustment of servo travel is made simply by pressing the “Neutral” button on DLx2. The actual reduction is indicated by blinking frequencies in groups of three of the red LED.

Follow these steps for adjustment:

Transmitter and receiver are both switched OFF. Initially, plug in the connection cable of DLx2 to receiver marked with a white dot on the plug. Then switch transmitter and receiver ON.

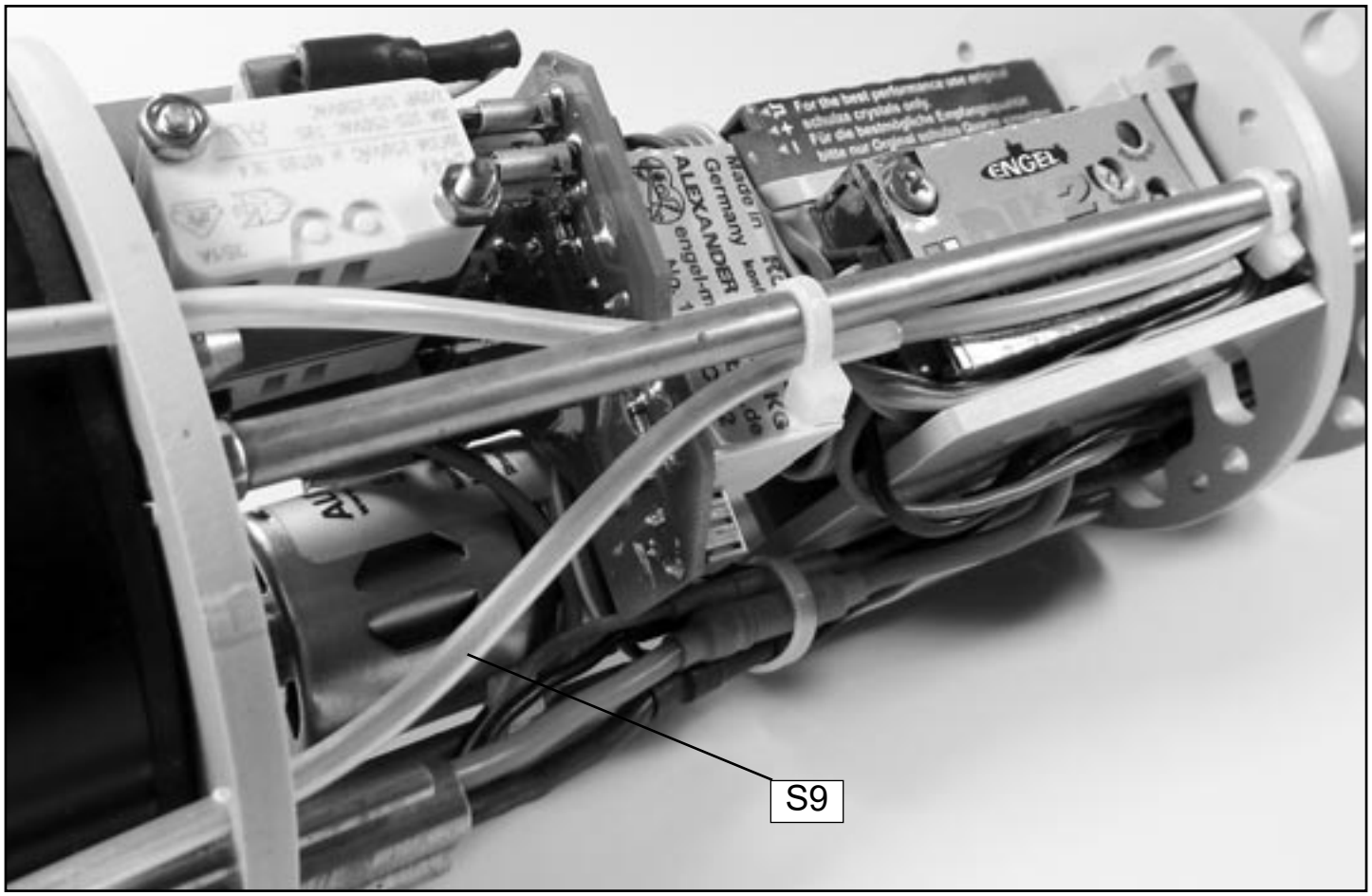
Press control stick of corresponding channel fully in one direction and hold in this position.

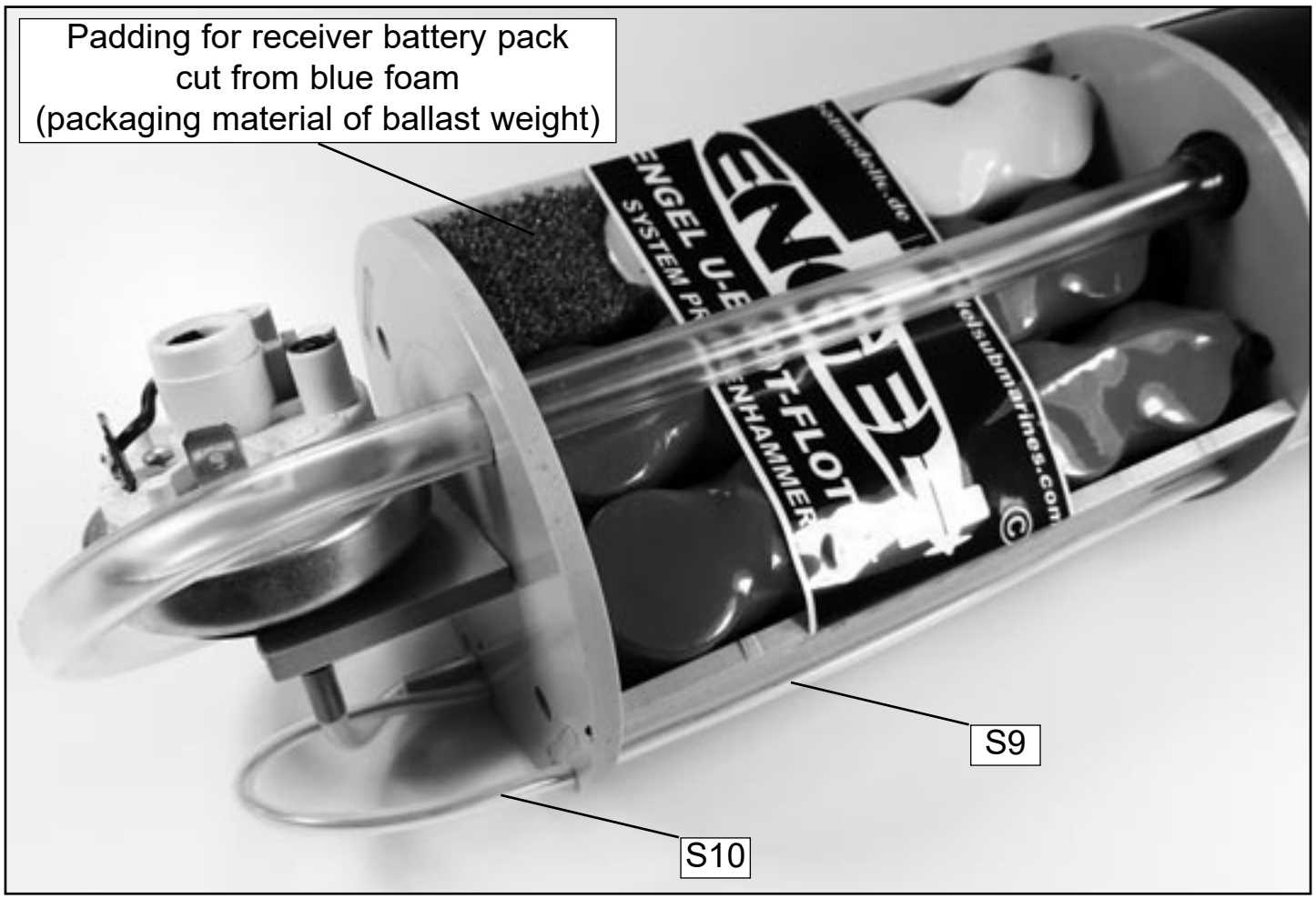
Press “Neutral” button and hold. Red LED starts to blink in a single manner.

Red LED blinks	1x	=	100%	servo travel (default setting)
	2x	=	90%	
	3x	=	80%	
	4x	=	70%	
	5x	=	60%	required for 212
	6x	=	50%	

As soon as the required setting has been achieved release “Neutral” button and let control stick also back to neutral.

The red LED indicates each level of reduction by a blinking frequency in groups of three and then switches to the next level of reduction by 10%. For switching back to a higher level of movement (e.g. 100% instead of 60%) the reduction procedure must be maintained down to 50% which is then followed by the initial 100% setting (no reduction = full servo movement); the LED indicates this again by single blinking for three times.





30. Proportional Control (with Hall sensor)

1. Hall sensor is fitted and connected to CTS2. Both jumpers MODE and SETUP are plugged onto CTS2. Receiver is ON and proportional slider is placed to BAIL (empty tank = resurface mode).

2. Switch receiver ON: green LED will light up indicating that receiver signal is satisfactory. Should piston rod not be fully retracted already piston tank drive will start and empty the tank (i.e. piston rod will be driven to actuation point of micro switch S1) and stop instantly. Actuation of Hall sensor is indicated by the CTS2's yellow LED.

3. Now the green LED will start to blink: CTS2 measures receiver signal BAIL.

4. The green LED shows a double blink: Push slider to FILL (fill tank = submerge mode). The unit now measures receiver signal FILL. Piston tank remains idle.

5. The green LED shows triple blinking. This indicates that the unit is ready for setting of mode, either to linear or 20/80.

6. With slider remaining in FILL position and pulling of jumper SETUP will switch CTS2 to linear mode. Yellow LED is OFF.

7. By pushing the slider to BAIL (yellow LED is ON) and pulling of jumper SETUP will switch the unit to 20/80 mode.

8. Piston tank now starts running with the CTS2 measuring piston tank length. Yellow LED indicates actuation of the Hall sensor. Piston is driven from its "empty" to its "full" position while Hall sensor counts the switching operations required for that full piston stroke.

9. Finally, piston is driven very shortly to BAIL in order to account for possible overrun whereby piston is briefly stopped. Piston then travels to the set position. Lighting of the green LED indicates that the system is now fully operational.

This setup procedure can be repeated simply by starting anew: Switch CTS2 OFF, plug jumper SETUP back onto CTS2 and switch unit ON again. Restart setup at step 1.

Jumper MODE remains plugged onto CTS2 as this activates Hall sensor mode. Jumper SETUP is required for programming only and is layed aside after successful setup of the unit.

Ensure correct direction of flow!
Connect the CTS2 to main battery BUT leave receiver switched OFF (by pulling receiver battery power lead from receiver). CTS2 must switch to BAIL (empty). If piston tank runs in the opposite direction (i.e. piston rod extends outward), the unit must IMMEDIATELY be stopped by pulling central plug. Reverse polarity on the motor (NOT on CTS2). Otherwise piston tank will not stop at its end position (micro switch S1) and stall.

The red LED indicates low battery voltage. If battery capacity has dropped below preset threshold value the red LED will light up. This consequently requires the main drive battery to be charged. If the LED is lit although battery voltage is sufficient threshold voltage might be set too high. This can be adjusted with potentiometer on CTS2. Anti-clockwise rotation of potentiometer increases threshold value, meaning that low battery mode will set-in earlier (at a higher voltage). Clockwise rotation will decrease this value; the battery monitor will activate resurfacing at lower battery voltage. For accurate adjustment a regulated mains unit is recommended. Alternatively, a battery with corresponding voltage can be used.

Blinking of the yellow LED indicates activation of pressure switch. CTS2 will remain in BAIL mode as long as pressure switch remains actuated.

The green LED indicates good signal quality. If transmitter signal is too weak or lost the green LED will be off. A lost or faulty signal will cause CTS2 to automatically switch to BAIL. CTS2 will only react to transmitter commands after signal has reached acceptable strength. Other than that the unit will remain in RESURFACE mode.

Possible Failures and Probable Causes

During setup:
Green LED always blinks once (or twice) and setup does not progress.
- Signal received is either not continual (e. g. interference) or shows negative values which can be either too low, too high or too close to midpoint (1.3 - 1.7 ms).
- Differential between "fill" to "bail" signal is too small.

Yellow LED does not blink. Green LED blinks hectically.
- Check Hall effect sensor and magnets. Probably disturbance caused by other magnets (i. e. motor).
- Distance between sensor and magnets too large.
- No impulses from Hall sensor.

During operation:
- Green LED is off but unit is still functional: Receiver signal is weak or disturbed.
- Green LED is off and Piston Tank switches to BAIL. That can result due to various reasons, e.g.:
    - •• Magnet impulses false, probably disturbance caused by other magnets (i. e. motor).
    - •• Receiver signal shows major disturbances or is totally lost.
    - •• Piston Tank is mechanically blocked.
    - •• Drop in voltage of receiver battery.

31. Main Ballast BOW

31.1 The main ballast for the bow hull section of the hull consists of two preformed half-shells made of lead. When working with the lead weights, always wear gloves and refrain from eating, drinking and smoking.

31.2 Clean the bonding surface on the inner wall of the hull with spirit or universal thinner.

31.3 The lead strips can be glued in place with a high-quality, fabric-reinforced, double-sided adhesive tape. For this purpose, two layers of adhesive tape are applied to the underside of each lead strip; this considerably increases the adhesive bond.

31.4 Alternatively, a 2-component adhesive can be applied and the weights firmly glued in place.

31.3 The lead strip on the RIGHT in the direction of travel (viewed from the rear to the front) must have an offset of exactly 1 mm to the center of the hull to the LEFT. In addition, BOTH lead strips must be as close to the inner edge of the bayonet ring as possible.

31.4 Two shaped pieces with a central bore are glued into the hull bilge at the factory. Insert a 25 mm long brass wire 2 mm (H5) into each of these holes.

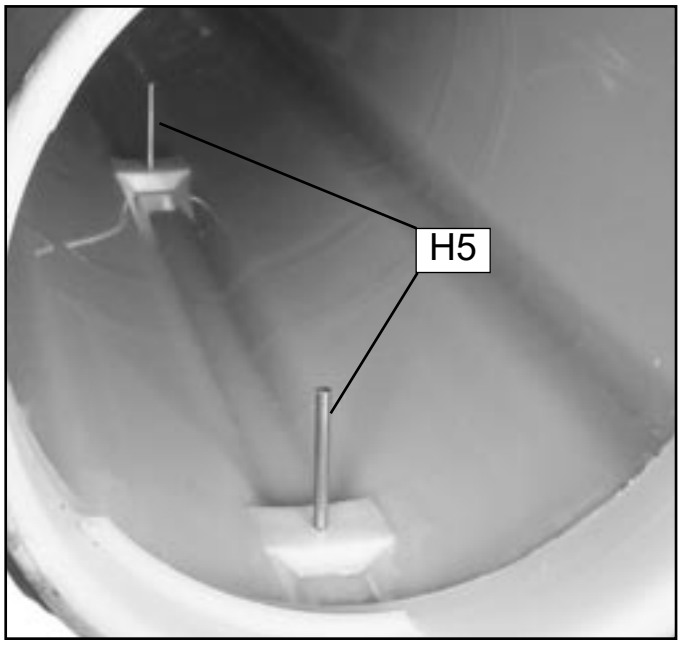
31.5 FIRST glue in the LEFT lead strip [1]!
Make sure that the strip is flush with the entire surface of the inner hull wall. If adhesive leaks from the bayonet ring, wipe it off immediately with a damp cloth.

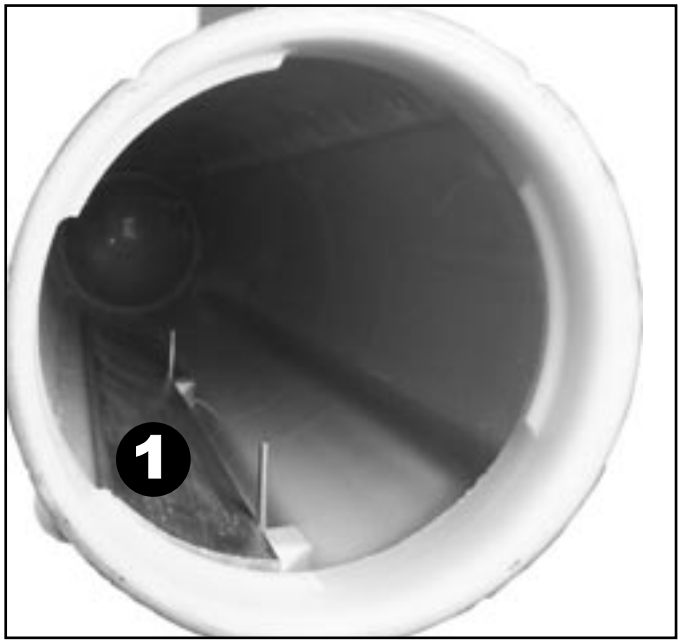
31.6 If 2K adhesive is used, remove the two brass pins immediately after tightening the adhesive.

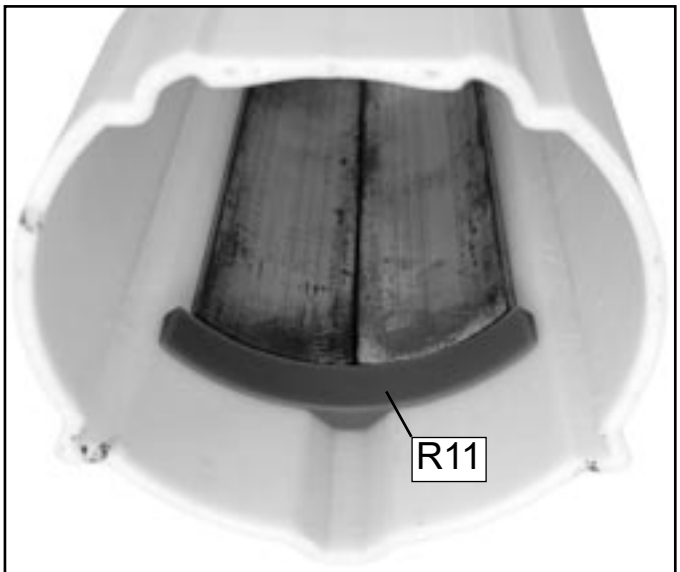
31.7 Then glue in the right-hand lead strip [2].
Again, ensure that the strip is flush with the entire surface of the inner hull walling. If glue leaks from the bayonet ring, wipe it off immediately with a damp cloth.

31.8 Two additional ballast pieces B3 and B4, each weighing approx. 50 g, are included in the kit. These pieces of lead are stowed in the nose area of the technical equipment (e.g. in or under the battery compartment) and are used for fine trimming the model.

31.9 If the model is equipped without a turret mechanism, appropriate balance weights are required. The two lead strips B5, which are attached to the bottom left and right of the piston tank in the turret area, are used for this purpose.





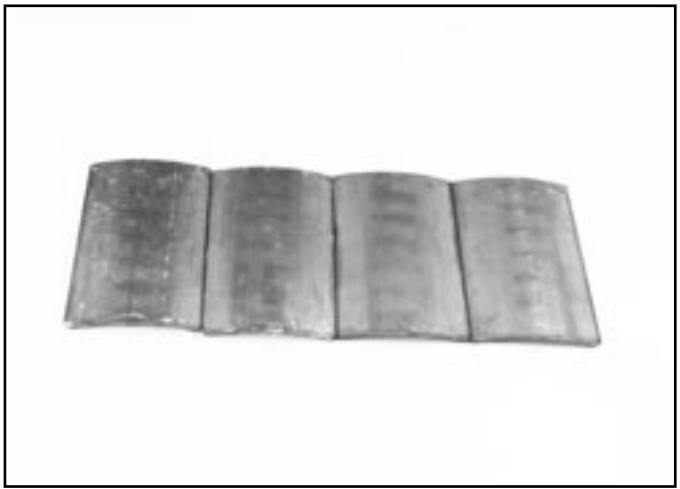


View shows cross-section of hull!

32. Main Ballast End Piece (Ramp)
To make it easier to remove the Tech Rack© from the bow section, an end piece R11 is glued to the bow end of the front main ballast with 2C, which serves as a kind of ramp.

32.1 Roughly sand the bonding surface (underside) of the end piece R11 and glue with 2K.

32.2 Insert end piece R11 into the hull and press on firmly. Allow to rest until glue has completely set.



33. Main Ballast AFT
The main ballast for the aft (rear) hull section consists of FOUR preformed lead half-shells.

33.1 The lead strips should be glued in place with a high-quality, fabric-reinforced, double-sided adhesive tape. For this purpose, two layers of adhesive tape are applied to the underside of each lead strip; this considerably increases the adhesive bond.

33.2 Two pieces of lead are attached exactly to the left and right of the center of the bilge. The lead pieces do not necessarily have to be glued in with 2K or similar, as long as a firm bond to the hull can be assured.

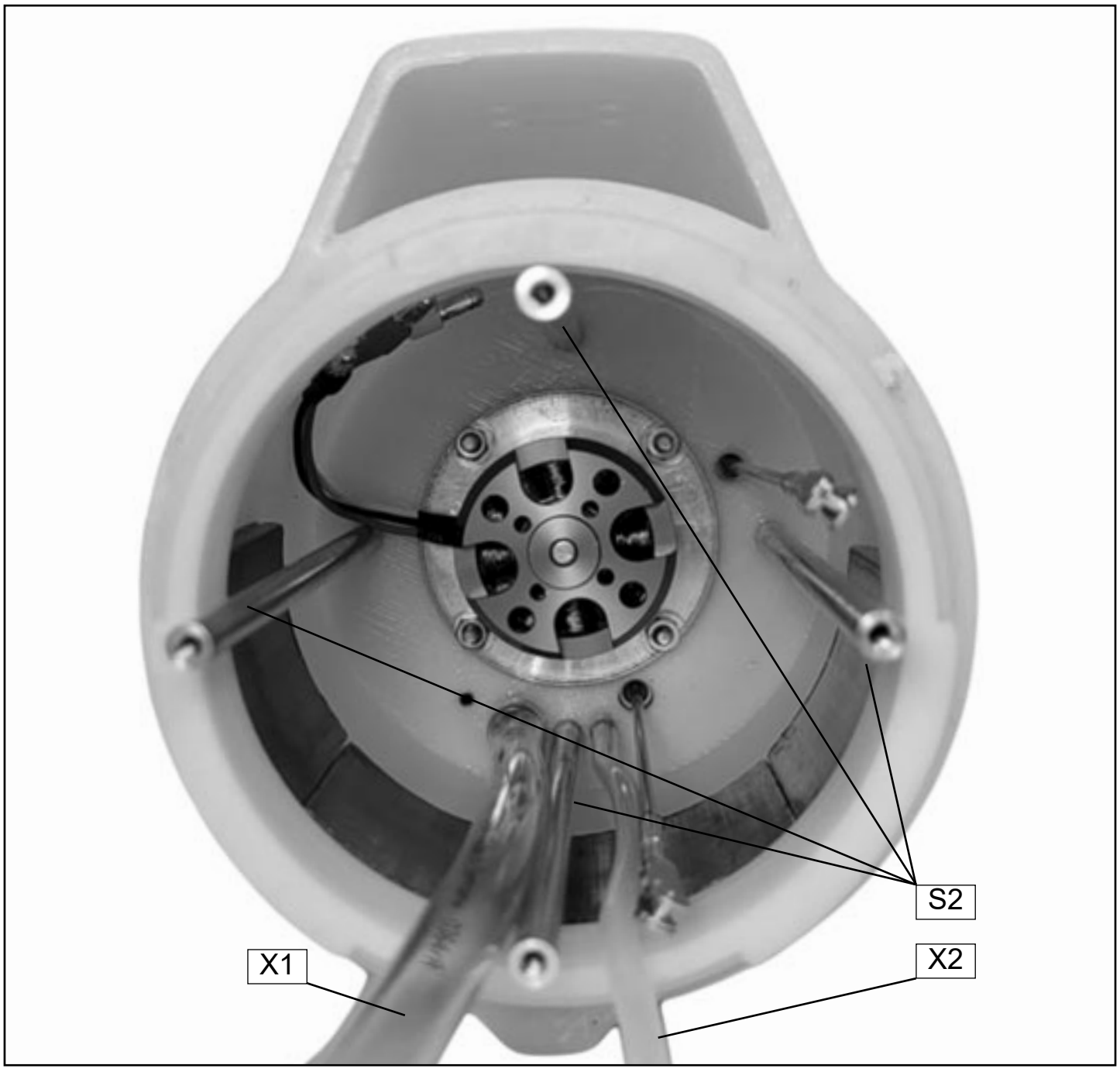
34. Joining Tech Rack© and Hull

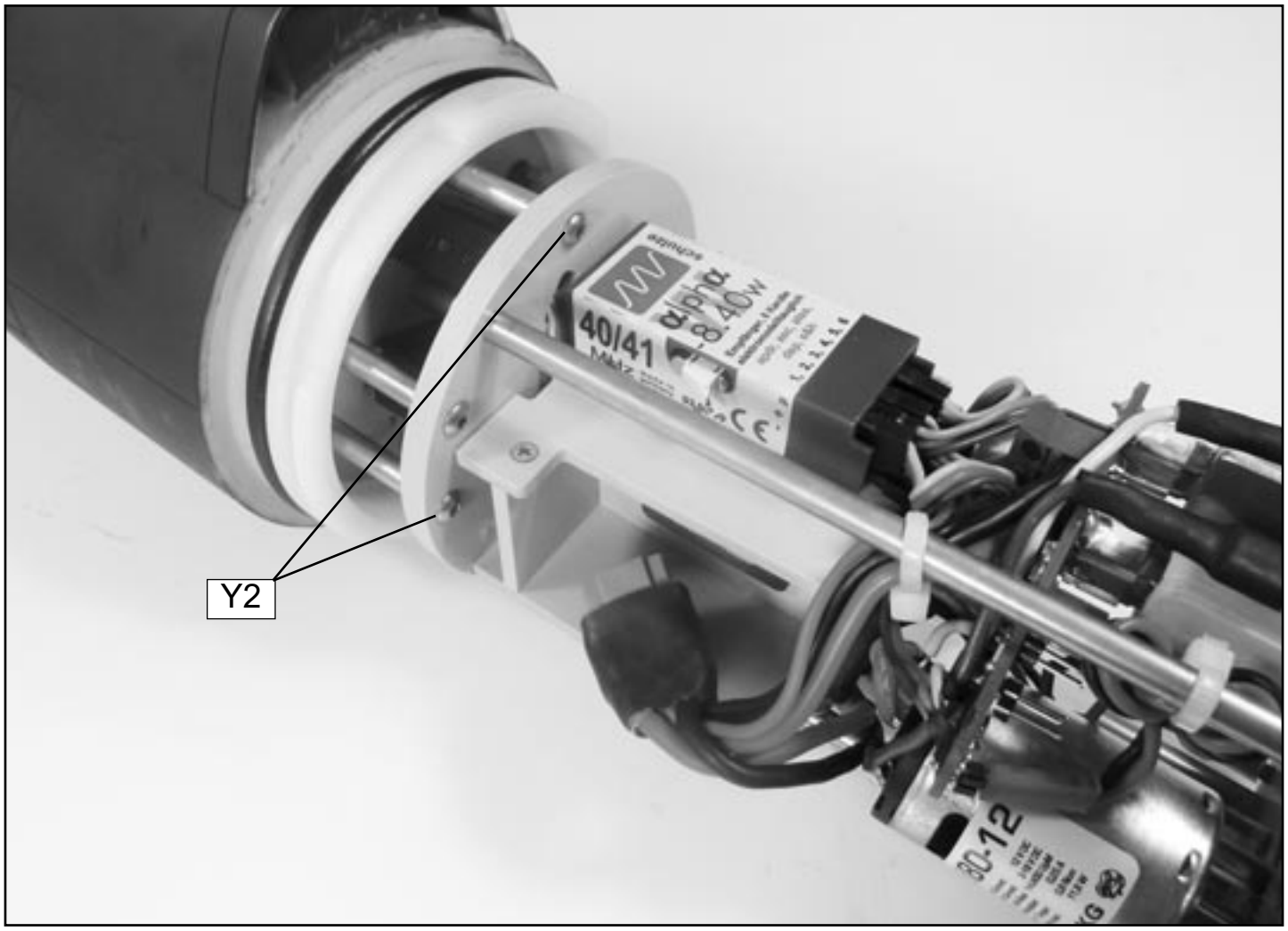
The following building sequences demand a fair amount of patience as well as diligence. Several components must now be connected almost simultaneously. These include ESC to motor, control rods to servos and, last but not least, two tubings (already fitted to outboard nozzles in main bulk head) to brass tubes running through the Tech Rack© . Separating the Centre Section from Piston Tank will make this procedure less difficult; this is not necessary but definitely helpful.

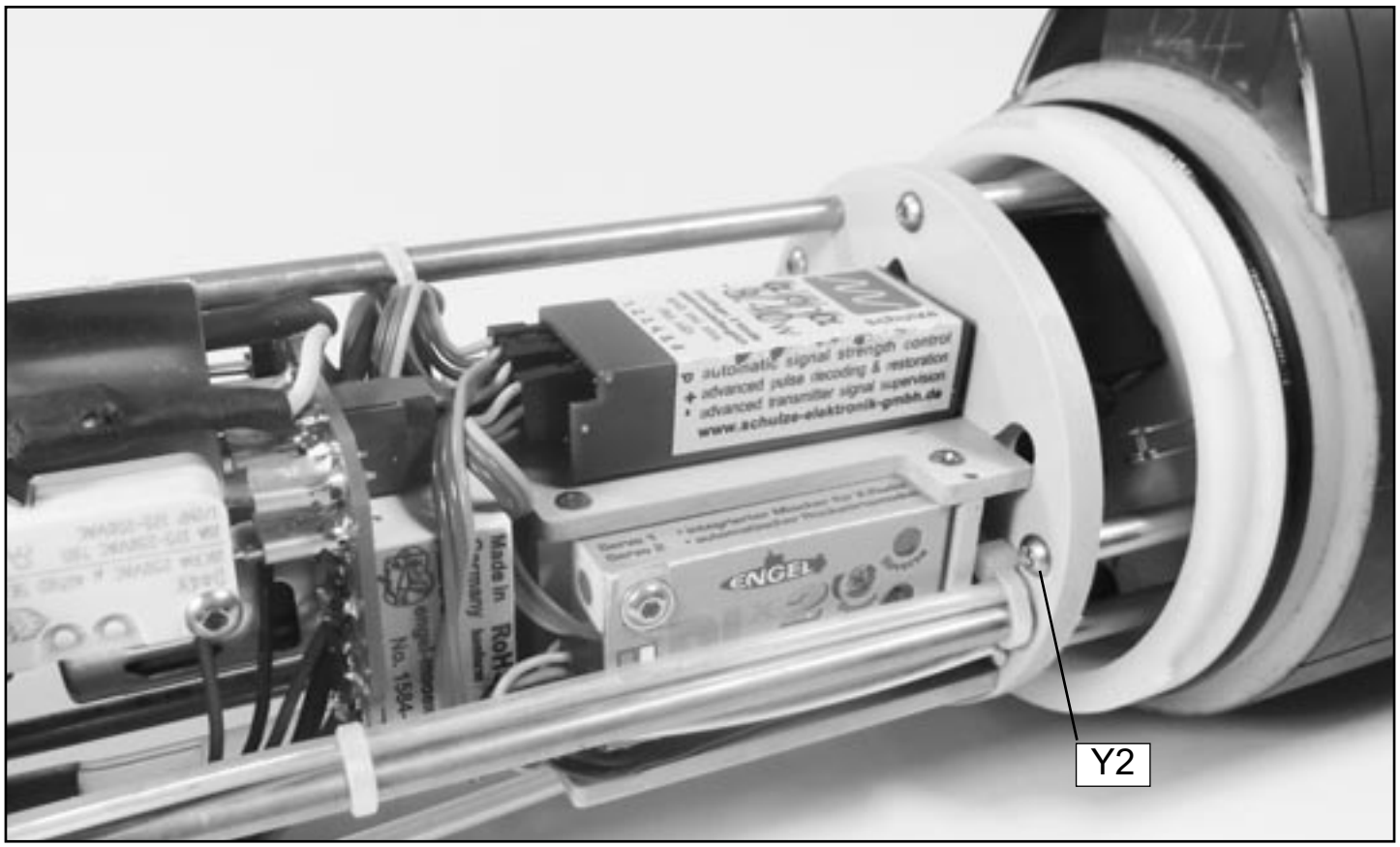
34.1 Screw four bars S2 onto threaded studs protruding the main bulk head. Fasten bars hand-tight only. Place Tech Rack© against hull and connect ESC to motor. Pull tubing for Piston Tank and Pressure Switch through corresponding bores in both servo bulk heads. TAKE GREAT CARE so tubings are not pulled off their nozzles in main bulk head.

34.2 Consecutively, feed control rods through servo bulk head and clip in outermost bore of servo arm. Press clevis firmly together (with your fingers!) for bolt to interlock fully.

34.3 Fasten bars S2 with four screws Y2 to front servo bulk head T7.







Part C

35. Leak Test

It is important to stick to the following sequence. Checking for leaks is essential. Before trimming can be commenced it must be ensured that the model is 100% pressure proof. If Conning Tower Mechanism is used, leave connected to hull but detach hull ridge. Testing will require a bathtub or sufficiently large container filled with water.

Preparation of leak test:

1. Place O-Ring X4 carefully to bajonet lock ring and grease thoroughly (with Silicone Grease, item no. 9710)
2. Push central plug into power socket. Model is powered up.
3. Switch piston tank to EMPTY.
4. Close breather tubing with brass stopper L7.
5. Close both hull section by fully turning bayonet lock ring.
6. Fill piston tank (dry, model not placed in water).
7. After about 1 minute open breather tube. Escaping pressure from hull must be audible.
8. Empty piston tank with breather tube OPEN.
9. Close breather tubing with brass stopper.
10. Fill piston tank (again dry, model not placed in water, yet).
11. Place model in water and check for air bubbles.
12. Move linikages and prop shaft. Check for bubbles.

36. Trimming

1. Condition before the first trim:
2. Plug in power supply, test all functions.
3. Piston tank in BAIL position.
4. Ventilation hose with cap is closed.
5. Place model in the water, the boat floats (slants and heels).
6. Command Piston Tank in FILL position until it is switched off.
7. Observe floating position, boat still floats.
8. Trim the boat to a horizontal position by placing trim weights on the upper deck in front of and behind the tower. and add trim weights until the boat sinks. Measure and mark position and size of trim weights.
9. Set the piston tank to the LOWER position.
10. Attach the trim weights in the lower part of the Tech Rack© exactly as recorded.
11. Ensure that the trim weights do not obstruct the insertion of the Tech Rack©.
12. Eliminate heeling by moving the trim weights sideways.
13. To correct the center of gravity, the receiver battery can be moved along the longitudinal axis.
14. The boat must be painted before final fine-trimming.

Part D

37. Sacrificial Anodes
The positions of the sacrificial anodes are embedded in the hull. The anodes are cut from the enclosed ASA strips D4 to a length of 8 mm, slightly rounded and painted in a lighter color. The underside, however, remains unpainted to allow it to be glued to the hull. The corresponding areas on the hull should be masked off before painting. The anodes are only glued on after the hull has been completely painted.

38. Painting
An airbrush paint kit is recommended for painting, which is available for little money. Of course, conventional painting is also promising; however, this is generally no cheaper if carried out by a specialist paint store, or rather worse if carried out by a layman with a conventional spray gun. Working with a simple airbrush gun, especially when painting in one color, is not that difficult. Good results can be achieved with a little practice. A PET bottle filled with water is very suitable for getting started.

There are also numerous explanations and pictures on the subject of airbrushing on the Internet. dsWe have had very good experiences with airbrush paints from VALLEJO. The advantage here is that this manufacturer offers a ready-to-use paint mixture in black-brown (No. 71.042 "cam black brown) and a clear coat (No. 70.520 "matt varnish), both in matt. Thinner (No. 73.524 "thinner medium") is also available for this range of varnishes.

The model can be primed. But: primer is not a necessity on the plastic used for the hull and the add-on parts, and secondly, this additional layer of paint is detrimental to the detailing of the hull. However, it is IMPERATIVE to pay attention when painting: Do NOT paint the guide rails and other mechanical components of the turret mechanism, as any coat of paint will impair the function of the mechanism.The positions of the position lights still to be fitted and the recessed mounts for the disks in the turret must be covered for painting, otherwise the adhesive will not adhere.

39. Boat Number and Water Level Markings
The kit includes a complete sheet with the boat numbers 181 to 184 as well as water level marks as so-called water slides. These are only partially waterproof after drying and should therefore be coated with matt clear varnish. First, the corresponding sections are carefully cut out of the sheet. Then use tweezers to dip the strips in water so that the stamps detach from the backing layer. Then place the stamps with the tweezers on the corresponding area and leave to dry.

40. Maiden Voyage
All functions must be checked again before the first trip in open water. A leak test is mandatory. Now flood the boat in the near shore area without moving until the boat begins to drift. A gentle drive will push any remaining air bubbles out of the free-floating area. If the boat now undercuts the waterline, the journey is stopped. Now the dive command is given again until the maximum diving depth is reached; the water depth at this point should be at least 2 m. The water pressure switch now automatically cancels the dive command and the piston tanks start to drain.

If the dive command "Park on bottom" is still active, the boat is brought above the maximum operating depth of approx. 1.8 m and immediately flooded again. If the "Trim" dive command is active, the boat rises above the maximum operating depth again and remains floating. The same maneuver also takes place in the event of a transmitter failure.

If these tests run smoothly, there is nothing to stop the boat from making its maiden voyage.If, after several diving maneuvers, it is suddenly no longer possible to descend, the water pressure switch has reacted due to negative pressure in the hull, which can be caused by temperature differences (between water and air temperature) or pressure loss (due to a leak).

41. Maintenance

The main issue in terms of maintenance is to keep the boat inside as dry as possible. As all marine vessels, the innards of a submarine are always exposed to some level of moisture. Therefore, open the model and pull out the Tech Rack© entirely after every voyage to allow condensed water to evaporate. This is even more important after operation in chlorinated water (i.e. pools).

Check seals such as rubber bellows and O-rings for signs of wear and replace immediately if damaged. Do not apply any grease to the inside of the bellows to ensure a tight fit on the couplers.

Regrease shaft sealing ring after every 20-25 hours operating time with high-performance adhesive lubricant (item no. 9705). Use a blunt cannula which is CAREFULLY pushed between shaft and lip of sealing ring. Alternatively use a brush and apply lubricant directly onto sealing ring. Just make sure that seal is not damaged by any circumstance!

A small amount of Silicone grease (item no. 9710) applied to the aft bayonet ring will not only keep O-ring (X4) nice and sleek but will also improve interlocking of rings.

ENGEL Piston Tanks are superior to other designs als superior in terms of resilience to pollution. Even slush will not cause a malfunction of the tank as all material drawn into the tank will eventually be discharged.

Maintenance of the Piston Tank only requires lubrication of the middle cog wheel's retaining bolt with white oil (as used for fire arms or sewing machines). Gun oil is ideal for this. Just place a drop between the bolt head and the cog wheel. After several turns the lubricant will be sucked-in by itself.

After operation in polluted waters (e. g. algae) the piston tanks should be rinsed with fresh water. Please note, that further lubrication of piston is only necessary, if a leakage of the Piston Tank itself is obvious. This might be the case if used in very sandy waters after a period of time. In this (very unlikely) circumstance, open the tank (unscrew at motor/gear cap), rinse the cylinder and lubricate piston and inner spindle with a high performance grease such as Q-Lube (recommended, item no. 9705) or a similar dedicated lubricant.

42. Safety Guidelines
Model Operation
If you are operating a radio-controlled model for the first time, we strongly recommend that you engage the help of an experienced modeller. Radio controlled models are not toys in the normal sense and should not be operated by anyone under 16 years of age without the consent and supervision of a responsible adult. Their construction and operation requires technical understanding, careful assembly and safety awareness in operation. Mistakes or carelessness in assembly of kit or operation of finished model can lead to serious damage to persons or property.

As the manufacturer and re-seller has no influence over the safe construction and operation of the model, this risk is advised to you and we absolve all responsibility for damage to persons or property, howsoever caused.

Mechanical or electrical technical defects, can lead to an unexpected starting of drive motors. This can in turn lead to parts being thrown from the drive train at high speed. Operation of the receiving system without the transmitter being switched on can lead to unexpected operation of motors and servos. Therefore the possibility of serious wounding is always there. All such driven rotating parts, offer a permanent threat to subject damage to persons or property. Avoid all personal contact with such parts of the model.

• **DO NOT** put people or animals at risk.
• **REFRAIN** from operating the model near weirs, locks, water works or sheltered waters.
• **ONLY** operate model in areas and waters in which r/c controlled models are permitted.

Take care when charging batteries!
Batteries that claim to be totally sealed can also release gas if they are handled incorrectly (for example: too high of a charging current, or too long of a charging time, or if an unsuitable charger is used). Batteries have a security valve to release any possible internal over-pressure. The gas produced is highly explosive and has an enormous destructive power.

For safety reasons, batteries MUST NEVER be charged within the hull!
The charger and the battery should be in an open, well-ventilated area. Therefore, Tech Rack must be fully drawn out of the hull while batteries are being charged. Even so-called "sealed" batteries allow a build-up of hydrogen gas while being charged which in turn can cause a serious EXPLOSION, tearing the model to pieces and endangering its immediate environment.
The installation of charging jacks of any type in the hull or its attaching parts will result in the WARRANTY being VOID!

If you have any questions regarding the assembly or functioning of the system, please do not hesitate to contact us by:

phone: int.+49-7043 - 93520 [Mon.-Thu. 10am - 4:30pm, Fri. 10am 3pm CET]
email: info@engel-modellbau.de

Happy sailings!

item no. 1599

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Assembly & Operation

Manual
Parts List

Please read the following building instructions and safety warnings carefully BEFORE commencing with assembly of kit and installation of technical equipment.
Please also refer to the safety guidelines on page 45.

WARNING!
During the charging period all batteries must be removed from the hull. NEVER charge the batteries within the hull as most regular lead batteries gas while being charged. Insufficient air circulation during the charging period may lead to a serious EXPLOSION!

Please adhere to your country's safety guidelines during construction and operation of this item.

We are not liable for any personal injury or damage of any kind resulting with the assembly and/or use of our products as we are neither able to delegate nor verify the assembly and/or use of these items.

We reserve the right to alter technical specifications.

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This symbol indicates that after the service life of this electrical device has ended it must be disposed separately from domestic refuse at your communal waste collection.

nce the completion of the first boat U31, the class 212 has enjoyed increasing popularity, both in the original and in the odel. With this kit, we would like to open up this technically demanding area of model shipbuilding to the less experienced odel builder, but also offer incentives for experienced submariners to acquire this model. First of all, a short construction ne with manageable technical resources is a basic prerequisite for such a concept. Furthermore, in terms of performance nd safety, it should be in no way inferior to the larger models in our submarine fleet. The result is this 212 - compact, easy handle and with a piston tank.

ne hull is made of 3 mm thick ABS, the hull ridge with sail, rudders, skegs and service hatch are made of resin. The hull nsists of three parts, front, center and rear section and is manufactured complete with bayonet lock and aft bulkhead. The quired bolts (for mounting the Tech Rack©) and all connections for the piston tank, pressure switch and breather tube are ready glued into the end bulkhead.

2-component adhesive, referred to as "2K" in the following text, is recommended for gluing the tail section to the center ection and all other joints on the hull. When bonding all components, ensure that the surfaces to be bonded are thoroughly eaned with white spirit or universal thinner.

ess stressed bonding can be carried out with CA adhesive (cyanoacrylate, RAPID CA medium viscosity Art. No. 96040), enerally known as superglue.

ive Set with Piston Tank and CompactTankSwitch CTS2

ne 212 is equipped with a piston tank type HA500-123 with automatic end position cut-off and Hall sensor for proportional ntrol. The cut-off ensures that the piston tank stops automatically as soon as the cylinder is completely filled or emptied. ne Hall sensor control allows sensitive trimming of the submerged model.The piston tank and the corresponding CTS2 com- act tank controller form a compact unit without complex and vulnerable wiring. On the transmitter side, a proportional slider ould be used to control the CTS2. Alternatively, the CTS2 or the piston tank can also be operated without a Hall sensor nd therefore not proportionally. In this case, the control can be carried out via a stick or 3-position switch (on/off/on).

TS2 offers four independently operating fail-safe devices:
ow battery monitor
oss of transmitter signal
oss of receiver signal
automatic resurfacing if model dives below approx. 1.8 m (via pressure switch)

R/C signal is lost due to excessive depth, failure of transmitter or receiver signal or any other circumstances CTS2 will auto- atically switch the piston tank to bail. The pressure switch limits operational depth to approx. 1.8 meters (6 ft). If the model ves below this level, the CTS2 will automatically switch to the "resurface" and empty the piston tank. The model will then surface unless the dive mode is still activated. Otherwise, with dive mode still activated the model will emerge to a depth ove 1.8 meters after which the tank will start filling again (and so on). Furthermore, the pressure switch acts as a second fety device. Should the overpressure which builds-up within the hull while submerging (by filling the tank) be lost due to a akage, the dive mode will be terminated. In this case, the yellow LED blinks steadily and the system does not allow the odel to dive again until this has been corrected. If voltage drops below a preset value (factory setting approx. 9V for 12V eration) the piston tank is automatically switched to empty. Low voltage will be indicated by lighting of the red LED on TS2.
ood receiver signal is indicated by the green LED on CTS2. If receiver battery or receiver itself fails CTS2 will switch the ston tank also automatically to bail. The fail safe function also comes into action if transmitter signal is lost.