

**SECTION B.**

**AUTOPILOT  
INSTALLATION,  
SERVICING AND  
TROUBLESHOOTING**

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**AUTOPILOT INSTALLATION,**  
**SERVICING AND TROUBLESHOOTING**

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# 1. PRE-INSTALLATION CHECKS

Before commencing the installation of your new Autopilot System one should carry out the following initial checks:

1. Correct items delivered.
2. Units undamaged.
3. Correct voltage drive unit supplied.
4. Correct chain and sprocket available for Rotary Drive Unit 930-402.

Turns HO/HO at Steering Sprocket HO/HO time 9 - 12 secs	Number of teeth on steering sprocket	
	<i>teeth</i>	<i>pignon</i>
	Planing and Displacement Twin Rudder	Displacement Single Rudder
2	19	25
3	13	19
3.5	13	19
4		19
5		13

5. Correct size fittings available to connect hydraulic pump.
6. Hydraulic fluid available and correct type for steering system.

## 2. INSTALLATION PROCEDURE

BEFORE ANY DRILLING OR CUTTING TAKES PLACE, THE EXACT LOCATION AND CABLE ROUTING FOR EVERY UNIT SHOULD BE DECIDED.

### 2.1 Installation Summary

1. Install distribution unit in selected position.
2. Install keyboard displays and route cable to distribution box.
3. Install compass sensor and route cable to distribution box.
4. Install rudder reference unit and route cable to distribution box.
5. Install drive unit. Route cable to distribution box.
6. Route light and heavy duty power supply to distribution box.
7. Fit light duty supply fused at 5 amps.
8. Fit heavy duty supply fused according to the drive unit fitted.

Heavy Duty Supply Fused Switch or Overload Trip

930-100	30A Antisurge
930-145/146	10A Antisurge
930-402	15A Antisurge

9. Connect cables to distribution box as per connection schedule.

### 2.2 Distribution Box

1. The distribution box must be installed in a dry position.
2. Install in an accessible position. In a new-build craft it may be accessible when it is installed, but will it be accessible when the boat is complete? "Think!" - you may be the person who has to get to this box at a later date.
3. The box should be positioned so that the heavy duty power supply from the batteries to the distribution box and from the distribution box to the drive unit is kept to a minimum. This is particularly important on sailing vessels where often you are operating on batteries which are not fully charged.
4. If the distribution box has to be installed in the engine room one should ensure that the area is properly ventilated to avoid high ambient temperatures.

## 2.3 Compass Sensor

1. The Compass Sensor needs to be carefully located. It should be mounted on a convenient bulkhead. The optimum position is as close as possible to the centre of pitch and roll.
2. On steel vessels it may be necessary to mount the sensor 1 to 3 metres above the super-structure.
3. Do not install the compass in a position where magnetic material i.e. tool-boxes, drink cans, chain etc. may be stowed at a later date.
4. Check the proposed location with a hand bearing compass for major deviation. Switch on any electrical equipment that may cause deviation and observe hand-bearing compass. If any change is observed, do not install sensor in this position, as this could cause the pilot to change course in a dangerous manner.
5. On fast vessels, it is advisable to fit the compass sensor well away from the forward end.
6. Further instructions on location of sensor are included with each sensor despatched from **Cetrek's** factory.

## 2.4 Keyboard Control

1. The Keyboard Control should be installed in a position convenient for the helmsman to operate from his normal steering position.
2. There must always be a pilot control within reach of the helmsman.

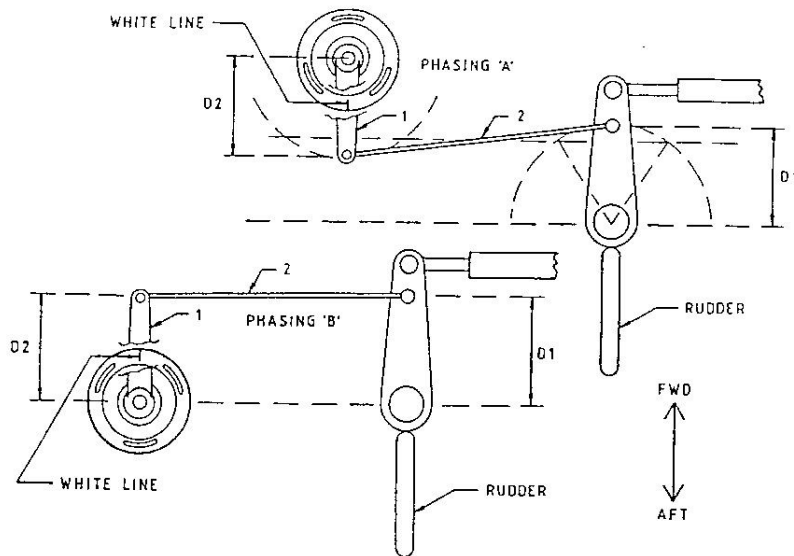
## 2.5 Rudder Reference Unit

1. The 930-807 unit is connected directly to the tiller, quadrant or tie bar of the steering system. It may be necessary to construct a mounting base for this unit.

The 930-817 Linear Feedback unit is mounted directly onto the power-drive system. This unit is normally used with the powerdrive system where space lacks.

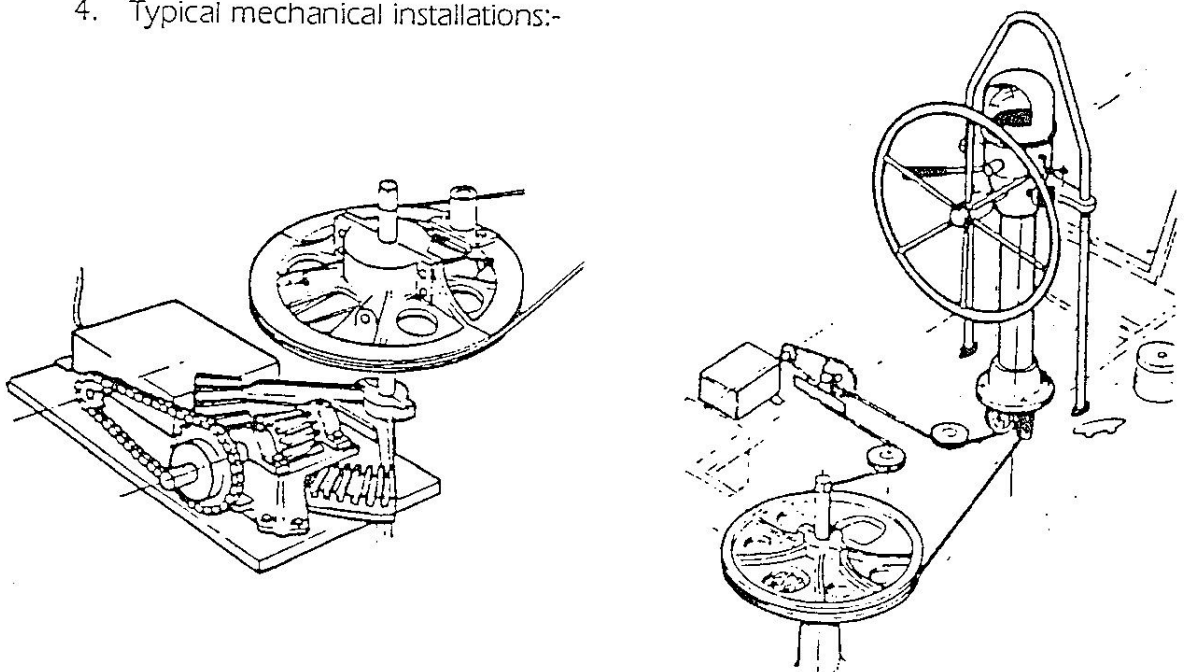
2. As the steering gear is often exposed in a locker which is used for stowage, ensure that the Rudder Reference Unit cannot be jammed by ropes, buckets, fenders etc. If necessary construct a cover unit to avoid this happening.

The rudder reference unit can be installed in two ways as shown in the drawing below. This results in different electrical phasing which is allowed for on electrical connection:-



## 2.6 Rotary Mechanical Drive Units

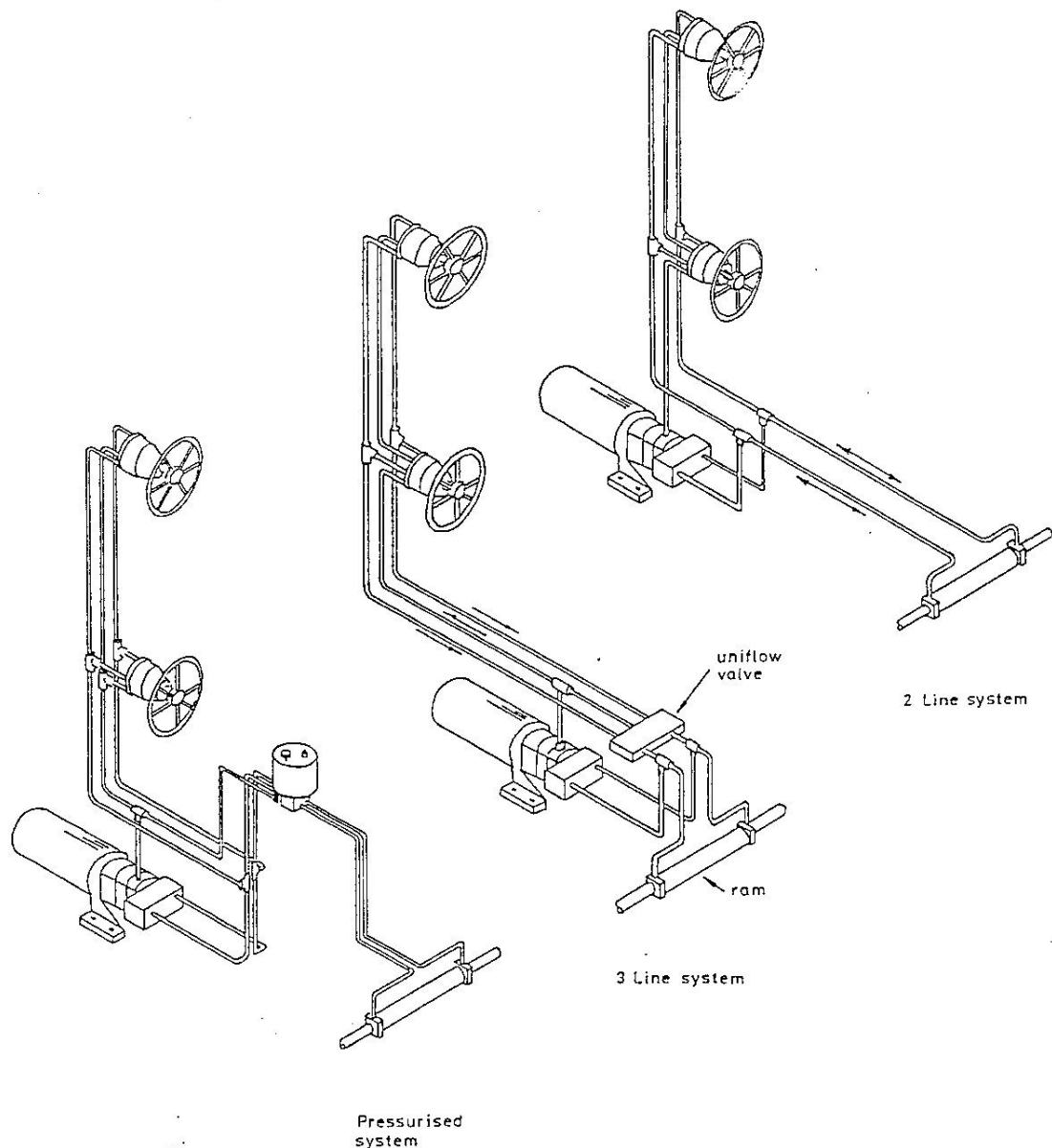
1. The size and position of the Mechanical Drive Unit should have been specified when originally ordering the Pilot System.
2. A Rotary Drive Unit will have to be positioned to align with the sprocket which will be fitted to the exiting mechanical steering system.
3. It is essential to ensure that a strong mechanical mounting is provided for these units as considerable loads are developed when under use.
4. Typical mechanical installations:-



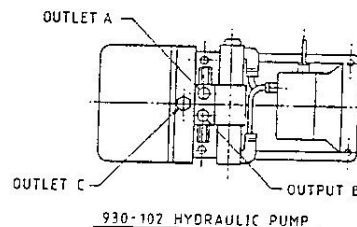
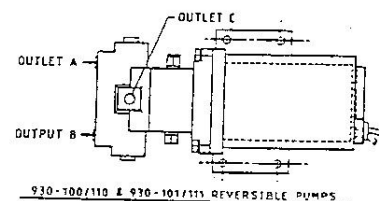
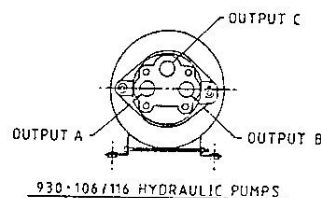
5. It is essential that the unit is connected using the correct gear ratio to give the required rudder speeds. In order to achieve this count the number of turns of the steering system from hardover to hardover at the chosen attachment point, and select the sprocket size from the table in section B1.
6. After the pilot system has been used for 8 - 10 hours it is recommended that the mounting and fastenings of the motor units are checked and re-tightened.

## 2.7 Hydraulic Pump

1. The Hydraulic Pump should be positioned to connect with the hand hydraulic system as indicated in drawings below:



2. A rigid base should be provided for the mounting of the hydraulic pump to avoid unnecessary vibration and noise.
3. Check if the helm unit is fitted with check valves. If they are not fitted it will be necessary to install a separate operated check valve between the hand hydraulic steering pump and the autopilot pump. This check valve is available from your **Cetrek** Distributor. Part Number 930-213.
4. The pump should be connected to the existing steering system, using flexible hoses. Installation kits are available from your local **Cetrek** distributor for most standard pipe sizes.
5. Connect outlets A and B to the drive lines of the hand hydraulic steering.
6. It does not matter which outlet is connected to which drive line as the direction of drive can be changed by reversing the electrical connections to the distribution box. (This is part of the checks covered in Pre-Trial Checks, Section B3.2)



7. Connect outlet C to the helm pump reservoir or in the case of a three-line steering system to the balance line.
8. Do not use any PTFE tape when connecting the hydraulic fittings. If it is necessary to seal a tapered fitting, use a recommended hydraulic oil sealant
9. Having connected the pump, refill and bleed the hydraulic steering system as per the manufacturers instructions.
10. Ensure that the correct oil is used to refill the system. Normally steering systems with pipe sizes larger than 12 mm or 1/2 in. use Automatic Transmission Fluid which can easily be obtained from your local garage. Systems with smaller 3/8 in. use a lighter fluid. You should check with the steering gear manufacturers' instructions to ensure correct oil used.
11. When installing hydraulic pumps take great care to ensure that no dirt or swarf enters the system as this may result in steering failure at a later date.



## 2.8 Good Wiring Practice

Having located the position of each unit as and before installing any unit it is essential to check to cabling runs to ensure that there are no problems.

1. All cable runs should be kept as clear as possible from other cables carrying RF or pulsed signals. At least 3 ft. clearance is advised. Take particular care to ensure clearance from radio transmitting aerals.
2. If it necessary to extend the control unit cables, the same type of cable must be used and the screens connected. The control unit system is provided with screened cables. These screens should be earthed at the distribution box using the clamping strips provided.
3. If it is necessary to extend the drive unit cables, then they should be extended using a heavy duty cable avoiding unnecessary power loss.
4. If the vessel has an earthing system, the case of the distribution box should be bonded to the system using a heavy duty cable.

**NOTE: DO NOT CONFUSE BATTERY NEGATIVE WITH EARTH.**

5. DC supply cables should be kept as short as possible, and should be taken directly from the battery via a switch/fuse or overload trip of a suitable rating for the system being installed.
6. A power supply cable should not be used to supply both the autopilot and other electronic equipment as switching transients can be very troublesome and this practice can cause RF interference.
7. It is good practice to cleat all cables to fixed points at no less than 0.5 m spacing, and where cables pass through bulkheads protection by way of a suitable grommet or sleeve should be provided.
8. Two separately switched and fused power supplies must be connected to the distribution box. The first is for the light primary supply for the electronic control system. The second the heavy duty supply for the drive unit.
9. Avoid running power and motor supply cables together with control and compass cables to reduce the risk of possible interference

## 2.9 Standard Autopilot Connections

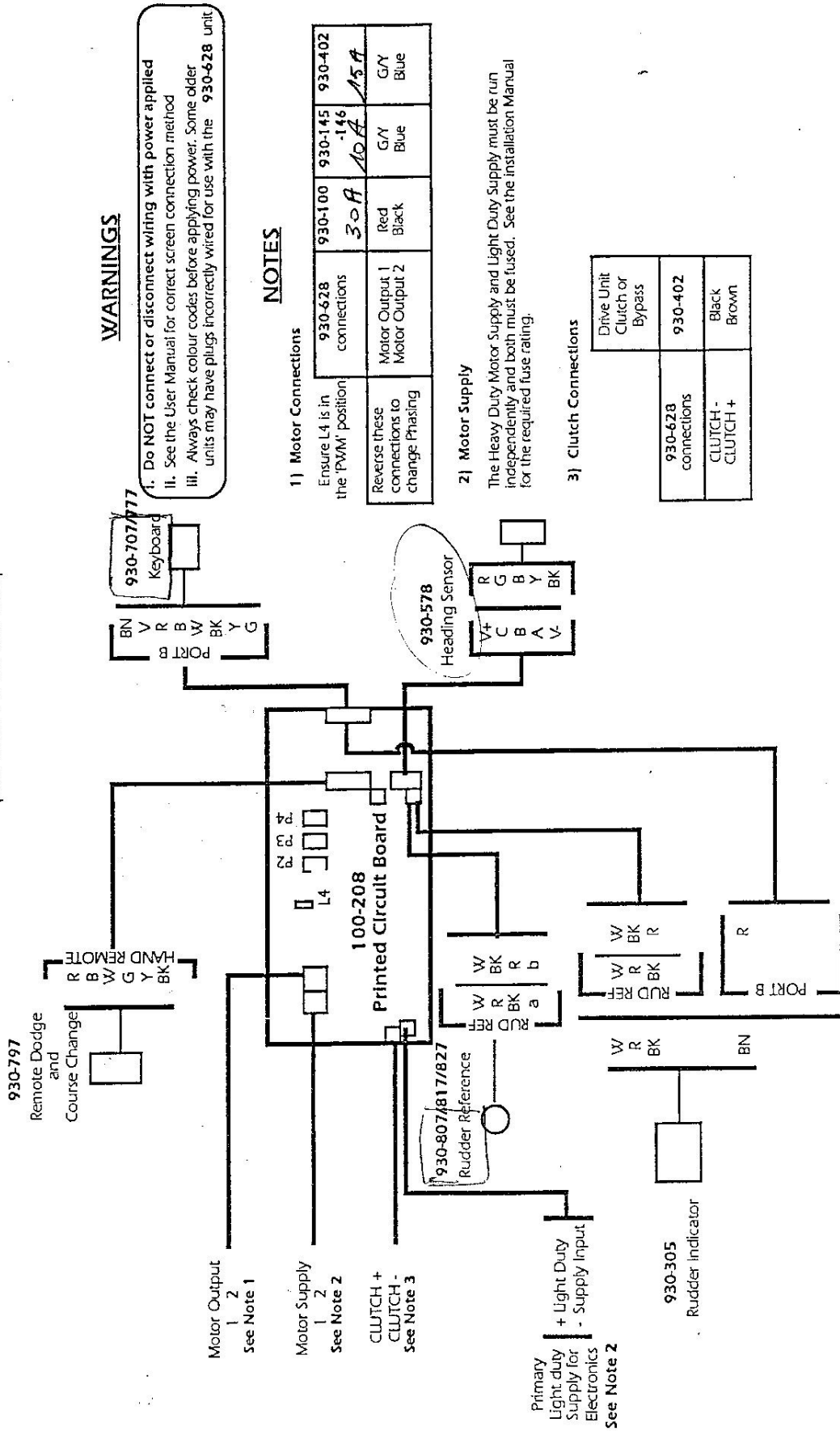
1. Wiring connections to the systems are made in the distribution box.
2. The distribution PCB is accessed by releasing the screws holding the front cover of the distribution box and lifting the cover clear.
3. The units are supplied with a plug and socket system for simple connection. The plugs can be simply removed if required.
4. Spare plugs are supplied for connection of navigators etc. Additional plugs being available from your **Cetrek** distributor.
5. The connections for each item are clearly indicated on the distribution board PCB.
6. All cables are colour coded: -

### Key to Colour Coding

R	Red	Rouge	Rot	Jojo
B	Blue	Bleu(e)	Blau	Azul
BK	Black	Noir(e)	Schwarz	Negro
BN	Brown	Brun(e)	Braun	Marron
V	Violet	Violet(te)	Violett	Mokado
G	Green	Vert(e)	Grün	Verde
W	White	Blanc(he)	Weiss	Blanco
GY	Grey	Gris(e)	Grau	Gris
Y	Yellow	Jaune	Gelb	Amarillo

NC	No connection	Pas de lien	Kein anschluss	No conectar
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# Installation Schematic - 930-628 used with 930-707 and 930-777 (100-208 PPC Iss. 2 or later)



### WARNINGS

- i. Do NOT connect or disconnect wiring with power applied
- ii. See the User Manual for correct screen connection method
- iii. Always check colour codes before applying power. Some older units may have colours incorrectly wired for use with the 930-628 unit

### NOTES

#### 1) Motor Connections

930-628 connections	930-100	930-145	930-402
Motor Output 1	Red	G/Y	G/Y
Motor Output 2	Black	Blue	Blue

Ensure L4 is in the 'PWM' position



Reverse these connections to change Phasing

#### 2) Motor Supply

The Heavy Duty Motor Supply and Light Duty Supply must be run independently and both must be fused. See the Installation Manual for the required fuse rating.

#### 3) Clutch Connections

930-628 connections	930-402
CLUTCH -	Black
CLUTCH +	Brown

8. Ensure it is safe for the steering gear to start automatically. Set rudder to amidships using normal steering. Ensure pilot presets set to suit type of vessel . Press "Standby Pilot". Very little or no rudder movement should occur. If rudder drives continuously to one side, switch off at once and reverse motor phasing. If rudder continuously hunts about amidships, increase the rudder response setting. Press  motor should drive and rudder should move to starboard. Pressing  should cause rudder to drive to port. If rudder moves in the incorrect direction switch off at once, isolate supplies and reverse the connections to the drive unit at terminals in the 930-628 distribution box. Restore supplies and repeat test. If rudder drives continuously, switch off at once and restart general checks.
9. Check transit screw removed from compass. Check compass heading similar to ship's heading. If large error, check that coil correctly aligned in compass housing. To realign compass remove cover, release clamp on coil PCB, rotate coil until correct heading displayed.
10. If a 930-797 dodge/course change is fitted check its full operation and that it operates course change or dodge in the correct direction.

Sea trials can now be carried out to determine the best settings for the optimum autopilot performance.

### 3.3 Sea Trials

1. It is advised that these trials are not executed in restricted or busy waters.
2. It is preferable to perform sea trials in average sea conditions.
3. Select preset pilot adjustments to suit type of craft.
4. It is recommended that the sea trial adjustments are carried out in the following order:-

#### a. Rudder and Rudder gain adjustments:-

If the vessel is understeering (i.e. too little rudder correction being applied) increase Rudder setting.

If too much rudder is being applied and the vessel is oversteering, decrease the setting.

**b. Counter Rudder adjustment:-**

*Adjustment*  
Press **◀▶** to turn pilot through 90° with vessel moving at normal cruising speed, the Counter Rudder should be adjusted to give approximately 10° of overshoot before returning to preselected course. If larger overshoot occurs, increase setting of Counter Rudder. If vessel approaches preset course very slowly then decrease Counter Rudder setting until overshoot occurs. After carrying out this adjustment, repeat (a) on the previous page.

**c. Trim adjustment:-**

*Notice*  
On single screwed vessels or sailing yachts it is only possible to check the Trim setting when prevailing conditions or use cause the vessel to steer with offset rudder and therefore the correct Trim adjustment setting for these types of vessel is best found by experience. To check the Trim adjustment with twin engine vessels, run the boat under pilot command with both engines running, then close down one engine. The vessel will initially go off course but should return to course in less than 60 seconds. If vessel takes longer period of time to return to course, increase the value set for Trim.

**Note:** After completing these initial sea trials, the data will be stored in the microprocessor memory until future adjustments are made. It is also advised that these settings are recorded in case they are accidentally changed at any time by an operator.

**WARNING:**

Pilot Data will not be stored unless pilot is turned off by 'Off' key on keyboard.