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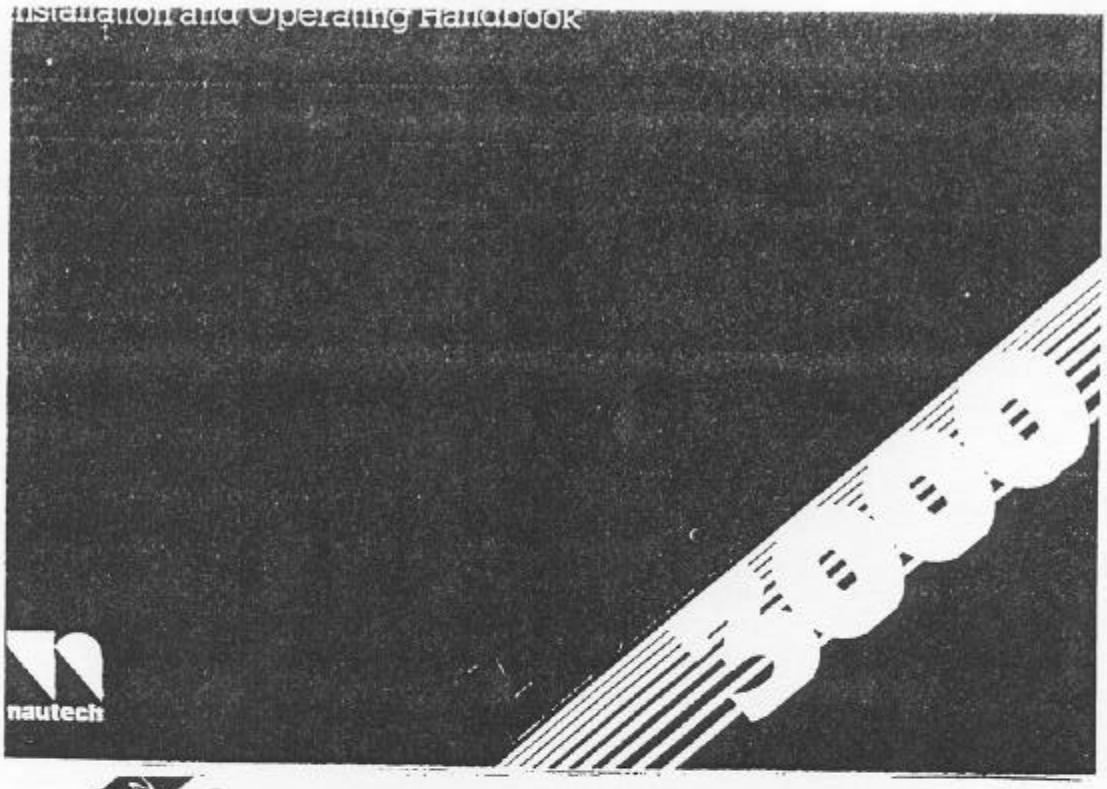
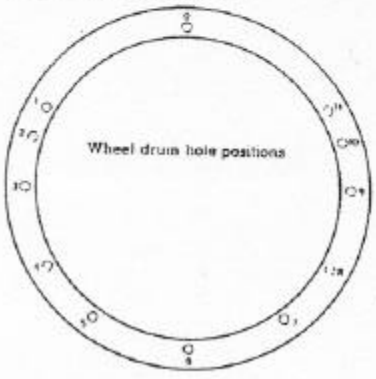


Installation and Operating Handbook

INSTALLATION

The wheel drive unit is attached by a single pin to a clevis permanently fixed to the cockpit structure. Drive is transmitted to the wheel by a tensioned toothed belt. A lever operated eccentric bush in the drive unit mounting arm enables belt tension to be released to facilitate manual override by allowing the belt to slip. The drive disengagement system is both effective and reliable.
The control unit is permanently connected to the drive unit by a 10ft (300cm) cable and is remotely mounted on a permanently fixed socket at a convenient location adjacent to the wheel.
After connection to the yacht's 12 volt power supply the system is ready for use.

Wheel drum attachment
The wheel drum has 12 holes to enable the spoke clamp bolts to pick up on all commonly found spoke pitches as shown below.

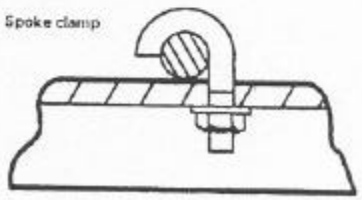


Hole 'O' is marked with a white dot. The following table indicates the holes to be used for differing numbers of wheel spokes.

Number of spokes	Hole numbers used
3	0, 4, 8
4	0, 3, 6, 9
5	0, 2, 5, 7, 10
6	0, 1, 4, 6, 8, 11

The wheel drum ideally should be fitted behind the wheel (ie between the wheel and the pedestal). In this case it will be necessary to remove the wheel. If there is insufficient clearance behind the wheel the wheel drum may be fitted on the other side.

The wheel drum is clamped to the wheel spokes by the 'U' bolts provided. After roughly positioning the drum the clamp nuts should be lightly tightened and concentricity checked by spinning the wheel. The drum should then be tapped central to achieve a total run-out of no more than $\frac{1}{16}$" (2mm) before the clamps nuts are finally tightened.

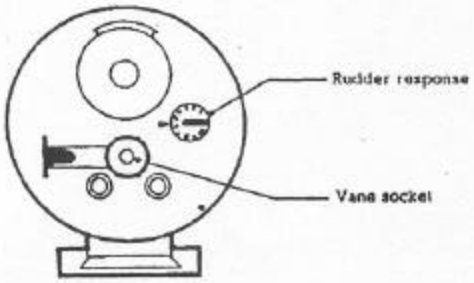


Dodge switch

The dodge switch has two distinct functions which are automatically selected by the setting of the control switch

1 When the control switch is in the Set position clockwise or anti-clockwise trigger movement will continuously energise the wheel drive unit to drive the wheel in either direction. This facility is useful when adjusting belt tension to check slip.

2 When the control switch is set to One, Two or Three, anti-clockwise movement of the trigger will alter course to starboard by 20 degrees. Conversely, clockwise trigger movement will alter course to port by the same amount. The vessel will return to the original course as soon as the trigger is released. This facility is useful when it is necessary to make temporary course alterations to dodge obstructions such as buoys or other vessels.



Rudder response

This control is used to set the response of the automatic pilot to match the steering characteristics of your vessel. The method of setting this control is fully described later. The control is 'hidden away' underneath the control unit since once it has been finally set no further adjustment will be necessary.

Vane socket

A waterproof wind vane jack socket is provided on the underside of the control unit. When a wind vane is fitted, insertion of the vane attachment jack plug will isolate the internal compass and transfer control to the wind vane.

Compass calibration

The compass dial has been factory set to indicate the correct heading against the forward lubber line when the control unit is mounted on an athwartships bulkhead at 90 degrees to the vessel's centreline. The fore-and-aft lubber lines consist of two deep grooves in the compass dial surround in line with the roll axis gimbal. If the bulkhead is not exactly at right angles to the vessel's centreline, the compass dial setting can be adjusted by the following procedure.

● Switch to Set and rotate the compass dial until the course read against the forward lubber line corresponds with the steering compass reading. If the compass dial is correctly adjusted both pilot lights will be extinguished when the compass readings correspond.

● If one of the pilot lights remains on, an adjustment error is present. When this is the case clamp the compass dial to the control unit case by applying firm finger pressure to a point on the dial periphery. Then rotate the central adjusting knob carefully until both pilot lights are extinguished. Finally check that both compasses now agree.

Standard compass calibration

The control unit compass has been factory set to give correct steering sense when the wheel drive unit is installed with the drive sprocket facing aft. With the drive sprocket in this position correct steering sense can be checked by setting the compass dial to the vessel's present heading and then switching to One. If the compass is correctly sensed small clockwise movements of the compass dial will cause the wheel to rotate anti-clockwise.

Forward facing drive sprocket

If the drive unit has been installed with the drive sprocket facing forward it will be necessary to reverse the compass calibration to regain correct steering sense. This is very simply done by switching to Set and then rotating the compass dial to the vessel's present heading when both pilot lights will be extinguished. Then clamp the compass as previously described and rotate the compass adjusting knob 180 degrees until both pilot lights are again extinguished.
Correct steering sense should be checked as described previously.

Deviation

It is possible that the main steering compass, the control unit compass or both, are subject to deviation due to the presence of iron (usually the engine) in their vicinity. Many yacht instruments also possess strong magnetic fields which can influence the compasses. When this is the case the main steering compass and control unit compasses will not agree on all headings.

Deviation errors on your main steering compass should of course be known and recorded. Ideally the main steering compass should be corrected by a compass adjustor. Since all courses are finally set up against the main steering compass slight discrepancies in the two readings due to deviation are of no real importance.

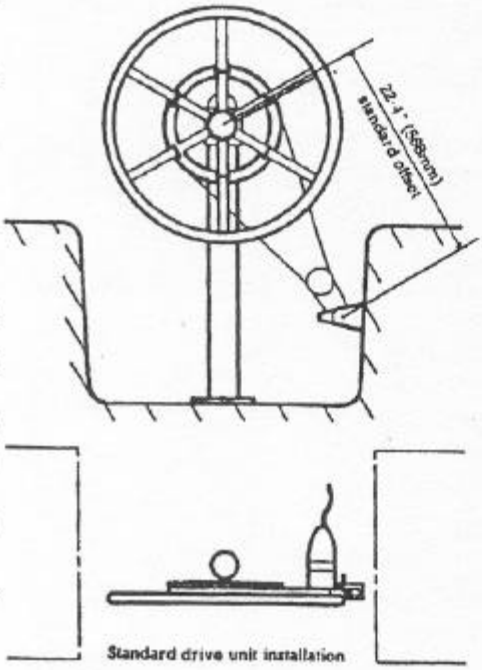
Reciprocal headings

You will find that both pilot lights can also be extinguished when the compass dial is set to a reciprocal heading. This is due to the nature of the autopilot compass design. Confusion can only occu when setting the autopilot to follow an existing course with the aid of the pilot lights. This can always be avoided by ensuring that the compass dial reading approximately corresponds to the vessel's present heading.

Drive unit installation

Standard installation method

The drive unit is normally mounted on the cockpit sole side wall as shown below.



Standard drive unit installation

Alternative belt sizes are available to increase or decrease the radial offset of the mounting pin. These may be used in cases where the standard belt does not allow a convenient location for the mounting clevis.

Belt size	Radial off-set
B —	18·9" (480mm)
A —	20·3" (515mm)
Standard	22·4" (568mm)
A +	27·1" (688mm)
B +	32·1" (815mm)

The mounting clevis is most easily positioned by the following method.

- Assemble the belt drive as shown in the diagram and attach the mounting clevis to the drive unit by the pin provided.
- Offer the clevis against the vertical side wall after first rotating the eccentric clutch lever fully clockwise against its stop. (ie to the 'tight belt' position).
- Push the clevis downwards against the side wall until the belt is just taught and then adjust its fore-and-aft position until the belt lies parallel to the wheel. A long straight edge, such as a sail batten, will enable the parallel run of the belt to be easily checked.
- Having found the correct position for the clevis carefully mark round its base to record its position. Then remove the drive unit and mark round the inside of the elongated fixing holes.

- Finally drill two $\frac{5}{16}$" (8mm) clearance holes for the clevis fixing bolts at the lower end of each elongated hole position. This allows the belt to be subsequently tightened.

NB Before drilling the holes check that you have access to the other side of the mounting wall to attach the nuts!

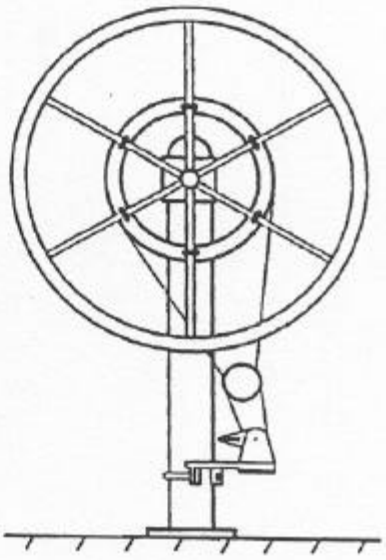
The mounting clevis may now be bolted into position with the fixing bolts positioned mid-way in the elongated holes. This will ensure that the belt is taught when it is tensioned by rotating the clutch lever fully clockwise. Re-assemble the complete drive system and check the operation of the clutch. The clutch lever may be repositioned on the splined eccentric bush if necessary to ensure that the lever can rotate 180° without obstruction.

When the belt is tensioned by rotating the clutch lever fully clockwise it should be possible to back wind the drive unit by slowly rotating the wheel. If belt slip occurs increase belt tension by reclamping the clevis in a slightly lower position. When the clutch lever is rotated fully anti-clockwise the wheel drum should slip easily against the belt.

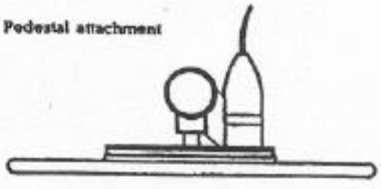
Pedestal mounting bracket

A special mounting bracket is available to mount the drive unit directly onto the wheel pedestal as shown below.

This mounting method is simple and compact and also avoids drilling holes in the yacht's structure. It also allows free access past both sides of the wheel. Full fitting instructions are enclosed with each pedestal mounting kit.



Pedestal attachment



nautech

It is also worth mentioning the more obvious and that is that an autopilot cannot anticipate. Sailing downwind in breaking seas needs particular care.

for life at the factory. Therefore no maintenance whatsoever will be required. Should a fault develop, the entire unit should be returned in the original packing for repair and servicing, which will be carried out speedily and at a moderate cos

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When sailing in open sea conditions the control switch should be set to **Two** or **Three**. If it is observed that the autopilot is responding to repeated yawing motion due to wave action, the control switch should be set to **Three**. When the control switch is set to **Three** the compass is fully de-sensitised and will not cause unnecessary steering activity due to regular rolling or repetitive wave action. The mean course will be accurately maintained nevertheless but power consumption will be substantially reduced by neglecting small repetitive disturbances.

Final adjustments to rudder control

The rudder control settings recommended on page 14 are typical and will provide good control whilst carrying out your initial sea trials. However, sailing craft of a particular category can vary widely in their response to the helm. If, for example, you know that your particular boat is somewhat lacking in response to the helm you will find that control will be improved by increasing the rudder control setting. The opposite is true for craft which are particularly sensitive to rudder control.

Before carrying out further adjustment of the rudder control the following general guides should be understood.

● If the rudder control is set excessively high the heading will tend to meander rapidly about the mean course even in flat calm conditions. In calm conditions the autopilot should settle the vessel on to an absolutely constant heading. Providing there is no significant free play in the steering gear, the autopilot should apply only a few corrections per minute in calm conditions when under power.

Even if course meander does not occur, tiller movements will appear to be excessive when the rudder control is set too high. In addition, excessive overshoot when making course alterations will be observed.

● If the rudder control is set too low, the automatic pilot will still maintain a good mean heading, but the vessel will respond sluggishly to course changes and will tend to remain above and below the mean course for excessive time periods.

It should be possible to observe either of the above extreme tendencies easily and to apply an appropriate adjustment to the rudder control. In fact, the setting of the rudder control is not over critical and if anything one should err towards a low setting since this will minimise tiller movements and hence reduce power consumption. Once the best setting has been found it should be noted and no further adjustment will be necessary.

Disengagement

When manual override is required the drive unit can be rapidly disengaged by operating the clutch lever to slacken the belt. If it is intended not to use the autopilot for a long period manual steering will be made easier by removing the belt altogether.

Operating hints

It is always desirable when sailing under automatic pilot to pay careful attention to sail balance and indeed your autopilot will make this possible. The Autohelm 3000 has been designed for sailing craft where battery drain economy is of paramount importance. The system's power output capability has therefore been deliberately limited and thus bad sail balance will detract from good steering performance. Good sail balance is particularly important in strong winds and gusting conditions.

When a yacht is sailing badly out of balance, sudden gusts will generally cause it to luff violently to windward. When hand steering the tendency is overcome by applying sufficient weather helm to maintain the original heading. The Autohelm 3000's automatic weather helm compensation circuit however, is intended only to take account of the gradual changes in standing helm that typically occur when passage making due to changing wind conditions.

When a sudden change in helm balance occurs the automatic compensation circuit will take approximately one minute to restore the original heading. In gusty conditions the course will tend to meander particularly if the sails are badly balanced. Significant improvement to course keeping can be obtained by ensuring that sail balance is maintained, and this may mean reefing

One should avoid sailing under autopilot when the wind is dead astern. Ideally, the wind should be brought at least 30 degrees towards the beam, and in breaking seas it is often better to remove the mainsail altogether and to sail under boomed out headsail alone.

Providing you ensure that your vessel is properly canvassed for the prevailing conditions, your Autohelm 3000 will be capable of sailing you through gale force winds. Moreover, it is times like this that it will endear itself most of all by leaving you fresh and alert to sail in safety.

Sailing under automatic pilot is a wonderful experience that can easily lead you into the temptation of relaxing permanent watch-keeping. This must be avoided however clear the sea ahead may appear to be. Remember, a large ship can cover two miles in five minutes – just the time it takes to brew a cup of coffee!

Stowage

After use the Autohelm 3000 system is easily stowed by detaching the drive unit from its mounting clevis and removing the control unit from its mounting socket. The entire system can be stowed easily in a small locker.

Maintenance

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Functional test procedure

After the compass has been checked and adjusted you should carry out the following functional test to familiarise yourself with the controls before attempting sea trials.

● Switch to **Set** and adjust the compass dial to the vessel's heading when both pilot lights will be extinguished.

● Centralise the wheel and engage the drive unit by operating the clutch lever.

● Switch to **One**. The autopilot is now set for duty and will steer the heading indicated on the compass dial.

● Operate the dodge switch to apply 20 degrees course change to port or starboard. The drive unit will apply a fixed wheel movement and if the vessel were moving would immediately alter course by 20 degrees. Release the dodge switch and allow the wheel to centralise again.

If the vessel is swinging about its mooring the tiller actuator will apply small corrections as the heading changes. You can then switch to **Two** and **Three** and note that the frequency of correction is progressively reduced.

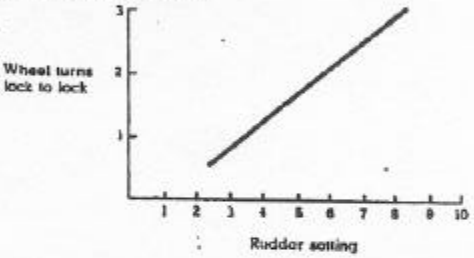
The automatic trimming capability of the autopilot can also be observed by the following test.

Set the control unit compass to the steering compass reading (with both pilot lights extinguished) and then switch to **One**.

Then offset the control unit compass by approximately 10 degrees. This effectively simulates a condition where the need for standing helm has suddenly developed and the vessel is not returning to course. You will notice that after an initial fixed helm movement has been applied the drive unit continues to apply further helm movements at a much slower rate. If left in this condition, the wheel will eventually rotate hard over. If, however, the vessel was moving through the water the progressive application of additional helm will eventually return the vessel to its original course. This can be simulated by rotating the compass dial back to the original course. The progressive application of helm will then cease leaving the wheel in an off-set position representing the amount of standing helm applied before the vessel returns to the original heading.

Rudder response control

Before attempting sea trials the rudder control must first be adjusted to suit the wheel reduction ratio of your particular vessel. The rudder control setting recommended for initial sea trials may be obtained from the following chart.



The rudder control setting is not too critical and the setting recommended overleaf should ensure that the system applies effective control during your initial sea trials. Later when you have gained operating experience you can apply final adjustments to the rudder control to ideally match the steering characteristics of your particular boat.

First sea trials

Your first trials at sea should ideally be carried out in calm conditions and with plenty of sea room. The following test programme is recommended.

● Steer onto a fixed heading under engine or sail and hold the course steady. If you are sailing, head slightly off the wind, and adjust sails so that you are nicely balanced.

● Switch to **Set** and adjust the compass dial to your compass heading so that both pilot lights are extinguished.

● Switch to **One**, engage the clutch and allow the auto-pilot to take control.

● When you are satisfied that the autopilot is maintaining the original heading you can steer onto new headings by adjusting the control unit compass dial and making appropriate sail adjustments.

● Switch to **Two** and then **Three** and note that the frequency of tiller correction is progressively reduced.

You have already observed the system's ability to make corrections for standing helm during your initial functional tests in harbour. You can now carry out the following test to observe standing helm correction when underway.

● Steer onto a broad reach with sails set to give neutral helm. Allow a few minutes to settle onto a constant course.

● Then haul in the mainsail to induce weather helm. The vessel will then luff slightly depending on the amount of weather helm induced. After a minute or so the autopilot will have automatically applied sufficient weather helm to restore the original heading.

● When the mainsheet is slackened to restore neutral helm the vessel will initially bear away and will again return to the original heading a minute or so later when the standing helm has been automatically removed.

Adjustment to sea conditions

The control switch should be set to **One**, **Two** or **Three** dependent on prevailing sea conditions. In general, when switched to **One** excessive actuator activity will occur in anything other than calm conditions. This setting is used for precise control in flat water harbour conditions.

OPERATION

The following description of the Autohelm 3000 principle of operation should help you to gain a rapid understanding of its controls.

The control unit houses an extremely sensitive compass which can be set to the desired course by means of a calibrated dial. Deviation from course is continuously monitored by the compass and corresponding corrective rudder action is applied by the wheel drive unit to bring the vessel back on to course. The degree of applied rudder is proportional to the course error at any time and thus when the original course is restored the rudder will be neutralised. The amount of rudder applied for a given off-course error is adjustable to match the steering characteristics of the vessel. A vessel with a small rudder, for example, will require more corrective helm than a similar size vessel with a large rudder.

The characteristic which distinguishes the Autohelm 3000 is its capability of making automatic correction for changes in trim or weather helm. When changes in trim occur due to changing weather conditions for example, the original heading can only be maintained by the application of permanent helm (weather or lee helm) to restore balance. Most automatic pilots are incapable of doing this and will allow the vessel to bear on to a new heading to achieve a new state of balance. When these circumstances occur the Autohelm 3000 detects that the original course has not been restored and will continue to apply additional helm until the vessel returns to the original heading. This facility ensures that the set course will always be rigidly held irrespective of changes in balance that may occur during the course of a passage.

Controls

The accompanying illustration of the control unit shows the position of all controls. Each control has the following functions.

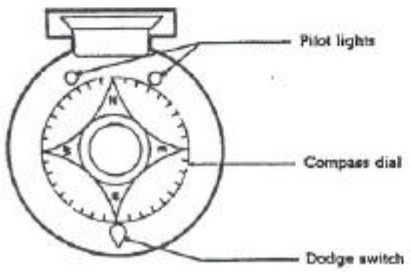
Compass dial
The course is set by rotating the compass dial to bring the desired heading against the forward lubber line.

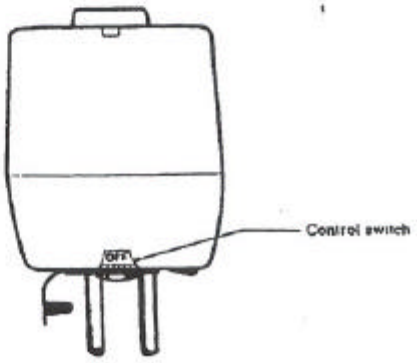
Pilot lights
Course errors to port or starboard are indicated by red and green light emitting diodes. When both lights are extinguished the autopilot compass is aligned with the vessel's heading. In this position the compass dial reading should agree with the steering compass.

Control switch
The autopilot operating mode is controlled by a five position thumb operated rotary switch. When the switch is rotated fully to the left the autopilot is switched off. The remaining four switch positions select the following modes of operation.

Set – Energises the compass and enables the compass dial to be set with the aid of the pilot lights to the vessel's heading.

One – Fully energises the autopilot for duty in calm sea conditions.
Two – Partially de-sensitises the compass to reduce actuator activity in moderate sea conditions.
Three – Fully de-sensitises the compass to further reduce actuator activity in rough sea conditions.





Attachment to athwartships bulkheads

In cases where the steering wheel is mounted on a bulkhead, special provision usually must be made to mount the drive unit. 'L' brackets are available to mount the clevis on a bulkhead as shown below.

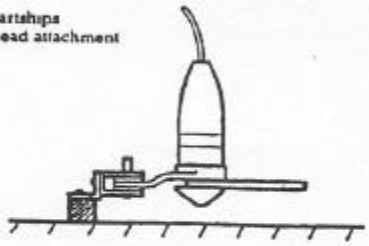
Hardwood packing may be required to gain correct alignment to the wheel drum.

Alternative mounting positions

The wheel drive unit may be positioned on either the port or starboard side of the wheel. The compass is calibrated to give correct steering sense when the drive unit sprocket is facing aft. Access to the clutch lever is also easier when the drive unit is mounted this way round.

If an obstruction precludes mounting the drive unit with the drive sprocket facing aft it may be mounted the other way round. In this case it will be necessary to re-adjust the compass calibration to regain correct steering sense and this procedure is described later in the Operating Instructions.

Athwartships
bulkhead attachment



Control unit installation

Selection of site

The control unit is suspended by a single axis ball bearing gimbal which slots into a permanently sited socket. Both the drive unit and the control unit are thus easily removed for stowage when not in use.

Two control unit mounting sockets are provided and therefore two alternative sites for mounting the control unit may be chosen. The single axis gimbal mounting is designed to allow the control unit to gimbal in the direction of roll only, and thus the vertical surface chosen for mounting must be orientated athwartships. The primary position for the control unit should be sufficiently near to the wheel so that it can be easily operated from the steering position. The control unit should be positioned at least 2' 6" (80cm) away from the main steering compass to avoid deviation of both compasses.

Deviation of the control unit compass is less important since headings should always be adjusted against the main steering compass. Nevertheless, deviation should be avoided if possible and thus the control unit should be sited as far away from other magnetic or iron devices as practical.

Mounting socket attachment

Having selected the best mounting sites the mounting sockets may now be secured using the self tapping screws provided. Alternatively, the mounting sockets may be bonded into position with silicone rubber (Bathtub Caulk). If this method is used the rear face of the socket moulding should be thoroughly roughened to ensure a good bond. Care should be taken to ensure that the cables emerging from the base of the control unit do not interfere with free gimbal movement.

Battery connection

For trial purposes the power supply lead emerging from the base of the control unit may be connected directly to the vessel's 12 volt battery. The brown lead should be connected to the positive terminal and the blue lead to the negative terminal. If the connections are accidently reversed the autopilot will not function but no damage will result.

It is recommended that a waterproof plug is situated adjacent to the unit and the power lead accordingly shortened. A standard 5 amp fuse should be provided in the power supply circuit to protect the internal supply cable between the battery and the waterproof outlet socket.

NB The equipment must not be connected to a battery charger for testing.

When sailing in open sea conditions the control switch should be set to **Two** or **Three**. If it is observed that the autopilot is responding to repeated yawing motion due to wave action, the control switch should be set to **Three**. When the control switch is set to **Three** the compass is fully de-sensitised and will not cause unnecessary steering activity due to regular rolling or repetitive wave action. The mean course will be accurately maintained nevertheless but power consumption will be substantially reduced by neglecting small repetitive disturbances.

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Stowage

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