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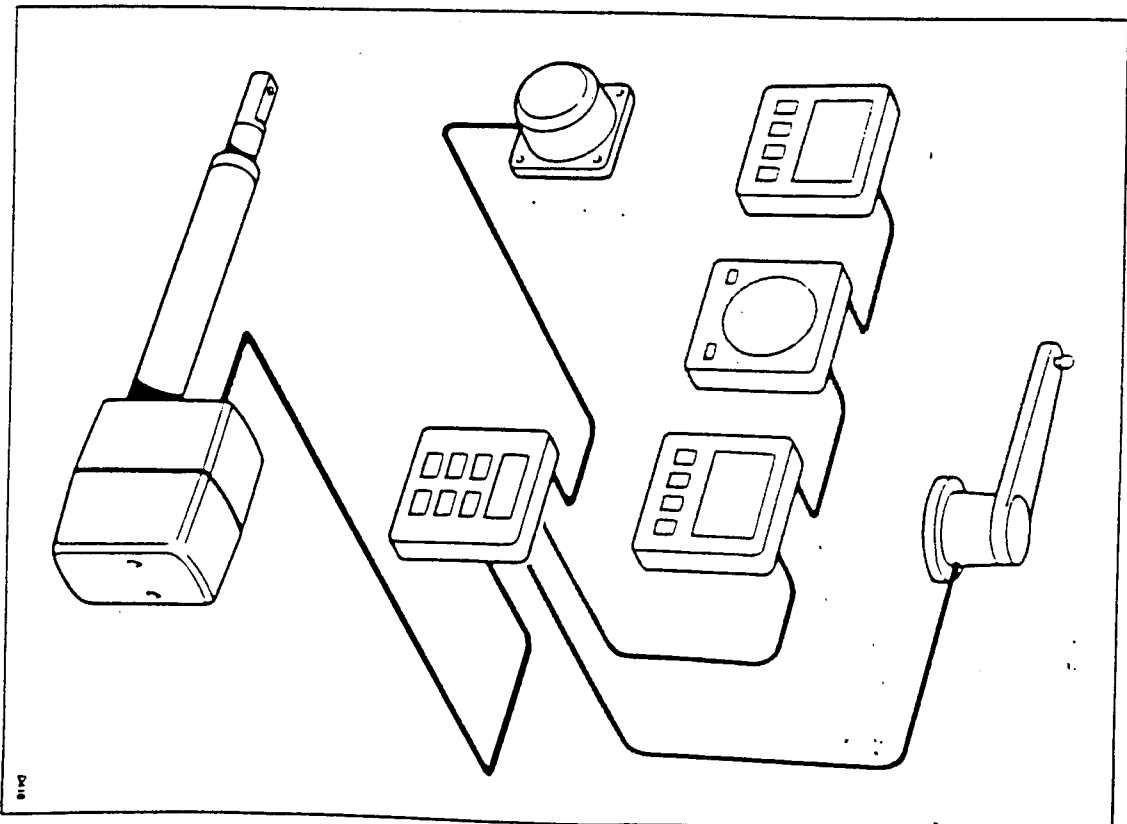
**Autohelm™**

**ST5000**

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**STERNDRIVE  
AUTOPILOT**  
Operation and  
Installation

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ST5000 Stern Drive Autopilot

## Contents

Specifications .....	
Introduction .....	
Safety .....	

## Basic Operation

Chapter 1: Operation .....	
1.1 Basic principles .....	
1.2 Operator controls .....	
Standby .....	
Auto .....	
Course changes (-1, +1, -10, +10) .....	
Hedge .....	
'Track Control' .....	
Automatic Deadband Control (Auto seastate) .....	
Illumination .....	
Off Course Alarm .....	
1.3 Operating hints .....	

## Advanced Operation

Chapter 2: Using 'Track Control' .....	1
Chapter 3: Adjusting autopilot performance .....	2
Chapter 4: Autopilot re-calibration .....	2

## Installation

Chapter 5: Installation .....	4
Chapter 6: Interfacing to GPS, Decca, Loran .....	5
Chapter 7: Functional Test and Initial Sea Trial .....	6
Chapter 8: Accessories .....	6
Chapter 9: Maintenance .....	7
Chapter 10: Fault Finding .....	7

## Specifications

- Power Supply
  - 10 to 15V d.c.
- Current consumption
  - Standby: 65mA (120mA with lighting)
  - Auto: between 0.7A and 2.5A depending on boat trim, helm load and sea conditions
- Operating temperature
  - 0°C to +70°C
- 6 button digital keypad
- LCD display of heading, locked course and navigational information
- User calibration for optimum performance
- SeaTalk compatible
- Automatic compass deviation correction
- North/Southerly heading compensation
- Automatic heading deadband
- Built-in radio navigation interface
- Waypoint advance feature
- Automatic emergency drive release
- Automatic autopilot gain adjustment with boat speed

## Introduction

The ST5000 is a permanently installed autopilot for power craft equipped with power assisted sterndrives. The basic system comprises of 3 units:

- Permanently mounted control head
- Stern drive linear actuator
- Remote fluxgate compass for precise heading information

The control head is SeaTalk compatible and therefore can share all data transmitted from other Autohelm SeaTalk instruments:

- Track information from either Navdata or Navcenter instruments provides waypoint control from the autopilot
- Boat speed from the Speed instrument for optimum Track keeping performance and automatic autopilot gain adjustment
- SeaTalk compatibility also allows additional fixed and handheld autopilot control units to be easily connected at secondary steering and control positions

The Control unit also includes a built in Navigation interface for use with a position transducer (GPS, Decca, Loran) transmitting MMEA 0183 data.

The drive unit attaches to the vessels power steering valve. Two mounting kits are available which allow the ST5000 to be fitted to different engine manufacturers equipment.

A rudder position transducer is also available which can be added to any installation to provide a precise readout of rudder position.

The ST5000 can be calibrated to suit each installation giving maximum performance with many types of boats.

As the ST5000 is permanently installed there are no trailing cables to contend with, resulting in a much safer, uncluttered cockpit – a luxury previously only seen with more expensive autopilots.

**Important Note:** The ST5000 stern drive pilot must only be used on stern drives with power assisted steering.

# Safety

Passage making under autopilot can greatly increase the pleasure of the voyage and ensure the crew can relax. However, this can lead to a dangerous lack of attention to basic seamanship. The following rules should always be observed:

- Maintain a permanent watch and check regularly all round for other vessels and obstacles to navigations. No matter how clear the sea may appear a dangerous situation can develop rapidly
- Maintain an accurate record of the vessel's position either by use of a radio navigation receiver or visual bearings
- Maintain a continuous plot of position on a current chart. Ensure the locked autopilot heading steers you clear of all obstacles. Make proper allowance for Tidal Set – the autopilot cannot!
- Even when your autopilot is locked to the desired Track using a radio navigation receiver maintain a log and a regular positional plot. Radio navigation signals can produce significant errors under some circumstances and the autopilot cannot detect this situation
- **Ensure that all members of crew are familiar with the procedures required to disengage the autopilot**
- When searoom is restricted a crew member must be close to the control head at all times if under autopilot control
- Permanent watch should be maintained at the steering station when at speed with the autopilot engaged

Your Autohelm ST5000 will add a new dimension to your boating enjoyment. However, it is the responsibility of the skipper to ensure the safety of the vessel at all times by careful observance of these basic rules.

# Basic Operation

# Contents

**Chapter 1: Operation** ..... 7

1.1 Basic principles ..... 7

1.2 Operator controls ..... 8

Standby ..... 8

Auto ..... 8

Course changes (-1, +1, -10, +10) ..... 9

Dodge ..... 10

'Track Control' ..... 11

Automatic Deadband Control (Auto seastate) ..... 11

Illumination ..... 12

Off Course Alarm ..... 12

1.3 Operating hints ..... 12

## Chapter 1: Operation

### Chapter 1: Operation

#### 1.1 Basic principles

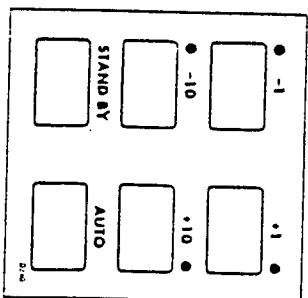
When switched on, the ST5000 will be in 'Standby' mode. To select automatic steering simply steady the vessel on the required heading and push Auto. At any time to return to manual steering push Standby.

Autopilot control has been simplified to a set of pushbutton operations, of which are confirmed with a 'beep' tone. In addition to the main single key functions there are several dual key press functions. Course changes can be made at any time using the -1, +1, -10, and +10 degree keys.

Passage making under automatic pilot is a very pleasant experience which can lead to the temptation of relaxing permanent watch. This must always be avoided no matter how clear the sea may appear to be.

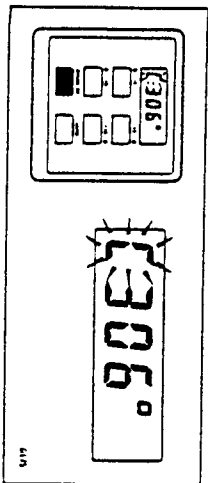
Remember, a large ship can travel two miles in five minutes - just the time it takes to make a cup of coffee.

The next few pages list all of the pushbutton operations needed for full autopilot control.



### 1.2 Operator controls

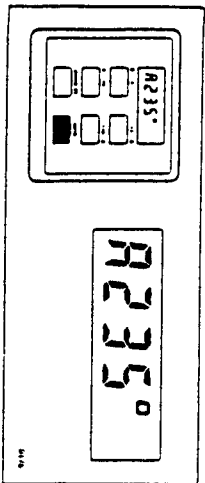
#### Standby



- Push to disengage the autopilot for hand steering  
The previous auto heading is memorised and can be recalled using the Auto key (see 'Auto').

In 'Standby' the display shows the vessels current compass heading.

#### Auto



- Push to engage automatic steering and maintain current heading  
In 'Auto' the display shows the locked autopilot heading.

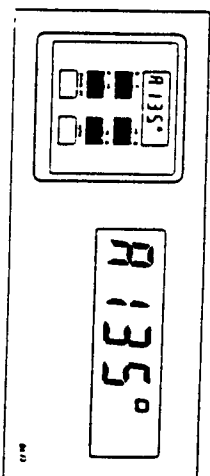
If for any reason the vessel is steered away from the selected locked heading (e.g. Dodge manoeuvre or selecting 'Standby') then:

- Push and hold down Auto for 1 second

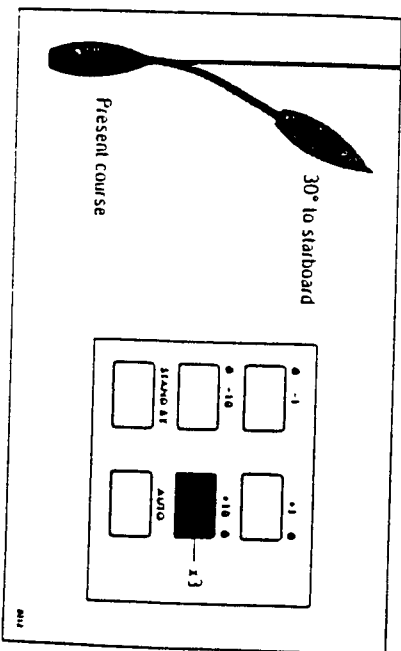
The previous locked heading will be flashed for 10 seconds. To select this heading, and resume the original course, press the Auto key once within 10 seconds.

Also see 'Dodge' - page 10.

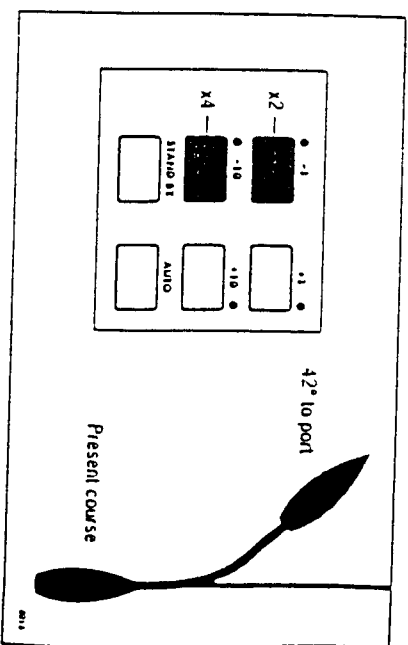
#### Course changes (-1, +1, -10, +10)



- Push to alter course 10 Port (-) and Starboard (+) in increments of 1 and 10°



30° course change to Starboard

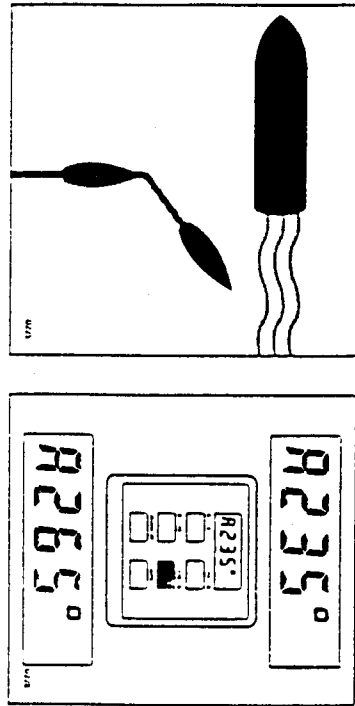


42° course change to Port



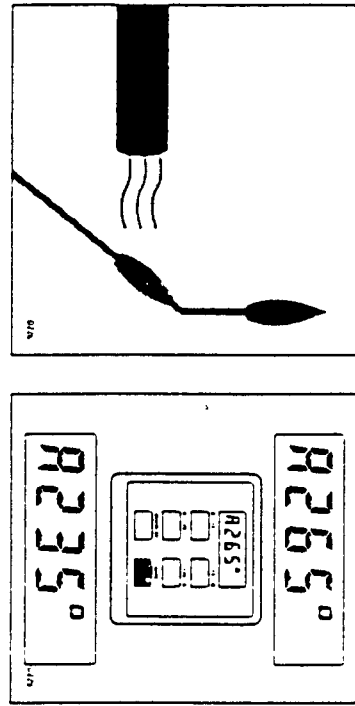
**Dodge**

In order to avoid an obstacle under autopilot control select a course change in the appropriate direction (say starboard 30° = 3 x +10°).



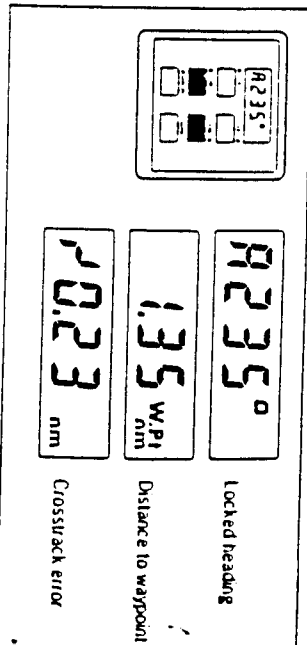
When safely clear of the obstacle press and hold down Auto for 1 second.

The previous locked heading will now be flashed on the screen. To return to the old course press Auto within 10 seconds.



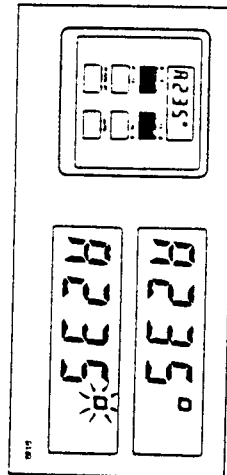
Alternatively the previous course change can be reversed via the key pad example: 3 x -10°.

**Track Control<sup>1</sup>**



- Press the +10 and -10 degree keys together to select Track Control from Auto. Press again to return to automatic steering
- Once in Track Control the autopilot will follow a predetermined track, up on a GPS/Decca/Loran navigation receiver, see Advanced operation for more details.

**Automatic Deadband Control (Auto seastate)**



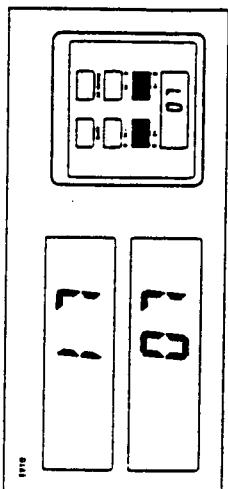
- Press the +1 and -1 degree course change keys together to toggle between auto deadband and fixed minimum deadband. The degree sign will flash when the fixed minimum dead band is selected. This can only be done with the Autopilot in 'Auto' mode.

'Automatic deadband' (Auto seastate) will cause the pilot to gradually neglect repetitive movements of the vessel and only respond to true variations in course. This provides the best compromise between power consumption and course keeping accuracy by neglecting unnecessary rudder movements.

<sup>1</sup>Minimum deadband will always provide the tightest course keeping possible but at the expense of increased power consumption and drive unit activity.

## Illumination

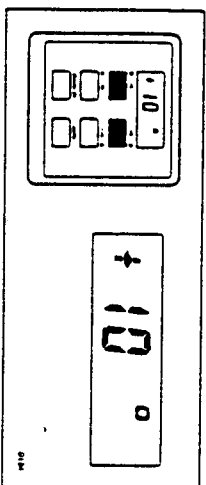
Illumination for the control head display can be switched on for night time viewing. This can only be done with the autopilot in Standby mode.



- Press the **+1** and **-1** degree keys together to toggle illumination on and off
- Also if other SeaTalk instruments or autopilot control units are connected to the SeaTalk bus the illumination on the ST5000 can be switched on or off from these units.

## Rudder Angle display

**Note:** Rudder angle display is only available if a rudder reference transducer has been fitted.

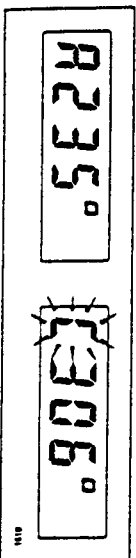


- Press the **+1** and **-1** degree keys together for 1 second to display rudder angle

This can only be done with the autopilot in Standby mode.

## Off Course Alarm

The off course alarm will sound if the locked autopilot heading and the vessel's current heading differ, for greater than 20 seconds, by more than the value set in calibration level 6.



## 1.3 Operating hints

To cancel the off course alarm push Standby to return to hand steering.

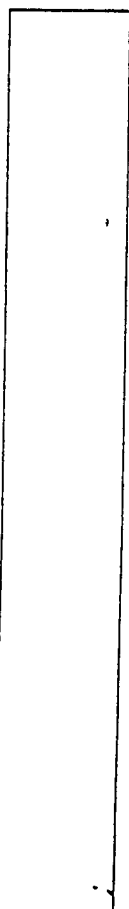
It is very important to understand the effect of sudden trim changes on steering performance. When a sudden trim change occurs, due for example to weather helm, there will be a delay before the automatic trim applies rudder to restore the locked heading. This correction can take to one minute. Large course changes which change the apparent wind direction can produce large trim changes. In these cases the autopilot not immediately assume the new automatic heading, and will only settle onto course when the automatic trim has been fully established.

To minimise the time delay the following procedure may be adopted for large course changes.

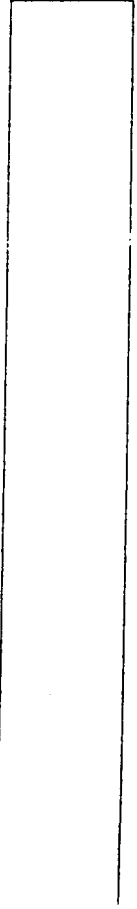
- Note required new heading
- Select **Standby** and steer manually
- Bring vessel onto new heading
- Select **Auto** and let vessel settle onto course
- Bring to final course with 1° increments

It is sound seamanship to make major course changes only whilst steering manually. In this way any obstructions or other vessels may be cleared properly and due account taken of the changed wind and sea conditions on the new heading prior to engaging the autopilot.

In gusting conditions the course may tend to wander slightly.



**Advanced Operation**



## Contents

<b>Chapter 2: Using 'Track Control'</b> .....	18
2.1 Operation in 'Track Control' .....	18
Operating hints .....	18
Cross Track Error .....	19
Tidal Stream Compensation .....	20
Waypoint Advance .....	20
Limitations .....	21
Low Speed Operation .....	21
Dodges .....	22
Safety .....	22
Warning messages .....	23
NMEA data not received .....	23
NMEA data error .....	23
Large cross track error .....	23
Waypoint advance .....	23
<b>Chapter 3: Adjusting autopilot performance</b> .....	24
3.1 Setting up Rudder Gain .....	24
3.2 Gain adjustment (N'tly/S'tly heading error compensation) .....	26
3.3 Automatic autopilot gain adjustment .....	26
3.4 Adding a Rudder Reference Transducer .....	27
<b>Chapter 4: Autopilot re-calibration</b> .....	28
4.1 Entering Calibration mode .....	28
4.2 Exiting calibration mode .....	29
4.3 Suggested initial calibration settings .....	29
4.4 Calibrating the autopilot to suit your boat .....	31
Calibration Level 1 (Rudder Gain) .....	31
Calibration Level 2 (Rudder Offset) .....	31
Calibration Level 3 (Rudder Limit) .....	31
Calibration Level 4 (Turn Rate Limit) .....	33
Calibration Level 5 (Cruise Speed) .....	33
Calibration Level 6 (Off course alarm angle) .....	34
Calibration Level 7 (Trim Level) .....	34
Calibration Level 8 (Steering system type) .....	35
Calibration Level 9 (Magnetic variation) .....	35
Calibration Level 10 (N'tly/S'tly heading error correction) .....	35
Calibration Level 11 (Current Vessel Latitude) .....	36
Calibration Level 12 (Emergency Steering release) .....	37
Calibration Level 13 (Rudder Damping) .....	37
4.5 Disabled calibration access .....	39

## Advanced operation

The ST5000 has been set up at the factory to provide stable performance for most types of boat. Depending on personal choice and type of boat many of the functions and features available in the ST5000 can be fine tuned. This is normally required if:

- The pilot does not maintain a selected heading
- A rudder reference transducer is fitted
- The boat appears to be unstable on Northerly/ headings (Southernly headings in the southern hemisphere)
- You wish to display True compass headings
- You wish to limit the rate of turn of the boat
- You operate in 'Track Control' mode
- You wish to change the Off Course alarm angle

The ST5000 is also capable of being supervised from a Navigation system such as a GPS, Decca or Loran receiver - automatically compensating for tidal streams and leeway.

'Advanced Operation' offers a complete guide to ST5000 calibration and comprehensively covers operation in 'Track Control' mode. It also shows how the system can be expanded to include other SeaTalk products.

## Chapter 2: Using 'Track Control'

### 2.1 Operation in 'Track Control'

'Track Control' allows the ST5000 to maintain track between two waypoints entered on a GPS, Decca, or Loran based Navigation system.

#### Operating hints

The Control head can receive cross track error data from any Navigation system transmitting data to the NMEA 0180 or 0183 format. The ST5000 will then compute course changes which will keep your boat on a pre-determined track, automatically compensating for tidal streams and leeway.

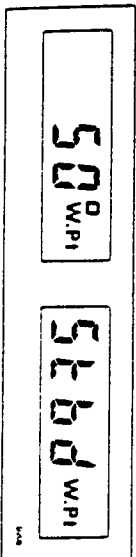
When initiating 'Track Control' the track can be acquired in one of two ways:

- Automatic acquisition (NMEA 0183 Cross Track Error and Bearing to Waypoint data received from the receiver)
- Manual acquisition (NMEA 0180 or 0183 Cross Track Error data required only)

Manual acquisition is achieved by steering the vessel to within 0.1nm of track and then bringing the heading to within 5° of the bearing to the next waypoint. The pilot is then switched over to 'Track Control' by firstly entering 'Auto' and then pressing the +10 and -10 degree keys together to initiate 'Track Control'. The Display will alternate between Cross track error and the locked pilot heading.

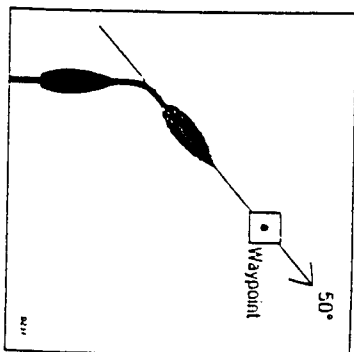
Automatic acquisition can only be achieved if the pilot is receiving Cross track error and bearing to waypoint information via the SeaTalk bus. It is initiated as follows:

- Bring the vessel to within 0.1nm of Track
  - Press **Auto**
  - Press the **+10** and **-10** degree keys together to enter 'Track Control'
- An alarm will sound and the display will show :



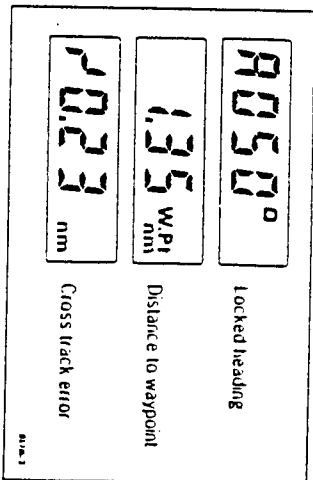
The information on the display alternates between the direction in which the boat will turn to take up the track and the new bearing to waypoint.

Check that it is safe to turn onto the new course.



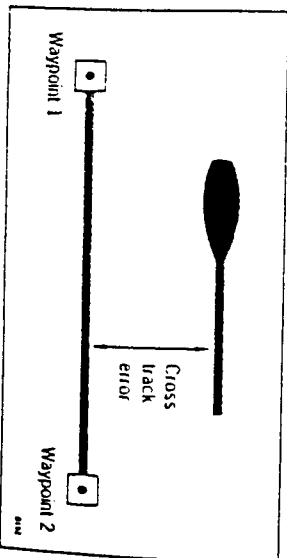
- Press the **+10** and **-10** degree keys together

The boat will now turn on to the new course and the alarm will cancel. The following navigation information will now be continuously cycled on the display:

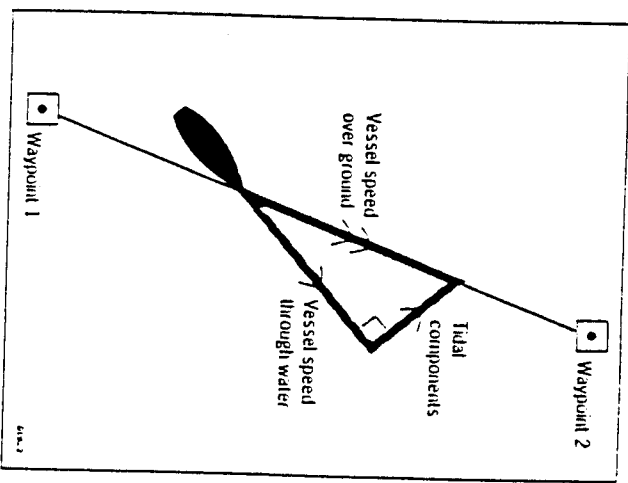


#### Cross Track Error

Cross track error is the vessel distance from a planned route. This is displayed in nautical miles and is read directly from your position transducer (see above).



## Tidal Stream Compensation



Under most conditions 'Track Control' will hold the selected track to within 1.0 05nm (300ft) or better.

The autopilot takes account of vessel speed when computing course changes to ensure optimum performance over a wide range of vessel speeds. If an Autolein ST50 Speed or Tridata instrument is connected to the SeaTalk bus the control head will use measured vessel speed, otherwise the cruise speed entered during calibration level 5 will be used.

### Waypoint Advance

If your navigation receiver transmits valid 'Waypoint Number' and 'Bearing to Waypoint' NMEA headers it is possible to advance from one waypoint to the next by simply pressing the  $-10$  and  $+10$  degree keys together.

As the vessel passes the target waypoint the navigation receiver should select, manually or automatically, the next target waypoint. The ST5000 will detect the new target waypoint number and display the new bearing to waypoint and also the direction it will turn to acquire it. This will be accompanied by an alarm to indicate waypoint arrival (see page 23).

**Note:** While the waypoint advance alarm is sounding, 'Track Control' is suspended and the ST5000 will maintain the current boat heading.

A check should be made to verify it is safe to turn onto the new track then the  $+10$  and  $-10$  degree keys pressed together. This will cancel waypoint arrival alarm and steer the boat towards the next waypoint. Unless the 'Waypoint Advance' is accepted in the above way the alarm continue to sound and the current course be maintained.

### Limitations

Although there is no need to fully understand the details of the track keeping algorithm, it is very important to understand its limitations so obtain the best performance from 'Track Control'. The most significant limitations is imposed if NMEA 0180 cross track error data is transmitted by the radio navigation receiver. This data is restricted to  $\pm 0.30$ nm, which means that even if the vessel were 5 miles to starboard of track, the transmitted data would still be 0.30nm.

Attempts to engage 'Track Control' beyond the 0.30nm limit will lead excessive overshoots and can result in the vessel circling. For this reason the alarm code is displayed (see page 22) whenever the cross track error exceeds 0.30nm. The requirement to remain within 0.30nm of track limits the maximum allowable angular error between the track course and the vessel's heading. If the angular error is too great, the 'Track Control' will be unable to cancel it within the 0.30nm limit leading to the problem outlined above.

The NMEA 0183 format transmits cross track error data up to 99.99 and enables the 'Track Control' to operate with larger cross track errors. However, the alarm code will still be displayed over 0.30nm in these are navigational hazards close to the intended track.

### Low Speed Operation

Operation of the manual acquisition of 'Track Control' at low speeds requires additional care as the effect of tidal streams is far more significant than at higher speeds. In general terms, providing the tidal flow is less than 35% of the vessel speed no noticeable difference will occur in the performance of 'Track Control'. However, extra care should be taken to ensure that the vessel is as close as possible to track, and that the direction made good over the ground is as close as possible to the direction of the next waypoint, before engaging 'Track Control'. Under these circumstances positive positional checks at regular intervals are vital especially if navigational hazards are close.

## Dodges

Full control remains available from the control head when the autopilot is in 'Track Control'. Dodges are accomplished by simply selecting the desired course change on the Autohelm keypad. Once the hazard has been avoided the course change selected for the dodge manoeuvre should be cancelled by selecting an equal course change in the opposite direction. Provided the vessel remains within 0.1nm of track there is no need to steer back towards the track.

## Safety

Passage making in 'Track Control' removes the chores of compensation for wind and tidal drift and will aid precise navigation. It is most important however to maintain an accurate log with regular plots and to verify the computed position read from the radio navigation receiver with a dead reckoned position from recording the average course steered and the distance logged. In open water such plots should be at least hourly and more frequent in confined waters or when potential hazards are near.

Local variations in radio signal quality and changes in the tidal stream will produce deviations from the desired track. When setting up waypoints, remember that deviations will occur, and thoroughly check along each track and to 0.5nm each side to ensure that there are no hazards within the zone. Always confirm the position given by the position transducer using an easily identifiable fixed object at the start of a passage to check and enable compensation to be made for fixed positional errors.

The use of 'Track Control' will enable accurate track keeping even in complex navigational situations. It cannot remove the responsibility of the skipper to ensure the safety of his vessel at all times by careful navigation and frequent position checks.

### Warning messages

#### MMEA data not received



The 'no data' display will be shown if 'Track Control' is engaged when the autopilot is not receiving either MMEA 0180 or 0183 data.

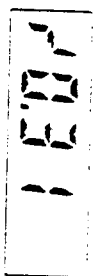
#### MMEA data error



The 'data error' display will be shown if 'Track Control' is engaged whilst the Position Transducer (GPS, Loran, Decca) is receiving a low strength signal.

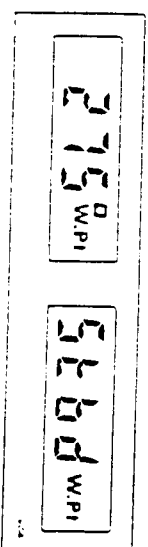
This will clear as soon as the signal strength improves.

#### Large cross track error



The 'large cross track error' alarm sounds if the cross track error received by the pilot exceeds 0.3nm.

#### Waypoint advance



The waypoint advance alarm sounds whenever the Radio Navigation Receiver (GPS, Loran, Decca) changes the target waypoint number. When this occurs the pilot will continue on its current heading but flash the bearing to the next waypoint on the display. This will alternate with the direction in which the boat will turn to take up that bearing. You should check to ensure that such a manoeuvre would be safe and, when you are ready to make the turn, momentarily press the +10 and -10 degree keys together. The pilot will then turn onto the new bearing and track toward the next waypoint.

Note: the waypoint advance will only operate on pilots receiving MMEA 0183 Bearing to waypoint information.

## Chapter 3: Adjusting autopilot performance

### 3.1 Setting up Rudder Gain

The factory set rudder gain level will provide stable control for initial sea trials. However, vessels can vary widely in their response to the helm, and further adjustment to the rudder gain may improve the autopilot's steering characteristics.

It is particularly important that the rudder gain is correctly set on high speed craft. Incorrect adjustment will lead to poor steering performance and is a dangerous condition at high speed. Adjust as follows:

- Steer onto a specific course
- Hold the course steady for 5 to 10 seconds
- Press **Auto** to engage the autopilot on the current heading

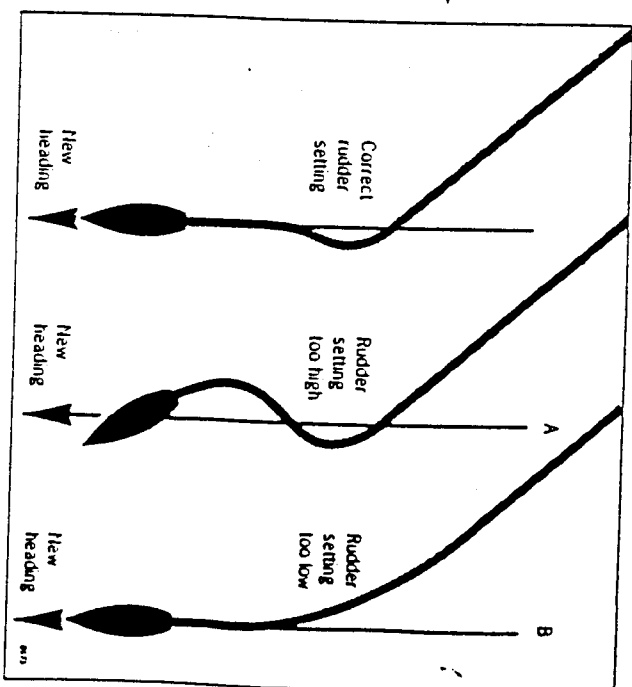
In calm conditions the boat should maintain the locked heading.

The following test will check if the rudder level is set too high or too low.

In clear water and with the autopilot in 'Auto' alter course to starboard by 40° by pressing the + 10 degree key four times.

Typically, at cruising speed, a course change of 40° should result in a crisp turn followed by an overshoot of no more than 2° to 5°. If this occurs the rudder gain is correctly adjusted.

An excessively high rudder setting results in oversteer which can be recognised by distinct overshoot of more than 5° (A). This condition can be corrected by reducing the rudder gain setting.



These actions are most easily recognised in calm sea conditions where wave action does not mask basic steering performance.

Similarly, an insufficient rudder control setting will result in understeer which gives sluggish steering performance (B). If the vessel takes a long time to make the turn and there is no overshoot then the rudder setting is too low.

Refer to chapter 4: 'Autopilot recalibration', for instructions on how to adjust the rudder gain setting.

Repeat the test until a crisp course change with no more than 2° to 5° of overshoot is achieved.

The rudder control setting is not over critical and should be set to the lowest setting consistent with accurate course keeping. This will minimise actuator movements and hence reduce power consumption and wear and tear generally.



### 3.2 Gain adjustment (Northerly/Southerly heading error compensation)

It may be noticed that the autopilot tends to be a little less stable on northerly headings in the higher latitudes of the Northern hemisphere (and conversely southerly headings in the Southern hemisphere). This is caused by the increasing angle of dip of the earth's magnetic field at higher latitudes which has the effect of amplifying rudder response on northerly (southerly) headings. This error effects all magnetic compasses and gets worse the further away from the equator you are.

It is recommended that for high speed craft the 'Auto Adapt' facility is selected. This automatically reduces the effects of Northerly/Southerly heading instability.

This feature is selected in calibration by entering the vessel's operating latitude Calibration level 10 – chapter 4. When selected, it automatically adjusts the autopilot rudder gain depending on heading. This removes the need for manual adjustment.

**Note:** If 'Auto Adapt' is not selected, manual adjustment of rudder gain is normally required when going from Northerly to Southerly headings or vice versa. Failure to do so can lead to poor course keeping.

### 3.3 Automatic autopilot gain adjustment

Due to the significant differences in dynamic stability between planing and non-planing conditions most high speed craft require rudder gain adjustment when going from planing to displacement speeds or vice versa. The required adjustment can be achieved automatically or manually.

When the ST5000 is used with the speed input from a SeaTalk Speed or Tridata instrument the rudder gain is automatically adjusted with boat speed. After setting the gain at planing speed no further manual adjustment should be required.

If no ST50 speed input is available manual adjustment should be carried out to the rudder gain adjusting as follows:

- Speed decreases from planing to displacement
  - Increase gain by 1 or 2 levels
- Speed decreases from planing to displacement
  - Decrease gain by 1 or 2 levels

#### **WARNING:**

The manual gain adjustment must be made after reducing from planing to displacement speed and before increasing from displacement to planing speed.

### 3.4 Adding a Rudder Reference Transducer

A rudder reference transducer can be used on all installations to provide a readout of rudder position.

Calibration level 8 must be changed as it is factory pre-set for operation without a rudder reference transducer. Please refer to chapter 4: Autopilot re-calibration, for instructions.

## Chapter 4: Autopilot re-calibration

The ST5000 can be adjusted to meet the characteristics of your vessel and steering system.

The calibration routine allows the following parameters to be adjusted from their factory default settings.

- Rudder gain (Value on power up)
- Rudder offset adjustment
- Rudder limit
- Rate of turn limit
- Off course alarm limit
- Automatic Trim adjustment delay
- Northerly/Southerly turning error compensation

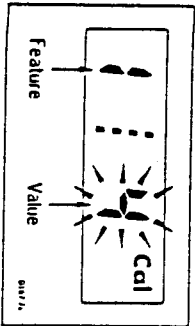
The autopilot also requires certain other information:

- Average cruise speed
- Local variation

This section will look at each feature in turn and explain how to fine tune it to suit your particular boat.

### 4.1 Entering Calibration mode

- Press the Standby button for 5 seconds until the display shows:

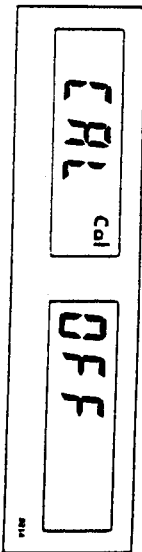


The number on the left identifies the feature (see table in section 4.3) and the number on the right the selected value for that feature.

Each feature can be cycled through using the Auto key.

The existing values can be viewed at any time without alteration, a simple momentary push of the Standby key will return the pilot to its normal operating mode without affecting the previous settings.

Note: If on entering calibration the display shows:



Please refer to 'Disabled calibration access' - section 4.5 for details on how to adjust.

### 4.2 Exiting calibration mode

You can exit calibration at any time in one of two ways:

- Press Standby for 1 second  
This will enter any adjusted values into memory.
- Momentarily press Standby  
This will exit calibration without entering any adjusted values into memory.

### 4.3 Suggested initial calibration settings

Listed below are suggested calibration settings for planning vessels. These will provide safe performance for the initial sea trial.

If you change any of the settings you can record them in the 'Adjusted Values' column for future reference.

Feature no	Feature	Factory setting	Adjusted Values
1	Rudder Gain	3	
2	Rudder Offset	0	
3	Rudder limit	30	
4	Turn rate limit	8	
5	Average Cruise speed	15	
6	Off course alarm angle	20	
7	Trim level	3	
8	Steering system type	2	(Set to 3 if a rudder reference transducer is fitted)
9	Local magnetic variation	-- °	
10	North/South turning error correction	1	0 = Off 1 = North 2 = South
11	Current vessel latitude	0°	
12	Emergency steering release	1	1 = On 0 = Off
13	Rudder damping	1	

Note: If level 10 is set to 0 then level 11 will be omitted.

#### 4.4 Calibrating the autopilot to suit your boat

Calibrate the pilot as follows:

- Enter calibration mode as described in section 4.1. The display will show:



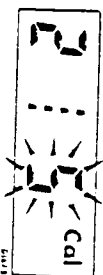
##### Calibration Level 1 (Rudder Gain)

Calibration level 1 is Rudder gain. This requires setting up whilst underway. Please refer to Rudder gain adjustment in chapter 3.

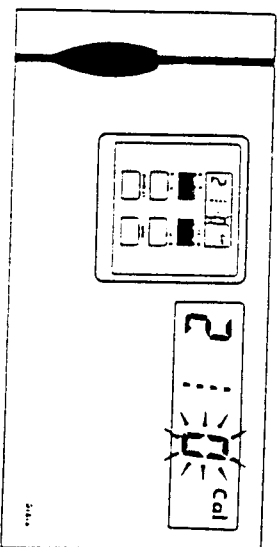
##### Calibration Level 2 (Rudder Offset)

Calibration level 2 is 'Rudder offset'. This will only require setting if your installation includes a rudder reference transducer.

- Press the Auto key



Manually place the helm in a central position. Use the + 1 and - 1 degree keys to adjust the rudder angle reading on the right hand side of the display to zero.



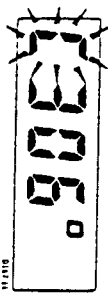
##### Calibration Level 3 (Rudder Limit)

Calibration level 3 is Rudder limit which limits autopilot rudder movement to just less than the steering systems mechanical stops. This avoids putting the steering system under unnecessary load.

It only requires setting if your installation includes a rudder reference transducer.

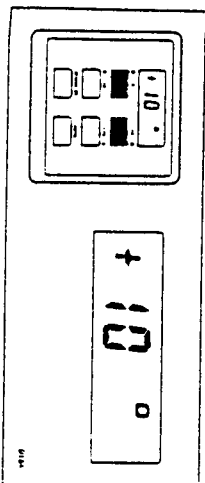
To set up the rudder limit it is first necessary to exit calibration and record the maximum rudder angles displayed on the ST5000.

- Exit calibration by pressing the **Standby** key for 1 second until the display shows:



Note: A momentary push will give the same display but will not store the previous calibration steps.

- Press the **+1** and **-1** degree keys together for 1 second to display rudder angle on the display



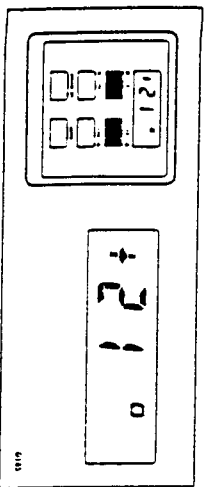
- Manually move the helm hard to port and record the displayed rudder angle
- Manually move the helm hard to starboard and record the displayed rudder angle

The rudder limit should be set to the smaller of the two recorded angles as follows:

- Enter calibration by pressing **Standby** for 5 seconds
- Select calibration number 3 (Rudder Angle) using the **Auto** key



- Adjust the displayed limit on the right hand side of the screen, using the **+1** and **-1** degree keys, to the minimum recorded angle



#### Calibration Level 4 (Turn Rate Limit)

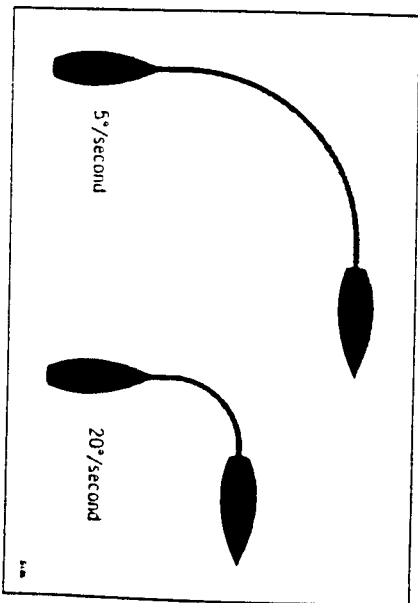
Calibration level 4 is Turn Rate Limit. This will limit the rate of turn of your vessel when under autopilot control.

- Press the **Auto** key



This should be set to give a comfortable rate of turn.

- Set up turn rate limit with the **+1** and **-1** degree keys



#### Calibration Level 5 (Cruise Speed)

Calibration level 5 sets the boat's normal cruising speed for use in 'Track Control'.

- Press the **Auto** key



When interfacing with Radio Navigation Systems the Control head uses the vessel's average cruising speed to perform track calculations.

Adjust the course speed with the **+1** and **-1** degree keys.

Note: If an ST50 Speed or Tridata instrument is connected to the SeaTalk bus they will transmit boat speed information directly to the control head

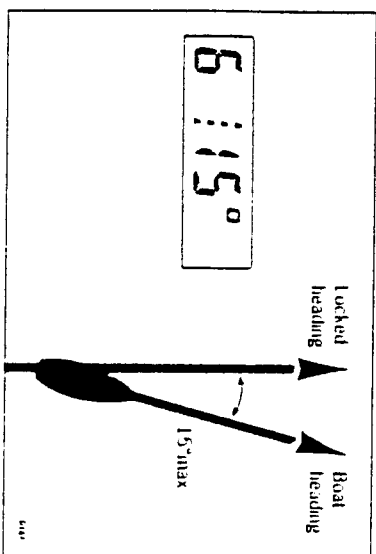
### Calibration Level 6 (Off course alarm angle)

Calibration Level 6 is Off Course Alarm angle. This is an alarm to warn you if the autopilot is unable to maintain its set course.

- Press the Auto key



The off-course alarm operates if the autopilot strays off course by more than the alarm angle limit for more than 20 seconds. This limit can be set in 1° increments anywhere between 15° and 40° using the +1 and -1 degree course change keys.



### Calibration Level 7 (Trim Level)

Calibration level 7 selects and sets the level for automatic trim.

- Press the Auto key



Trim can be set to one of three rates or switched off completely.

- Level 0 Trim off
  - Level 1 Not applicable for ST5000 applications
  - Level 2 Not applicable for ST5000 applications
  - Level 3 Medium trim correction
  - Level 4 Fast trim correction
- Adjust the trim level using the +1 and -1 degree keys.

### Calibration Level 8 (Steering system type)

Calibration level 8 is only set up if a rudder reference transducer is included in the installation.

- Press the Auto key



1. Not applicable
2. Sternrive. (Without rudder reference transducer)
3. Sternrive. (With rudder reference)
4. Not applicable

Select the correct drive using the +1 and -1 degree keys.

### Calibration Level 9 (Magnetic variation)

Calibration level 9 tells the pilot the level of magnetic variation present at the boat's current position.

- Press the Auto key



You should enter your local variation using +1 and -1 degree keys. This value will then be transmitted onto the SeaTalk bus and picked up by other SeaTalk instruments such as the Multi-repeater.

Note: +ve variation: East

-ve variation: West

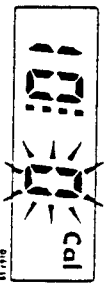
### Calibration Level 10 (Northerly/Southerly heading error correction)

Calibration level 10 allows Northerly or Southerly heading error correction to be switched in.

It may be noticed that the autopilot tends to be a little less stable on northerly headings in the higher latitudes of the Northern hemisphere (or conversely southerly headings in the Southern hemisphere). This is caused by the increasing angle of dip of the earth's magnetic field at higher latitudes which has the effect of angling the rudder response on northerly (southerly) headings. This error affects all magnetic compasses and gets worse the further away from the equator you are.

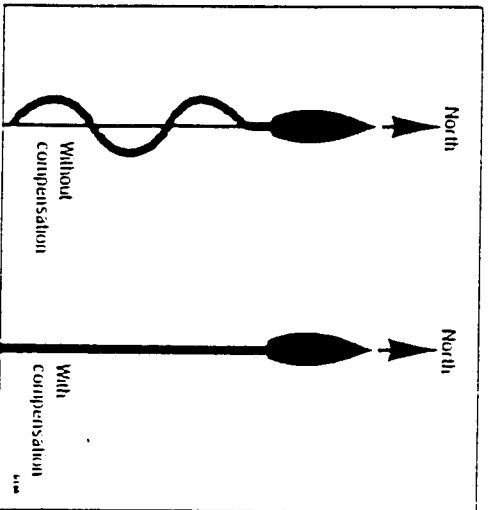
The S15000 is able to compensate for this and provide precise course keeping on all headings by automatically adjusting the gain of the autopilot depending on heading:

- Press the **Auto** key



Use the +1 and -1 degree keys to select:

- 0 = Off
- 1 = Northern Hemisphere
- 2 = Southern Hemisphere



### Calibration Level 11 (Current Vessel Latitude)

Calibration level 11 requires the boat's current latitude (to the nearest degree) in order to compensate for Northerly/Southerly heading error.

- Press the **Auto** key



- Set up latitude using the -1 and +1 degree keys

Note: If the correction is set to 0 in Calibration Level 10 then level 11 will be omitted and pressing the Auto key in Calibration Level 10 will move the display directly onto level 12.

### Calibration Level 12 (Emergency Steering release)

Level 12 enables or disables the emergency steering release function.

- Press the **Auto** key



0 = Emergency Steering release disabled.

1 = Emergency Steering release enabled. Adjust the release function using the -1 and +1 degree keys.

### Calibration Level 13 (Rudder Damping)

Level 13 only requires setting up if the installation includes a rudder reference transducer and the drive unit 'hunts' when trying to position the rudder.

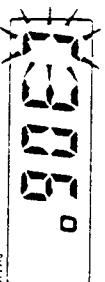
- Press the **Auto** key



Calibration level 13 allows 1 of nine levels of rudder damping to be selected. This should always be set to 1 initially.

Rudder damping should be set up as follows:

- Exit calibration by pressing the Standby key for 1 second until the display shows:



Note: An momentary push will give the same display but will not store the previously calibration steps.

- Press the **Auto** key

- Press the +10 degree course change key once

Observe the wheel movement. If the rudder appears to position and then hunt e.g. drive port and then starboard in small jerky movements then return to calibration level 13 and increase the rudder damping level by one, using the +1 and -1 degree keys, and repeat the test until the rudder positions without hunting.

Note: It is most important that the rudder damping level is set as low as possible for best possible course keeping.

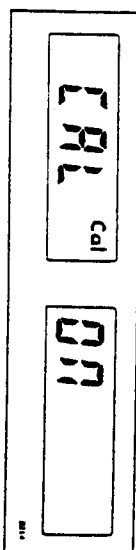
The calibration should now be saved by pressing the Standby key for 1 second.

#### 4.5 Disabled calibration access

It is possible to disable the calibration set-up to prevent unauthorised access.

This is achieved as follows:

- Press and hold the -1 and Standby keys for 10 seconds until the display shows:



- Toggle the calibration access on and off using the -1 and +1 degree keys
- Store the setting by pressing the -1 and Standby keys for 10 seconds until the control head returns to normal operation

If preferred this page can be removed from the handbook after access has been switched off.



**Installation**

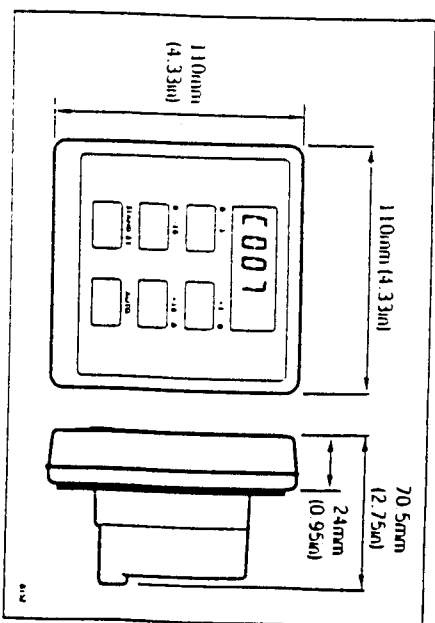


# Contents

<b>Chapter 5: Installation</b> .....	43
5.1 Control head .....	43
Siting .....	43
Mounting procedure .....	43
Cable connectors .....	43
Power supply connection .....	44
Connection to the SeaTalk bus .....	45
5.2 Fluxgate Compass .....	46
Mounting position .....	47
Cabling .....	47
5.3 Rudder Reference Transducer .....	49
Mounting position .....	49
Control dimensions .....	49
Cabling .....	51
5.4 Sterndrive Actuator Installation .....	52
Installation – Volvo (Post type 872215) .....	52
Installation – Mercruiser/OMC/Yamaha .....	54
Mounting in a Restricted Area .....	54
Cable Connection .....	56
<b>Chapter 6: Interfacing to GPS, Decca, Loran</b> .....	57
6.1 Cabling .....	58
6.2 NMEA data transmission to other equipment .....	58
6.3 Data formats .....	58
<b>Chapter 7: Functional Test and Initial Sea Trial</b> .....	59
7.1 Functional test .....	60
Switch on .....	60
Operating sense .....	60
Rudder reference phase .....	61
Navigation interface (GPS, Decca, Loran) .....	61
SeaTalk bus .....	62
7.2 Initial Sea trial .....	63
Automatic Compass deviation correction .....	63
Manual override .....	64
Autopilot operation .....	65
Operating sense reversal .....	66
<b>Chapter 8: Accessories</b> .....	67
<b>Chapter 9: Maintenance</b> .....	68
Control head .....	70
Drive unit .....	70
Cabling .....	70
<b>Chapter 10: Fault Finding</b> .....	71

## Chapter 5: Installation

### 5.1 Control head



#### Siting

The ST5000 control head is totally waterproof and should be sited where:

- It can easily be reached from the steering position
- Protected from physical damage
- At least 230mm (9in) from a compass
- At least 500mm (20in) from radio receiving equipment
- Accessible from behind to secure and run cables

Note: The back cover is designed to breath through the cable boss to prevent moisture accumulation. This must be protected from the weather by following the mounting procedure.

#### Mounting procedure

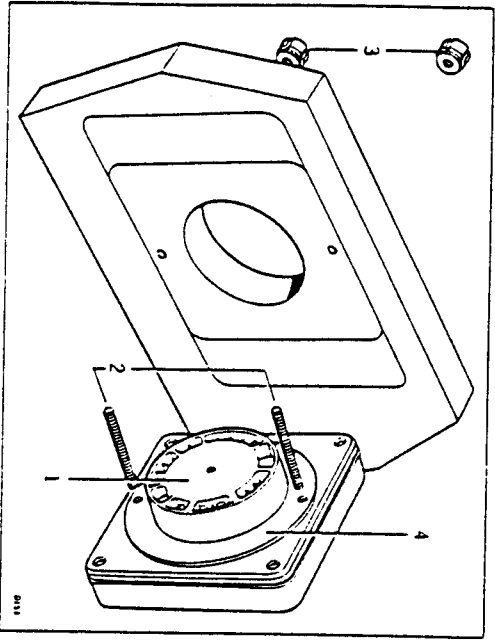
The surface must be smooth and flat.

- Use the template provided to mark the centers of the two fixing holes and cable boss

Note: Adjacent Control heads and ST50 instruments should have 6mm (0.25in) separation to allow room for the protective covers.

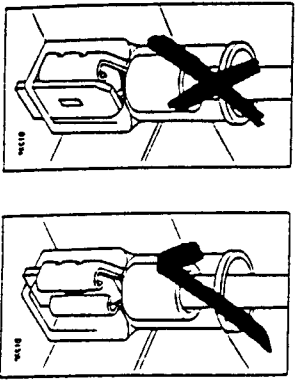
- Drill to 4mm (0.16in) diameter
- Use a 70mm (2.75in) diameter cutter to drill the hole for the center boss (1)

- Screw the two fixing studs (2) into the back cover
  - Pass the cables through the central hole
  - Attach the wiring loom to the terminals on the rear of the ST5000 (see later sections)
  - Attach the harness protection cover using the central screw provided
  - Secure the Control head with the thumb nuts provided (3)
- A sealing gasket (4) is already attached to the back cover of the Control head.



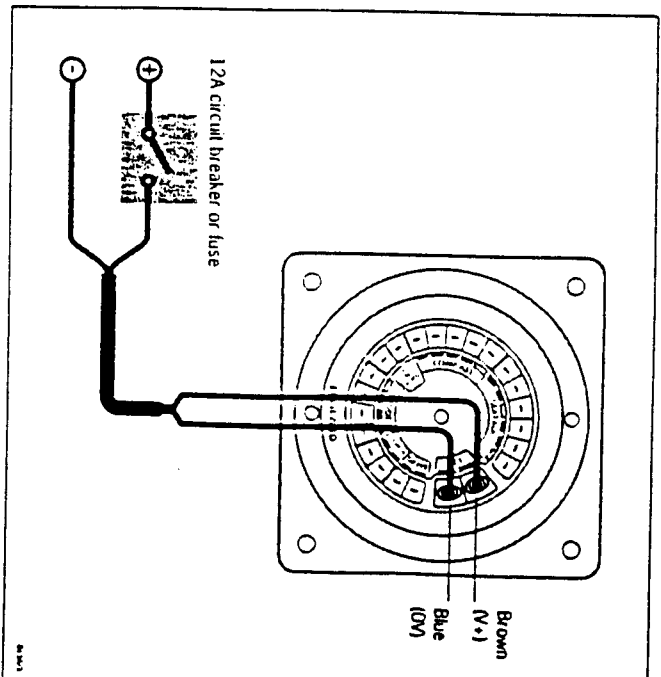
**Cable connectors**

All electrical connections to the ST5000 are made via spade connectors on the rear case. When installing each spade connector make sure the connector fits securely over the blade and not between the connector and its plastic insulating boot. This will give an intermittent connection and faulty autopilot operation.



**Power supply connection**

The ST5000 requires its own dedicated power supply as it cannot source power from the SeaTalk bus. A 1m (3ft) power lead is supplied for this purpose and is terminated with 1/4in spade connectors. A 12A circuit breaker or fuse should be fitted as shown below.



The lead can be extended if required. The following table shows the minimum cable sizes acceptable:

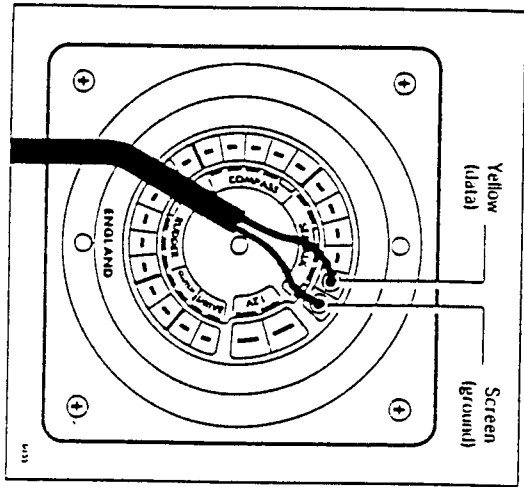
Cable length	Copper area	AWG
Up to 2.5m (8ft)	1.5mm <sup>2</sup>	16
Up to 4.0m (13ft)	2.5mm <sup>2</sup>	14

**Important!**

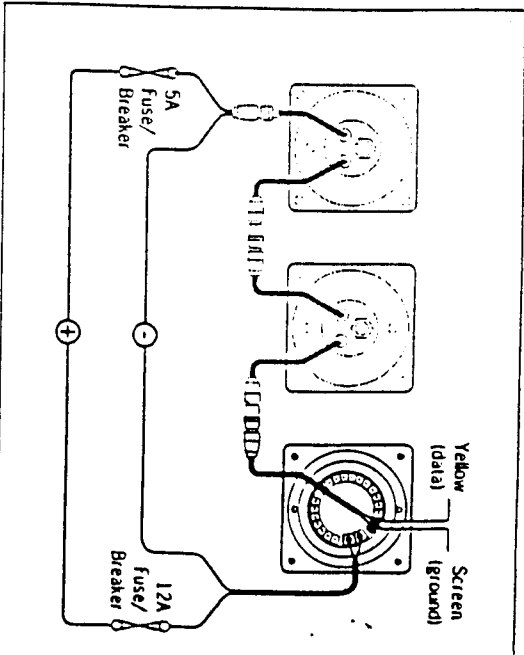
Correct cable size is critical for correct autopilot operation. The cable you choose may meet the required current specification but, if too small, will drop voltage between the supply and the control head. This will reduce the power of the drive unit.

**Connection to the SeaTalk bus**

The ST5000 is supplied with one SeaTalk cable tail. This can be connected to the spade connectors marked 'SeaTalk' on the rear of the Control head as shown below:



Other SeaTalk instruments can now be connected to the control head using a SeaTalk extension cable (see chapter 8 'Accessories').

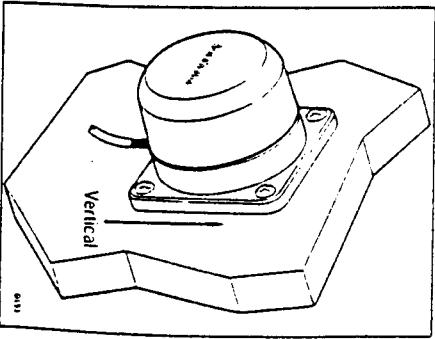


For safety reasons the ST5000 should not supply power to the SeaTalk bus. Any SeaTalk instruments fitted must be powered via a separate 5A fuse /breaker as shown using the power lead supplied with the instruments.

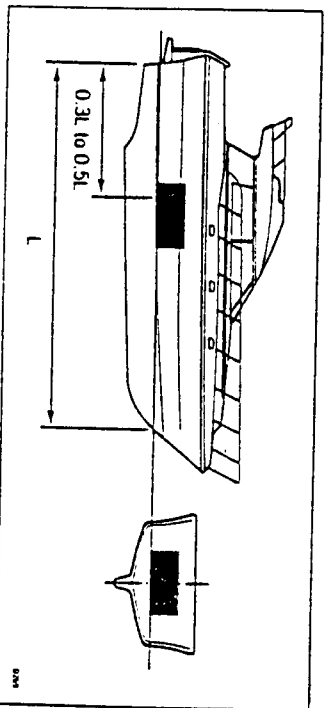
**5.2 Fluxgate Compass**

**Mounting position**

The fluxgate compass should be attached to a convenient vertical surface using the self tapping screws provided. There is no need to orient the fluxgate compass fore and aft. Heading alignment is carried out electrically.



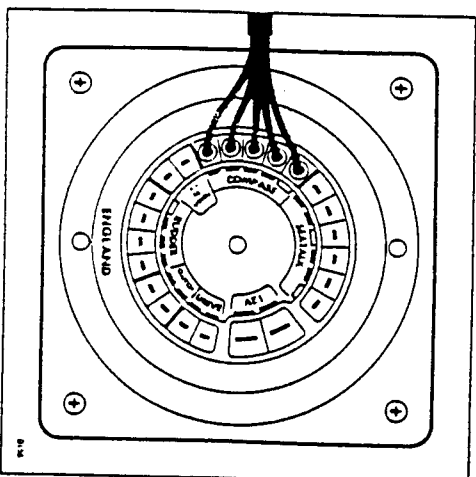
Correct positioning of the fluxgate is crucial if ultimate performance from the autopilot is to be achieved. The fluxgate should ideally be positioned as near as possible to the pitch and roll centre of the vessel in order to minimise gimbal disturbance.



It is very important to ensure that the fluxgate is positioned at least 0.8m (2.5ft) away from the vessel's steering compass in order to avoid deviation of both compasses. The fluxgate must also be positioned as far away as possible from large iron masses, such as the engine and other magnetic devices which may cause deviation and reduce the sensitivity of the sensor. If any doubt exists over magnetic suitability of the chosen site, the position may be surveyed using a simple hand bearing compass. The hand bearing compass should be fixed in the chosen position and the vessel swung through 360°. Relative differences in reading between the hand bearing compass and the vessel's main steering compass should ideally not exceed 20° on any heading.

### Cabling

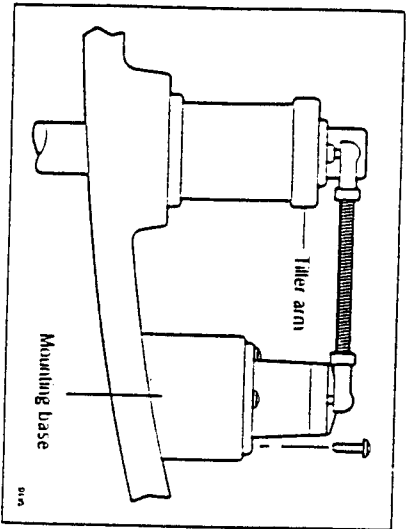
Once the fluxgate has been positioned the cable should be led back to control head. The cable has five tails each of which is fitted with a space connector. These should be connected colour for colour to the 'Comp' section at the rear of the unit as shown below:



## 5.3 Rudder Reference Transducer

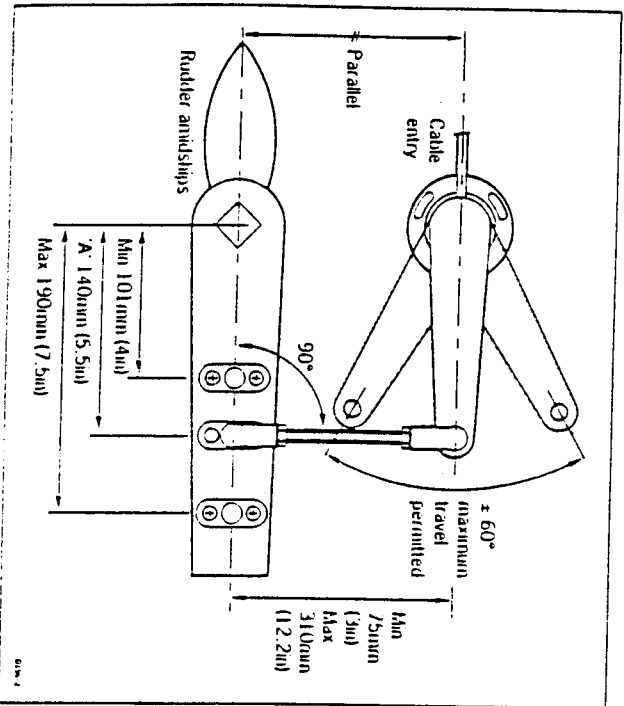
### Mounting position

The rudder reference unit must be mounted on a suitable base adjacent to the rudder stock using the self tapping screws provided. The base fitting must ensure correct vertical alignment of the rudder reference unit arm and tiller arm. If it is more convenient, the rudder reference unit may be mounted upside down (logo downwards), but if this is done, the red and green wires from the transducer must be reversed on the rear of the Control head.



The rudder reference unit has a built in spring to remove any free play in the linkage to the tiller. This gives very precise rudder position.

The rudder reference arm movement is limited to  $\pm 60^\circ$ . Care must be taken during installation to ensure the rudder reference arm is opposite the cable entry when the rudder is amidships. Failure to do this could result in damage if the rudder reference arm is driven onto its end stops by the steering system.



### Control dimensions

It is important to ensure that the dimensions set out below are within the limits set and the tiller arm and rudder reference arm are parallel to each other.

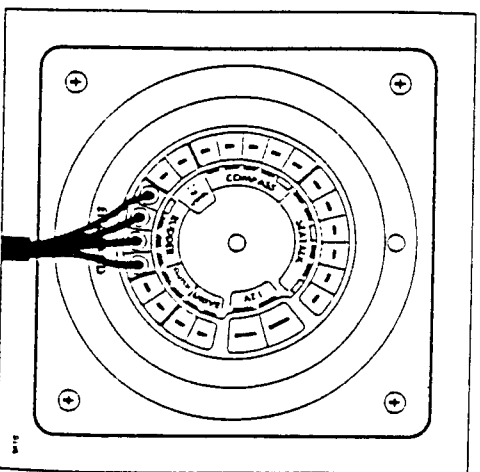
With the rudder amidships, the rudder reference arm should be opposite the cable entry and at  $90^\circ$  to the connecting bar. Minor adjustment can be made by slackening off the 3 securing screws and rotating the transducer body.

The tiller pin must be positioned within the limits shown. Clearly dimension 'A' should be 140mm (5.5mm). However, changing this within the limits shown will not degrade the autopilot performance but will slightly alter the scaling of the rudder angle display. The tiller pin is secured to the tiller arm using the self tapping screws provided.

Cut the studding to length and screw on the lock nuts and ball pin socket. The sockets can then be pressed onto the pins. Move the rudder from side to side to ensure the linkage is free from any obstruction at all rudder angles.

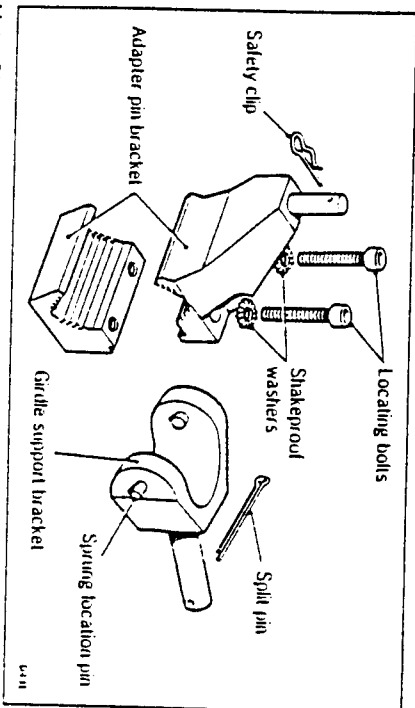
### Cabling

Once the rudder reference has been positioned the cable should be led back to the Control head. The cable has four tails each of which is fitted with a spade connector. These should be connected colour for colour to the 'RUDDER' connections at the rear of the Control head as shown below:



## 5.4 Sterndrive Actuator Installation

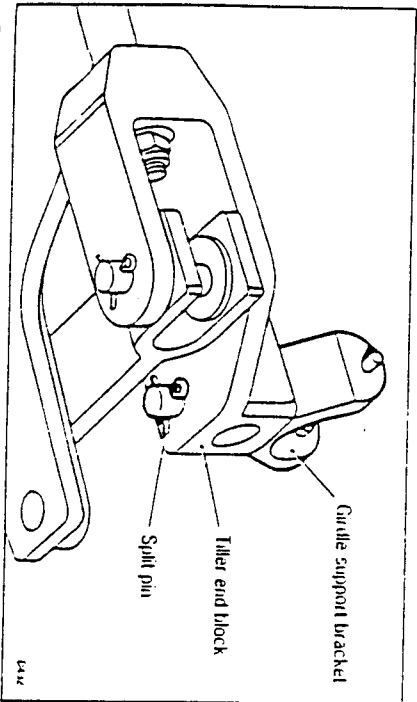
The sterndrive actuator can be fitted, using a universal fitting kit, to power assisted sterndrive systems made by Volvo, Mercruiser, OMC and Yamaha.



Note: Older Volvo steering systems (Pre type 872215) require a D129 adapter bracket.

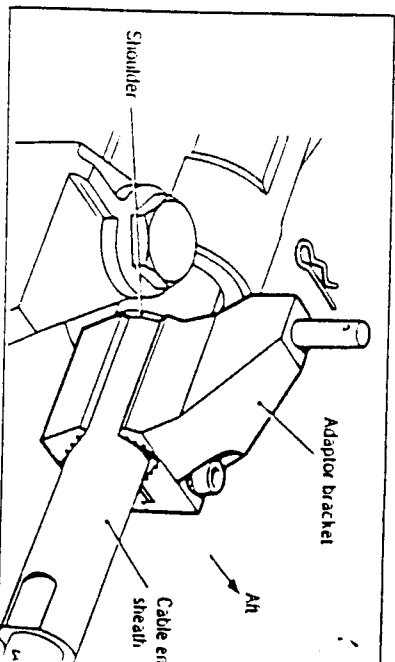
### Installation – Volvo (Post type 872215)

- Remove the locating pin attaching the cable rod to the tiller end block and replace it with the girde support bracket as shown

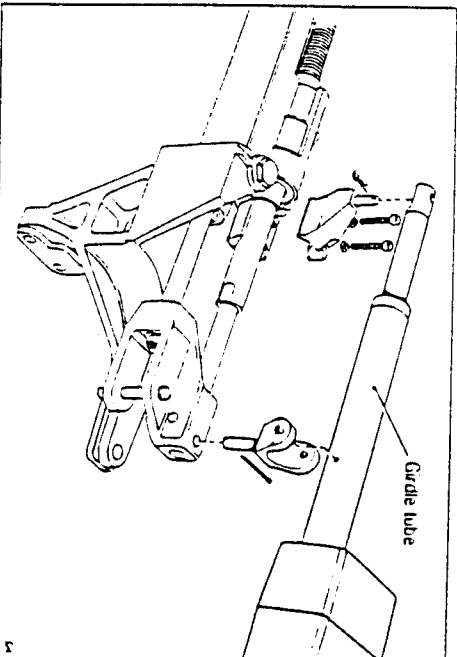


- Secure the assembly with the split pin supplied
- Install the adaptor pin bracket onto the cable end sheath as shown

Note: The adaptor pin bracket must sit against, but not on, the shoulder the cable end sheath. Also it is important that the securing bolts are sternside of the steering cable end sheath.



- Ensure the bracket remains vertical and tighten the two locating bolts
- Rotate the girde support bracket so that the sprung locator pin is facing forward
- Position the sterndrive actuator to locate the fixed support pin on the girde support bracket into its location hole in the girde tube



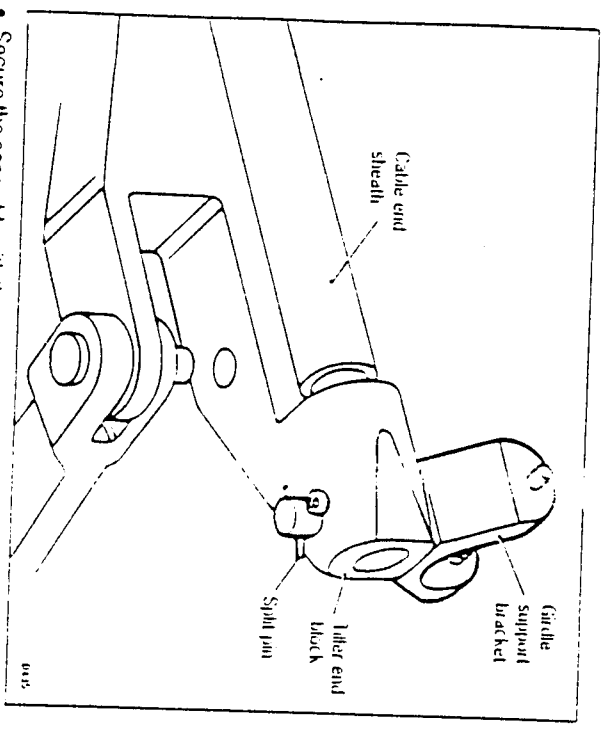
- Gently twist and lower the actuator into the girde support bracket until the sprung pin locates into the opposite side of the girde tube

Note: It is most important that both the solid and sprung location pins are fully engaged in the actuator girde tube. Failure to do so will end in autopilot failure.

- Position the drive unit pushrod over the top of the adaptor pin and secure with the safety clip
- Slowly turn the steering system from hard over to hard over. It is most important that the drive unit and the adaptor pin bracket do not touch any part of the engine or steering system. This includes any engine hoses that may only have a passing contact with the autopilot actuator, after a time these will wear and ultimately fail

### Installation – Mercruiser/OMC/Yamaha

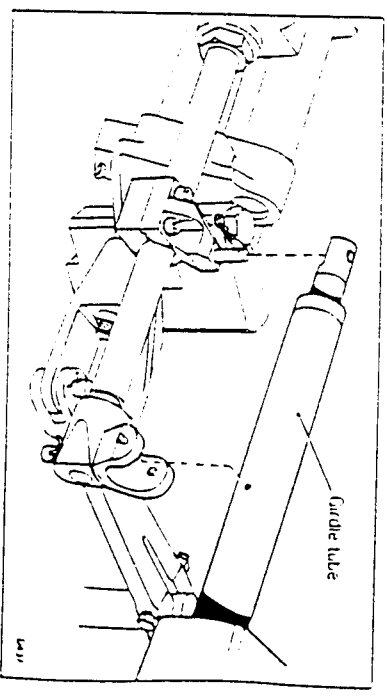
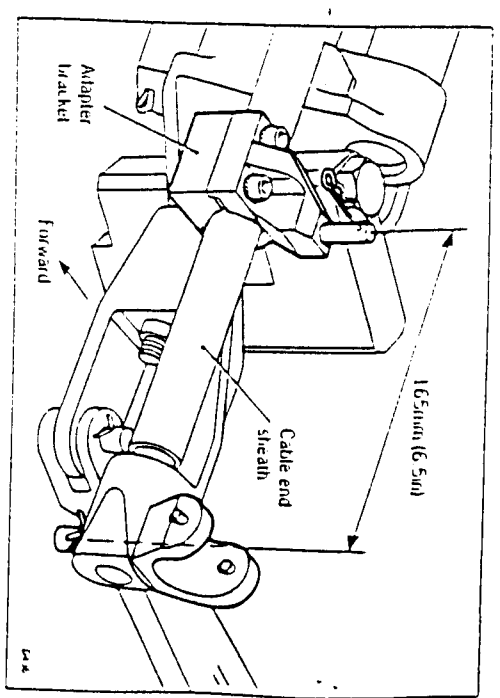
- Remove the locating pin attaching the cable end to the tiller end block and replace it with the girdle support bracket as shown.



- Secure the assembly with the split pin supplied

With the helm turned hard to port assemble the adaptor pin bracket onto the cable end sheath as shown. It is important that the securing bolts are bow side of the cable end sheath. The bracket should be positioned 165mm (6.5in) from the girdle support bracket.

- Ensure the bracket remains vertical and tighten the two locating bolts.
- Rotate the girdle support bracket so that the spring locator pin is facing forward
- Position the sterndrive actuator to locate the fixed support pin on the girdle support bracket into its location hole in the girdle tube



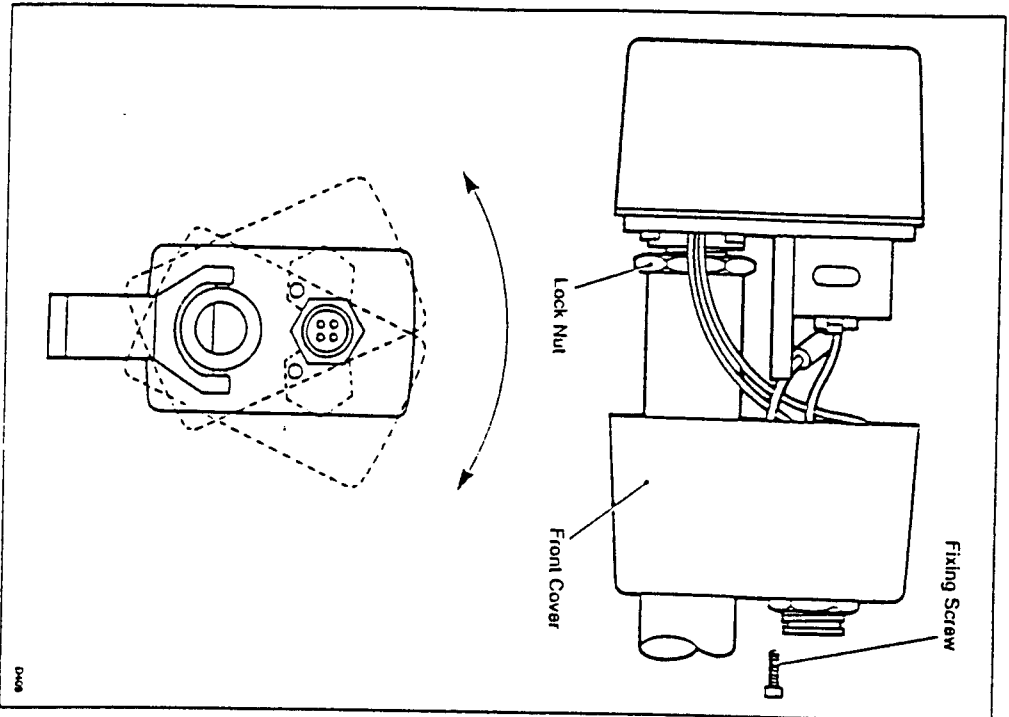
- Gently twist and lower the actuator into the girdle support bracket until the spring pin locates into the opposite side of the girdle tube

Note: It is most important that both the solid and sprung location pins are fully engaged in the actuator girdle tube. Failure to do so will end in autopilot failure.

- Position the drive unit pushrod over the top of the adaptor pin and secure with the safety clip
- Slowly turn the steering system from hard over to hard over. It is most important that the drive unit and the adaptor pin bracket do not touch any part of the engine or steering system. This includes any engine hoses that may only have a passing contact with the autopilot actuator, after a time these will wear and ultimately fail

### Mounting in a Restricted Area

If an obstruction prevents installation of the drive unit as supplied, the main body can be rotated relative to the mounting bracket as follows :

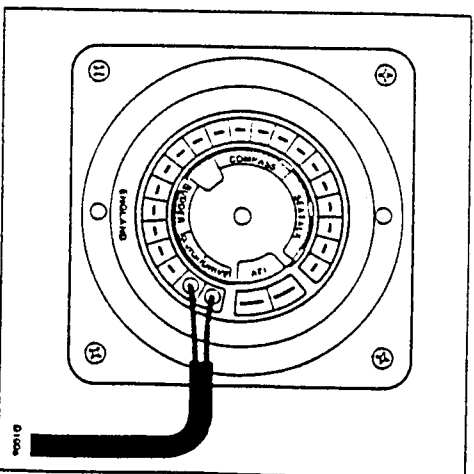


- Remove the 2 fixing screws and gently slide the cover forwards, ensuring that the four cables do not pull from the plug inside the cover
- Slacken off the lock nut and rotate the main body as required
- Retighten the lock nut securely and make sure that the lock nut is no more than one turn from the start of the thread

- Replace the cover taking care not to trap any cables
- Using the steering wheel move from hard over to hard over and check that no part of the drive unit touches any part of the vessel/fittings

### Cable Connection

- Plug in the cable supplied with the drive unit making sure that the connector is locked in place by turning the locking ring clockwise
- Route the cable back to the control head. Secure the cable close to drive unit but allowing sufficient free length to accommodate the drive unit movement



Once again using the steering wheel to move the rudder from hard over hard over and check that the cable does not catch on any part of the vessel/fittings.

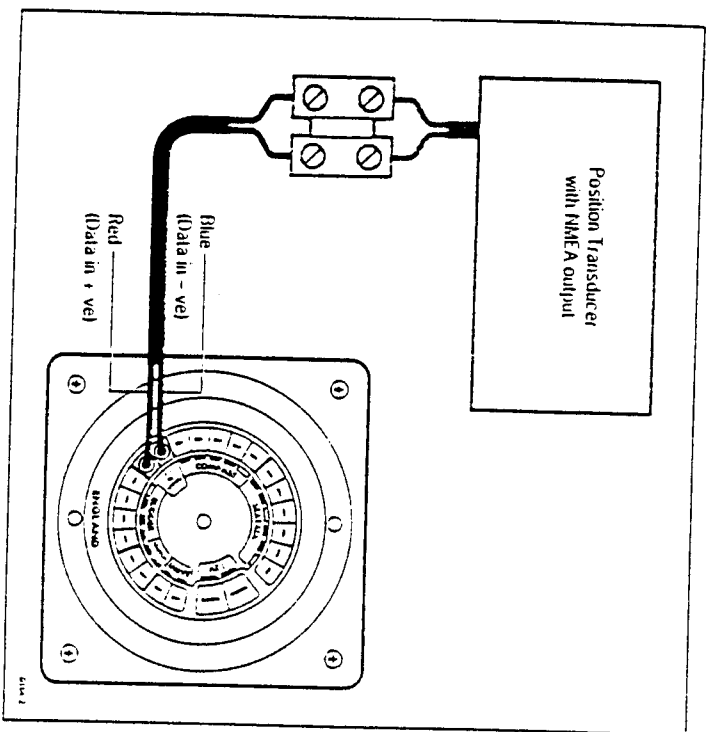


## Chapter 6: Interfacing to GPS, Decca, Loran

### 1 Cabling

The ST5000 will accept navigation data in the NMEA format for use in 'Track Control' mode. The required data formats are shown in section 6.3.

The NMEA data port is on the rear of the ST5000 and should be connected to a Position Transducer or wind instrument as shown:

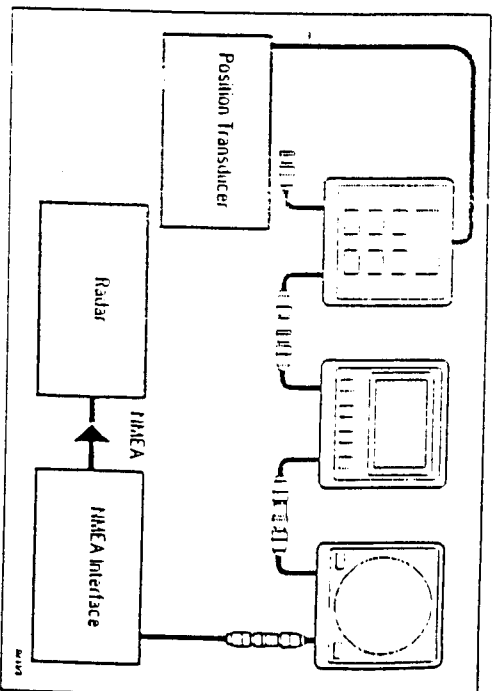


### 2 NMEA data transmission to other equipment

If you wish to transmit NMEA information to other equipment an NMEA Interface (D1 53) should be installed as shown:

### 6.3 Data formats

The following NMEA 0183 wind and navigation data can be decoded by the ST5000.



#### Data NMEA 0183

Latitude and Longitude	GLL,RHAC,RMA,HA,G1P,GOP,GXP,GDP, G1F,G0F,GXF,G1F,G0F,GCA,GA, G0AGXA,GDA
Course over the ground	V1G,V1A,RHAC,RMA
Speed over the ground	V1G,V1A,RHAC,RMA
Cross Track Error	APB,APA,RHIB,XTE,XTR
Bearing To Waypoint	APB,BP1,BWR,BWC,BER,BEC,RHIB
Distance to Waypoint	WDR,WDC,BP1,BWR,BWC,BER,BEC,RHIB
Waypoint Number	APB,APA,BP1,BWR,WDR,BWC,WDC,RHIB, B0D,WCV,BER,BEC
Variation	V1VA,RHAC,RMA,HVD

NMEA 0180 cross track error information is also acceptable for operation in 'Track Control'. However, as waypoint distance, bearing and number are not transmitted these cannot be displayed.

## Chapter 7: Functional Test and Initial Sea Trial

This section of the handbook consists of a set of simple tests followed by a short sea trial. This will confirm that the system is wired correctly and is also set-up to suit your type of boat.

### 7.1 Functional test

#### Switch on

Having installed your ST5000 autopilot, switch on the main power breaker.

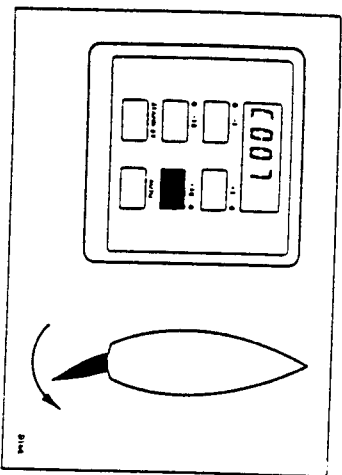
The control head should beep and display ST5000. Within 2 seconds a compass heading preceded by a flashing 'C' should be displayed e.g. 'C' 234. This shows the control head is active. If the head does not beep please refer to chapter 10 – 'Fault Finding'.

#### Operating sense

The operating sense of the autopilot defines the direction helm will be applied when a course change button is pressed or the vessel goes off course. It can be checked as follows:

- Press **Auto**
- Press **+10°**

The helm should move to produce a turn to Starboard. If it moves to port then please refer to page 67 – 'Operating sense reversal' for instructions on how to reverse the sense.



#### Rudder reference phase

This should only be carried out if a rudder reference transducer is fitted. Enter calibration mode as described in chapter 4 and adjust calibration level 8 (Steering system type 1) to 3. Store calibration by pressing the Standby key for 1 second.

Check the rudder reference cabling and phase as follows:

- Press **+1** degree and **-1** degree keys together for 1 second. The display will now indicate rudder angle.
- Move the helm to its center position

The display should now indicate within  $\pm 7^\circ$ . If this is not the case then the rudder reference mounting bolts should be slackened and the base rotated until it does. Final adjustment to accurately set up the display and helm is carried out in the 'autopilot calibration' section of this handbook.

- Turn the helm to produce a turn to starboard

The rudder angle display should increase in a positive direction.

If instead it increases in a negative direction reverse the rudder reference green and red wires on the rear of the Control head and re-check the above test.

It is recommended that the 'Manual override' facility is used when the Autohelm mechanical sterndrive actuator is installed. If this is enabled in calibration level 12 then it should be checked as follows:

- Start engines
- Manually drive the steering hardover to starboard
- Press **Auto** and drive the steering over to the opposite lock (Port) with repeated presses of the **-10** degree key

The autopilot should drive the steering onto the end stops, display and sound an alarm and then revert to Standby mode.

Re-engage the autopilot by pressing **Auto** and repeat the above procedure this time driving the steering hard to starboard using the **+10** key.

The autopilot should again drive onto the endstop, display and sound an alarm and then revert to Standby.

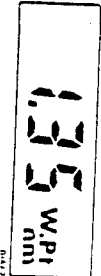
Note: If the ST5000 displays and sounds an alarm before reaching the opposite lock carefully check the vessel's steering system for any stiffness or mechanical jamming. If the condition persists set the 'Manual override' function to 'off' (0) and contact Autolhelm's Product Support Department for further advice.

### Navigation interface (GPS, Decca, Loran)

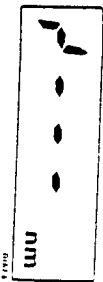
If the ST5000 is interfaced to a position transducer, via its NMEA data port, then the position transducer must be set up to transmit data as detailed in section 6.3.

The interface can be simply checked as follows:

- Set up a Track on the position transducer to give a cross track error of between 0 and 0.3nm
  - Enter 'Auto' mode by pressing the **Auto** key
  - Enter 'Track' mode by pressing the **Auto** key
- After 3 seconds the pilot should automatically scroll through three navigation displays:



If instead it shows one of the following error displays then there is either a wiring error or the position transducer is not set up to transmit the required data format:



This display indicates data is not being received. The most likely reason being a cabling error – either open circuit, short circuit or wires reversed.

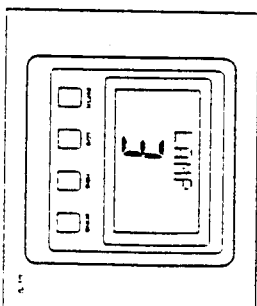


This indicates that the signals being received by the position transducer are too weak for reliable navigation. Reference should be made to the position transducer handbook for further action.

### SeaTalk bus

If the ST5000 has been linked to other SeaTalk instruments via the SeaTalk bus the link can be checked as follows:

- Push **Standby** on the autopilot Control head
- Select display illumination level 3 on any other SeaTalk instrument or autopilot control unit



The ST5000 should immediately respond by switching on its display illumination.

If the illumination does not switch on then a cabling fault exists in the SeaTalk cabling between the ST5000 control head and the instrument/control unit.

## 7.2 Initial Sea trial

Having checked that the system is functioning correctly a short sea trial is now required to complete the setting up. This should be carried out in calm waters clear of any obstructions, at no more than medium speed.

The ST5000 has a built in calibration capability which enables it to be fine tuned to suit the individual vessel, its steering system and dynamic steering characteristics. As supplied from the factory the unit is calibrated to provide safe stable autopilot control for the majority of vessels (see section 4.3).

Before carrying out the first sea trial it is recommended that the calibration levels be checked and if necessary reset to the recommended levels. This procedure will only take a minute or so and full details are given in chapter 4.

- Do not attempt to make any permanent change to the recommended calibration values until a sea trial has been carried out

- It is important that the initial sea trial is carried out in conditions of light wind and calm water so that autopilot performance can be assessed without the influence of strong winds or large waves

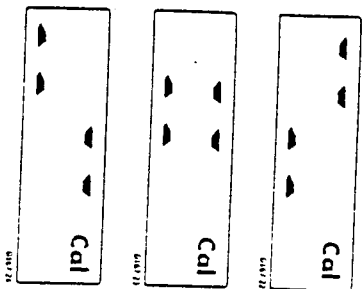
**Note:** At any time during the sea trial you can disengage the autopilot by pressing **Standby**.

### Automatic Compass deviation correction

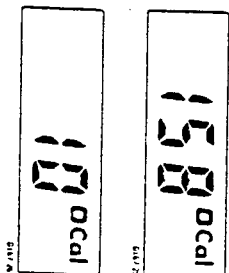
The ST5000 will correct the fluxgate compass for most deviating magnetic fields. **Before carrying out the initial sea trial it is vital to carry out the Compass Deviation Correction.** Failure to do so may result in the autopilot performance being impaired on some compass headings. This procedure should be carried out in calm conditions preferably in flat water.

Select compass correction as follows:

- Push and hold **Standby** for 1 second



Keeping boat speed below 2 knots, turn the vessel slowly in a circle, so that it takes at least 3 minutes to complete 360°. Keep turning until the display changes to show the amount of deviation the autopilot has detected. Deviation and current vessel heading will alternate every 1 second.



**Note:** If the amount of deviation exceeds 15°, it is recommended the fluxgate is re-sited.

Use the course change keys (+ and -) to increase or decrease the displayed heading until it agrees with the steering compass or a known transit bearing.

Exit compass adjust and store the compass correction/alignment as follows:

- Push and hold **Standby** for 1 second
- or, to exit compass adjust without saving any new settings
- Push **Standby** momentarily

### Manual override

Manual override is selected during calibration using Calibration level 12 and must only be used on installations fitted with the Sterndrive actuator. When selected, the ST5000 can be overridden to allow hand steering by turning the steering wheel. This will return the ST5000 to **Standby** and sound the control head buzzer for 10 seconds. There is a slight delay before the ST5000 will return to **Standby**. Excessive force is not required and will not reduce this delay.

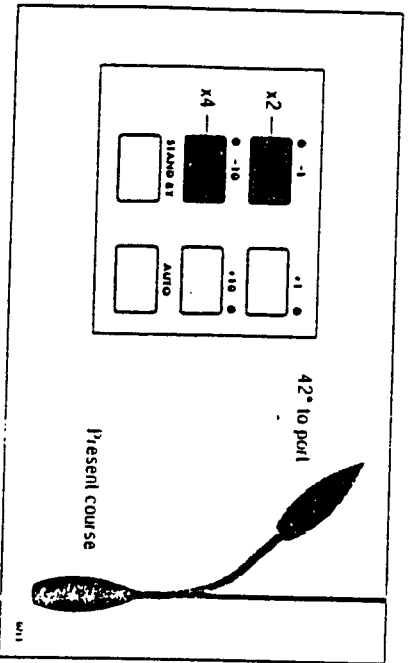
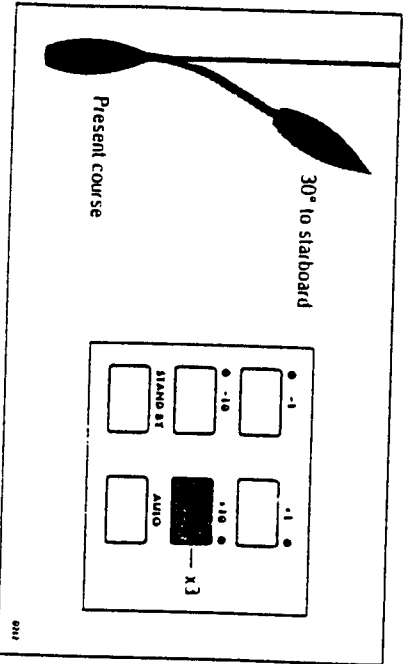
With the ST5000 in 'Auto' and clear of obstruction turn the steering wheel to observe the manual override. Repeat two or three times until you are confident with its operation.

The manual override is intended for emergency use only. The ST5000 should normally be disengaged by pushing the **Standby** button on the control unit.

### Autopilot operation

Having calibrated the compass the following procedure is recommended to familiarise yourself with autopilot operation:

- Steer onto a compass heading and hold the course steady
- Push **Auto** to lock onto the current heading. In calm sea conditions a constant heading will be achieved
- Alter course to port or starboard in multiples of 1° and 10°



- Push **Standby** and disengage the autopilot to return to hand steering

### Operating sense reversal

The operating sense of the Autopilot can be reversed as follows:

- Press the **+1** and **-1** degree keys together for 5 seconds

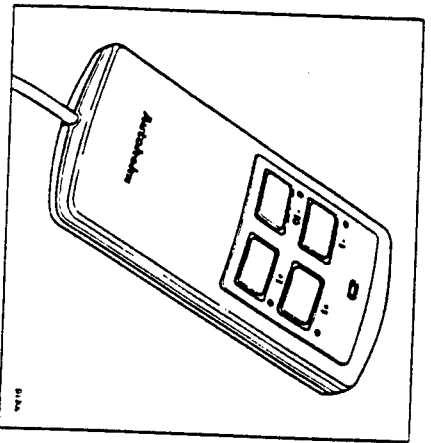
The display will then show either port or starboard and the phase of the autopilot will automatically change.

The Control head will automatically revert back to its normal operation after 5 seconds.

## Chapter 8: Accessories

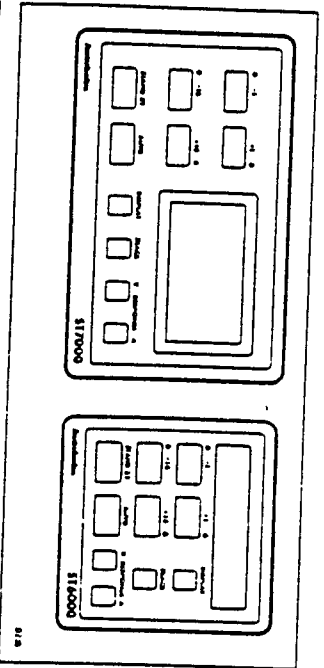
Various accessories are available for your ST5000 autopilot. These include:

- Handheld remote control (Z1011)



The handheld remote is supplied with 6m (20ft) of cable and a waterproof plug and socket. It allows you remote access to the four autopilot course change buttons.

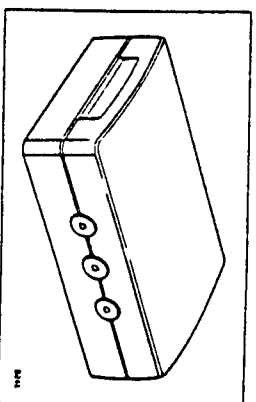
- Fixed control units – ST7000 (Z082), ST6000 (Z124)



These control units are available for permanent mounting at additional positions where autopilot control is desired.

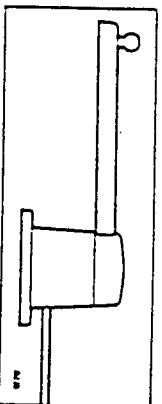
## Chapter 8: Accessories

- NMEA Interface (D153)



The NMEA interface will convert SeaTalk data to NMEA 0183. This allows you to feed NMEA 0183 Navigation data to a plotter or Speed and Compass information back to a position transducer for dead reckoning (assuming the correct instruments are present on the SeaTalk bus to generate the information initially).

- Rudder Reference Transducer (Z1311)



A rudder reference transducer can be added to provide a continuous readout of rudder position.

- Extension SeaTalk Cables

Extension SeaTalk cables are available in various lengths. These are fitted with a plug and socket and allow connection of remotely mounted SeaTalk equipment to the SeaTalk bus.

- D124 — 1m SeaTalk Interconnect Cable
- D125 — 3m SeaTalk Interconnect Cable
- D126 — 6m SeaTalk Interconnect Cable
- D154 — 9m SeaTalk Interconnect Cable

## Chapter 9: Maintenance

### Control head

- In certain conditions, condensation may appear on the window. This will not harm the unit, and can be cleared by switching on the illumination
- Never use any chemical or abrasive materials to clean your ST5000. If the Control head becomes dirty wipe clean with a damp cloth

### Drive unit

- Never use any chemical or abrasive materials to clean your drive unit. If the drive unit becomes dirty wipe clean with a damp cloth

### Cabling

- Avoid running cables through bilges where possible and secure any coiled lengths at regular intervals
- Avoid running cables close to fluorescent lights, engines, radio transmitting equipment etc
- Check cabling for chafing or damage to outer casing, replace where necessary and re-secure

#### Advice

Should any difficulties arise, please consult Nautech's Product Support department in the U.K. or your own National Distributor who will be able to provide expert assistance.

The working parts of the drive system are sealed and lubricated for life during manufacture and therefore do not require servicing.

If a fault does develop the autopilot's plugability ensures that only the defective unit be returned.

Before this is done please double check that the power supply cable is sound and that all connections are tight and free from corrosion. Then refer to the fault finding section of this manual. If the fault cannot be traced then please contact your nearest Autohelm dealer or service center for advice.

Always quote the serial number, which is printed on the label on the back of the control head.

## Chapter 10: Fault Finding

All Autohelm products are subject to a comprehensive test procedure prior to packing and shipment. In the unlikely event that a fault does arise the following check list should help cure the problem.

Fault	Cause	Action
Control Head display blank	No supply	Check supply. Check Fuse/Breaker. Return head for repair
Displayed heading does not change in Standby mode	Flurgate compass mis-connected	Check compass connections on rear of Control head
Rudder position display cannot be called up	No Rudder reference transducer fitted	Fit Rudder reference transducer
	Calibration level 8 (Steering type) set incorrectly	Set calibration level 8 to 3 (See chapter 4)
Drive unit steers helm hard over as soon as Auto is engaged	Dive phase set incorrectly	Refer to chapter 7 and carry out the functional test.
Displayed compass heading does not agree with Ships compass	Compass requires deviation correction and alignment	Refer to chapter 7 Automatic compass deviation correction
Vessel turns slowly and takes a long time to come onto course	Rudder gain too low	Refer to section 3.1 Setting up Rudder gain
Vessel overshoots when turning onto a new course	Rudder gain too high	Refer to section 3.1 Setting up Rudder gain
Displayed rudder angle not zero when helm is amidships	Rudder offset incorrectly set	Refer to chapter 4 Autopilot recalibration and set up level 2
Pilot appears to be unstable on Northerly headings (Southernly in Southern hemisphere)	Northerly/Southerly heading correction not set-up	Refer to chapter 4 Autopilot re-calibration and set-up levels 10 and 11

Fault	Cause	Action
Drive unit hunts when trying to position the rudder	Rudder damping incorrectly set	Refer to chapter 4 Autopilot re-calibration and set-up level 13
Display shows Cal - Off when entering calibration	Calibration locked out	Security protection switched on by owner
Control head will not talk to other SeaTalk instruments or Control units	Cabling problem	Check security of all SeaTalk connectors and cables
Pilot will not auto advance between waypoints	No Bearing to waypoint information transmitted from the position transducer	Refer to position transducer handbook
Pilot will not display Distance to waypoint, Bearing to waypoint or waypoint number	Incorrect NMEA sentences transmitted from Position Transducer	Refer to section 6.3 for sentence requirement

## Index

- A**
- Accessories 68
  - Additional Control units 68
  - Hand held control unit 68
  - NMEA interface 69
  - Rudder Reference Transducers 69
  - SeaTalk Extension Cables 69
  - Auto 8
  - Automatic Heading deadband (Auto seastate) 11
  - Autopilot re-calibration 28
  - Automatic autopilot gain adjustment 26
  - Automatic trim 34
- B**
- Basic principals (Operation) 7
- C**
- Cable connections 44
  - Calibration 28
  - Cruise Speed (Calibration Level 5) 33
  - Disabled access 39
  - Entering calibration 28
  - Exiting calibration 29
  - Factory settings 30
  - Latitude (Calibration Level 11) 36
  - Magnetic variation (Calibration Level 9) 35
  - Northerly/Southerly heading error correction (Calibration Level 10) 35
  - Off course alarm limit (Calibration Level 6) 34
  - Recording settings 38
  - Rudder damping (Calibration Level 13) 37
  - Rudder Gain (Calibration Level 1) 31
  - Rudder Offset (Calibration Level 2) 31
  - Rudder Limit (Calibration Level 3) 31
  - Steering system type (Calibration Level 8) 35
  - Trim Level (Calibration Level 7) 34
  - Turn Rate Limit (Calibration Level 4) 33
  - Variation (Calibration Level 9) 35
- D**
- Dodge 10
- F**
- Fault finding 71
  - Furgate Compass 47
  - Alignment 65
  - Cabling 49
  - Deviation correction 64
  - Installation 47
  - Mounting position 47
  - Functional test 60
  - Manual override 65
  - Operating sense 60
  - Rudder reference phase 61
  - Navigation interface 62
  - SeaTalk bus 63
  - Fuse ratings 45
- H**
- Handheld Remote Control Unit 68
- I**
- Illumination 12
- M**
- Magnetic variation 35
  - Maintenance 70
- N**
- Navigation interface 58
  - NMEA
  - Data Format /headers 59
  - Transmission to other equipment 56
  - Northerly heading error 26



**O**  
Off Course Alarm 12  
Operating sense 60

**P**  
Power supply 45

**R**  
Rudder Angle display 12  
Rudder Gain 24  
Rudder Reference 49  
Accessory 68  
Cabling 51  
Control dimensions 51  
Installation 49  
Mounting position 49  
Phase 61  
Requirement 27

**T**  
Track Control 18  
Automatic acquisition 18  
Cross Track Error 19  
Data error warning 23  
Large cross track error warning 23  
Manual acquisition 18  
No data warning 23  
Operation at Low Speed 21  
Operating limits 18  
Operating limitations 21  
Waypoint Advance 20  
Warning messages 23  
Turn Rate Limit 33

**W**  
Warning messages 23  
Waypoint advance 23

**S**  
Safety 4  
SeaTalk  
Operation with other SeaTalk  
Instruments 3, 46, 68  
Connection to bus 46  
Functional test 60  
Sea trial 63  
Sourtherly turning error 26  
Standby 8  
Steering system type 35  
Sterndrive Actuator 52  
Installation 52