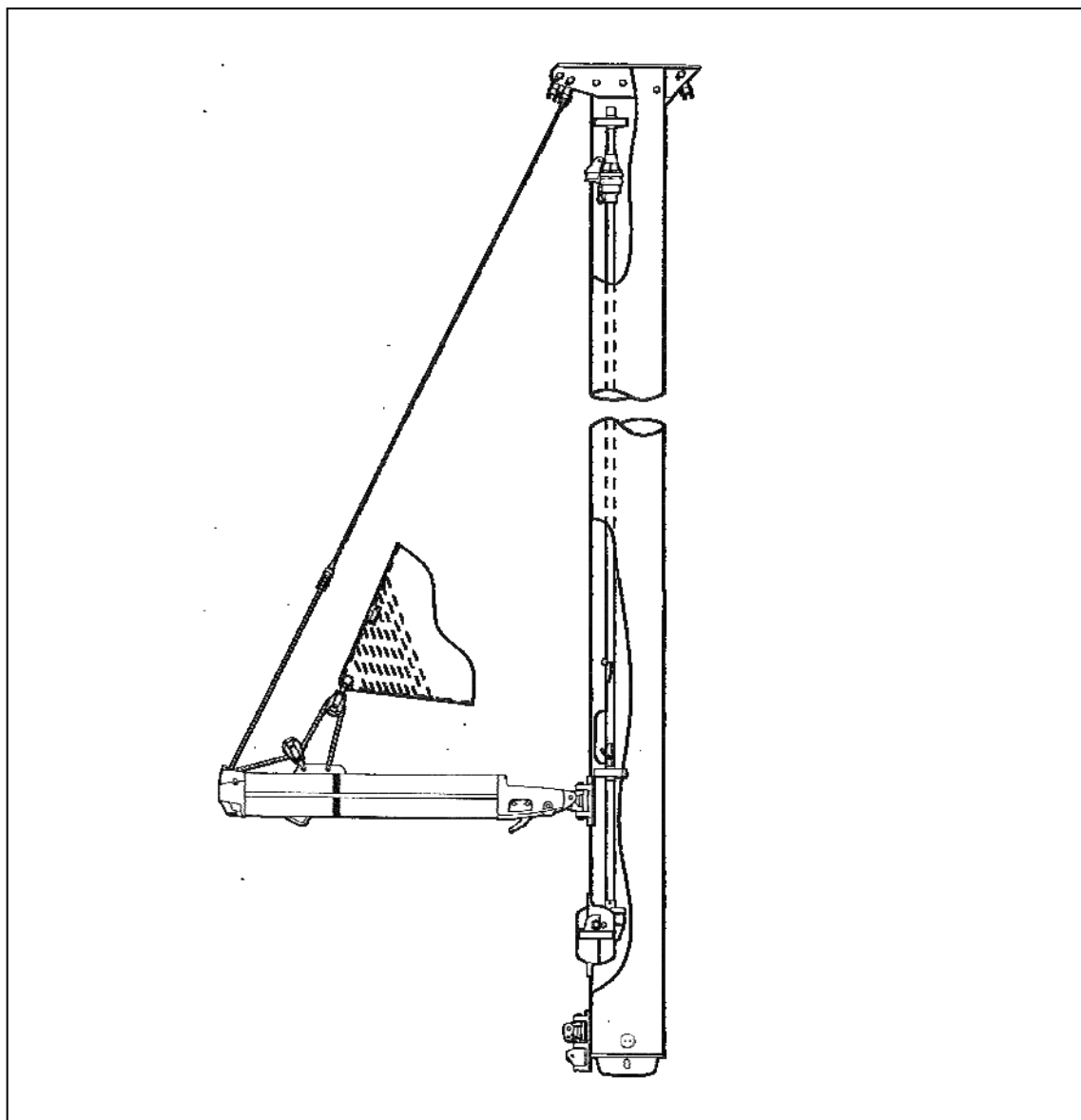


Manual for Electric Furling Mast



1 Introduction

1.1 The manual

- ❑ To derive the maximum benefit and enjoyment from your Electric Furlin system, we recommend that you study this manual carefully.
- ❑ The manual is divided into two sections, one dealing with the INSTALLATION and one with OPERATION. Each section contains references to the other. It is very important to read and note these cross-references.
- ❑ This manual is a supplement to the manual furling systems manual “FURLIN RB/RC Mk2 MANUAL” which is included with your documentation. Both manuals are required for installation and operation of this system.

All safety-related information is indicated by the following symbol:



- ❑ The manual covers Electric Furlin RB, RC and RD



PLEASE read the entire manual prior to installation and operation!

- ❑ This manual must be followed to avoid damage to the system and the risk of personal injury.
- ❑ The guarantee is only valid if the system has been installed and operated correctly according to the manual.

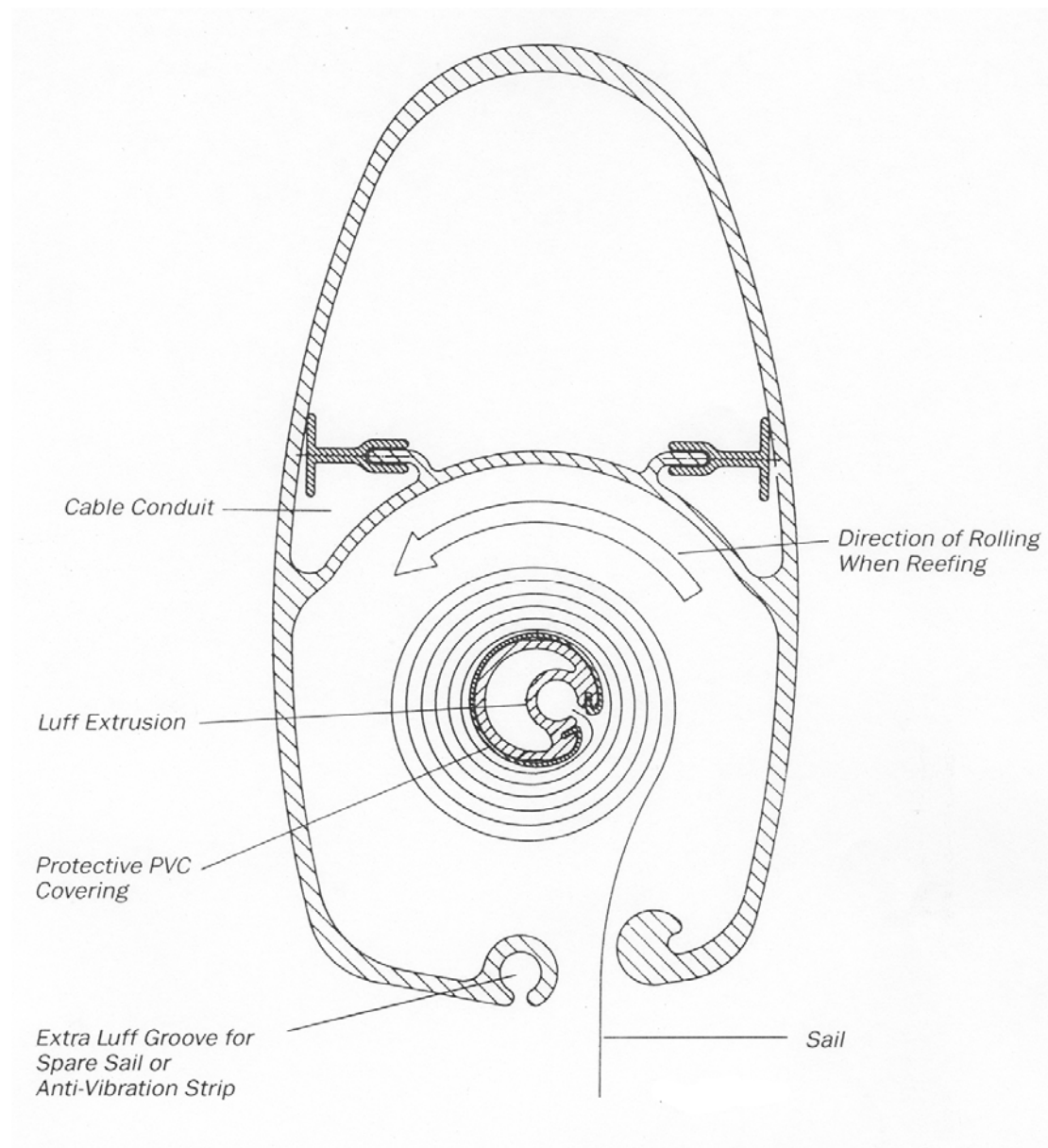
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1.2 Product Description

- ❑ FURLIN ELECTRIC is an electrically operated motor driven reefing system for the mainsail. The design is based on Seldén's long experience with roller reefing. The system has been engineered to ensure simplicity and reliability, and the modular construction allows easy servicing.
- ❑ Operation is controlled from the cockpit. The sail is set and rolled on a luff extrusion in the mast's sail compartment, located between the electric motor drive unit and a top swivel at the masthead. Cockpit mounted Reef and UnReef switches operate the electric motor drive unit.
- ❑ The luff extrusion is tensioned, and has an asymmetric profile. These features reduce friction when the sail is rolled or unrolled.
- ❑ The electric motor operates in a sealed gearbox unit. The final drive is via a self-locking worm gear, which holds the sail securely at any desired area.
- ❑ The system uses large ball bearings and incorporates patented friction reducing features. Careful design ensures a high degree of efficiency and reliability.
- ❑ All control electric's are included with the system.
- ❑ The motor incorporates a standard winch handle star socket for emergency manual operation.
- ❑ The entire reefing mechanism can be dismantled and removed from the mast.
- ❑ The Furlin Electric system shares many parts with the manual RB/RC Seldén furling systems. A copy of the RB/RC manual and RB/RC spare parts listings are included with your mast.
- ❑ For information on rigging and tuning the mast, please refer to the Hints and Advice booklet from Seldén Mast.

1.3 Mast Cross Section



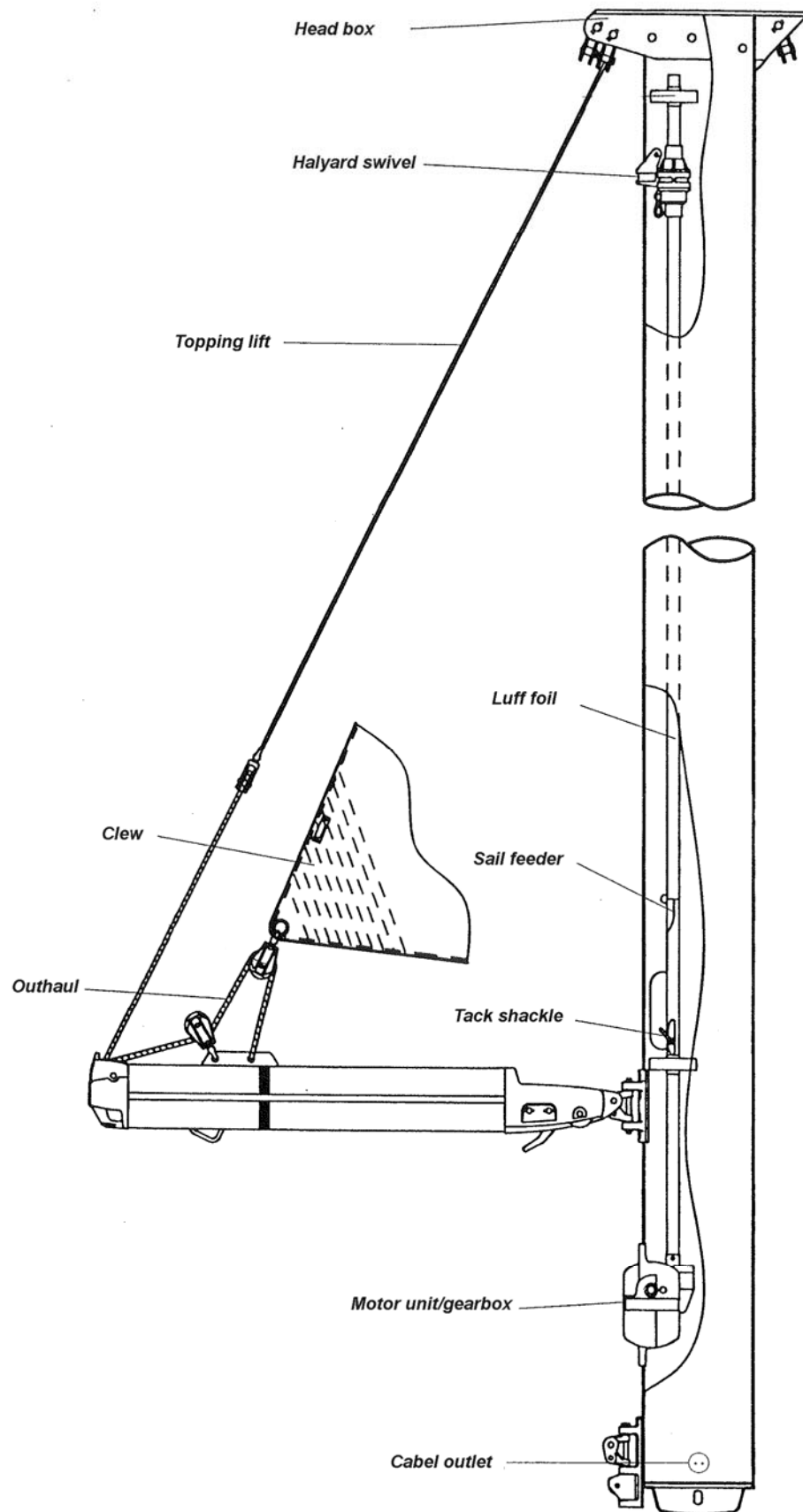
1.4 Spare Mainsail

The extrusion is fitted with an extra luff groove for raising a storm trysail or spare mainsail. Foresails made for use with a luff extrusion can also be raised in this groove.

1.5 Anti-Vibration Strip

Vibration can arise in any aluminium mast of normal design. With wind coming from approximately abeam at speeds of 4-12 knots the mast oscillates longitudinally at a rate of 3-6 cycles per second. Seldén Mast can provide an 'anti-vibration strip' for hoisting in the spare luff groove to prevent vibration and reduce wind noise.

1.6 The reefing System



1.7 12v or 24v

- ❑ The 12v or 24v system options should have been discussed when you ordered your mast. This is mostly influenced by the standard alternator fitted to your engine, but a 24 volt system will give lower current drain and allow longer cable runs.
- ❑ If you're adding several powered extras to your boat, think about upgrading the electric's to 24 volts

1.8 Battery

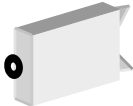
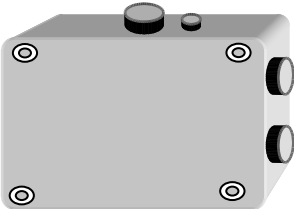
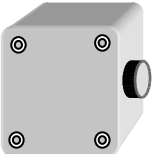
- ❑ A minimum extra battery capacity of 200 Amp-hour is recommended.

2 Installation

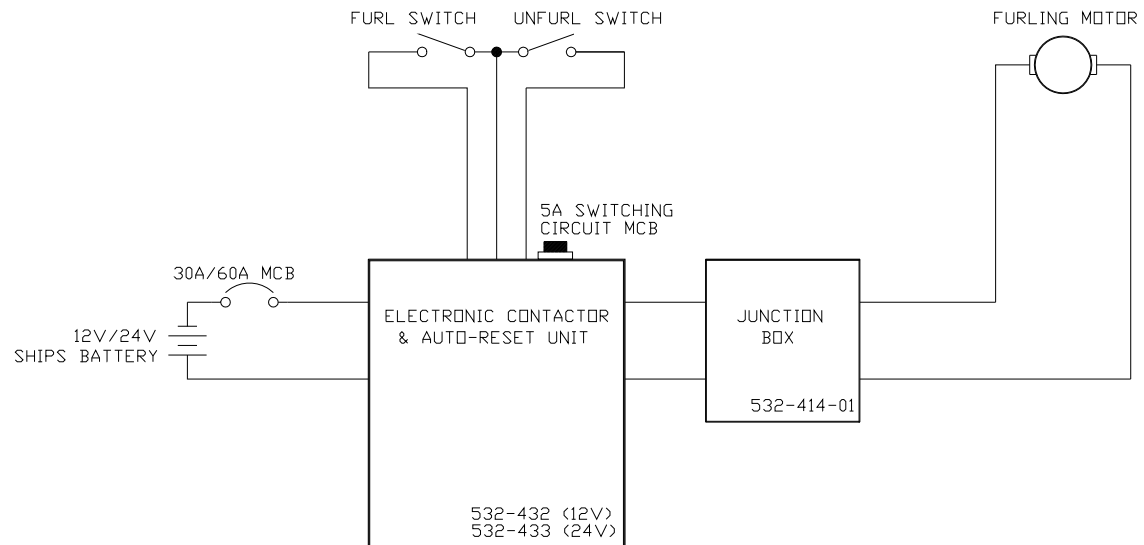
2.1 Checklist

The reefing mechanism, motor & gearbox has been factory installed in your ELECTROREEF mast

The following parts are supplied loose with your Electric Furlin Mast.

✓	Description	Qty	Seldén p.n.
☐	Miniature Circuit Breaker 	1	Incl in assy: 532-432-01 (60A - 12v systems) 532-433-01 (30A - 24v systems)
☐	Electronic Contactor/ Auto-Reset Unit 	1	532-432 (12v systems) 532-433 (24v systems)
☐	Junction Box Assembly 	1	532-414-01
☐	Cockpit Mounted Button Switches.	1	540-459-02 (Furling out switch) 540-460-02 (Furling in switch)
☐	WINCH HANDLE L=125(INT)	1	533-910
☐	LUBRICATING GREASE 90g -HAZ	1	312-501
☐	PREFEEDER ø12-44 BRASS	1	505-515
☐	DECK CONDUIT ASSY (E-REEF) (Deck stepped assemblies only)	1	540-437-01
☐	Manual for Furling mast (Type RB MkII/RC MkII)	1	595-063-E (English) 595-063-S (Swedish) 595-063-T (German)
☐	Spare Parts List Seldén in-mast furling and reefing system Type: RA MK III/RB MK III/ RC MK III	1	595-110-E

2.2 Electrical Circuit Diagram

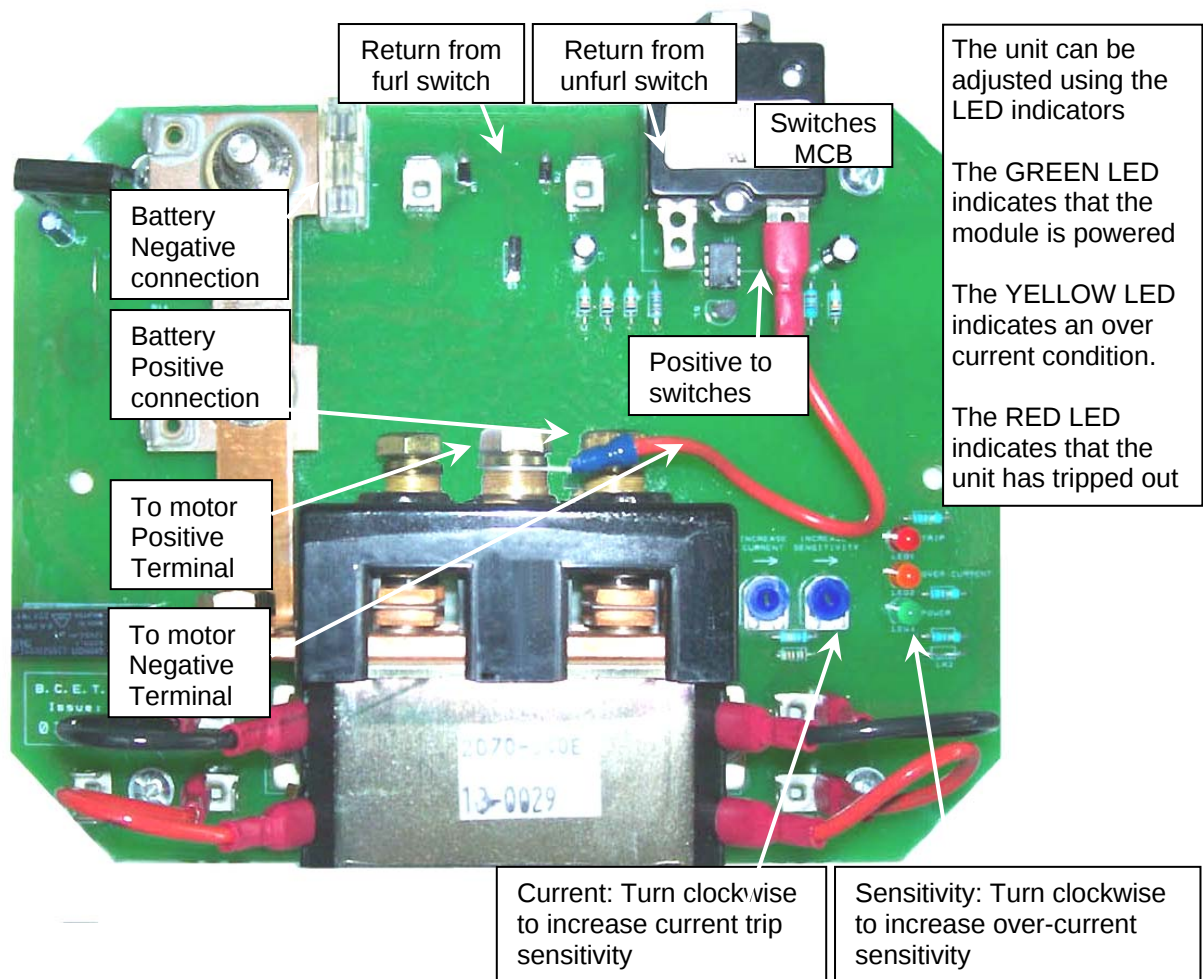


2.3 Main Power Miniature Circuit Breaker (MCB)

- The MCB is an over current protection device. Its purpose is to protect the electrical motor, control system and wiring from excessive current resulting from an electrical fault or incorrectly set up ECU. It is therefore important that the MCB be located close to the battery so as to include protection for the electrical cable running from the battery to the electronic contactor unit. This MCB should be located in a position where the user can gain easy access.

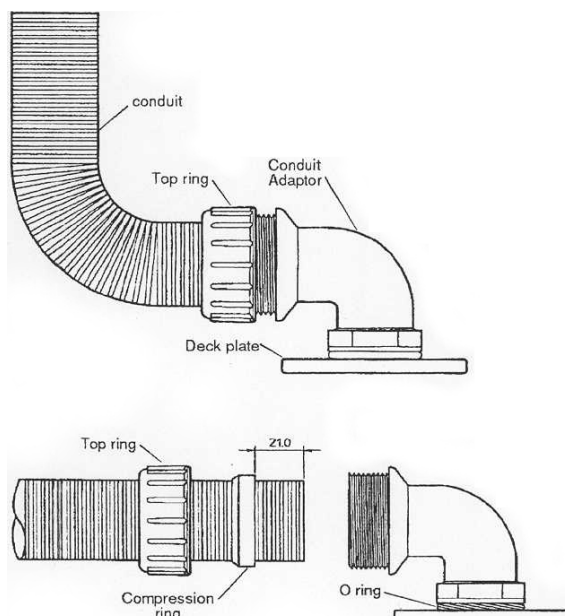
2.4 Electronic Contactor and Auto-Reset Unit (ECU)

- A built in contactor (relay) controls the direction of the electric gearbox assembly. The contactor is actuated by the cockpit-mounted Reef and UnReef switches. For wiring instructions please refer to the above circuit diagram and picture below.
- The cables that run from the unit to the cockpit-mounted Reef and UnReef switches are separately protected from overload by a 5A circuit breaker (MCB). This small MCB is mounted inside the box and protrudes through the top face. The unit needs to be accessible to enable the user to reset this breaker in the event of an electrical fault in the switching circuit.
- The motor current draw is electronically monitored by the ECU. Should the current reach a pre-set level the supply to the motor is automatically cut off to protect the motor. This is possible in the event of the operator furling against a high load induced by a tight outhaul or a sail jam causing the motor to stall. When the Reef or UnReef switch is released the unit automatically re-sets after a few seconds. This enables the user to correct the cause of the overload and continue furling without having to reset a circuit breaker below decks. The current threshold and sensitivity are factory pre-set to 25A for the 24V system and 50A for the 12V system, but can be adjusted using the internally mounted potentiometers (See picture below).
- The unit has cable glands fitted for power supply, motor supply and control switches that offer protection against moisture ingress. However, it is recommended that the unit be installed in a dry and accessible location



2.5 Junction Box

The junction box should be fitted below deck, as close as possible to the mast. This box allows the cables to be disconnected when the mast is unstepped. Make sure that the riggers can easily find the junction box when the mast is unstepped at a later date.



2.6 Deck Plate

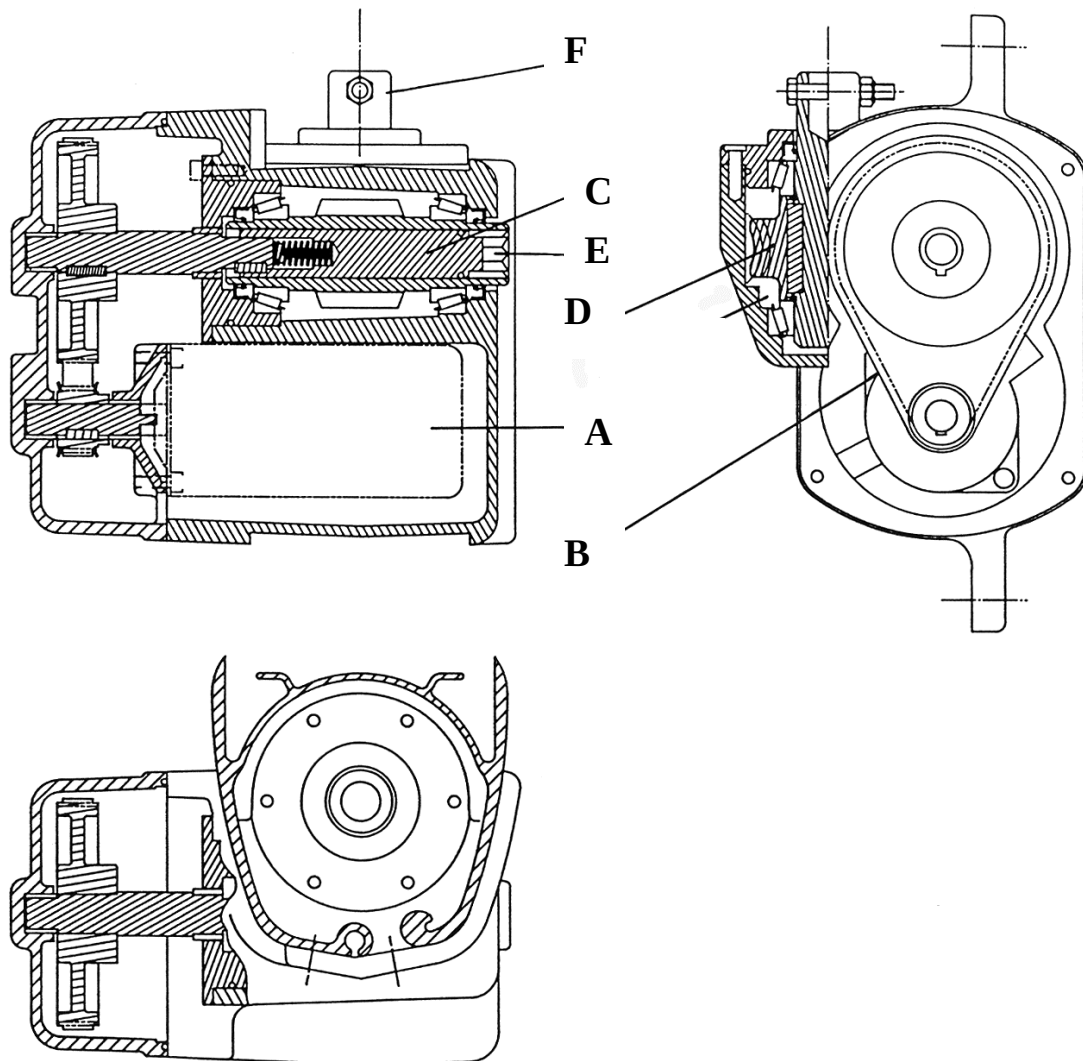
The deck plate is part of a conduit system supplied with deck stepped assemblies only. It is designed to provide a totally waterproof path, above deck, for the two motor power cables. These two electric cables lead out of the mast, near the deck, through a plastic conduit and through the deck plate into the cabin.

Fit the O ring to the conduit adapter and screw the adapter tightly into the deck plate. Position the deck plate about 200mm from the mast, on the same side as the mast exit, with the adapter pointing at the mast. Mark the hole positions and, using a 33mm holesaw, cut a hole through the deck. Bolt or screw the plate to the deck on a layer of flexible sealant.

After the mast has been stepped, cut the conduit to the correct length and fit the adapter top ring to it. Fit the neoprene compression ring, as shown in the diagram, pass the two cables through the deck plate and tighten the top ring onto the adapter.

2.7 Furling Gearbox

The main part of your Electroreef mast is the motor/gearbox unit. This consists of a rigid, heat treated, aluminium alloy case, in which a Lucas dc, permanent magnet electric motor (A) drives the luff spar via a drive shaft (F), worm gear (C/D), a belt drive (B). Large taper roller bearings, lubricated by grease, carry the main forces on the worm gear. Maintenance free bearings are used in the toothed belt drive and motor. Heavy duty electric cables pass through a heavy duty, flexible PVC conduit, one end of which is fastened to the deck. The other end is connected to the motor compartment inside the mast. O rings and rubber seals ensure that no electric components can be affected by salt water.



The motor unit rotates a long, torsionally stiff, aluminium alloy luff extrusion, onto which the sail is fed. The luff extrusion incorporates a tensioning screw between the tack hook and the sail entry slot and is supported at the masthead by the top swivel and at the gooseneck by the motor drive shaft. The halyard swivel slides up the PVC covered luff extrusion and allows a conventional main halyard to be used.

The electrical motor is rated at its maximum power for a time period of no more than four minutes. A typical furling operation will last less than one minute, and therefore under normal operating conditions this is no restriction to operation. However, during the test procedure described below, it is possible that excessive testing at maximum power could overheat the windings if time is not taken to allow the motor to cool.

2.8 Cables

We strongly recommend that you think very carefully about where the cables are led inside the boat. Keep the length of all cables to a minimum and try not to run them through the bilges. If you have to run cables through the bilges, use a water tight conduit to protect them from water. All electrical cables must be properly secured with strong cable clips and make sure that there are no sharp edges on fittings, or interior furniture that can cut the insulation.



1. All cables should be to BS6231 (UK), CSA TEW (Canada) and UL style 1283 (USA).
2. Select 4 AWG/ 25mm² for up to 7 meters distance between the junction box and the battery, 2 AWG/ 35mm² if more than 7 metres.

Step 1. From mast to junction box:

- ❑ The Furlin Electric mast unit is fitted with sufficient 4 AWG/25mm² cable to reach the junction box. Cut the two mast cables to the correct length, lead them through the glands and crimp an ø8.4 eye terminal to the ends.

. Step 2. From junction box to ECU

- ❑ Lead the lines to the ECU through the glands into the junction box, fit ø8.4 eyes. Connect to the mast cables with the supplied screws, nuts and washers.
- ❑ Route and secure the cables from the junction box to the ECU. Cut to length and feed through the glands on the right hand side of the ECU. Crimp ø8.4mm eye terminals and fix as shown in the picture shown in [2.4 Electronic Contactor and Auto-Reset Unit (ECU)].
- ❑ Check wiring for any stray cable strands, continuity and short circuits.

Step 3. From the ECU to the Reef and UnReef switches

- ❑ Lead an 18 AWG (0.75mm² wire) three-core control cable through the top gland of the ECU, fix spade terminals and attach as shown in the picture [2.4 Electronic Contactor and Auto-Reset Unit (ECU)].
- ❑ Route and secure the cable from the ECU to the cockpit-mounted switches and wire according to the circuit diagram shown in [2.2 Electrical Circuit Diagram].
- ❑ Check wiring for any stray cable strands, continuity and shorts.

Step 4. From ECU to MCB and Ships battery

- ❑ First feed the two cables through the glands on the left hand side of the ECU, crimp ø8.4mm eye terminals and fix as shown in the picture shown in [2.4 Electronic Contactor and Auto-Reset Unit (ECU)].
- ❑ Route and secure with cable clips the negative supply cables from the ECU to the negative terminal of the ships battery – leave disconnected.
- ❑ Route and secure the positive supply cables from the ECU, via the Main Power MCB to the positive terminal of the ships battery – leave disconnected.
- ❑ Check wiring for any stray cable strands, continuity and shorts.
- ❑ Connect negative and then positive cables to the ships battery.



1. The electrical furling system can generate high torque in the luffspar and high loads in the sail. It must be operated by an experienced and qualified skipper who is aware of the dangers associated with high power deck equipment. They must ensure that all crew are aware of the equipment and the dangers associated with it.
2. Before testing the installation, ensure that the luff-spar is free to rotate without restriction. The sail should not be hoisted at this stage.
3. The electrical motor fitted in the gearbox is rated for no more than 4 minutes continuous duty at full power. Regular testing at full power could result in overheating and damage to the motor windings. Please ensure that at least 4 minutes of rest time is given between each ECU trip test.

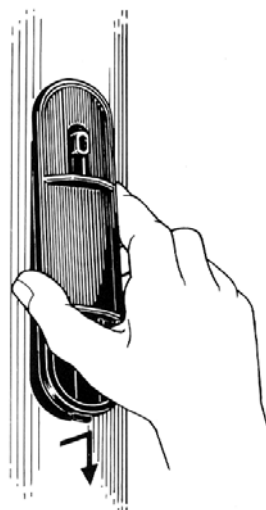
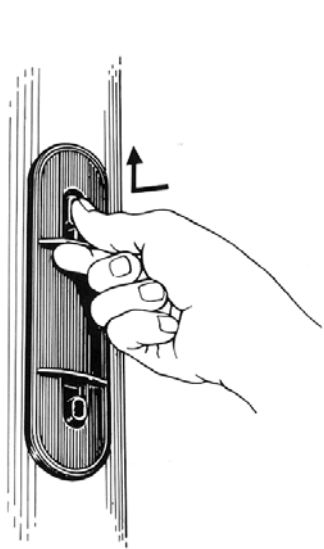
2.9 Test & Setup

- ❑ Depress the Reef switch in the cockpit and check that the luff spar rotates. Note direction of rotation. With reference to the drawing [1.3 Mast Cross Section] check that the spar is rotating anti-clockwise as viewed from above.
- ❑ If the luff spar rotates clockwise, swap the Reef and UnReef spade terminals from the switches in the ECU. Re-test and confirm that the spar now rotates anti-clockwise when the Reef switch is depressed.
- ❑ Depress the UnReef switch in the cockpit and check that the luff spar rotates clockwise with reference to drawing [1.3 Mast Cross Section].
- ❑ Hoist the sail as per instructions [2.10 Fitting and hoisting the sail].
- ❑ With the yacht pointing into wind, furl in the main sail as per instructions in [3.2 Furling in].
- ❑ If Reefing in trips the ECU, it is likely that excessive outhaul tension has temporarily overloaded the furling system – try again with less outhaul tension.
- ❑ If Reefing still trips the ECU, then it is possible that the ECU may need to be adjusted. See picture in 2.4 to locate the potentiometer. Only small adjustments should be made before re-checking.
- ❑ If the Main Power MCB trips, then either the ECU is set too high, or there is a serious fault in the system that needs to be investigated.

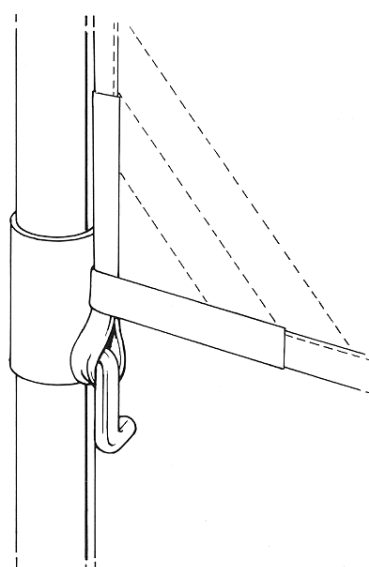
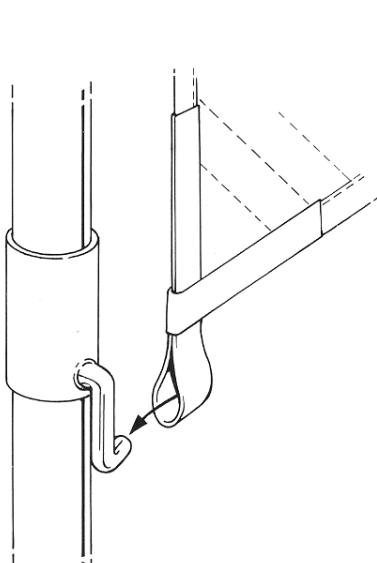
- ❑ Now check for correct operation of the ECU Auto-Reset device
- ❑ ! This test will take the motor to its stall condition and can result in over-heating of the windings if repeated without sufficient time to cool down. Allow 4 minutes between tests to be sure that the motor is not damaged.
- ❑ Reef in the sail against a firmly held outhaul – keep the Reef button depressed. The ECU should quickly cut in and isolate the electrical supply to the motor. Release the outhaul whilst still keeping the Reef button depressed – the motor should remain isolated.
- ❑ Now release the Reef button, wait 5 seconds, and press the Reef button again. The system should now reef. If the main MCB trips during this test, the ECU trip current is set too high and needs to be adjusted as described above .
- ❑ Finally check for correct operation of the manual-furling feature. Firmly insert the supplied winch handle into the socket on the Starboard side of the furling motor and rotate clockwise to reef, Anti-Clockwise to furl out.

2.10 Fitting and Hoisting the Sail

- ❑ Remove the covers



- ❑ Join the head to the halyard swivel
- ❑ Join the Tack to the Tack Hook



- ❑ Attach the clew to the outhaul car.
- ❑ Lash the sail feeder as close to the aft face of the mast as possible. Then thread the sail feeder on the sail from the top of the luff.
- ❑ Feed the luff into the luff extrusion sail feed, and hoist the sail while checking that the luff is feeding correctly.
- ❑ Tension the halyard until the horizontal folds disappear, and lock it with the stopper. Further increase the halyard tension to obtain the best sail shape.
- ❑ Remove the sail feeder.
- ❑ Furl the sail in as described in [3.2 Furling In].

Test the sail a few times while still in harbour to check all functions and to ensure that the sail has been correctly dimensioned.

3. OPERATION

3.1 Furling Out

- ❑ Pull on the clew outhaul while simultaneously pressing the UnReef switch.
- ❑ Release the switch for an instant if the motor rolls the sail out faster than it can be taken in on the outhaul.
- ❑ Do not use the motor without taking in on the outhaul.
- ❑ Stop the motor when the sail is fully rolled out. A red mark on the sail should indicate this position.
- ❑ Continuing to press the UnReef switch will result in the sail furling back onto the luff spar in the wrong direction.
- ❑ Foot tension **must only** be applied with the outhaul line, not the furling motor.

3.2 Furling In

- ❑ Keep the aft face of the mast clear of all halyards and lines to avoid them being rolled in with the sail.
- ❑ The leech and foot of the sail should both be fairly tight. The sail will then form a tight roll around the luff extrusion.
- ❑ Leech tightness is adjusted with the topping lift and kicking strap. Foot tightness is controlled with the outhaul.
- ❑ The mast and the luff extrusion are asymmetrical to ease rolling in, in one direction. The sail should therefore always be rolled in on the starboard side of the extrusion.
- ❑ Furling is done with the Reef switch, but it is important to be ready to pay off on the outhaul first. Lay the outhaul line one turn around the winch, and pay off as the sail is rolled in. Keeping excessive tension on the outhaul will result in overloading of the furling motor. Furl the sail until only the clew is exposed.

3.3 Reefing

- ❑ Follow the same procedure as for furling.
- ❑ The mainsail can be reefed to any desired size.
- ❑ The sail is always securely held by the self-locking worm gear when the motor is stopped.
- ❑ Foot tension must be only applied with the outhaul line, not the furling motor.

3.4 Outhaul Line

We recommend a self-tailing winch for the outhaul. A rope stopper is recommended for securing. The stopper should be of the type that allows controlled paying out.

3.5 Topping Lift and Kicking Strap

We recommend that both topping lift and kicking strap are controlled from the cockpit. Their lines are best secured with rope stoppers. The topping lift should have a stopper-knot to prevent it inadvertently running out, escaping, and allowing the boom to fall in to the cockpit. The stopper-knot should be put where the line exits from the boom, and be positioned for the “lowest safe level” of the boom. (NOTE! This is not essential if a Rodkicker is used).

3.6 Manual Operation

The manual operation drive socket is mounted on the starboard side of the gearbox casing. In the event of loss of electrical supply the user can over-ride the gearbox and electrical motor and furl the sail in or out manually. A 200 mm standard lock-in winch handle is supplied and is inserted into the star socket. This automatically disconnects the electric motor for safety, in case the switch is accidentally pushed, whilst the handle is fitted. The gear ratio of 17:1 means that it will take very little effort, but about 4 minutes of winding, to fully stow the sail. Remember to slacken the outhaul when furling. When you remove the handle, check that the spring loaded driveshaft has re-engaged in the star socket. If not, partially reinsert the handle, twisting it in each direction until you hear the driveshaft re-engage.



Ensure that the winch handle is fully and securely inserted in the winch socket. Only when fully inserted is the electrical motor isolated.

4. MAINTENANCE

It is important to periodically check and maintain the reefing system if it is to give you uninterrupted years of easy reefing and good service. Even if the system is well protected inside the mast, which reduces the need for maintenance, it should be given a thorough check at the end of each season. Follow the below noted service points.

4.1 Cleaning

- ❑ When the mast has been laid on trestles and the sail removed, it is easy to get to everything for hosing down and cleaning with fresh water. Hose down well to remove all traces of salt. **THIS IS THE MOST IMPORTANT SERVICE ITEM!**
- ❑ It is all right to use detergents provided that all traces are rinsed off afterwards. Most detergents contain elements that can corrode aluminium alloys.
- ❑ Finish off by treating all aluminium surfaces with silicone-free boat polish or wax. They protect well and also reduce contamination of sails.

4.2 Service

Avoid using too much grease on external moving parts!

- ❑ The top swivel bearing is lubricated with the supplied grease (p.n. 312-501) through the hole marked “grease”. This can be done through the sail slot on the mast.
- ❑ The halyard swivel bearings are lubricated by injecting the grease through the gaps in the bearings into the ball races.
- ❑ The drive gearbox is factory pre-greased and sealed for many years use.
- ❑ About once every three years (max 5 years) the gearbox unit should be removed from the mast and returned to Seldén Mast. The unit will be stripped and all bearings and gears will be checked for wear. All seals will be replaced, the unit will be test run and the power output checked. A new one-year warranty will be issued.
- ❑ To remove the gearbox if the mast is stepped, lower and remove the mainsail and disconnect the motor cables at the junction box. Disconnect the conduit at the deck-plate (deck stepped masts). Remove the bolt that secures the motor drive shaft to the luff extrusion gaining access through the two ø29-mm holes in the mast wall. Fully tighten the tensioning screw in the luff extrusion, so that the luff extrusion lifts clear of the top of the gearbox output shaft. Attach a mouse line to the ends of the cable to facilitate easy re-routing of the cables. Remove the four screws securing the gearbox/motor unit, and withdraw it and the attached cables from the mast. Assistance may be needed to feed the cables at deck or keel. After it has been serviced, refit the unit in the mast, whilst pulling the conduit and cables through the mast. Reconnect the cables and test.
- ❑ Refer to Hints and Advice booklet from Seldén Mast for general spar service instructions.

4.3 Storage

Hose the mast down first to clean it of all dirt and traces of salt. Store the mast in a dry and well ventilated area. See that no wire halyards or standing rigging lie against the mast as they can cause galvanic damage.

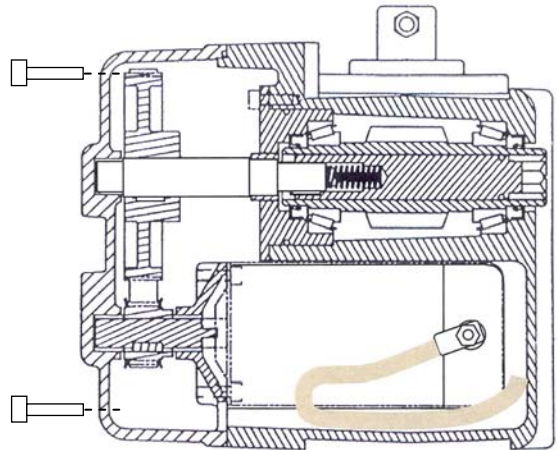
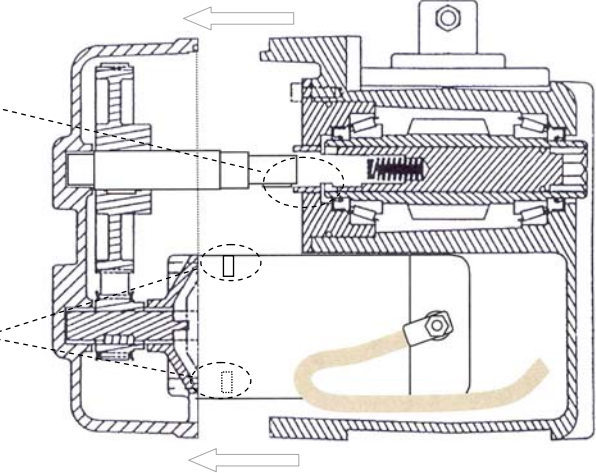


UNDER NO CIRCUMSTANCES SHOULD A DAMP OR DIRTY FURLIN
MAST BE KEPT IN PLASTIC OR OTHER IMPERVIOUS MATERIAL.

4.4 Trouble Shooting

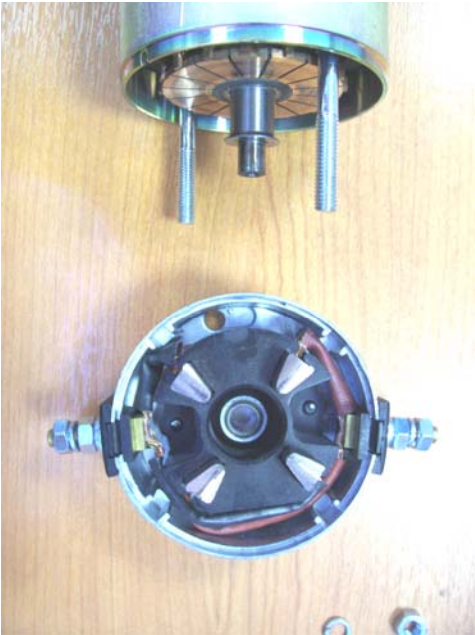
	Problem	Probable Cause	Action
4.4.1	Switch pressed. “Click” in ECU (Electrical control unit) Motor spins. Sail does not roll.	• Drive shaft is not connected.	• Fit winch handle half way into the gearbox socket (Stbd). • Turn slightly in both directions until a Click is heard. This indicates that the spring loaded driveshaft has now fully engaged. (see 3.6)
		• Drive belt has failed.	• Remove the gearbox port side oval end cap far enough to see it's contents (see 4.4.4) • Check that the rubber drive belt has failed. • Disconnect the motor cables • Disconnect the motor from the cover • Replace the drive belt. • Reconnect, and refit the oval end cap. Ensure that there is a 10mm drain gap in the rubber seal at the bottom.
		• Connection to luff extrusion is damaged	• Remove the port side access covers and investigate. • Contact Seldén Mast.
4.4.2	Switch pressed “Click” in ECU Motor does not spin Sail does not roll	• Electrical supply to motor has failed.	• Check electrical continuity of cables from ECU to motor connection.
		• Electric motor has possibly failed.	• Remove, inspect and test the electric motor (see 4.4.5)
4.4.3	Switch pressed No “click” in ECU Motor does not spin Sail does not roll	• ECU main supply has tripped.	• Wait for 1 minute, then try again • If still tripped, carry out Test & Setup procedure again (see 2.9)
		• Supply to switches has tripped.	• Reset circuit breaker button protruding from ECU.
		• Main supply has tripped.	• Reset the main supply MCB

4.4.4 Opening the Gearbox

	• Remove 4x machine screws holding the port side oval cover in place. • Separate the cover from the main housing. It might need a narrow bladed screwdriver in the slot to help. Take care not to damage the rubber seal.	
4.4.4	• Continue to move the cover +motor away. Take care not to lose the upper driveshaft key. • When they can be reached, disconnect the power cables. • The motor is held in the cover with two bolts. Remove these and separate the motor. • Test the electrical supply to the power cables.	

4.4.5 Electric Motor Checks

4.4.5	• Turn the motor shaft by hand. It should rotate in a series of jerky movements. If the movement is smooth, the motor is unserviceable. • Put the motor aside, and check the supply to the two disconnected power leads inside the main housing. • Note the position of two parallel marks on the main body (inside the circle). Remove the two nuts at the motor rear and remove the cast end cap (Fig 1)	
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	• Look inside the aluminium end cap and check for loose carbon brushes or any obvious problems. Check the attachment of the brush cable at the power connection stud. If one is not connected, it is possible for a good electrician to solder it back into place. • Check inside the main motor body. The permanent magnets should be firmly bonded to the inside of the body. • Re-assemble the motor, and check that the marks are correctly aligned. • Hold the motor securely and connect to a 12v/24v supply. At full revolutions, without any load, the motor should draw approx. 25amps. The motor on a 12v system is marked “24v”.	
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4.4.5 Gearbox Casing Checks and Reassembly

	• Check for evidence of water inside the main housing and also the oval cover. • Check that the rubber cord seal between the oval cover and main housing is intact. There should be a 10mm break at the lower end, to allow water to drain away. • Check the upper and lower bearing inside the oval cover for correct operation. If necessary, lubricate with Furlex grease (or similar waterproof type).
	• Reassembly of the motor and gearbox is the reverse process. • Check that the upper drive shaft key (nose) is still in place. • Check that the recess for the drive shaft is still aligned correctly. If necessary, use a winch handle in the Stbd socket to re-align. • Reconnect the motor power cables, and slide the oval cover +motor into place. The cables are a close fit, so may need assistance to move into place. • Refit the oval end cap screws. • Use the winch handle to check that manual operation is possible, then check that the powered drive is connected (see 3.6)

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