COMMISSIONING CONTENTS

H-RANGE PILOT COMMISSIONING

Before the H-Range Pilot can be used, it is necessary to set and calibrate various parameters. This procedure is called Commissioning. This manual covers both ACP 1 and ACP 2 Pilot systems.

PILOT INSTALLATION CHECK LIST

The check list below should be used prior to the commissioning of the autopilot to ensure that the entire system is correct before applying power.

DRIVE UNIT & STEERING SYSTEM

1. Drive unit securely fixed to a rigid part of the boat structure .❒
2. Gauge of power cable is appropriate .....❒

HYDRAULIC RAMS:

1. Boat end stops must limit the rudder movement, not the stroke of the Hydraulic ram .....❒
2. Split pin that holds the pivot pin in the mounting foot must be secure .....❒
3. Absence of oil leaks .....❒
4. Correct diameter bolt in universal ball joint, correct size hole in tiller .....❒
5. Ram free to move side to side & up and down .....❒
6. Additional reservoir fitted if black ram mounted on its side .❒
7. Reservoir at highest point if ram split .....❒

HYDRAULIC PUMPS:

1. Absence of oil leaks ..... ❒
2. Absence of air in the hydraulic steering..... ❒

ROTARY DRIVES:

1. No backlash or excessive slackness in chain..... ❒

RUDDER REFERENCE INSTALLATION

1. Base securely fixed to boat structure ..... ❒
2. Arm securely fixed to boss ..... ❒
3. Ball joint securely fixed to arm..... ❒
4. Linkage has not been over extended ..... ❒
5. No slack or backlash in the linkage ..... ❒
6. Linkage does not foul when rudder moved hardover to hardover ..... ❒
7. Arm moves through at least 90° when rudder moved hardover to hardover (there must be at least 1 volt difference between the end stops) ..... ❒
8. Ball joint securely fixed to quadrant/tiller ..... ❒

COMPASS INSTALLATION

1. Clear of sources of magnetic interference, including power cables to other equipment, if in doubt check 1 metre around with small hand compass. Look the other side of the bulkhead! ..... ❒
2. Fitted as near to centre of motion of boat as other factors allow, aft of centre preferred because usually less motion than fore of centre ..... ❒

ELECTRONICS INSTALLATION

1. Cables secure ..... ❒
2. Cables undamaged ..... ❒
3. No loose bits of wire ..... ❒
4. Screens connected in accordance with wiring instructions and sleeved where appropriate ..... ❒

INTRODUCTION TO PILOT COMMISSIONING

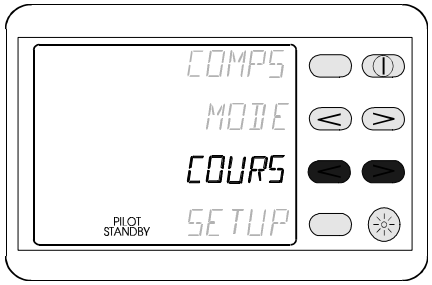
The following is a list of the parameters that have to be set during commissioning. They are selected by pressing the keys indicated on the diagrams while in commissioning mode. Each parameter will be explained in the following sections.

BTYPE	Select boat type: Sail, Power P, Power D
SWING	Compass Deviation Correction
H SRC	Heading Source, compass data selection
H OFF	Heading Offset, compass alignment correction
DIP	Magnetic Dip Angle compensation
DRIVE	Rudder drive type selection
RUD P	Rudder end stop Port
RUD S	Rudder end stop Starboard
RUD M	Rudder mid position
RUD T	Rudder Hard-over time
S CAL	Speed sensor calibration
B LEN	Boat waterline length in Metres
B LAG	Boat lag value
R GAN	Rudder gain value
R MAX	Maximum rudder angle value
LOCK	Watch alarm lock facility, disables alarm on/off control

The procedures for commissioning can be divided into two sections. The first to be carried out alongside and the second to be carried out or checked during the course of a sea trial. The order in which the commissioning procedures are carried is not necessarily the order in which they appear when the keys are pressed, continue pressing the key until the one that is required is displayed.

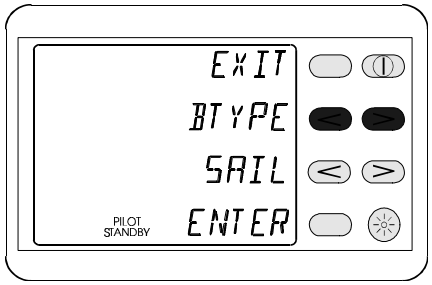
ENTERING COMMISSIONING MODE

To enter commissioning mode, simultaneously press the two keys shown.
The autopilot must be in **STANDBY** to do this.



LISTING THE COMMISSIONING PARAMETERS

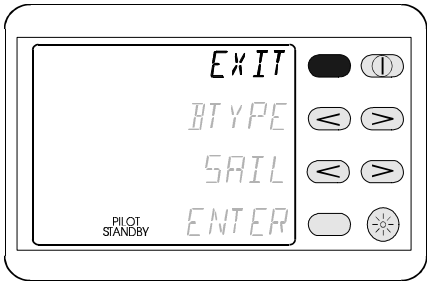
The display will now show the commissioning menu. Press either of the two keys shown to list the commissioning parameters.



NOTE: If this is the first time the Pilot has been commissioned ***SELCT*** will be displayed instead of ***SAIL***, ***PWR P*** or ***PWR D***.

EXITING COMMISSIONING MODE

To exit commissioning mode press the key next to the ***EXIT*** legend.



COMMISSIONING ALONGSIDE

INTRODUCTION

The following parameters should be set prior to a sea trial.

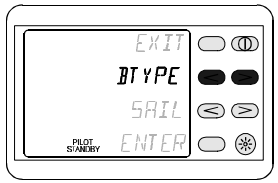
BTYPE	Select boat type: Sail, Power P, Power D
H SCR	Heading Source, compass data selection
H OFF	Heading Offset, compass alignment correction
DIP	Magnetic Dip Angle compensation
DRIVE	Rudder drive type selection
RUD P	Rudder end stop Port
RUD S	Rudder end stop Starboard
RUD M	Rudder Mid position
RUD T	Rudder hard-over Time
R MAX	Maximum rudder angle value
B LEN	Boat waterline length in Metres

BTYPE - SELECTING THE BOAT TYPE

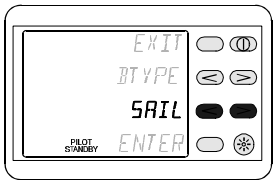
There are three selections available:

SAIL	For all sail boats.
PWR D	For power boats with displacement hulls.
PWR P	For power boats with planing hulls.

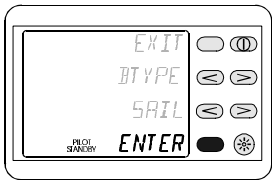
SETTING THE BOAT TYPE



Select ***BTYPE*** from the menu.



Select ***SAIL*** ***PWR P*** ***PWR D***.



Press ***ENTER*** to store the parameter.

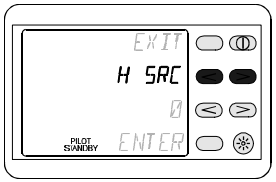
H SRC - HEADING SOURCE (COMPASS)

The Heading Source setting instructs the Pilot from where the compass data is to be supplied. This setting is determined by the H-Range Instruments or the H-Range Pilot system.
Most systems will use the Pilot remote compass unit. The compass sensor supplies heading data to the Pilot and the instruments. However, some systems may have a Super Halcyon 3 Compass fitted. This could be in addition or in lieu of the Pilot compass. Settings are available to select any of the compass sensors, select the correct one for the system from the table below.

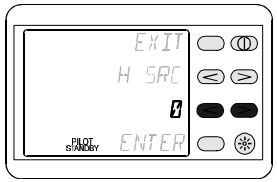
H SRC	**COMPASS DATA**
0	Default
5	Super Halcyon 3, connected via the H-Range instrument system.
18	ACP Remote Compass Unit.

The node must be set to either 5 to receive heading from a Super Halcyon or 18 to receive heading from Pilot Compass.

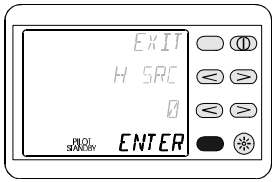
SETTING THE HEADING SOURCE VALUE



Select ***H SRC*** from the menu.



Select the value from the table.



Press ***ENTER*** to store the value.

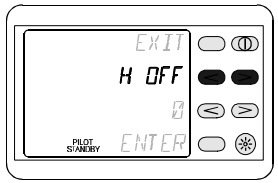
H OFF - HEADING OFFSET

(COMPASS ALIGNMENT)
The Compass Alignment electronically compensates for the misalignment between the autopilots fluxgate compass and the Earth's magnetic field.
The boats actual heading must be known, use a bowl compass or hand-held compass for reference.
Enter the heading offset (in degrees) to correct the misalignment, in the range -180 to 180. For Example:

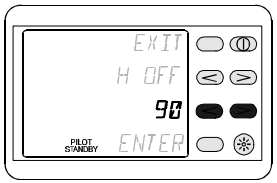
- The boats actual heading is Due North, 000.
- The autopilot display is indicating West, 270.
- Enter the Heading Offset value of 90.

Heading Offset should be checked during a sea trial to ensure that it has been entered accurately.

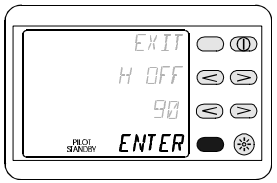
ADJUSTING THE HEADING OFFSET



Select ***H OFF*** from the menu.



Calculate the correct value for the offset.



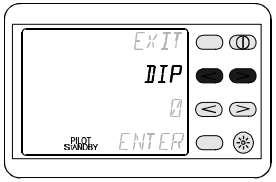
Press ***ENTER*** to store the value.

DIP - MAGNETIC DIP ANGLE

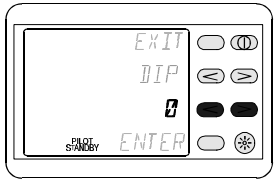
BOATS FASTER THAN 20 KNOTS ONLY

All magnetic compasses are effected by `Northerly turning errors' in the Northern Hemisphere or `Southerly turning errors' in the Southern Hemisphere, which increase with boat speed and magnetic dip angle in higher latitudes. These can cause heading instability at boat speeds greater than 20 knots when steering with an autopilot. By entering the dip value indicated on the compensation chart, the autopilot will be able to correct for these errors and improve the heading stability. Use the minimum value necessary to stabilise the heading.

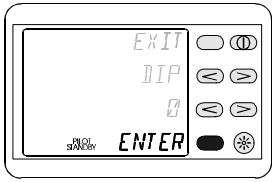
SETTING THE MAGNETIC DIP VALUE



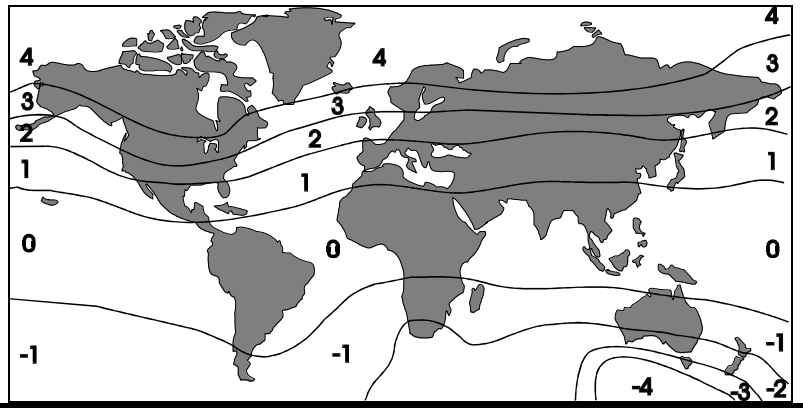
Select ***DIP*** from the menu.



Select the correct value from the chart below.



Press ***ENTER*** to store the value.

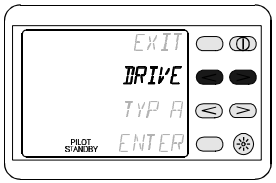


DRIVE - RUDDER DRIVE TYPE

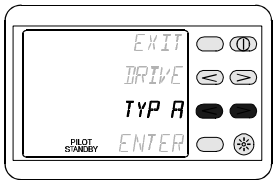
Depending upon the type of rudder drive unit fitted the Pilot controls the rudder drive motor in different ways, this optimises the autopilot steering response.
There are four selections for ***DRIVE***:

TYP A	All Linear Rams, Hydraulic pumps and Rotary drives.
TYP B	Pedestal drive motors fitted by some steering gear manufacturers.
TYP C	Outdrive drive units and Continuous drive units.
TYP D	Proportional solenoid valves.

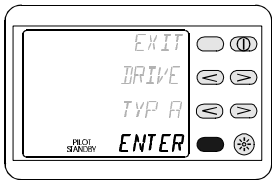
SETTING THE DRIVE TYPE



Select ***DRIVE*** from the menu.



Select the correct value from the list above.

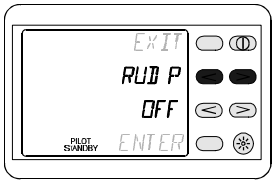


Press ***ENTER*** to store the drive type.

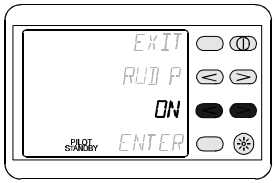
SETTING THE RUDDER END STOPS

Before the Pilot can be used it must know the position of the rudder end stops.

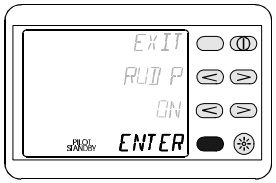
RUD P - SETTING THE PORT END STOP



Select ***RUD P*** from the menu.

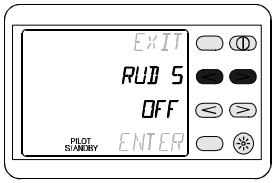


Turn the wheel until the rudder is hardover to port. Change the ***OFF*** legend to ***ON*** with the keys shown.

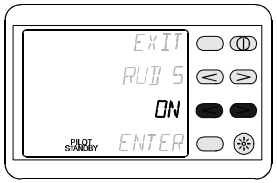


Press ***ENTER*** to set the port end stop position.

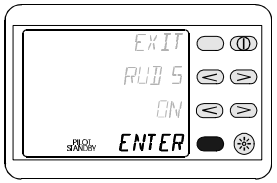
RUD S - SETTING THE STARBOARD END STOP



Select ***RUD S*** from the menu.

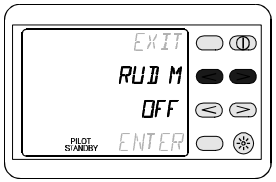


Turn the wheel until the rudder is hardover to starboard. Change the ***OFF*** legend to ***ON*** with the keys shown.

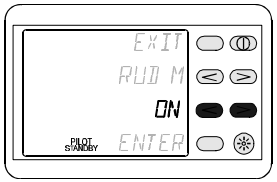


Press ***ENTER*** to set the starboard end stop position.

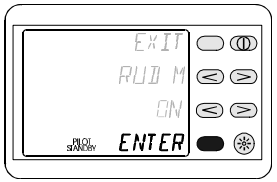
RUD M - SETTING THE MIDSHIPS POSITION



Select ***RUD M*** from the menu.



Turn the wheel until the rudder is amidships. Change the ***OFF*** legend to ***ON*** with the keys shown.



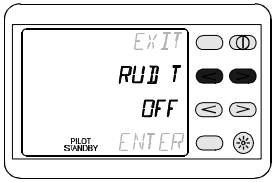
Press ***ENTER*** to set the midships position.

NOTE: Due to hull design and steering characteristics the best rudder midships position can only be set when underway, at normal cruising speed. It is therefore necessary to re-adjust the midships position during a sea trial.

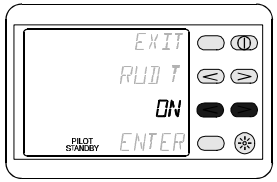
RUD T - RUDDER HARD-OVER TIME

To finish the rudder end stop commissioning procedure the autopilot must calculate the rudder hard-over port to hard-over starboard time. The following points must observed before carrying out the procedure:

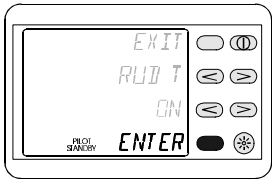
- If the boat is equipped with hydraulic power assisted steering the engines must be running during setting the rudder end stops.
- The rudder hard-over to hard-over time can only be calculated with the boat stationary



Select ***RUD T*** from the menu.



Change the ***OFF*** legend to ***ON*** with the keys shown.



Press ***ENTER*** to start the timing. The Pilot will drive the rudder to measure the hardover to hardover time.

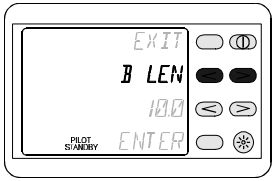
If ***RUD T*** fails to work then check the following:

- The boat speed must be less than 3 knots.
- Turn the wheel, check that the rudder bar display on the Pilot display is indicating. If it fails to indicate carry out the end stop procedures again.
- The RRU must move through a minimum of 90° when the wheel is turning from lock to lock

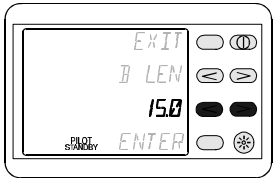
B LEN - BOAT LENGTH

The boats waterline length in Metres must be entered into the autopilot for it to steer accurately.

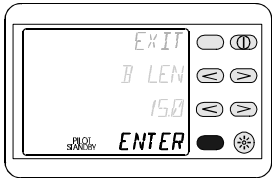
SETTING THE BOAT LENGTH



Select ***B LEN*** from the menu.



Enter the correct waterline length in metres.

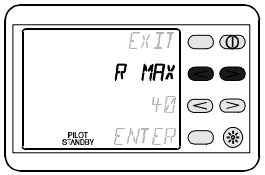


Press ***ENTER*** to set the value.

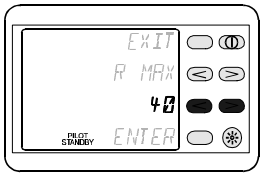
R MAX - SETTING THE RUDDER ANGLE

This optional menu is only present on some versions of display software.
The default rudder angle value is ± 40º. If the mechanical rudder angle is significantly different from the default value enter the actual rudder angle value .

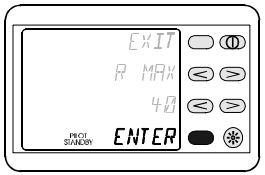
SETTING THE MAXIMUM RUDDER ANGLE



Select ***R MAX*** from the menu.



Enter the corrected maximum rudder angle (± 5º).



Press ***ENTER*** to set the value.

WHAT TO DO NEXT?

It is now necessary to carry out a Sea Trial to finish the autopilot commissioning.

IMPORTANT NOTE:
Until all parameters have been set or checked the autopilot should not be used to steer the boat.

COMMISSIONING SEA TRIAL

INTRODUCTION

The following parameters should be set and checked during the initial sea trial.

SWING	Compass Deviation Correction
H OFF	Heading Offset, compass alignment correction
RUD M	Rudder mid position
S CAL	Speed sensor calibration
B LAG	Boat lag value
R GAN	Rudder gain value
LOCK	Watch alarm lock facility, disables alarm on/off control

The commissioning sea trial should be carried out in open water on a calm day. The procedures for the remainder of the commissioning involve continual course and speed changes, it is very important that a constant look out is maintained.
The autopilot will be initially operating from the factory default values for Boat Lag (***B LAG***) and Rudder Gain (***R GAN***), these are different for sail or power boats. During the sea trial the Pilot learning algorithm will automatically set and adjust the value for Rudder Gain. The values for boat lag and rudder gain will be checked and adjusted to finely tune the autopilot steering performance when necessary. The default values are automatically set depending upon the type of vessel by the setting ***BTYPE***.

IMPORTANT NOTE

- On the initial sea trial ***DO NOT EXCEED 15 KNOTS***.
- Always maintain a proper lookout.
- If in doubt, disengage the autopilot with the red OFF key on any Pilot Display or Hand-held Controller, and return to manual steering.

ENGAGING THE PILOT

- Steer the boat onto a suitable heading, allow time for the boat to settle on this course.
- Engage Pilot in ***COMPS*** (compass) mode.
- The autopilot will now be steering the boat on the selected heading. Alter course in multiple increments using the 10º and 1º course change buttons on any Pilot Display or Hand-held Controller.

DISENGAGING THE PILOT

- Press the red off key to disengage the autopilot and return to manual steering.

For full instructions on using the Pilot refer to the Pilot Operation handbook.

POWER - VERIFY RUDDER DRIVE

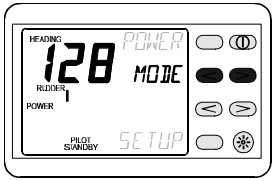
USE OF POWER STEER MODE

Power Steer mode can be used to verify that the Rudder Drive is operating correctly. This mode allows the user to directly control the boats rudder by using any Pilot Display or Hand-held Controller course change keys.
This could be used in an emergency if the normal manual steering system becomes defective, e.g. a broken steering quadrant cable or control rod. It can also enable faults in the ram drive unit or drive pump, the rudder reference unit and its linkage to the steering system to be diagnosed because the autopilot normal course control software is by-passed.

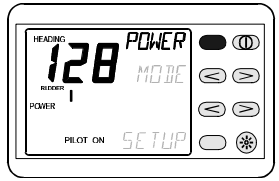
SELECTING POWER STEER MODE

- The Pilot must be in STANDBY.
- Turn the wheel so the rudder is in the amidships position (if possible).
- Press the key next to the ***POWER*** legend.
- To exit power steer mode press the red **OFF** key.

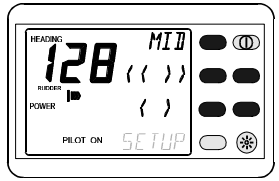
NOTE: When the ***MID*** key is pressed the rudder will return to the position it was in when ***POWER*** steer was engaged. If the rudder was set at the amidships position then ***MID*** key will return it to that position.



Press the keys next to the ***MODE*** legend until ***POWER*** is displayed on the top line.



With the rudder amidships, press the key next to ***POWER*** legend to engage the Pilot in power steer mode.



Use the **< <** or **> >** keys to adjust the rudder position by 3º. Use the **<** or **>** keys to adjust the rudder position by 0.6º. Press ***MID*** to return the rudder to the amidships position. (See note on previous page.)

POWER STEER CHECK

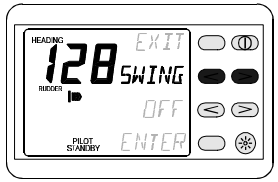
1. Engage the Pilot, check clutch / bypass valve operation.
2. With the Pilot engaged, try to move rudder with the wheel. The backlash should be less than 1º of rudder movement. Investigate and rectify any backlash steering problems immediately.
3. Use the **<< >>** keys to move the rudder, check that the Pilot can move the rudder by large amounts, verify by watching the rudder angle on the display, each press should give about 3º rudder movement
4. Use the **< >** keys to move the rudder, check that the Pilot can move the rudder by small amounts, verify by watching the rudder angle on the display, each press should give about 0.6º rudder movement

SWING - COMPASS CALIBRATION

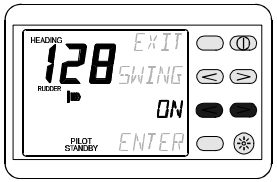
This procedure will automatically correct the ACP remote compass unit for any deviation errors. It should be carried out in open water, preferably on a calm day, with minimal wind and waves.

IMPORTANT NOTE: If the Pilot is using a Super Halcyon 3 Compass as its Heading Source then it must be calibrated at this point. Refer to the calibration procedure in the Super Halcyon 3 Compass handbook.

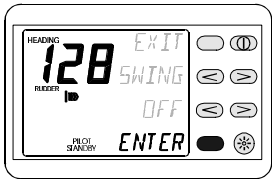
CALIBRATING THE PILOT COMPASS



1. Press **SETUP** key, until the display shows ***SWING***.



2. Use the keys to change ***OFF*** to ***ON***.



3. Press **ENTER** to start the swing.

NOTE: The ***SWING*** can be stopped at any time by pressing the ***EXIT*** key.

- With the speed below 5 knots, turn the boat through 360º at a rate of turn not greater than 2º per second i.e. the turn should take about 3 minutes to complete. The display will show the amount of turn completed so far in degrees.

- Keep turning until ***PAS*** or ***FAIL*** is displayed.

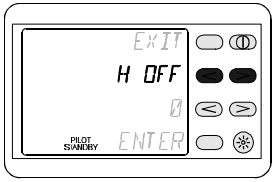
- ***PAS*** will alternately be displayed with a number which indicates the amount of correction applied. If this is greater than approximately 15º, consider re-siting the remote compass unit in a more favourable position away from external magnetic influences. (Some versions of the display software only.)

- If ***FAIL*** shows the swing was unsuccessful, the display will return to **000º** and the procedure will have to be repeated.

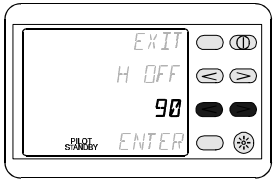
H OFF - CHECKING THE HEADING OFFSET

The heading offset was originally set while the boat was alongside. It would be advisable to check that the offset value is correct now that the Pilot compass has been swung. Refer to Setting the Heading Offset to review the procedure in full.

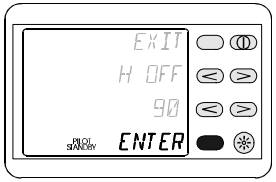
SETTING THE HEADING OFFSET VALUE



Select ***H OFF*** from the menu.



Calculate the correct value for the offset.

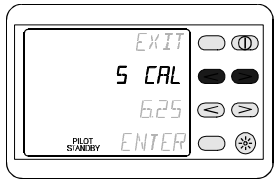


Press ***ENTER*** to store the value.

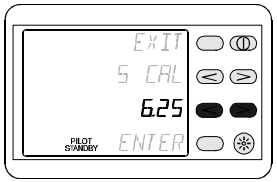
S CAL - CALIBRATION OF SPEED INPUT

The ACP computer unit can take a direct speed input from a Paddle Wheel with a hall effect output. Normally the Pilot uses boat speed supplied via the system network from the instrument system, this facility is only used when the installation does not include an H-range instrument system.
All B&G Speed Sensors (paddle wheel types) are compatible.
The Hertz/Knot value is entered into the system to ensure the autopilot steering response is controlled with reference to boat speed. The default Hertz/Knot value is 6.25, this is the setting for B&G speed sensors.
To determine if the value is correct compare the boat speed value displayed by the Pilot display (when the SPEED key is pressed) with the displayed value of speed on the log/speedo fitted.

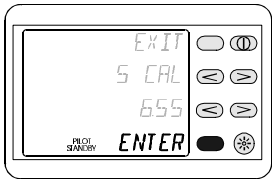
SETTING THE SPEED CALIBRATION VALUE



Select ***S CAL*** from the menu.



Adjust the value with the keys shown.



Press ***ENTER*** to set the value.

R GAN - RUDDER GAIN

When the Pilot is part of an integrated system, boat speed data will be supplied via the system network cables from the H-Range Instruments. By monitoring boat speed and rate of turn the Pilot will automatically `learn' the correct value for Rudder Gain giving a rate of turn of approximate 6º per second for a sail boat or 8º for a power boat.
If there is no direct speed input or the speed is being set by the Pilot Display Manual Speed Band selections, then the Rudder Gain value must be entered manually, miss out this section and go straight to Manual Rudder Gain.

CHECKING RUDDER GAIN LEARNING

- Steer the boat onto a suitable heading, allow time for the boat to settle on this course.
- Engage the pilot in ***COMPS*** (compass)mode.
- **AT A SPEED NOT EXCEEDING 15 KNOTS**, make at least 6 large course changes of at least 100º, by multiple presses of the 10º course change buttons on any Pilot Display or Hand-held Controller. This enables the autopilot to learn the rudder gain value.
- When the autopilot has learnt the rudder gain value the rate of turn will be approximately 6º (sail) or 8º (power) per second. (To estimate the rate of turn the display is updated twice per second, therefore the heading display should jump in 3-4º steps.)
- Press the red off key to disengage the autopilot and return to manual steering.

SETTING THE RUDDER GAIN MANUALLY

- Steer the boat onto a suitable heading, allow time for the boat to settle on this course.
- Engage the pilot in ***COMPS*** (compass) mode.
- **AT A SPEED NOT EXCEEDING 15 KNOTS**, make at least 6 large course changes of at least 100º, by multiple presses of the 10º course change buttons on any Pilot Display or Hand-held Controller.
- Observe and estimate the rate of turn. It should be approximately 6º to 8º per second. (To estimate the rate of turn the display is updated twice per second, therefore the heading display should jump in 3º to 4º steps).
- Also observe the performance of the autopilot when changing course. If the rate of turn is too **SLOW**, **REDUCE** the value of rudder gain and the Pilot will use more rudder. If the rate of turn is too **FAST**, **INCREASE** the value of rudder gain and the Pilot will use less rudder.
- Adjust the Rudder Gain to give an average rate of turn of approximately 6º to 8º per second.

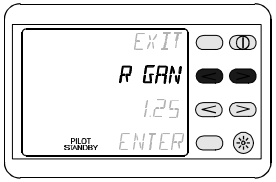
RUDDER GAIN VALUE TABLE

BOAT TYPE	FACTORY SET VALUE	TYPICAL VALUES
SAIL BOATS	2.0	1.0 to 3.0
POWER BOATS	0.8	0.3 to 1.0

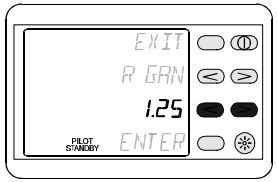
NOTE: The factory set value is selected by setting Boat Type and Rudder Drive Type during commissioning.

SETTING THE RUDDER GAIN VALUE

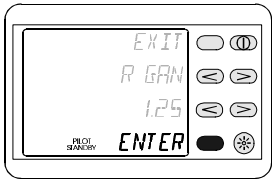
NOTE: The autopilot must be disengaged and in commissioning mode to adjust the Rudder Gain value.



Select ***R GAN*** from the menu.



Adjust the value with the keys shown.



Press ***ENTER*** to set the value.

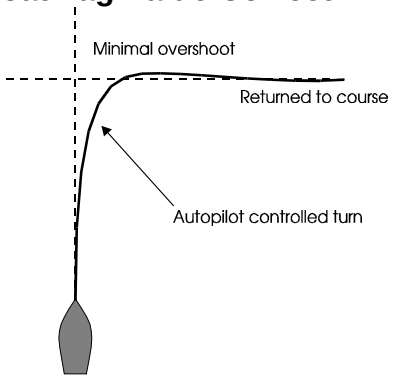
B LAG - BOAT LAG

Boat Lag is the time taken for the boat to respond to changes in helm. For example, heavy displacement hulls require a larger value for boat lag.

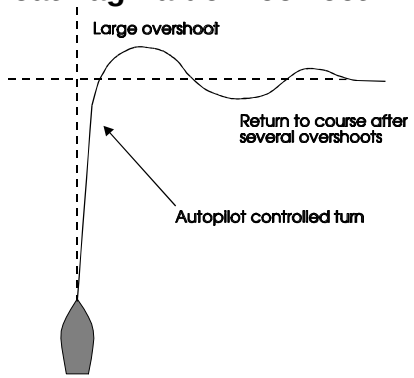
CHECKING THE BOAT LAG

- Engage the autopilot as previously explained in Initial Pilot Sea Trial.
- At a speed not exceeding 15 knots, change course by 90º in each direction.
- Observe the autopilot steering performance. The boat should turn onto the new heading with minimal overshoot (a slight overshoot is acceptable).
- If the overshoot is consistently more than 5º for course changes in both directions increase the Boat Lag value in steps of 0.1 until the overshoot is corrected.
- It is easier to spot overshoot than undershoot, hence if no overshoot is observed decrease the boat lag in steps of 0.1 until a small overshoot is seen.
- Use the smallest value of Boat Lag to stop overshoot.

Boat Lag Value Correct



Boat Lag Value Incorrect



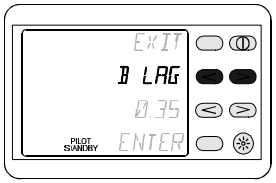
BOAT LAG VALUE TABLE

BOAT TYPE	FACTORY SET VALUE	TYPICAL VALUE
SAIL BOATS	0.30	0.3 to 1.0
POWER BOATS	0.50	0.3 to 1.0

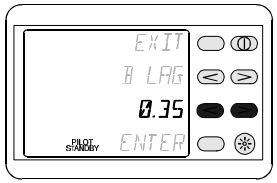
NOTE: The factory set value is selected by setting Boat Type and Rudder Drive Type during commissioning.

SETTING THE BOAT LAG VALUE

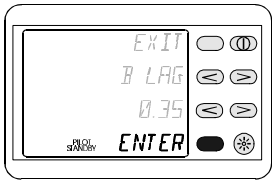
NOTE; The autopilot must be disengaged and commissioning mode selected to adjust the Boat Lag value.



Select ***B LAG*** from the menu.



Adjust the value with the keys shown.



Press ***ENTER*** to set the value.