H3000

# Pilot Handbook

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# NOTIFICATION

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Tel: +44 1794 518448
Fax: +44 1794 518077
www.bandg.com
Email: sales@bandg.com
Email: support@bandg.com

B&G Ltd.
Premier Way, Abbey Park
Romsey, SO51 9DH
United Kingdom

# LIABILITY AND SAFETY WARNINGS

Brookes and Gatehouse Limited accept no responsibility for the use and/or operation of this equipment. It is the user's responsibility to ensure that under all circumstances the equipment is used for the purposes for which it has been designed.

**Warning: Electrical Hazard**

This equipment uses high voltage electrical power. Contact with high voltages may result in injury and/or loss of life.

**Warning: Calibration**

The safe operation of this equipment is dependent on accurate and correct calibration. Incorrect calibration of this equipment may lead to false and inaccurate navigational readings placing the yacht into danger.

**Warning: Operational Hazard**

The H3000 system is an Electronic Navigation aid and is designed to assist in the navigation of your yacht. It is not designed to totally replace conventional navigation procedures and precautions and all necessary precautions should be taken to ensure that the yacht is not placed into danger.

The Pilot is an aid to steering the vessel. It is the users responsibility to ensure the safe control and movement of the vessel at all times.

**Warning: Navigation Hazard**

The Pilot must be fully commissioned and a satisfactory sea-trial completed before the Pilot is used to steer the vessel. Failure to do so could endanger life and/or other vessels.

**Caution: Electrical Supply**

This equipment is designed for use with a power supply source of 12V dc. The application of any other power supply may result in permanent damage to the equipment.

**Caution: Cleaning**

The use of alcohol or solvent-based cleaners will damage this equipment and any warranty in force will be invalidated.

**Caution: Display Installation**

Displays installed into locations manufactured from conductive materials (e.g. Steel, Carbon Fibre etc.) should be insulated from the structure to prevent damage to the casings as a result of the effects of electrolysis.

**Caution: Processor Installation**

All B&G Processors should be installed below decks in a dry location protected from water and moisture.

**Power Off Disclaimer**

When in standby mode the H3000 system continues to consume power. To conserve the vessel's battery life switch off power at the main breaker.

# CONTENTS

# ABOUT B&G

**B&G** has welcomed the constant challenge to develop new electronic solutions for every sailor's need. Harnessing technical developments and providing proven solutions has continued to be the focus that keeps **B&G** on the leading edge of advanced marine electronics.

Proven in the worlds most testing environments, **B&G** offers the most accurate and reliable systems used by blue water cruisers, single-handed racers and record breakers alike firmly establishing ourselves as one of the leading innovators of the most highly advanced marine electronics.

**B&G** is renowned for tried and trusted solutions and is ever evolving to offer the best technology to the customer.

**B&G'**s Promise.

"Uncompromising performance, precision and reliability from both our products and our people".

# ABOUT THIS MANUAL

Instructions in this manual describe the controls and calibration of your **H3000** Pilot system. You can also use the controls on the B&G RemoteVision details of which can be found in the RemoteVision handbook.

The icons shown below are used in this manual

| Icon | Meaning |
|---|---|
|  | Indicates that the function is available on **H3000 Performance** systems only |

# INTRODUCTION

## SYSTEM OVERVIEW

The H3000 Pilot fully integrates with the H3000 instrument system, both in terms of style and performance. The instrument system transmits sensor information via the B&G Fastnet network to the ACP Pilot computer unit.

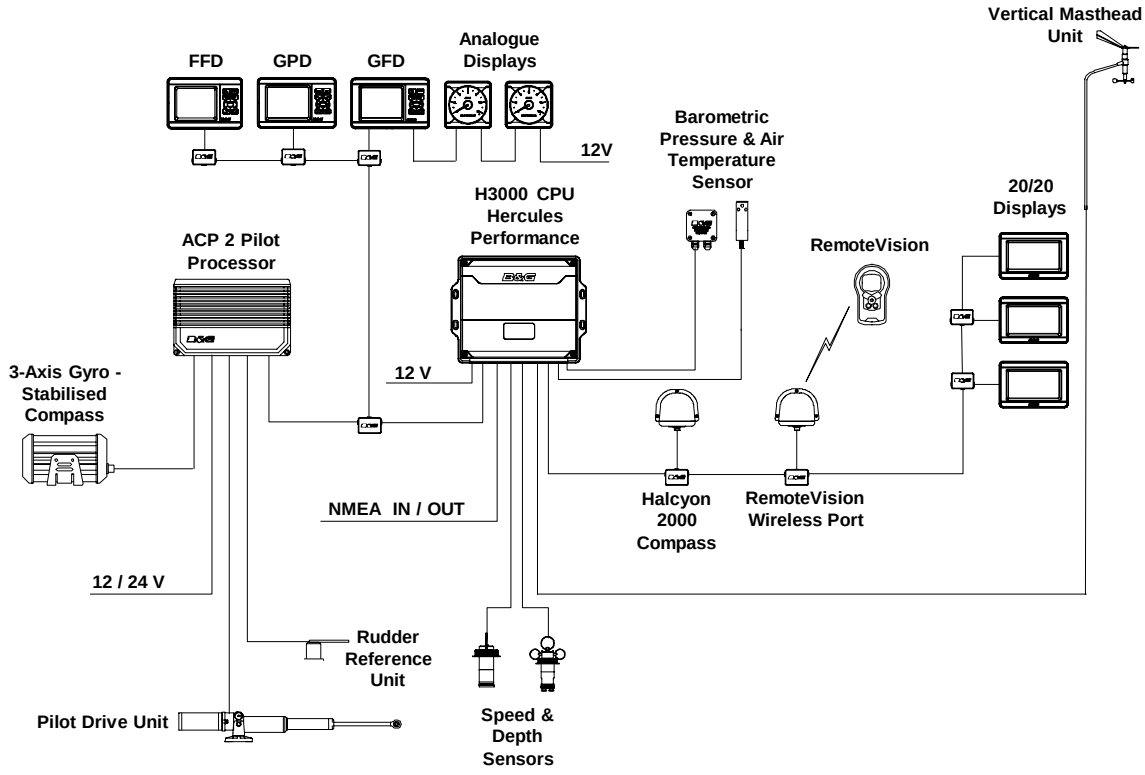
The Pilot computer processes the sensor data and then sends signals to the rudder drive system (linear ram, rotary drive or hydraulic pump) to steer the vessel on the desired course. The complex learning algorithms used in the Pilot computer ensure that the steering performance is optimised for the sea and weather conditions, and quickly responds to any changes that may occur.

Control of the Pilot is via the keys on any one of the dedicated Graphical Pilot Displays (GPD). Each display acts as a master allowing control of the Pilot from any station.

H3000 Pilots are available with a wide range of powerful and reliable 12V or 24V dc rudder drive units suitable for boats of over 7m (23ft). The ACP (Advanced Control Program) Pilot computers are supplied in two specifications ACP1 or ACP2 (Advanced Control Programming) depending on the size of vessel, power requirements and options in use.

The H3000 Pilot can be used for both sailing and power boats that have a H3000 System installed.

# H3000 System Example



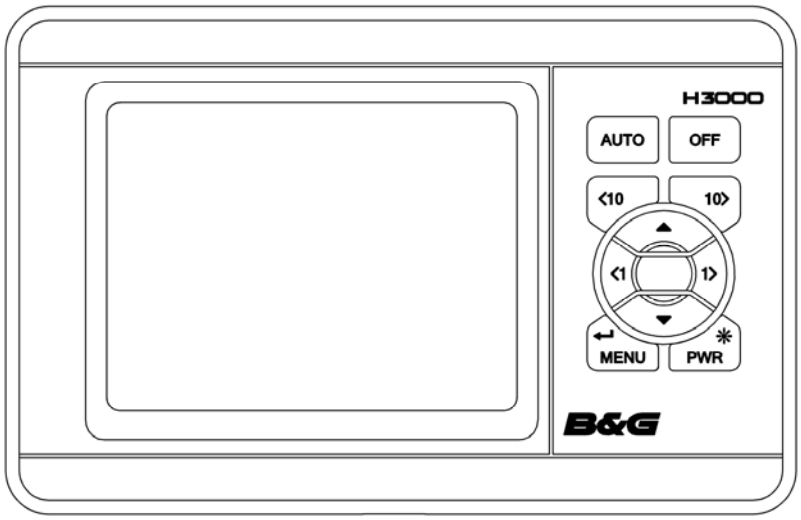

**H3000 System example with Pilot**

Above is an example of a typical H3000 system. At the centre of the system is the Central Processor Unit (CPU).

All sensor information is fed back to the CPU and can be easily controlled and configured via the Graphical Function Display (GFD).

The ACP Pilot processor integrates with the CPU to optimise the performance of the B&G system providing data for the autopilot to steer the boat.

# GRAPHICAL PILOT DISPLAY (GPD)




**H3000 GPD – Graphical Pilot Display**

The GPD utilises a high-resolution graphical display that allows the use of a very intuitive user interface, and flexible data representation.

Monochrome and colour versions are available. The monochrome version is intended for on-deck use and viewing from distance, the colour version is designed to allow additional clarity in short-range applications such as navigation stations, cabins, pedestal mounts etc

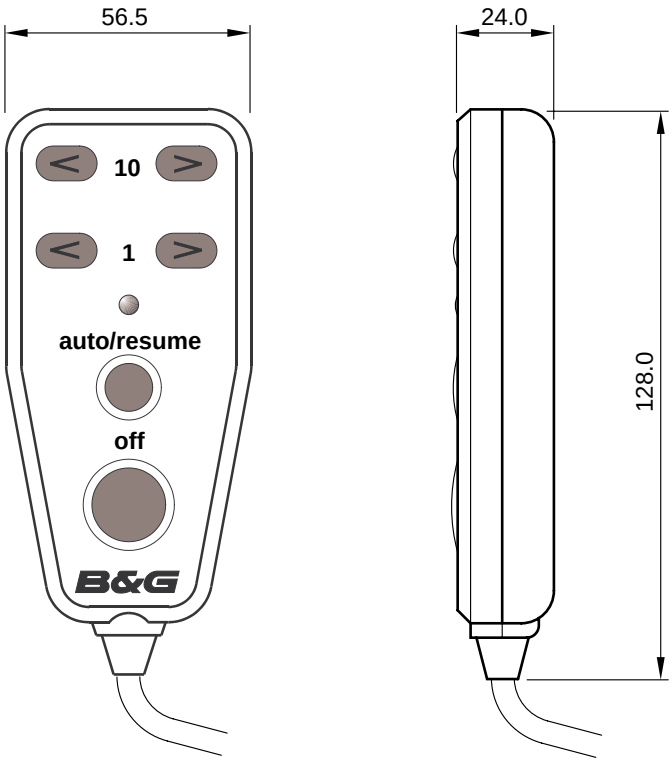
The GPD has a simple, easy to learn, user interface and keypad layout that simplifies the operation and configuration of the system.

There are dedicated keys for direct Pilot control (Auto, Off, 10º port, and 10º starboard) as well as the menu navigation keys used on the GFD.

It is possible to display a number of user configurable instrument pages, and access the main H3000 setup and control menus as per the GFD.

Index matched bonded display technology is used to give the dual benefits of increased display clarity in all lighting conditions and complete elimination of the possibility of condensation obscuring the display.

# HAND-HELD CONTROLLER




**Hand-held Controller**

The Hand-held Controller provides a wired remote control of the H3000 Pilot. The six keys used for dedicated functions are as follows:

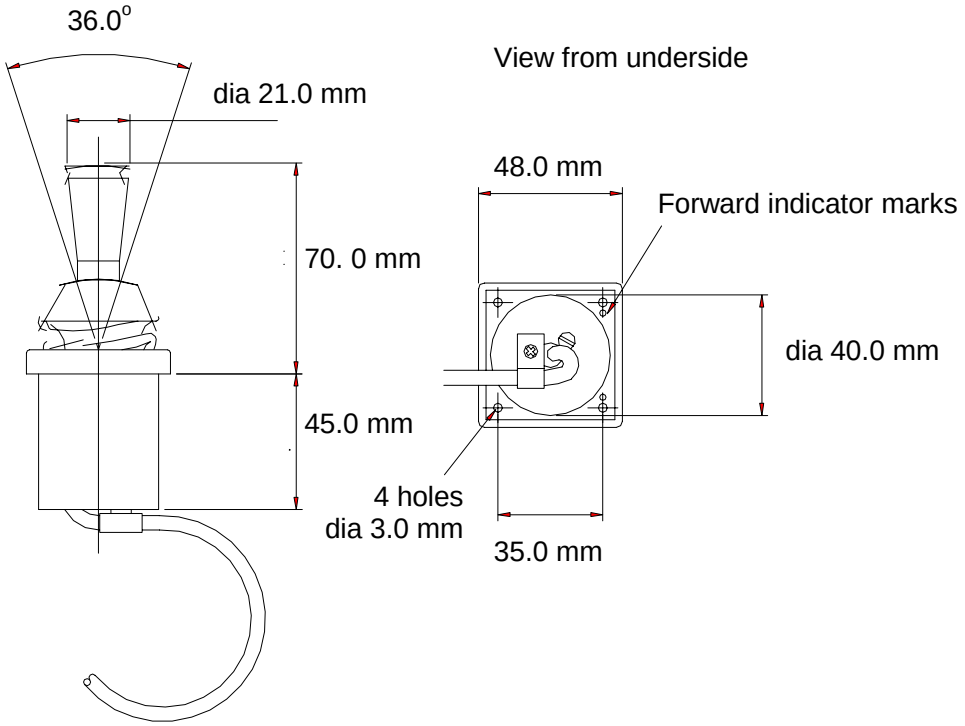
10 degree course change (Port/Starboard).

1 degree course change (Port/Starboard).

Auto/Resume - Pilot engage and return to course.

Off - Pilot disengage.

# JOYSTICK




**Joystick**

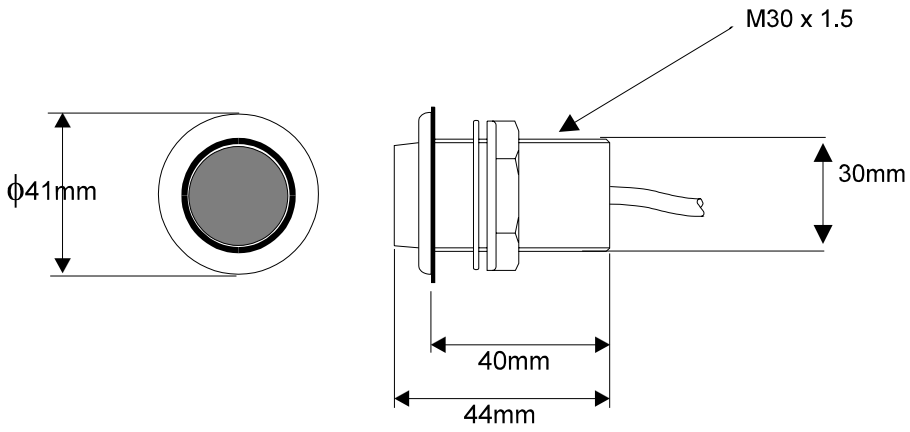
The Joystick allows direct control of the rudder via the Pilot control electronics. The unit is deck-mountable, allowing it to be used internal or external steering positions. A 10m (30ft) 6-core screened cable connects the unit directly into the ACP. Joystick steering is engaged and disengaged with the separate red control button. The lever controls the port and starboard movement of the rudder.

There are two modes of joystick operation available to the Helmsman, these are as follows:

**Normal Steering** - The rudder moves in the direction of the Joystick. When the Joystick is returned to the central position the rudder movement stops. The greater the movement of the Joystick the faster the response of the rudder.

**Proportional Steering** - The position of the rudder follows the position of the Joystick. When the Joystick returns to the central position the rudder returns to its initial position.

# MAN OVERBOARD BUTTON




**Man Overboard Button**

The Man Overboard (MOB) button is an optional extra that activates the Pilot's Man Overboard procedure to assist in the recovery of the person, or persons, that may have been lost overboard.

The MOB facility will operate when the system has a valid source of boat speed in use (not Manual Speed or SOG). It will function whether the Pilot is engaged or not.

Two modes of operation are available, Manual Recovery and Automatic Recovery.

**Manual Recovery** displays Range and Bearing to the MOB position on the GPD, GFD and FFD displays to enable the crew to steer the boat back to the MOB position. The range and bearing is calculated by dead reckoning so tidal influences are effectively corrected for. If you have a GPS MOB facility you should also activate this to store a geographic MOB position. Manual recovery is available for both sailing and power boats.

**Automatic Recovery** allows power boat users to follow the range & bearing function with a request to the Pilot to carry out a Williamson turn which will bring the boat back in the vicinity of the MOB position.

**Manual Recovery procedure:**

**WARNING**

This procedure is in addition to standard MOB practices, ensure that you and your crew are familiar with normal MOB procedures.

1) Press the MOB button as soon as the person is lost overboard. The alarm will sound (if fitted) and the displays will show the Man Overboard message. The GFD, GPD and FFD displays will now show the bearing and distance to the person overboard. On FFDs the bearing will be flashed three times and then the distance (in Nautical Miles) once, this pattern will repeat until cancelled.

2) Maintain a lookout and keep visual contact with the person in the water. Steer the boat back to the person overboard following the bearing and distance displays. The boat can be steered using the course change buttons when the Pilot is engaged, or **press the red Off Key to disengage the Pilot** and steer the boat manually. Recover the person overboard.

3) To end the MOB sequence press and hold the MOB for 5 seconds. The displays of bearing and distance are cancelled and the Pilot will return to the normal (previous) setting. Alternatively select Silence on a GFD or GPD alarm window, or click Enter twice on a FFD.

**Automatic Recovery procedure:**

**WARNING**

This procedure is in addition to standard MOB practices, ensure that you and your crew are familiar with normal MOB procedures. If you are unfamiliar or unsure of the Automatic Recovery mode do NOT use it, use manual recovery and standard MOB practices instead.

1) Press the MOB button as soon as the person is lost overboard. The alarm will sound (if fitted) and the displays will show the Man Overboard message. The GFD, GPD and FFD displays will now show the bearing and distance to the person overboard. On FFDs the bearing will be flashed three times and then the distance (in Nautical Miles) once, this pattern will repeat until cancelled.

2) Maintain a lookout and keep visual contact with the person in the water. Reduce the boat speed to **LESS THAN** 8 knots. Ensure that the area is clear of other boats and obstacles.

3) Press the MOB three times in quick succession to initiate an Automatic Recovery. The Pilot will control the steering and execute a Williamson Turn. **AT ANY STAGE you may press the red Off Key to disengage the Pilot** and steer the boat manually. Recover the person overboard.

4) To end the MOB sequence press and hold the MOB for 5 seconds. The displays of bearing and distance are cancelled and the Pilot will return to the normal (previous) setting. Alternatively select Silence on a GFD or GPD alarm window, or click Enter twice on a FFD.

# OPERATING INFORMATION

## SWITCHING ON

The H3000 Pilot has two power supplies (instrument and heavy duty rudder drive supply) these are normally connected via circuit breaker. The Pilot computer and Pilot displays are powered via the Fastnet network cable and share the same source of power supply as the H3000 instrument system.

The hydraulic ram, rotary drive or hydraulic pump supplies are routed via the Pilot computer. The heavy-duty supply is dedicated to the rudder drive unit and is connected via a separate heavy-duty fuse or circuit breaker.

To switch the Pilot ON, proceed as follows:

Switch ON the instrument supplies.

Switch ON the heavy-duty power supply for the rudder drive unit.

The Pilot will only operate if both the heavy duty and instrument supplies are switched ON.

**Notes:**

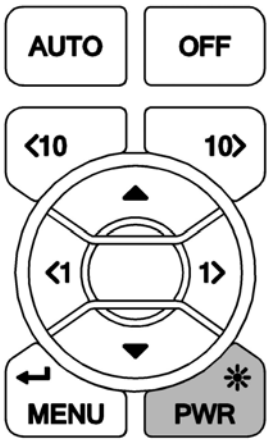
If the Pilot Display indicates **Fault 115** when engaged for the first time, check that the heavy-duty drive supply is switched ON. If it is off switch ON the heavy-duty supply and clear the fault message.

If the Pilot Display shows **Fault 104** when engaged, this indicates that there is no boat speed input from the sensor. This is normal if the Pilot is switched on at the dockside.

# GETTING STARTED

# GPD KEYS EXPLAINED

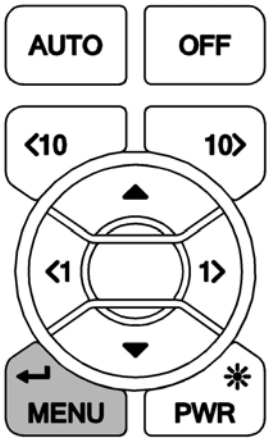
### Power / Lights




To power on/off the H3000 system press and hold the Power key until the unit powers up/powers down. At start up the Pilot screen will be displayed.

A Short press of the Power key will provide full background illumination on all system displays. Further short presses of the key decrease the illumination in three stages from full brightness to OFF. The next press of the key enables full illumination**.**

### Menu / Enter

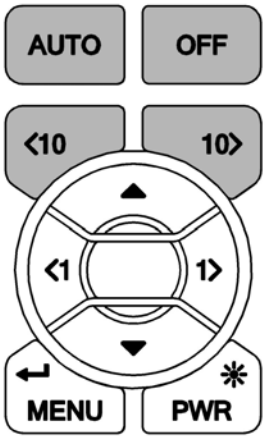



The Menu/Enter key either activates the main menu or actions a menu item.
When the GPD is in compass mode NORMAL pressing the menu key (MENU) will bring up the main menu as shown on page 19

However if a menu item is highlighted the key acts as an enter key to select the menu choice.

If editing a parameter this key also confirms the new value.

### Pilot function keys




These are dedicated function keys that will control the Pilot regardless of which menu you are navigating.

Pressing one of these keys whilst in any menu will bring up the Pilot screen and perform the relevant function at the same time.


**Auto:** When the Pilot is in standby a single press engages the Pilot. The Pilot screen will be displayed.


**Off:** (RED Button) When the Pilot is engaged a single press disengages the Pilot. The Pilot screen will be displayed.


**10º Port:** This is a 10º degree dodge function that changes the Pilot course by 10º Port.
The Pilot screen will be displayed.

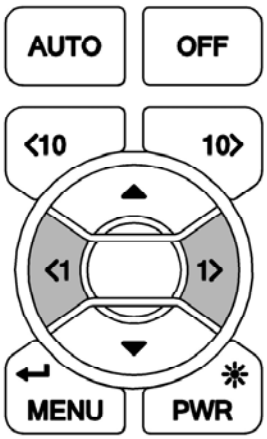

**10º Starboard:** This is a 10º dodge function that changes the Pilot course by 10º Starboard. The Pilot screen will be displayed.

**WARNING:** Pressing the Auto key when the Pilot is disengaged will engage the Pilot. Pressing the Off key when the Pilot is engaged will disengage the Pilot. **Be aware of your Pilot status before your use these keys!**

### 1º Keys

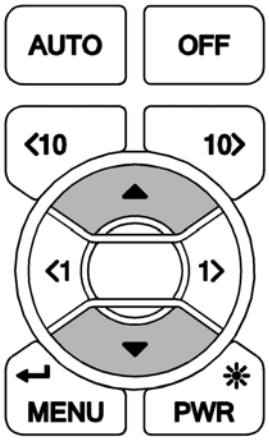
These function keys change the Pilot course by 1º Port or 1ºStarboard as applicable. When in compass mode you can use these keys to pre-set the course.

When navigating menus they perform as left and right action keys. Un this mode they do not affect the Pilot course.




### Up & Down

Navigate up and down within the Pilot screen and standard menu modes.



# GPD Menu Structure

The central concept to the operation of the GPD is the menu system; once this is grasped operation very quickly becomes familiar.

The idea of structured layers of menus is seen everywhere in modern software, and regular mobile phone or computer users should have a head start.

The principle is that at any one level there is a set of choices that you can scroll through until you find the one you want. Having found the correct menu entry, it is then selected by pressing ↵ (or ▶ key) the GPD then displays the next menu down.

Here you again scroll through the available options until you find and select your choice. In many cases this is as far as you will need to go, e.g. to choose a function for display.

To complete some actions such as entering a calibration value, switching on an alarm, and so on, you will need to navigate the GPD menus. Throughout this handbook there are some standard formats used to assist you.

Each menu choice selected will be in **CAPITALS.**
The page description / contents will be in **lower case.**

Indicates the menu key should be pressed to enter main menu

▶ Indicates scroll right, to enter a sub menu

◀ Indicates scroll left, to return to the previous menu

▼ Indicates scroll down / Reduce value

▲ Indicates scroll up / Increase value

↵ Indicates press Enter to confirm an action

Indicates 1º right

Indicates 1º left

Indicates Dodge 10º right

Indicates Dodge 10º left

At any time during the navigation of the GPD, press the AUTO key to return to the Pilot screen, and engage the Pilot.

At any time during the navigation of the GPD, press the OFF key to return to the Pilot screen, and disengage the Pilot.

At any time during the navigation of the GPD, press the <10 10> keys to return to the Pilot screen. If the Pilot is engaged it will dodge 10º in the direction that corresponds to the key press.

**Example 1:** Engaging the Pilot

At anytime whilst the Pilot is disengaged press AUTO to engage the Pilot. The Pilot will steer the boat to the currently selected course for the mode selected. e.g. in compass mode the current heading is selected as the desired course. In WIND T mode the Pilot will steer to the current TWA (True Wind Angle).

**Example 2:** Disengaging the Pilot

Press OFF to disengage the Pilot. The Pilot will be switched off and you will be required to take manual control of the wheel.

**Example 3**: To set a course from the Pilot screen

You must be on the Pilot screen and the Pilot must be engaged for you to be able to utilise this function.

**▼ Highlight SET COURSE ↵ ▲▼ Set the required course ↵**

**Example 4**: To set an alarm function.

MENU **SETUP ▶ ALARMS ▶ Select Alarm ▶Input Value ▶ Toggle ON/OFF ↵**

**Example 5:** Watch Alarm

The Pilot will sound an alarm (if an audible alarm is installed to the Instrument system) and cause all the system displays to display a warning at a pre-set time interval to keep the helmsman and crew alert. There are two selections:

**OFF**: The alarm is disabled (default).

**ON**: 1 to 360 - A number is set in minutes. The alarm is enabled when the value is entered.

To set-up **WATCH alarm**:

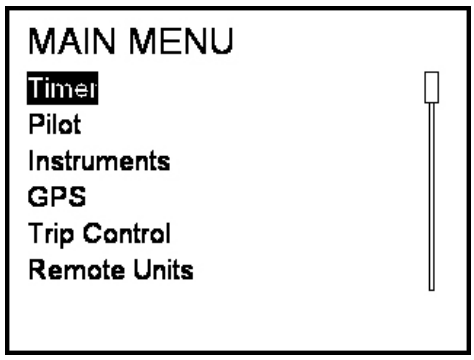

**SETUP ▶ ALARMS ▶ WATCH ▶ Using ▼▲ Set the required time ▶ Using ▼▲ turn on watch.**

# GPD MAIN MENU

Pressing the 

key will display the main menu.

Below is a list of the menu options, their functions, or setup information.




## TIMER

The timer is designed as a start / elapsed timer; it will count up from zero and will count down to zero if a time value is set.

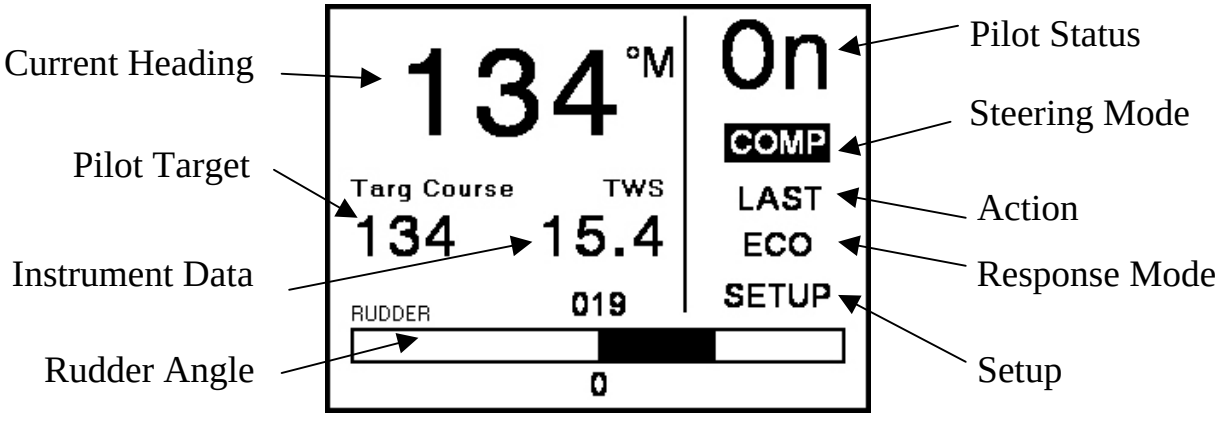
**TIMER ▶ ▼**

**SYNC** ↵ Jumps to the nearest whole minute. i.e. 4:45 or 5:07 both become 5:00
**START** ↵ Starts Timer
**SET** ↵ ▼▲ (Set countdown timer value) ↵ To timer menu.

## PILOT

Selecting Pilot will take you to the Pilot screen.

**PILOT ▶ Pilot Data Page**



## Current Heading

- Current system Heading

## Pilot Target

- Desired Course, Wind Angle, Bearing to Waypoint or Cross Track Error.

**Note:** This will display different types of data determined by which steering mode is selected.

## Instrument Data

- Displays one item of data from the H3000 Instrument system. TWS is the default but this can be changed to show any of the H3000 systems instruments data.

## Rudder Angle

- Graphic in 1-degree resolution, to Port or Starboard.
- Numeric value shown above graphic

## Pilot Status "ON" or "OFF"

Can be controlled by the ON/OFF keys on Pilot display, or RemoteVision.

## Steering Mode Indication

- COMP - Steer to Compass
- WINDA - Steer to Apparent Wind
- WINDT - Steer to True Wind
- NAV - Steer to Waypoint
- POLAR - Steer to Target TWA.
- POWER - Manual steering via the GPD Port & Starboard keys

## Action

- Last – Last course –Option in COMP mode
- Next – Next waypoint – Option in NAV mode
- Tack – Tack on command – Option in WINDA & T modes
- Gybe – Gybe on command – Option in WINDA & T modes
- Mid – Return to mid position – Option in POWER mode

## Response Mode

- ECON – Economy: The rudder movement is limited; this reduces the overall consumption of the autopilot system.
- NORM – Normal course keeping and rudder response.
- DWIND – Downwind: More active steering control especially for downwind steering in demanding conditions.
- PERF1 Performance. When a Gyro Compass is connected
- PERF2 you will have the performance option - PERF this
- PERF3 function has 4 levels that allow for manual
- PERF4 increase and decrease of steering response.

**Note:** ECON consumes the least amount of power when steering the Pilot but offers the slowest response to the Pilot processors information. PERF4 consumes the most power but has the highest response time.

## Setup shortcut

- Advanced Settings Menu.

**Note:** This menu can also be found via: **MENU ▶ SETUP ▶ COMMISSION ▶ PILOT ▶ ADVANCED SETTINGS**

See Page 64 for Advanced Settings

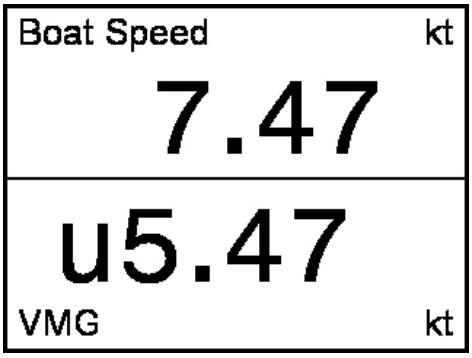
## INSTRUMENTS

There are six pre-set pages of instrument data.

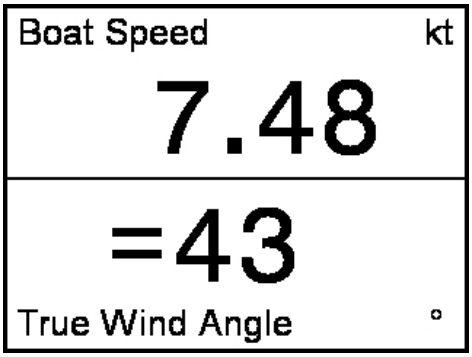

**INSTRUMENTS ▶**

Use the ▶ key to step through each of the instrument pages.

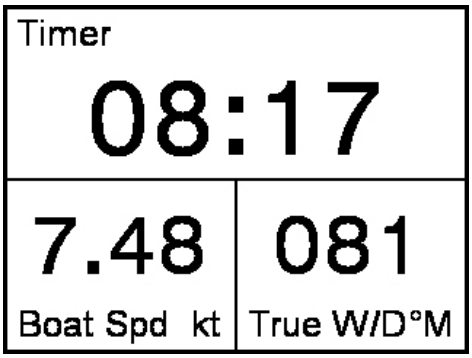
**Page 1:** Boat Speed - Velocity Made Good (VMG)



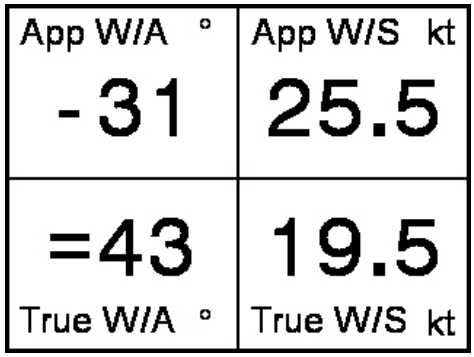

▶ **Page 2:** Boat Speed - True Wind Angle



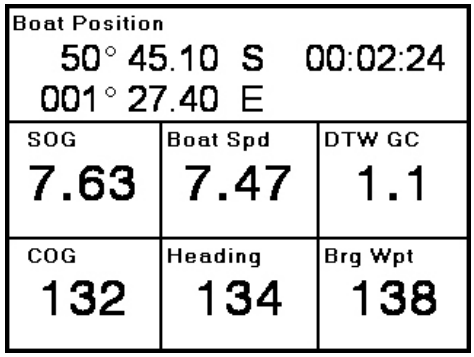

▶ **Page 3:** Timer, Boat Speed - True Wind Direction



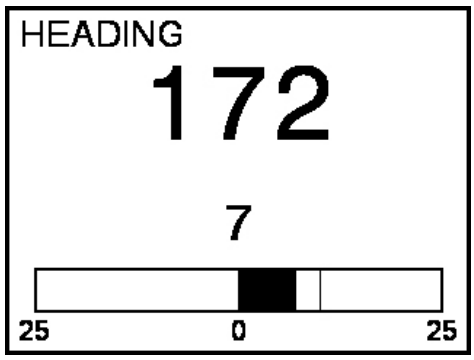
▶ **Page 4:** Apparent Wind Angle - Apparent Wind Speed - True Wind Angle - True Wind Speed




▶ **Page 5:** Boat Position – Speed Over Ground – Boat Speed – Distance to Waypoint – Course Over Ground – Heading – Bearing to Waypoint - Local Time




▶ **Page 6:** Steering Compass Graphic




## Displaying temporary information on any instrument page

It is possible to quickly access additional information from the instrument pages, you can display this data by following the example below.

To change the display data whilst navigating the speed and depth pages.

SPD/DEP **Select the page you wish to temporarily change ▼**

**Highlight the data you wish to change ↵**

**Select the new data to be displayed ↵**

**Note:** Any changes in configuration made to the current display page by this method are not stored, the page will return to its previous configuration when any other display page is selected. To permanently change contents see page 37

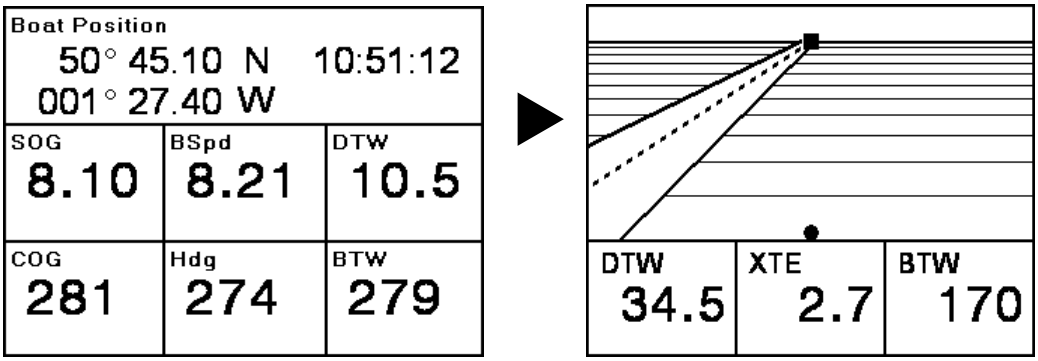
## GPS

There are two pages that show GPS data.

**Page 1** shows nine pieces of data:
Boat Position – Speed Over ground – Boat Speed – Distance to Waypoint – Course Over Ground – Heading – Bearing to Waypoint – Local Time

**Page 2** has a rolling road with three pieces of data: Distance to Waypoint – Cross Track Error – Bearing to Waypoint. Both shown below.

**GPS ▶ GPS Data Page 1 ▶ GPS Data Page 2**



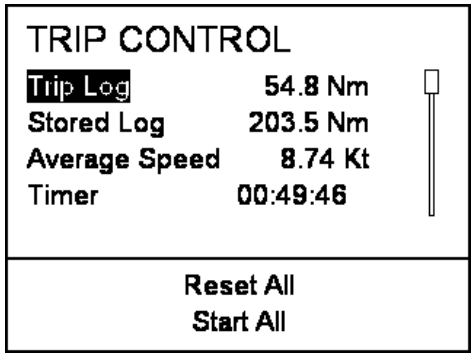

**Note:** This Information relies on a suitable GPS interfaced to the H3000 via NMEA 0183, or the USB port.

## TRIP CONTROL

This page shows all trip functions in one menu including the stored log that allows easy access to reset and start operations. The stored log is also displayed but cannot be reset.

When any trip function is started, all other trip functions that have been reset start simultaneously, except when the timer countdown is started**.** Under this condition, the other functions start, again if previously reset, when the countdown reaches zero**.**

This is designed for the beginning of races, so that you have DR, log and timer running automatically, from the race start time.




**Example 1:** Reset Trip Log

**TRIP CONTROL ▶ Trip Log ▶ ▼ Reset ↵**

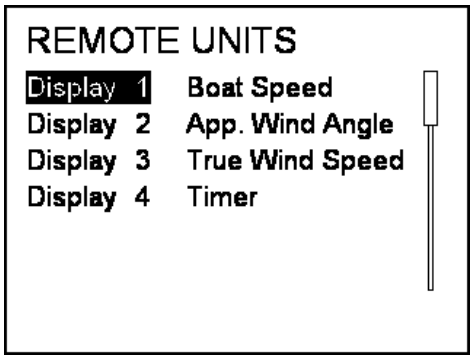
**Example 2:** Start all trip functions.

**TRIP CONTROL ▼ Start All ↵**

## REMOTE UNITS

This option provides remote control of any 20/20 or 40/40 type display. Below is an example of how to change the data shown on display 1.

**REMOTE UNITS ▶ Display 1 ▶ Boat Speed ▼▲ Select one of the 14 preset data pages ◀ Scroll left to save the new display data**




**Note:** When a display is selected, as shown above, the remote display will flash so you can identify the physical display unit you are controlling.

Below is an example of how to change any of the pre-set pages to display alternative data.

**REMOTE UNITS ▶ Display 1 ▶ Boat Speed ↵**

**This will display the data menu ▶ Highlight the required piece of**

**data ↵ Will bring you back to the remote units page.**

**Note:** The selected function data will then be stored in that particular remote display's preset page.

# SETUP

The Setup menu provides access to system alarms, calibration, damping, this display, and commissioning.

## ALARMS


**SETUP ▶ ALARMS**

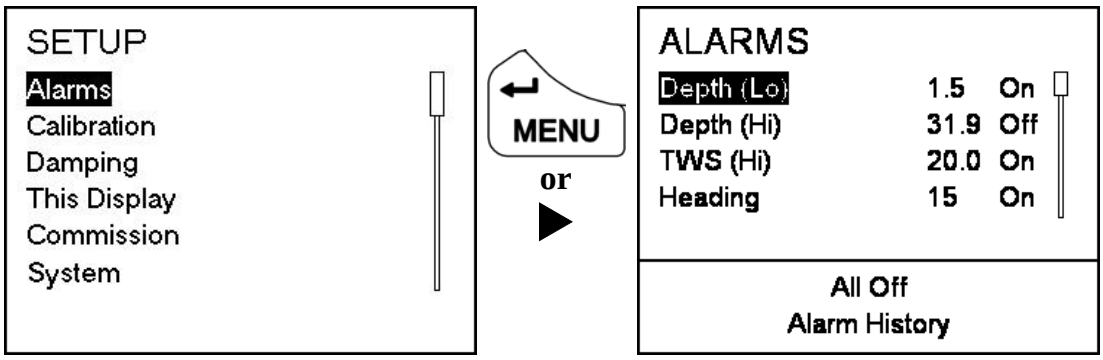
You can preset alarm parameters to trigger a warning when the set limits are reached. This will flash a message on the display to warn you. An audible alarm can also be installed. Any user alarm can be switched on or off.

There are 3 types of alarm. Hi, Low and Sector. The sector alarm is activated if you move outside a specified sector angle.

When an alarm is on and that alarm is triggered it will send a warning message to all GPDs and GFDs. FFDs will flash with the function that has triggered the alarm. If you select ignore then the alarm will not be displayed on that individual unit, but will continue to be shown on all other displays until silenced.

If you select 'silent' the warning screen will disappear on all displays.
The alarm will automatically become active again once you move back within the alarm limits.

Each time the alarm zone is reached it will trigger the alarm. You must set the alarm to off to deactivate it completely.




**Note:** All alarms can be turned off by highlighting **ALL OFF** in the alarms menu and pressing ↵

**Note:** Only the common alarms are listed. For other available alarms go to **ALARMS ▶ OTHER ALARMS**

**Example 1:** Setting Depth Low Alarm

**SETUP ▶ ALARMS ▶ Depth (Low) ▶ Set ▼▲ Lo limit ▶ Switch ▼▲ On/Off**

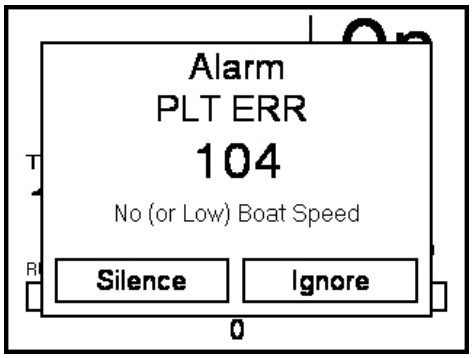
**Example 2:** Accessing Alarm History


**SETUP ▶ ALARMS ▶ ALARM HISTORY ↵**

Alarm History displays all alarms that have been triggered. This information is cleared when the power is switched off.

**Example 3:** No (or Low) Boat Speed Alarm

In the screen shot below the 'No (or Low) Boat Speed' Alarm is shown. To accept and clear remove the alarm window globally from all GFDs select **SILENCE** and press ↵**,** if you wish to remove this warning from the display you are using select **IGNORE** and press ↵




**▼ ◀ SILENCE ↵**

**▼ ▶ IGNORE ↵**

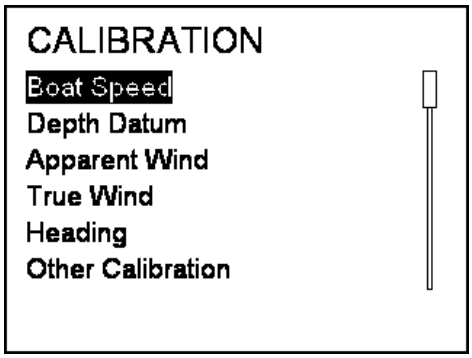
## CALIBRATION


**SETUP ▶ CALIBRATION**

It cannot be over stressed how important it is to calibrate the system properly, in both the initial stages of the installation and operation, and throughout the life of the system.

Calibration is an ongoing process and is something you must be aware of each time you go sailing. This is particularly relevant of the true wind calibration, where constant refining will pay huge dividends in accuracy.

To this end the process has been simplified as far as possible, so that all you require for accurate instrument data is some background knowledge together with a few simple techniques.




**Note:** Information regarding calibrating your H3000 system can be found in the H3000 Instrument Handbook.

## COMPASS CALIBRATION

B&G's Autoswing compasses contain software that allows them to record the magnetic fields in the yacht that are causing deviation errors. It calculates the corrections when the COMP CAL function is started and provided the following conditions are met: -

The 360° turn - Halcyon 2000 and Halcyon Gyro Stabilised Compass is completed in the same direction.

The rate of change of heading does not exceed 3°/s; i.e. the turn should take about 3 minutes to complete.

The rate of change of heading must not fall below 0.2 of a degree per second during the 360° turn, i.e. the turn must not take longer than 12 minutes.

The rate of change in heading is reasonably constant.

The compass is installed in a location a safe distance from magnetic interference such as iron keels, engines, loudspeakers etc.

Consideration should also be given to electrical cables which may carry high currents (e.g. large motors).

The compass is installed in a location as close to the centreline of the boat as possible. Avoid areas such as the fore peak and the sides of the hull where the effects of pitch and roll are at their greatest.

On steel hulled vessels, the compass will need to be installed above decks away from the effects of the hull.

## HALCYON 2000 COMPASS CALIBRATION PROCEDURE(Auto Swing)

Check for any magnetic devices placed near the compass, especially ones that are out of their normal places.

On a calm day select a stretch of open water with little traffic (so you will not have to take avoiding action which would affect the calibration). The flatter the water and the less the wind the easier it will be to meet the conditions for calibration.

Check for and avoid sailing close to any large steel structures nearby, that may cause additional, erratic deviations.

Now select:-


**SETUP ▶ COMMISSION ▶ START COMPASS SWING ▶**

The display will now show the degrees of turn completed so far. When the full 360 deg turn has completed within the limits described earlier, the display should say “PASS” to indicate a successful swing.

A “FAIL” indication suggest that the turn was not completed within the guidelines or quite possibly that there is too great a magnetic influence close to the sensor. This will require investigation before the swing process is retried.

Now the swing is complete its important to eliminate any constant error in heading due to the physical alignment of the sensor relative to the fore / aft line of the boat.

This is normally checked for by using shore-based transits, once the error is known it can be eliminated by entering the value into the system under:


**SETUP ▶ CALIBRATION ▶ HEADING ▶ SET OFFSET VALUE ▶ (Enter new value) ↵**

For example, the compass was reading 320º and it should read 316º, then the value to enter would be –4º from the current set value

**Note**

- The first time the system is switched on, or after a system reset, the Heading will alternate with CAL. This is to indicate to the user that the compass must be calibrated. This will disappear after the compass has been swung correctly.

## HALCYON GYRO COMPASS CALIBRATION and SETUP

This section describes the setup and calibration of the Halcyon Gyro compass connected to the H3000 system via the Halcyon Gyro Processor unit.

The conditions and preparations for performing an Auto swing are the same as described in the previous section for the Halcyon 2000 Compass.

Once ready to start the swing select:-


**SETUP ▶ CALIBRATION ▶ OTHER CALIBRATION ▶ MISC ▶ HALCYON ▶ START ▶ (Set value to 1 starts swing) ↵**

The display will now show the degrees of turn completed so far. When the full 360 deg turn has completed within the limits described earlier, the display should say, “PASS” to indicate a successful swing.

A “FAIL” indication suggest that the turn was not completed within the guidelines or quite possibly that there is too great a magnetic influence close to the sensor. This will require investigation before the swing process is retried.

Now the swing is complete its important to eliminate any constant error in heading due to the physical alignment of the sensor relative to the fore / aft line of the boat.

This is normally checked for by using shore-based transits, once the error is known it can be eliminated by entering the value into the system under:


**SETUP ▶ CALIBRATION ▶ HEADING ▶ SET OFFSET VALUE ▶ (Enter new value) ↵**

For example, the compass was reading 320 degrees and it should read 316, then the value to enter would be –4 from the current set value

## HEADING SOURCE SELECTION

The H3000 System can accept heading data from a variety of different sources. These different sources are known as Nodes and allow the system to identify which heading devices are connected to the system.

The list below shows the various sources of heading available with its respective address node:

## DAMPING


**SETUP ▶ DAMPING**

Another important facility that you need to be constantly aware of is the damping available on certain functions. This allows you to filter signal noise on the function when in unstable or rough conditions.

The damping works by applying a filter over a time period; the more you increase this time period, the smoother the data readings will be, but the longer it will take to see the effect of any change. Similarly the lower the time period the greater the jumps you will see in the numbers, but the response to any change will be faster. It is recommended to use the smallest value which still gives stable data.

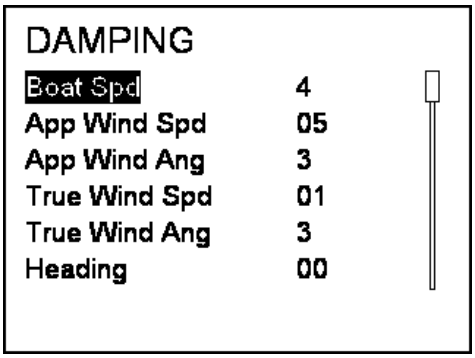
## DYNAMIC DAMPING


Dynamic Damping adjusts your system to deliver the most accurate and real-time information, i.e. when on a beat, it is essential that the wind angle information is accurate but steady with most ‘noise filtered out, however, when tacking, data needs to be more real-time. With Dynamic Damping, the damping value applied will reduce to almost zero during conditions when the data is changing rapidly and then settles again after the tack.

The Damping value is set (in seconds) to a steady state value, the Dynamic Damping is set to a value between 0 (off) and 10 (maximum), the higher the value, the more sensitive the function is to rates of change, and the faster the damping value is lowered.

This allows the effects of the change to be more readily seen on the instruments. As the rate of change of the function reduces, so the damping value is allowed to rise to the preset Damping Value to ensure signal noise is filtered out of the data.

Damping should not be confused with the update rate which is the number of times per second that the function value is sent to the display. The update rate is fixed for all the functions.



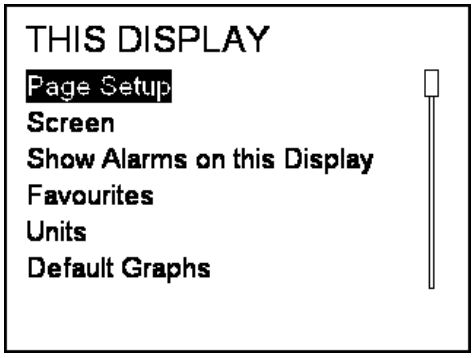

**Example 1:** Set Boat Speed Damping


**SETUP ▶ DAMPING ▶ BOAT SPD ▶ Set Value ↵**

# THIS DISPLAY


**SETUP ▶ THIS DISPLAY**

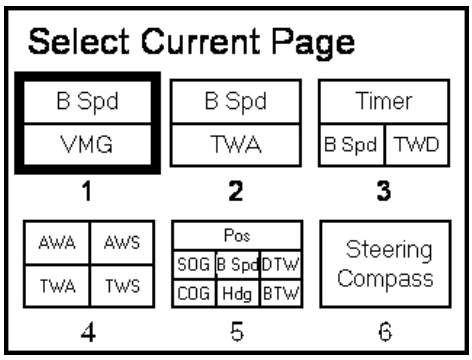
THIS DISPLAY menu is where you can modify the general settings of the GPD. Any changes to the default settings will be saved. To return to default settings go to **SETUP ▶ SYSTEM ▶ RESET OPTIONS ▶ THIS DIDSPLAY.** This will only affect the individual display unit.



## PAGE SETUP

You can reconfigure the Instrument pages are accessed from the Main Menu. You can change the default pages, and change how each page is configured.

Screen layouts can be selected for each page and configured to display whatever data is required. Once this has been changed it is saved for future use.




**Example 1:** To change data displayed on page 1

**Highlight the page that you want to reconfigure ↵**

**Select which page format you desire ↵**

**Highlight the display pane you wish to reconfigure ↵**

**Select the new data you wish to be displayed ↵**

**Note:** reconfiguring the page key in this manner will permanently change the displayed data. To return to the default pages see reset defaults on page 36

## Displaying temporary information on any data page

To enable you to quickly access additional information whilst navigating the data pages you can display this data by following the example below.

**Example 1:** To change the display data whilst navigating the instrument pages.

**Note:** Any changes in configuration made to the current display page will return to its previous configuration when any other display page is selected.

## SCREEN

The screen option allows modification of Lighting and Contrast settings.

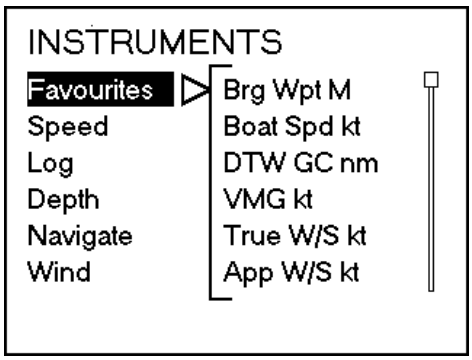
**SCREEN ▶ ▼ Highlight lights control ▶ Select local or system**
**▼ Highlight colour ▶ Select Red or White**
**▼ Highlight contrast bar ◀▶ to modify contrast**

## SHOW ALARMS ON THIS DISPLAY

Enable or disable alarms appearing on an individual display. This function is useful where many displays are installed next to each other and it is unnecessary for all to show alarms.

## FAVOURITES

Favourites enables you to configure six pieces of most commonly required instrument data. Normally these are six additional pieces of data that are not already allocated to the page keys.



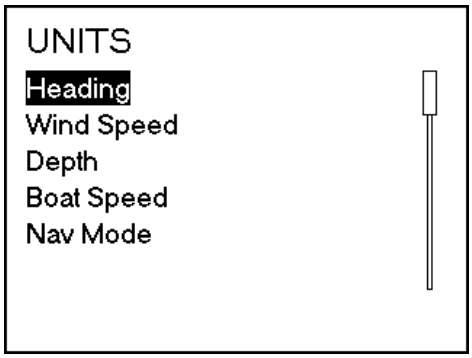

**Example 1:** Modifying the favourites menu.

**FAVOURITES ▶ (Select data header you wish to change) ↵**

**Highlight top-level data menu heading e.g. SPEED ▶**
**Select type of data e.g. BOAT SPEED Kt ↵**

## UNITS

Allows you to configure the units and type of measurement used for Heading, Wind Speed, Depth, Boat Speed, and Nav Mode.




**Example 1:** Changing the Heading reference from Magnetic to True.

**UNITS ▶ HEADING ▶ TRUE ºT ↵**

**GFD UNITS OF MEASUREMENT**

| GFD UNITS of MEASUREMENT | | | |
|---|---|---|---|
| **TYPE** | **OPTIONS** | **ABBREV** | **DEFAULT** |
| Heading | Magnetic | ºM | Magnetic – ºM |
| | True | ºT | |
| Wind Speed | Knots | Kts | Knots - Kts |
| | Metres/s | m/s | |
| Depth | Metres | m | Metres - m |
| | Feet | Ft | |
| | Fathoms | Fm | |
| Boat Speed | Knots | Kts | Knots - Kts |
| | Km Per Hr | KPH | |
| | Miles Per Hr | MPH | |
| Nav Mode | Great Circle | GC | Great Circle - GC |
| | Rhumb Line | RL | |

**GFD Units of Measurement**

### UNIT INFORMATION

Displays the current software version operating in your H3000 system


**SETUP ▶ THIS DISPLAY ▶ UNIT INFORMATION ▶**

### KEY LOCK

Pressing and holding the Menu and Lights key together will lock the keys to the GPD. There are two key lock settings that you can choose from.

| | |
|---|---|
| All Keys | Locks all keys except the OFF key |
| Pilot Keys | Locks Auto, OFF, ◀10º & 10º▶ |

All Keys is the default setting. Whichever key lock setting you select will be remembered

## COMMISSION

From the commission menu you can setup the H3000 system. From here you can decide to use SOG as boat speed, set which compass is being used, commission the Pilot, start a compass swing and setup a second depth input.


**SETUP ▶ COMMISSION**

## USE SOG AS SPEED INPUT

This sets the speed source used by the instrument system.

Choose between Boat Speed and SOG (Speed Over Ground) as your speed input. The default setting takes speed input from the paddle wheel sensor. If you choose to use SOG instead of boat speed this will take data from your GPS input. This can be used in the event of damage/fouling of the paddle wheel sensor and/or on very high-speed vessels where the sensor has limited contact with the water.

**Note:** If SOG is selected the Pilot will also be using SOG even if set to use boat speed. If you wish to use SOG only on the Pilot refer to page 65.

**Example 1:** Use SOG as speed input

**COMMISSION ▶ USE SOG AS BOATSPEED ▶ ON/OFF ▼▲ ↵**

## HEADING

This setting controls the source of heading data used by the instrument and Pilot system.

Select the heading source:

| Device | Node |
|---|---|
| CPU (NMEA input) | 5 |
| Halcyon Processor (“Halcyon Gyro” input) | 15 |
| Halcyon Processor (NMEA input) | 15 |
| Halcyon 2000 Compass | 16 |
| ACP Pilot (direct “Halcyon Gyro” input) | 18 |
| NMEA Input to NMEA FFD | 96, 97… |

**Heading Source**

**Example 1:** Set the heading source to use a Halcyon Gyro-Stabilised Compass connected directly to the PILOT ACP

**COMMISSION ▶ HEADING ▶ Select Source (18) ▼▲ ↵**

## PILOT

The Pilot can be fully commissioned via the GPD. For full detailed instructions on how to do this please refer to page 56

**COMMISSION ▶ PILOT**

## START COMPASS SWING

**Example 1:** Starting a compass swing.

**COMMISSION ▶ START COMPASS SWING ↵**

**Note:** The compass swing will automatically finish once a 360º turn has been completed. If the commission has been successful then the display will show PASS. If unsuccessful the display will show FAIL and the process will need to be repeated.

## SYSTEM

From this menu you can look up software versions and reset any B&G equipment on the network.

**Example 1:** Reset Options – How to reset this display


**SETUP ▶ SYSTEM ▶ RESET OPTIONS ▶ THIS DISPLAY ▶ Reset this display ▼▲ YES/NO ↵**

**Example 2:** System Versions - How to check the software versions currently installed on the system.


**SETUP ▶ SYSTEM ▶ SYSTEM VERSIONS ▶ THIS DISPLAY ▶ Shows current software version for that display.**

# PILOT OPERATION

## ENGAGING THE PILOT

From the **Pilot Display**: Steer the boat on the desired course, press the **AUTO** key to engage the Pilot.

From the **Hand-held Controller:** Steer the boat on the desired course, press the **Auto/Resume** Key to engage the Pilot.

## DIS-ENGAGING THE PILOT

**Note:** When the Pilot is engaged, the instrument system GFD and FFD Power-Off keys are disabled, preventing accidental switching OFF of the Pilot whilst in use.

At any **Pilot Display** press the **Red Off** Key. The Pilot immediately disengages and returns the boat to manual steering.

From the **Handheld Controller** press the **Red Off** Key. The Pilot immediately disengages and returns the boat to manual steering.

## CHANGING THE PILOT COURSE

**Note:** The **Pilot** can be immediately disengaged and the steering returned to manual control by pressing the **Red Off** Key on any Pilot Display or Hand-held Controller.

**Fine Adjustments** - Multiple key operations are added together to give the required course change, e.g. for a $5^{o}$ course change press the **$1^{o}$** button 5 times.

**Coarse Adjustments** - Multiple key operations are added together to give the required course change, e.g. for an **$11^{o}$** course change press the **$10^{o}$** + **$1^{o}$** button.

# PILOT MODE SELECTION

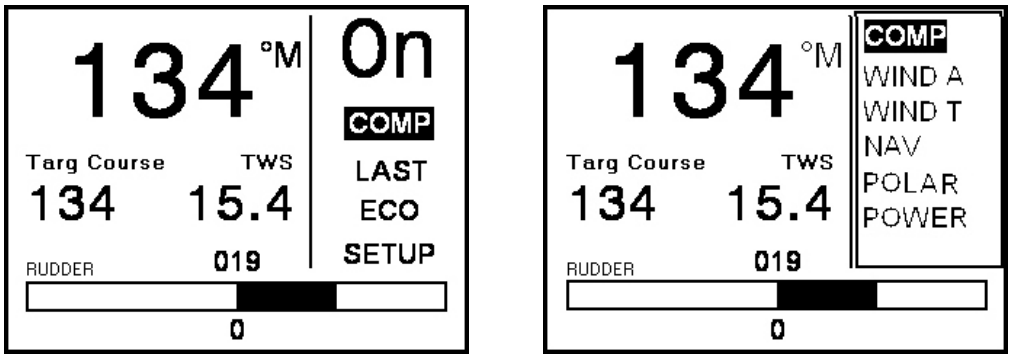
The Pilot software automatically determines which modes of operation are available depending on the boat type selection and available data.

When first switched ON the Pilot will be in Standby and Steer to Compass (**COMP**) mode.

There are up to 6 modes to select from:

**COMP** Steer to Compass
**WIND A** Steer to Apparent Wind Angle
**WIND T** Steer to True Wind Angle
**NAV** Steer to Waypoint
**POLAR** Steer to Target True Wind Angle
**POWER** Manual steering via the GPD Port & Starboard Buttons

The mode is changed by highlighting the mode indicator and press ↵.




**PILOT SCREEN ▼ highlight mode ↵ ▲▼ Select mode type ↵**

Each mode of steering is described in the following pages.

## STEER TO COMPASS (COMP)

Steer to Compass is available with all Pilot configurations and is the basic method of Pilot steering. The boat is steered on the desired compass heading and the Pilot is engaged with a single key press.

The Pilot will steer using heading data either from a Halcyon 2000 Compass connected to the Fastnet databus, a Halcyon Gyro Stabilised compass connected directly to the Pilot ACP processor, or from other system sources.

The Pilot Target will show your target course (Pilot Course)

## STEER TO APPARENT WIND ANGLE (WIND A)

This mode of steering is available to sailing boats that have a H3000 System fitted with a masthead Unit.

When **WIND A** is selected the Pilot will steer a course that maintains a pre-defined Apparent Wind Angle (AWA). If the wind shifts, or the boat moves off course, the Pilot will alter course so that the AWA remains the same.

The Pilot Target will show your desired AWA(Pilot AWA)

In general this works well when sailing upwind. For downwind steering to TWA may often prove more efficient.

## STEER TO TRUE WIND ANGLE (WIND T)

This mode of steering is only available to sailing boats that have H3000 system fitted with a masthead unit.

When **WINDT** is selected the Pilot will steer a course that maintains a pre-defined True Wind Angle (TWA). If the wind shifts, the Pilot will alter course so that the actual wind angle remains the same.

The Pilot Target will show your desired TWA (Pilot TWA)
This mode is particularly effective when trying to maintain a steady wind angle downwind when the boat tends to change speed significantly on waves.

## STEER TO WAYPOINT (NAV)

This mode of steering is available to both sail and powerboats. It is available for Pilot systems that are using a H3000 Instrument system, interfaced with a compatible position-fixing device using NMEA 0183 protocols.

When engaged in NAV mode the Pilot will steer a course using waypoint data from the position fixer programmed with the waypoint positions.

It is important to remember that when the Pilot is steering to a waypoint using NMEA data, any erratic data or positional errors generated by the position fixer will be transferred to the Pilot via the NMEA interface and the; instrument system. Position fixer errors can be due to many causes including: poor reception, bad satellite constellation, radio beacon chain transitions, local geography and high power transmitters.

Position fixer errors can cause steering inaccuracy. Always maintain a log and position plot on an up-to-date chart. Remember to check that the Pilot course (waypoint to waypoint) will steer the boat clear of any obstacles, taking into account the effects of tide and possible course errors.

Before using the NAV mode steer the boat manually until the XTE distance is less than 0.03 NM and the heading is close to the waypoint Bearing (Waypoint Course) as shown on the Pilot Display.

If XTE is more than 0.03 NM when the Pilot is engaged in Steer to waypoint mode, the course will be altered by up to $30^{o}$ to bring the boat back onto track.

The Pilot Target will alternate between your bearing to waypoint (BTW) and cross track error (XTE)

**Caution:** Before using NAV mode, check the following points:

The position fixer has a compatible NMEA 0183 interface set-up in accordance with the manufacturer’s instructions.

The appropriate NMEA sentences are selected and set to be transmitted. The minimum data requirement is XTE (cross track error); however, XTE and BTW give the best steering performance. For Pilot operation select any of the following NMEA sentences: RMB (best option), XTE, APA, or APB together with BWR or BWC.

The position fixer is switched ON and has the correct current position.

The signal and noise levels are within the manufacturer's recommended limits.

The waypoints have been entered correctly, and the waypoint arrival alarm is switched ON.

If using waypoints in a route or sail plan, the waypoints have been entered correctly and in the correct order, the direction of the route has been selected and the route is enabled.

## STEER TO TARGET TWA (POLAR)


Polar mode steers the boat to the Target TWA, this feature is available to sailing boats using the H3000 Hercules Performance CPU.

Data from the H3000 polar tables, stored in the H3000 Hercules Performance CPU allows the boat to sail at the Target TWA and is particularly useful for achieving maximum VMG (Velocity Made Good) upwind or downwind

The Pilot Target will show your Target TWA

## POWER (MANUAL STEER)

Power steer is available with all Pilot configurations, and allows the helmsman to directly control the rudder using either the GPD keys or the Hand-held Controller. When in Power Steer mode, the Pilot control software is by-passed and the key operations directly control the rudder drive unit.

Power steer can be used in an emergency if the normal manual steering linkage became defective.

# RESPONSE MODE

The Response Mode controls the response of the steering. Different selections are available dependent on whether the heading source is from the Halcyon Gyro-Stabilised Compass, or from standard heading source.

## Response Settings with Halcyon Gyro-Stabilised Compass

**NORM** – Normal course keeping and rudder response (default).

**ECON** – Economy: The rudder movement is limited, this reduces the overall power consumption of the Pilot system, however there is a slight reduction in course keeping.

**PERF 1** to **4** – Performance: Rudder movement is increased to give added course keeping performance at the expense of additional power consumption.

Of the four PERF settings, PERF 1 is the minimum setting and PERF 4 is the maximum.

## Response Settings with Halcyon 2000 compass or other sources

**NORM** - Normal course keeping and rudder response (default).

**ECON** - Economy: the rudder movement is limited, this reduces the overall power consumption of the Pilot system, however there is a slight reduction in course keeping.

**DWIND** – Down wind: The response is changed for down-wind steering by applying the rudder more quickly. This allows the Pilot to hold a better course in adverse conditions, such as sailing down-wind or with a quartering sea. However there is an increase in the power consumption.

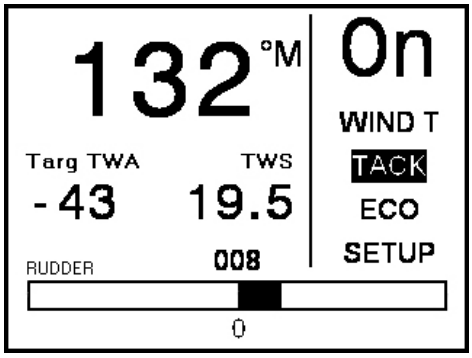
ECON consumes the least amount of power when steering and offers the slowest response time consumes the most power and has the highest response time down wind.

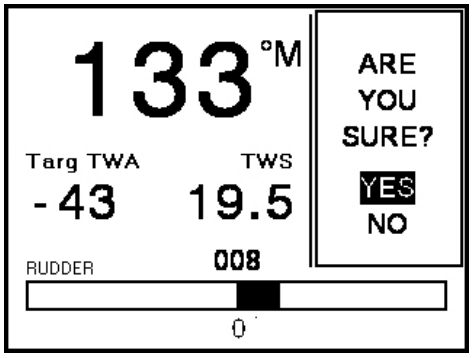
# ACTION

The action field will be populated with the relevant available action associated with the steering mode.

To implement the action, highlight the action on the Pilot screen press ↵, select YES, press ↵. The action will be implemented immediately.

**▼ Highlight the ACTION field ↵ Highlight YES ↵.**



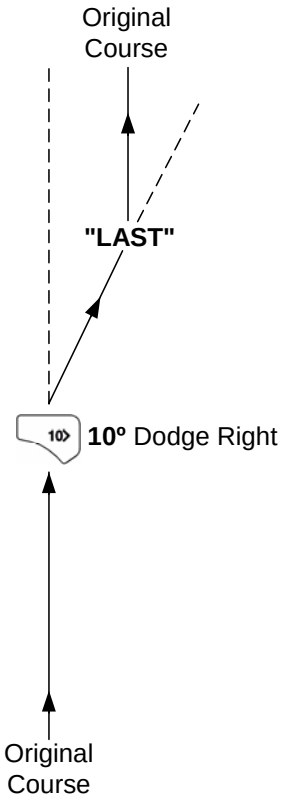

| MODE | ACTION | DESCRIPTION |
|---|---|---|
| COMP | **LAST** | Last Course |
| NAV | **NEXT** | Next Waypoint |
| WIND A & T | **TACK** | Tack on command |
| WIND A & T | **GYBE** | Gybe on command |
| POWER | **MID** | Return to Original Position |

**LAST:** In compass mode (COMP) As soon as you use the º10 left or right dodge keys to change course LAST will be shown in the action field.

When the boat is dodged 10º or a combination of 10º key
presses the last course is kept in the Pilots memory and LAST will appear in the action field.

Highlight the field as shown in the action example and press Enter.

Select Yes and press Enter. The Pilot will return the boat to the last course.



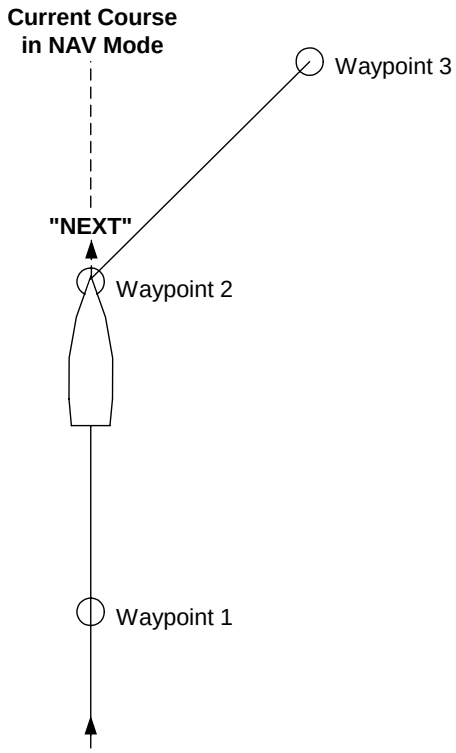
**NEXT:** In navigation mode (NAV) NEXT is shown in the action field as soon as you reach each waypoint.

Selecting NEXT will change your course to head towards the next waypoint. As the boat passes waypoint 2 NEXT will appear in the action field.

Highlight the field as shown in the action example and press

Select Yes and press enter. The Pilot will steer the course to the next waypoint.

**WARNING:** If no action is taken the boat will continue on its current course.

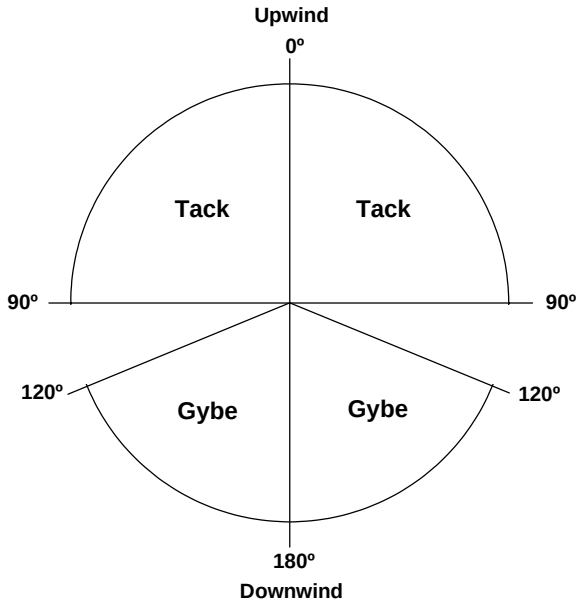



**TACK & GYBE:** In WIND A & WIND T modes depending on whether you are sailing upwind or downwind you will be given the option to TACK or GYBE in the action field.

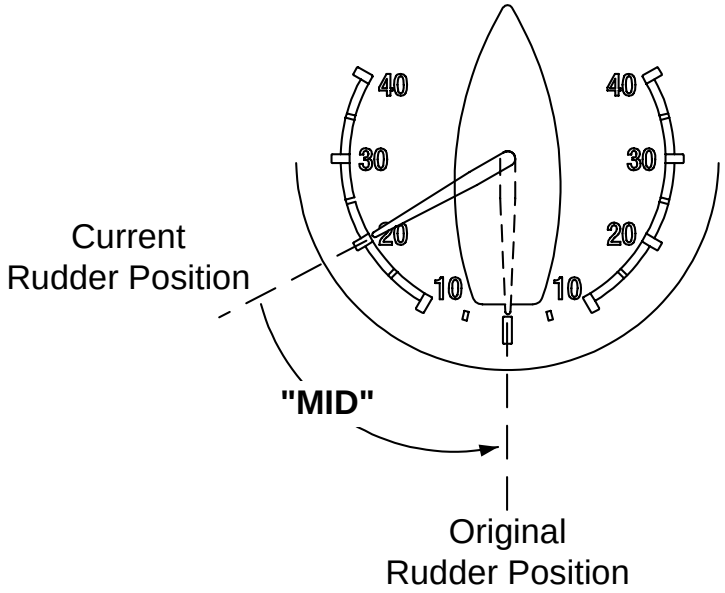
As shown in the diagram, when sailing upwind TACK will be shown in the action field. The tack option is available up to 90º TWA.

When sailing downwind GYBE will be shown in the action field. The gybe option is available from 120º to 180º TWA

Between 90º and 120º the action field will remain blank.



**MID:** In POWER mode MID is shown in the action field at all times.




When you manoeuvre the boat in power mode via the GPD the rudder will move from the original rudder position, which keeps you on a straight course. To return the rudder to this position highlight the field as shown in the action example and press ↵.

Select Yes and press ↵. The Pilot will then return the rudder to the original position.

# SETUP

Setup takes you directly to Advanced Settings. See page 64 for details of these settings and how to update and modify them.

# COMMISSIONING

Before the H3000 Pilot can be used, it is necessary to carry out some commissioning procedures. This encompasses the setting and calibration of various parameters, installation and functional checks of the Pilot equipment. These items are listed below.

The procedure for commissioning can be divided into two stages. The first stage is carried out alongside at the dock and the second stage is performed during the course of a sea trial. The order in which the commissioning procedures are carried out is not the order in which they appear in the menu.

This manual covers both the ACP 1 (25A) and ACP 2 (40A) Pilot Systems.

### Pilot Installation Check List

The checklist below should be used before the commissioning of the Pilot to ensure that the entire system is functional before applying power.

### Drive Unit and Steering System

Drive unit securely fixed to a rigid part of the boat structure.

Correct gauge of power cable has been selected.

### Hydraulic Rams

Mechanical end stops must limit the rudder movement, not the stroke of the hydraulic ram.

Split pins and spacers that secure the ram to its mounting foot are secure.

Absence of oil leaks.

Correct diameter bolt in universal ball joint, correct size hole in tiller.

Ram free to move side to side and up and down throughout the rudder travel.

Oil reservoir is at the highest point if external to the Ram.

## Hydraulic Pumps

Pump unit is shielded from the direct effects of the elements.

Minimise the lengths of the hydraulic lines from the pump to the cylinder and where possible the pump motor supply cables.

Absence of oil leaks.

Absence of air in the hydraulic system.

## Rotary Drives

No backlash or excessive slackness in chains/linkages.

## Rudder Reference Installation

Base securely fixed to boat structure.

Arm securely fixed to boss.

Ball joint securely fixed to arm.

Linkage has not been over extended.

No slack or backlash in the linkage.

Linkage does not foul when rudder moved hard over to hard over.

Arm moves through at least 90° when rudder moved hard over to hard over (there must be at least a 1.0V difference between the end stops).

Ball joint securely fixed to quadrant/tiller.

## Compass Installation

Mount the unit according to the installation guidelines.

Fitted as near to centre of motion of boat as other factors allow, aft of centre preferred as there is usually less motion than forward of centre.

A safe distance from external magnetic interference: 1m/3ft from VHF, loudspeakers, depth sounders, engines, power cables carrying heavy current, etc., 3m/(10ft) from radar and SSB equipment. Check the other side of bulkheads.

## Electronics Installation

Cables secure.

Cables undamaged.

No loose bits of wire.

Screens connected in accordance with wiring instructions and sleeved where appropriate.

## Parameters to be Set

The following is a list of the parameters that have to be set during commissioning.
These parameters must be set and configured prior to using the Autopilot.

| Parameter | Page No. |
|---|---|
| Boat Type: Select Sail, Power Planning or, Power Displacement | 56 |
| Compass Swing: Compass deviation correction | 31 |
| Heading Source: Compass data selection | 35 |
| Heading Offset: Compass alignment correction | 31 |
| Magnetic DIP angle compensation: | 68 |
| Rudder drive type selection | 57 |
| Rudder end stop Port position | 57 |
| Rudder end stop Starboard position | 58 |
| Rudder Mid position | 58 |
| Rudder hard over time | 58 |
| Speed sensor calibration | 69 |
| Boat waterline length in meters | 70 |
| Boat Lag value | 64 |
| Rudder Gain value | 62 |
| Watch alarm lock – Disables alarm ON/OF control | 71 |

# PILOT COMMISSION

## DOCKSIDE SETUP

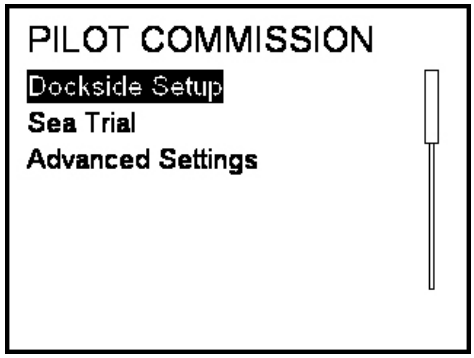
The following parameters must be set and configured before leaving the dockside.

When you leave the dockside follow the sea trial instructions before using the Pilot.


**SETUP ▶ COMMISSION ▶ PILOT ▶**

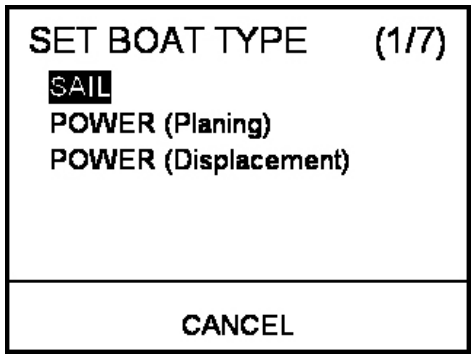
**Step 1:** Select Dockside Setup

**▶ Highlight Dockside Setup ↵**



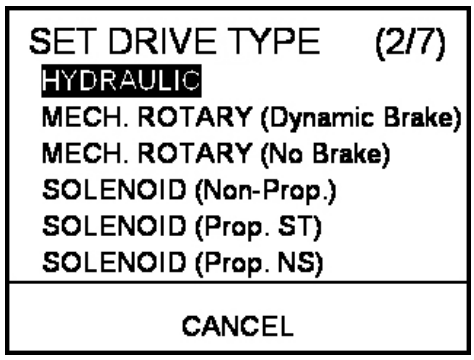

**Step 2:** Select the Boat Type that the Pilot is fitted to.

**▶ SET BOAT TYPE ▼ Select Boat Type ↵**



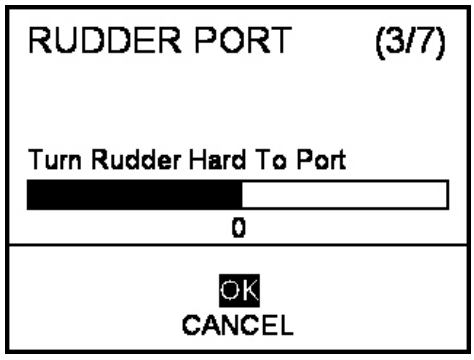
**Step 3:** Select the Drive Type that is fitted to the boat. This information should be available in the documentation that was supplied with the vessel. We recommend that a visual confirmation of this is made before proceeding.

**▶ SET DRIVE TYPE ▼ ↵**



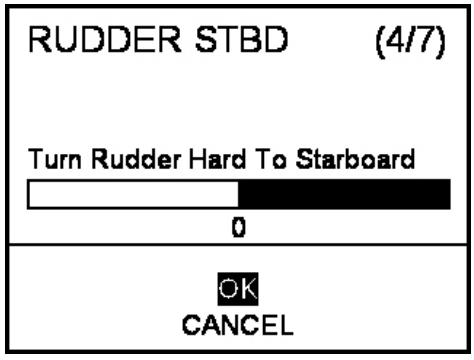

**Step 4:** Turn rudder hard to port so that the wheel is turned until the rudder gets to its physical end stop. This enables the Pilot to know its maximum possible extent of the rudder travel.

**▶ TURN RUDDER HARD TO PORT ▼ OK ↵**



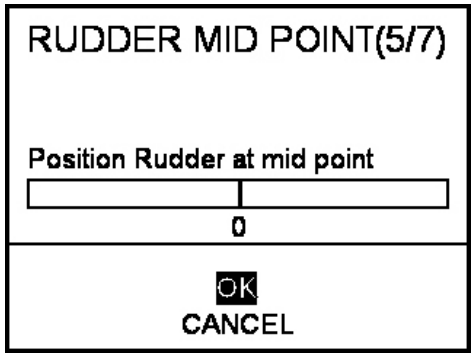

**Step 5:** Turn rudder hard to starboard so that the wheel is turned until the rudder gets to its end stop. This enables the Pilot to know its maximum possible extent of the rudder travel.

**▶ TURN RUDDER HARD TO STARBOARD ▼ ↵**




**Step 6:** Set the rudder to the mid position. This stores the rudders mid position. This is reset during the sea trial so absolute accuracy is not critical at this stage.

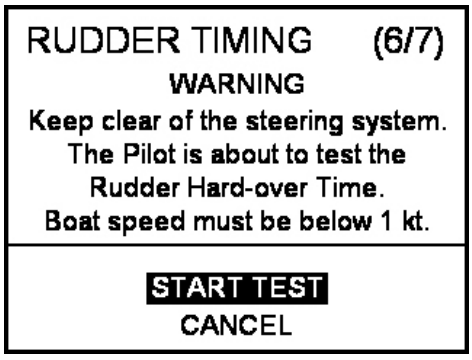
**▶ SET RUDDER MID POINT ▼ ↵**

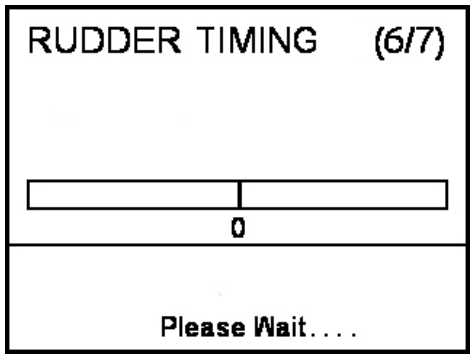



**Step 7:** Start hard over time test. This will turn the rudder hard to port then hard to starboard back to port and then return to the mid position.

**WARNING: Stand well clear of the boat wheel as in many cases this will turn as the rudder is moved from side to side.**

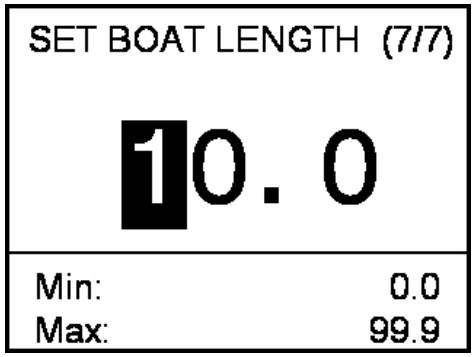
**▶ TEST RUDDER HARD OVER TIME ▼ START TEST ↵**



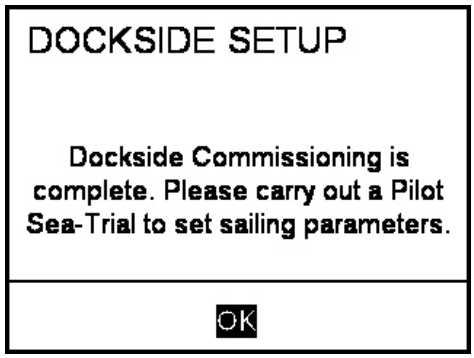
**Step 8:** Set the waterline boat length. This is the length of the boat in the water from stern to bow. Highlight each number individually and modify using the up and down keys ▼▲ **Set the boat length in meters** ↵

**▶ SET WATERLINE BOAT LENGTH ▼▲◀▶ ↵**




After you have set the boat length dockside commissioning is complete. Select OK to return to normal operation.

**▶ DOCKSIDE COMMISSIONING IS COMPLETE ▼ OK ↵**



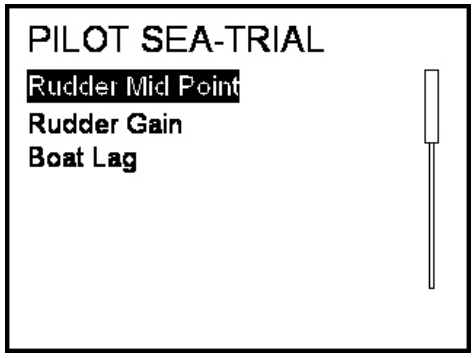
# SEA TRIAL

Before using the Pilot the following parameters must be set and configured during a sea trial.


**SETUP ▶ COMMISSION ▶ PILOT**

**Step 1:** Select Sea Trial

**SEA TRIAL ↵**

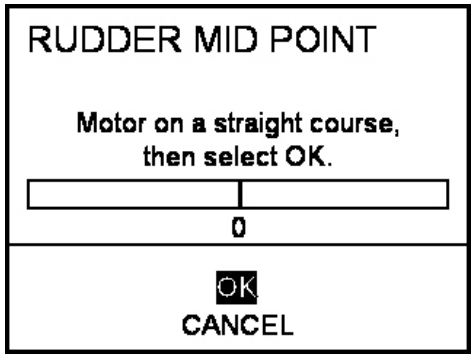



**Step 2:** Set Rudder Mid Point.

Steer the boat manually under motor at a speed no greater than 15 knots. Head towards a landmark and maintain a straight course.

The rudder bar may well show a slight deviation from the centre line that was set at the dockside. When you are happy that you are on a straight course highlight OK without moving the wheel and press ↵ This will reset the rudder mid position to zero.

**▼ RUDDER MID POINT ↵**



**Step 3:** Set Rudder Gain

When the Pilot is part of an integrated system; boat speed data is supplied via Fastnet network from the H3000 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 approximately $6^o$ per second for a sailing boat or $8^o$ for a power boat.

If there is no direct speed input, or the speed source is set to manual, the Rudder Gain value must be entered manually; for these types of installations omit this section and proceed to Manual Rudder Gain below.

**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 **Compass** mode.

**AT A SPEED NOT EXCEEDING 15 KNOTS**, make a minimum of 6 large course changes of at least **$100^o$** (ideally 170°) by multiple presses of the $10^o$ course change buttons on any GPD or Handheld Controller. This enables the Pilot to learn the rudder gain value.

When the Pilot has learnt the rudder gain value the rate of turn will be approximately $6^o$ (sail) or $8^o$ (power) per second.

Press the **Off** Key to disengage the Pilot 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 **Compass** mode.

**AT A SPEED NOT EXCEEDING 15 KNOTS**, make at least six large course changes of at least $100^o$ by multiple presses of the $10^o$ course change buttons on any GPD or Handheld Controller.

Observe and estimate the rate of turn. It should be approximately $6^o$ to $8^o$ per second.

Observe the performance of the Pilot when changing course. The rudder gain value is inversely proportional, therefore 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 $6^o$ to $8^o$ per second.

| Boat Type | Factory Set Value | Typical Values |
|---|---|---|
| Sail | 2.0 | 1.0 to 3.0 |
| Power | 0.8 | 0.3 to 1.0 |

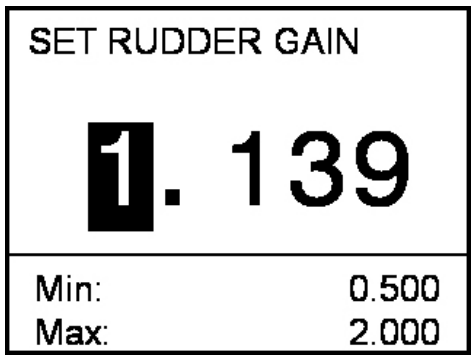
**Rudder Gain Value**

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

**SETTING THE RUDDER GAIN VALUE**

The Pilot must be disengaged and in commissioning mode to adjust the Rudder Gain value.

**▼ RUDDER GAIN ↵ ◀▶▲▼ Adjust value ↵**




**WARNING:** When manually changing Rudder Gain use small increments (0-1) and test between each change. Very low values can cause steering instability.

**Step 4:** Boat lag

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

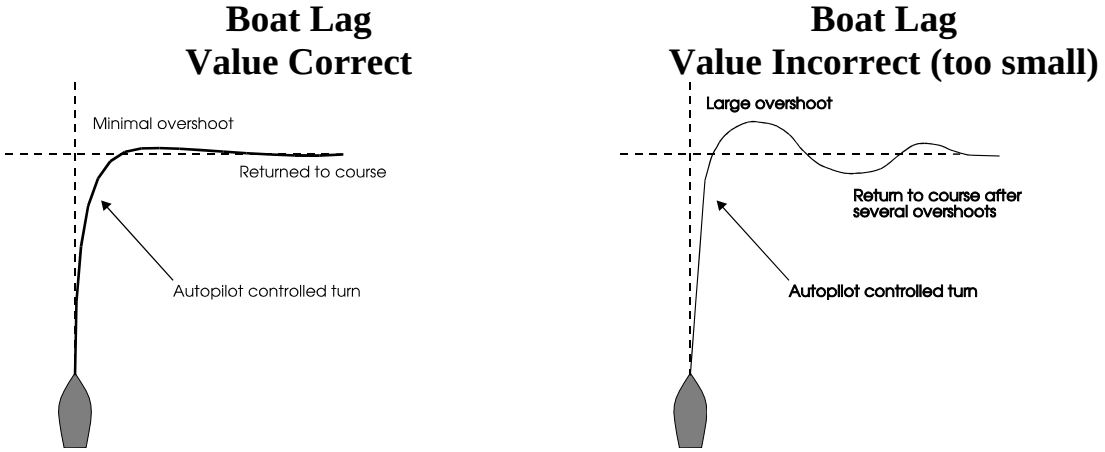
**Checking the boat lag:**

At a speed not exceeding 15 knots, change course by $90^{o}$ in either direction.

Observe the Pilot 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 $5^{o}$ for course changes in both directions increase the Boat Lag value in steps of 0.1 until the overshoot is corrected.

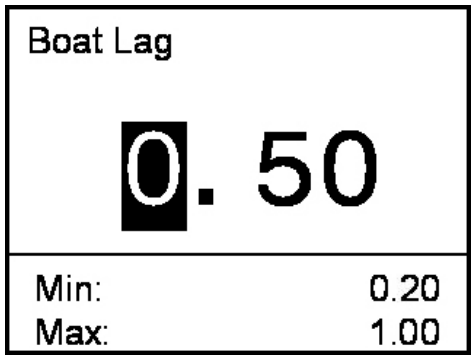
It is easier to spot overshoot than undershoot, hence if no overshoot is observed decrease the boat lag in steps of 0.1 until a small overshoot is seen. Use the smallest value of Boat Lag possible to minimise overshoot.




**Boat Lag Response**

**Setting the Boat Lag Value**

**▼ BOAT LAG ↵ ◀▶▲▼ Adjust value ↵**

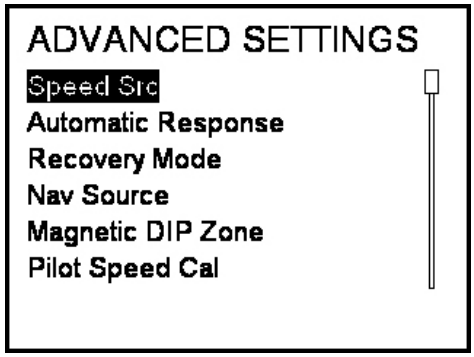



# ADVANCED SETTINGS

These are optional settings that can be configured to optimise the performance of the Pilot. These settings are not essential for the Pilot to operate correctly.

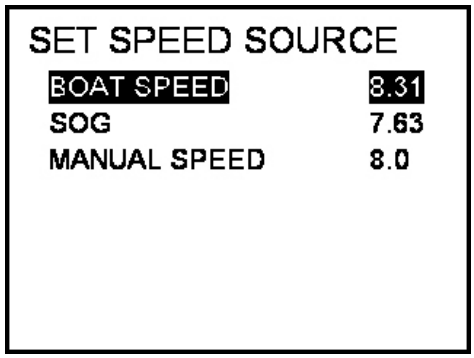

**SETUP ▶ COMMISSION ▶ PILOT ▶ ADVANCED SETTINGS**

From the advanced settings menu you can access and modify the Pilot specific settings.



## SPEED SOURCE

The Speed Source set-up allows the source used for speed data to be selected.




To select the desired speed source ▼ **Highlight the required source** ↵

When manual speed is selected you will also need to set the speed value. Use the ▲▼ keys to adjust the value in increments of 0.5 to the desired speed within the range 0.5 to 60.0 and press ↵

The default value for a sailing boat is 8.0 knots and 25.0 knots for a powerboat.

## AUTOMATIC RESPONSE

This option is only available if a Halcyon Gyro Stabilised Compass is fitted.

The Auto Response set-up enables the Pilot to automatically alter the response level. There are four options available:

**Off**: The Pilot will always remain in the response mode selected.

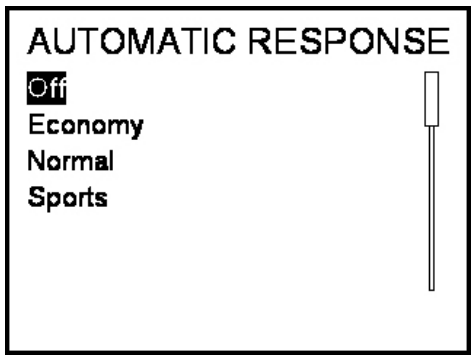
**Economy**: The Pilot will need to sense large environmental changes before increasing the response setting.

**Normal**: The Pilot will respond to moderate environmental changes state before increasing the response setting.

**Sport**: The Pilot will be most sensitive to changing conditions and will automatically increase its response rate to counter environmental changes.

The Automatic Response mode will never reduce the response setting below the manually set value.

When the conditions have improved the Pilot will automatically return to the manual response setting.




## RECOVERY MODE

This function is only available when a Halcyon Gyro Stabilised Compass is connected to the system.

Recovery Mode allows the user to set the sensitivity to course errors. Pilot to react to unexpected events, for example sudden wave or wind shifts. This function allows the Pilot to instantaneously increase the steering response to its maximum setting (PERF 4), and make a rapid recovery.

The Recovery Mode will automatically switch off after 15 seconds or when the heading error has been corrected. The Pilot will then resume the previous response setting and continue normal operation.

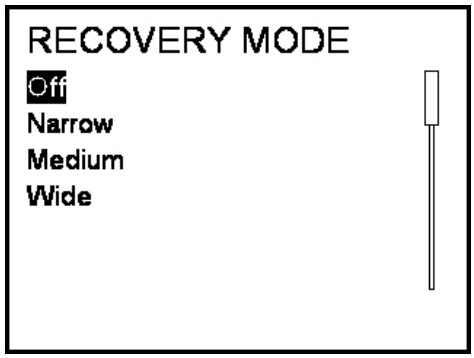
There are four options available.

**Off**: The Recovery Mode function is switched off.

**Narrow:** The Pilot is most sensitive to sudden course changes corrected.

**Medium:** The Pilot is configured to the medium value when correcting sudden course changes.

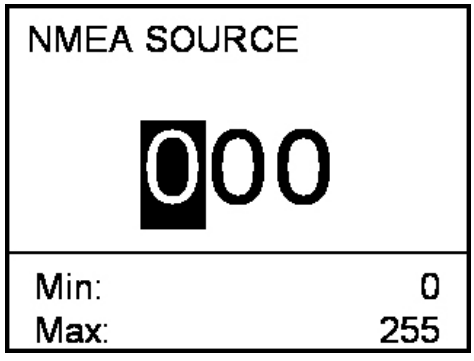
**Wide:** The Pilot is least sensitive to sudden course changes.




## NAV SOURCE

Nav Source allows the selection of a NMEA input on the system to use as the primary source of navigation data for the Pilot Steer to Waypoint mode. In most systems, where there is only one source of NMEA navigation data, this can be left on the default setting of zero which will automatically prioritise the navigation data from that source.

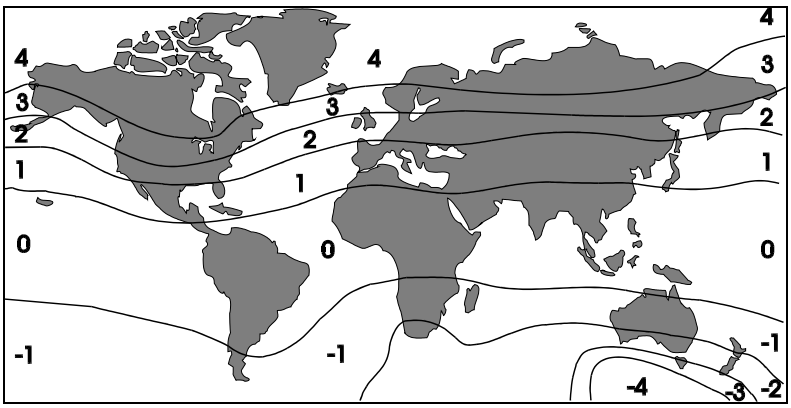
If you have more than one source of data it is necessary to enter the node address of the source you wish to use, normally this value will be for either the CPU (node 5) or a NMEA FFD (node 96, 97...).



## MAGNETIC DIP ZONE

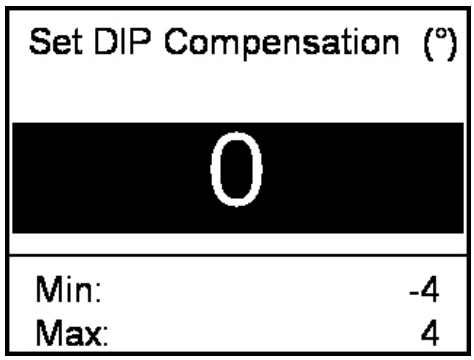
All magnetic compasses are affected by “northerly turning errors” in the northern hemisphere or “southerly turning errors” in the southern hemisphere, which increase with boat speed and magnetic DIP angle in higher latitudes.

These can cause heading instability at boat speeds greater than 20 knots when steering with a Pilot. By entering the dip value indicated on the compensation chart, the Pilot will be able to correct for these errors and improve the heading stability.




Select Magnetic DIP zone from the menu. Enter the value using the ▲▼ keys and press ↵. Use the minimum value necessary to stabilise the heading.

**Note:** This applies to boats faster than 20 Knots only.

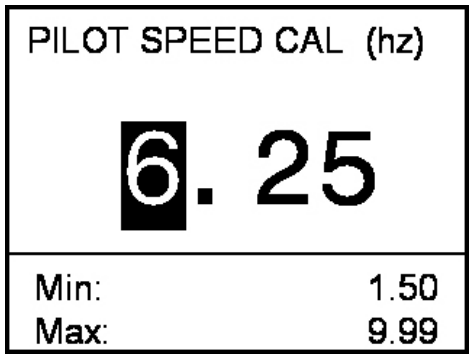


## PILOT SPEED CAL

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 Fastnet network from the instrument system, this facility is only used when the installation does not include a compatible instrument system.

All B&G paddle wheel type speed sensors are compatible. The Hertz/Knot value is entered into the system to ensure the Pilot steering response is controlled with reference to an accurate boat speed. The default Hertz/Knot value is 3.80; this is the default 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/speedometer fitted.




**Setting the Speed Calibration Value**

**Note**
The speed cal reading is inversely proportional; i.e. to increase the boat speed, decrease the Hertz/Knot value.

**Joystick Type**

The joystick allows direct control of the rudder via the Pilot computer for quick and responsive steering. Joystick steering is engaged and disengaged with the separate Red Joystick Button. The lever can only be moved to port or starboard.

There are two joystick steering options available to the helmsman:

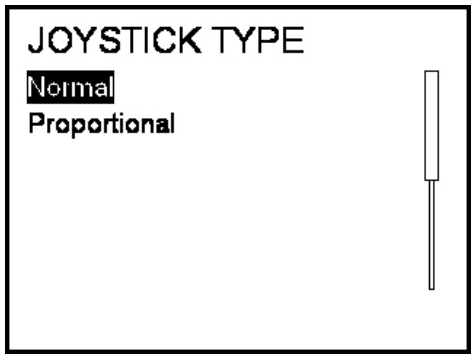
**Normal Steering:** The rudder moves in the direction of the joystick movement, when the joystick returns to the central position the rudder movement

stops. The greater the movement of the joystick, the faster the response of the rudder.

**Proportional Steering:** The position of the rudder follows the position of the joystick. When the joystick returns to the central position the rudder returns to its initial position.

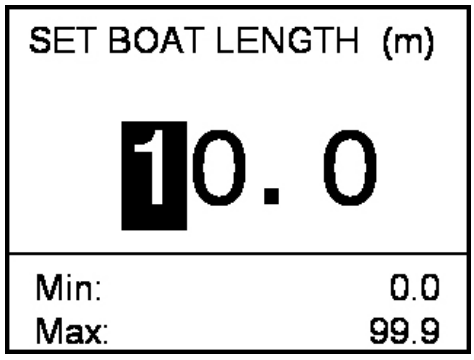
Joystick mode can only be engaged by using the Joystick Button. Select Normal or Proportional via the GPD by highlighting your selection and pressing ↵. This is the mode that will be used when you engage the Pilot via the Joystick button.

When the Pilot is engaged in Joystick mode the rudder position at the moment of engaging will become the central (null) position of the joystick. To counteract any external influences on the steering, e.g. wind and tide, steer the boat on to a straight and steady course before engaging the Pilot.




**Boat Length**

Use the ▲▼ keys to set the waterline length of your boat. Highlight each digit individually and change it accordingly. Press ↵ when this is completed.

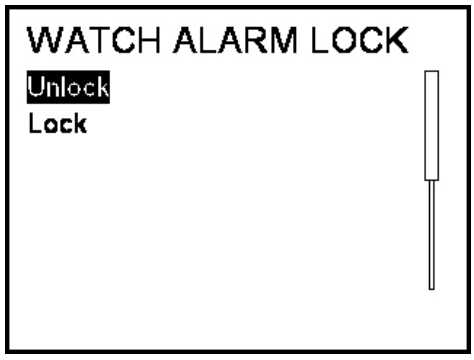


## Rudder Max Angle

This sets the maximum angle of the rudder between 25º and 45º. The default angle is 40º. The angle should be set to match the physical value from centre line to rudder end stop on the boat.

## Watch Alarm Lock

Watch Alarm Lock removes the ability to disable the watch alarm via the normal Alarms menu. The Watch Alarm lock must be unlocked before alarms can be disabled.



# INSTALLATION INFORMATION

# CABLE AND CONNECTION INFORMATION

## EMC Compliance

B&G equipment is designed to be operated in leisure craft. Every care has been taken in the design and testing to ensure compliance with the European EMC Directive. Provided the equipment is installed and operated in accordance with the instructions supplied and the units and cables are used unmodified no problems should be encountered. Specific attention is drawn to the requirements to maintain cable separation, where stated. To comply with these regulations:

Ensure proper connection of cable screens.

Transmissions from poorly installed or maintained Single Sideband (SSB) equipment may adversely affect the functioning of this equipment. On vessels fitted with an SSB, it is essential that such equipment be installed following good installation practice and as recommended by the manufacturer.

## General Wiring Notes

**CAUTION: Do not apply power to the Pilot system until all units are connected and the wiring has been checked.**

Where spade connectors are supplied always use the correct crimping tool to attach them to the cable. This is extremely important where cables carry high currents, i.e. rudder drive unit supply cables (ACP 1 - 25 Amps or ACP 2 - 40 Amps).

Keep supply cables as short as possible to reduce voltage drop in the cables.

Always fit a suitable fuse or circuit breaker in supply cables. A 25 Amp (ACP 1) or 40 Amp (ACP 2) MCB is essential for the heavy-duty power cables.

Clearly identify each cable to prevent incorrect connection.

All cables should be routed at least 1m/(3ft) from cables or components that carry or generate high currents, e.g. alternators, starter motors and cabling, trim-tab cables, etc.

To minimise interference avoid routing Network cables alongside high power radio or Radar cables, allow 3m/(10ft) spacing, or within 1m/(3ft) of engine starter motors and cables and other cables carrying heavy current.

To prevent damage to cabling always secure in position using cable clips or tie-wraps. Where cables pass through bulkheads always protect the cable from chafing by installing grommets.

Do not allow cables to rest in the bilge where prolonged immersion in water, fuel etc. could occur.

Always fit splash covers and lids on processors, computer units and junctions boxes, where supplied.

## Pilot Drive Unit Cables

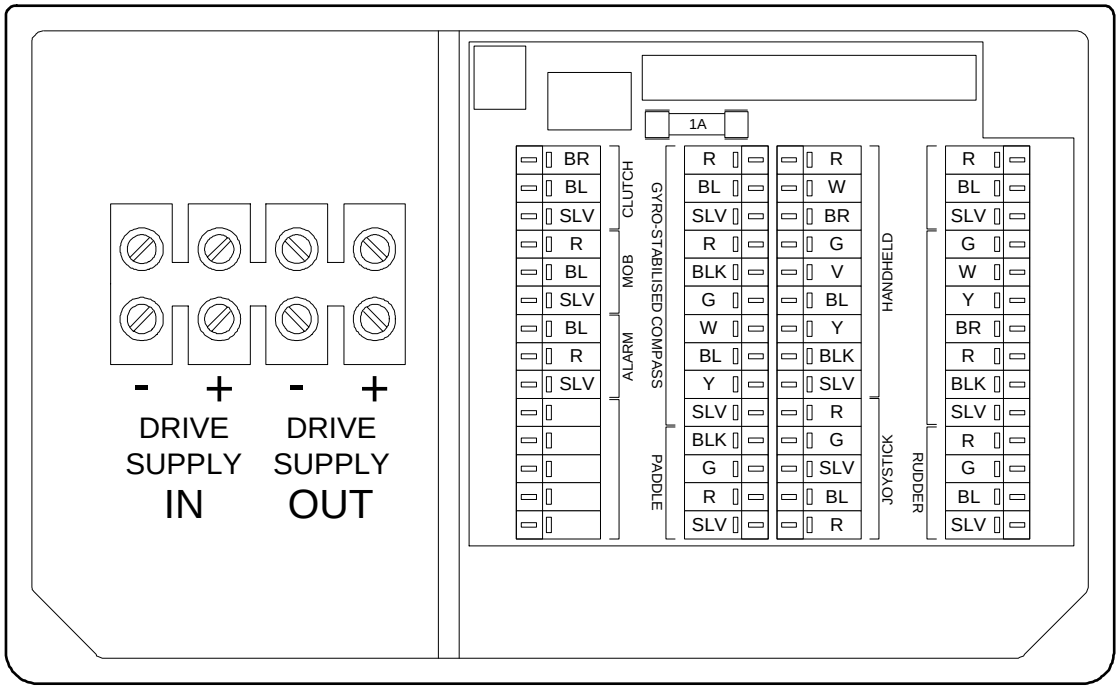
| Cable Length | B&G Cable Part No. | Copper Area | Cable Gauge |
|---|---|---|---|
| Up to 8m/(26ft) | 135-0A-128 | 4.0mm² | 12 AWG |
| Up to 12m/(40ft) | Not available | 6.0mm² | 10 AWG |
| Up to 20m/(65ft) | Not available | 10.0mm² | 7 AWG |

All Rudder Drives - Heavy Duty Power Cables

| Cable Length | B&G Cable Part No. | Copper Area | Cable Gauge |
|---|---|---|---|
| Up to 9m/(30ft) | 135-0C-096 | 0.5mm² | 22 AWG |
| Up to 15m/(50ft) | 135-0B-096 | 0.5mm² | 22 AWG |

**Rams and Rotary Drives - Clutch/Valve Cables**

# ACP Unit Terminal Details




**ACP Unit Terminal Details**

| Wire Colour Table | | | |
|---|---|---|---|
| R | Red | V | Violet |
| BLK | Black | Y | Yellow |
| BL | Blue | O | Orange |
| BR | Brown | W | White |
| G | Green | Blank | Silver N/C |
| | | SLV | Screen |
| | | Blank | Not Used |

**Wire Colour Coding/Abbreviations**

## Clutch Voltage Selection

The ACP computer unit can output different clutch/solenoid voltages depending upon the size of the rudder drive unit fitted. The clutch/solenoid valve is only required for rams or rotary drive units. This is achieved by setting dip switches on the computer drive PCB in the lid of the computer unit.

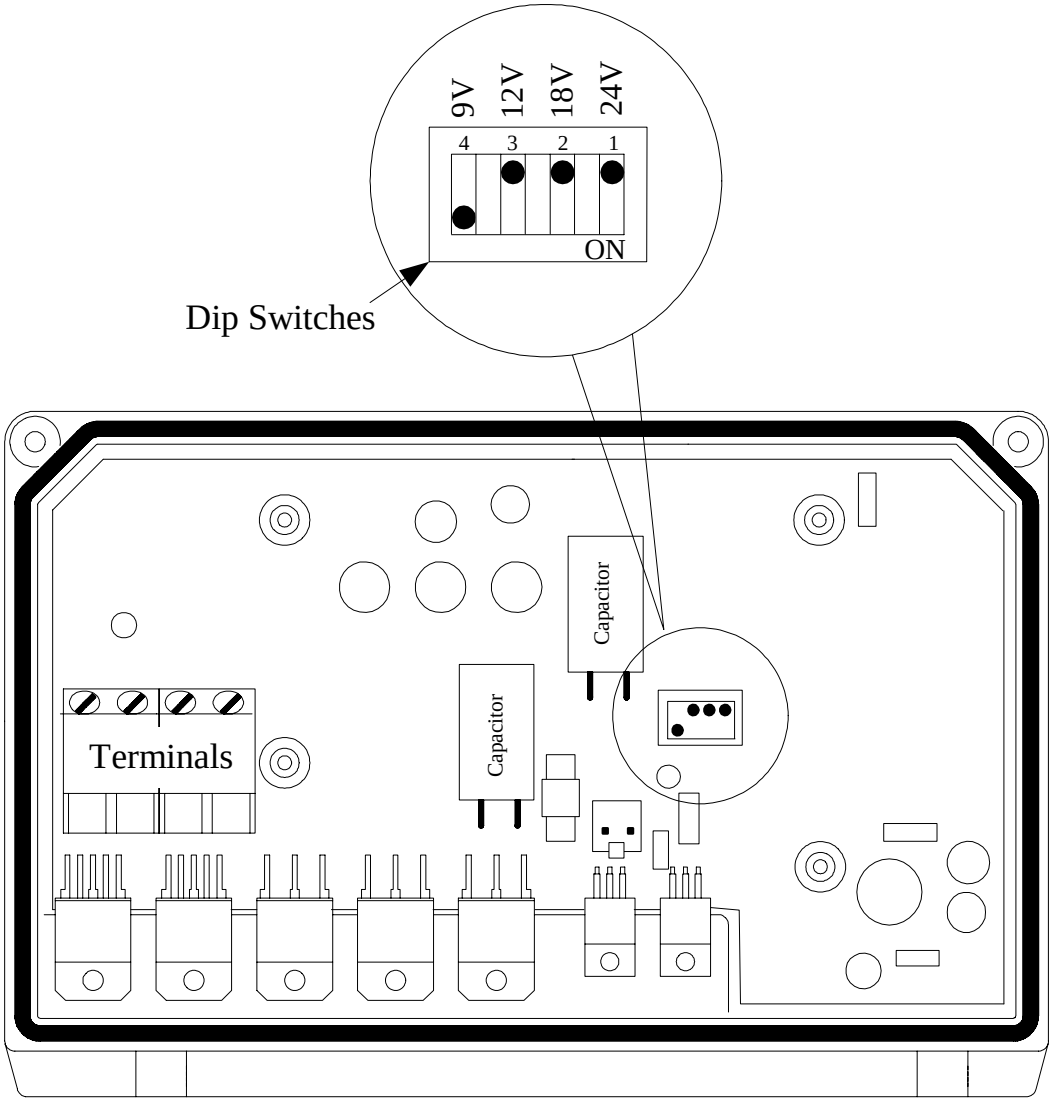
Set the switches as per the table below. The default setting is 9V, (switch 4 ON) suitable for size 1, 12V rams and size 2, 12V rams.

| DIP Switch | Clutch Voltage | Drive Size/Type |
|---|---|---|
| 1 | 24V | 24V Rotary |
| 2 | 18V | Size 3, 24V Ram |
| 3 | 12V | 12V Rotary |
| 4 | 9V | Size 1 and 2 12V Rams |

**ACP DIP Switch Selection**

**Note:** when using drives from another manufacturer, it is important to refer to the documentation supplied with that drive to determine the correct clutch voltage selection. Refer to the manufacturer of the drive for further information.

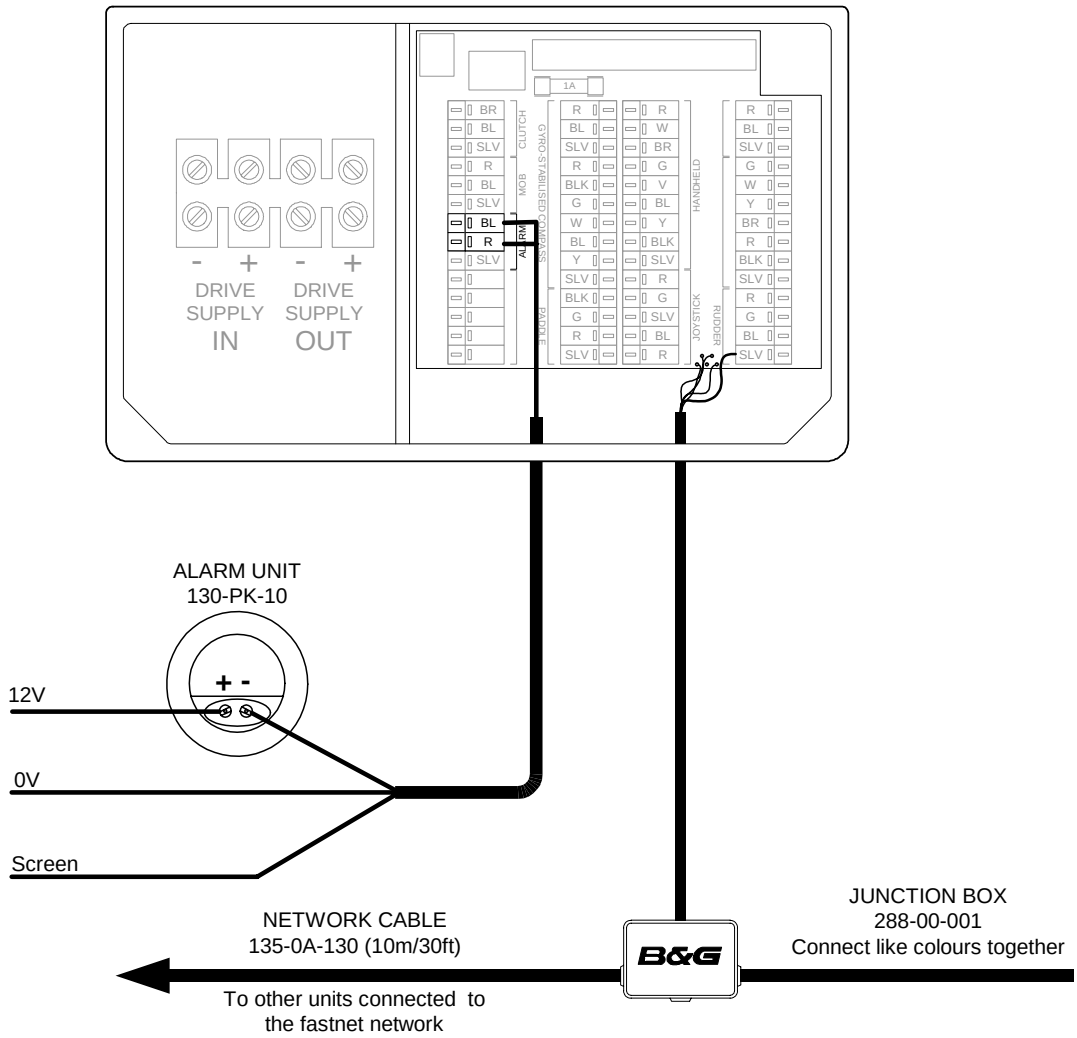
## Dip Switch Location




**DIP Switch Location**

# ACP WIRING CONNECTIONS

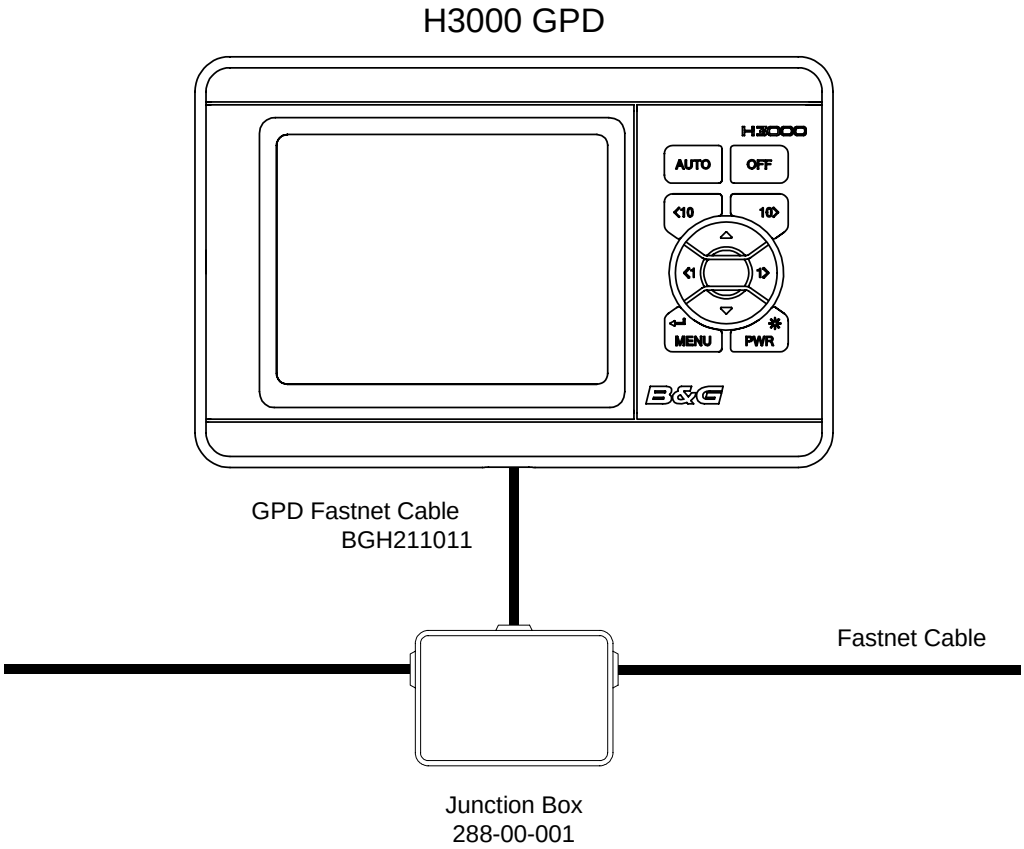
## Network and Alarm Connections




**Network and Alarm Connections**

**Note:** the maximum rating for the alarm output is 12V, 20mA.

## Pilot Display Connections



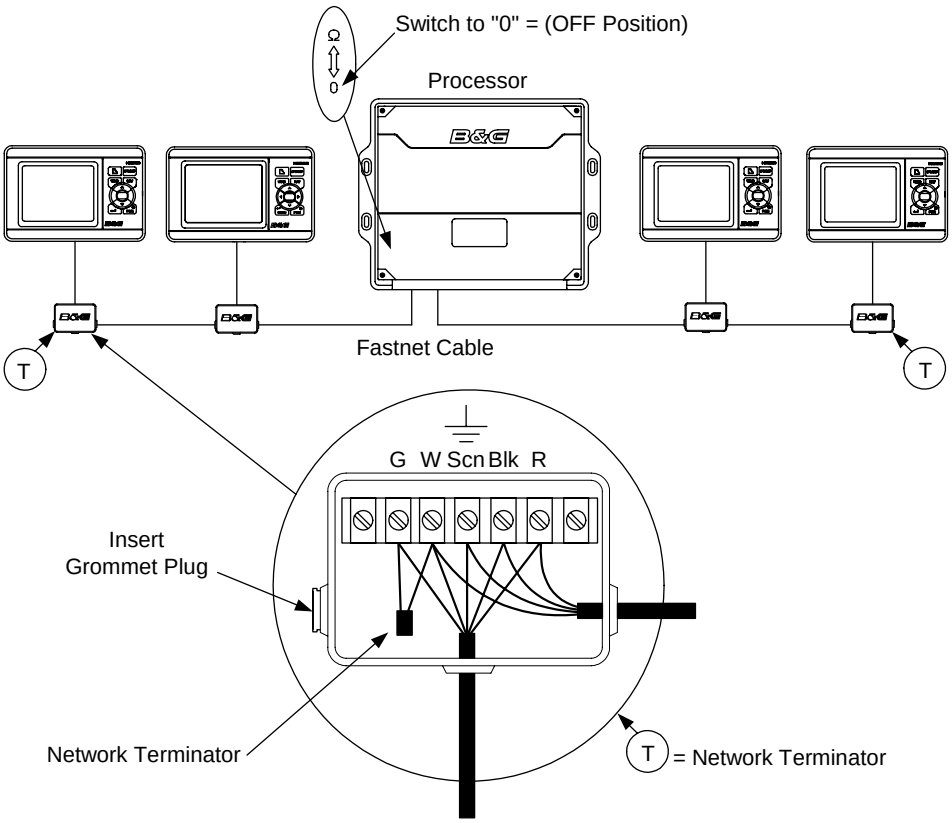

**Pilot Display Connections**

**Note:** The extreme ends of the Fastnet network should be terminated by connecting terminators between the white and green data wires. Maximum of two per system.

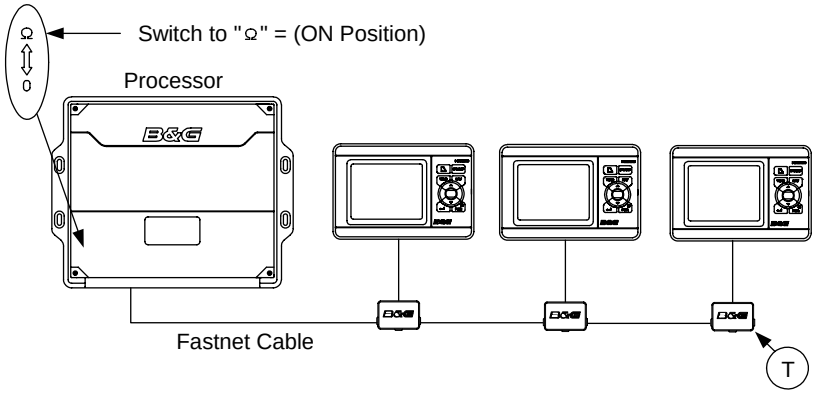
# Network Installation

The Fastnet network installation shown below should be installed in a linear fashion and ideally run in a line from one end to another with short ‘spurs’ to displays and processors etc. A ‘star’ network with many network spurs off one point will not work correctly, and must be avoided.

**Example 1: Two network cables from the processor unit. Processor switch = OFF. Terminated in the last junction box at each end**

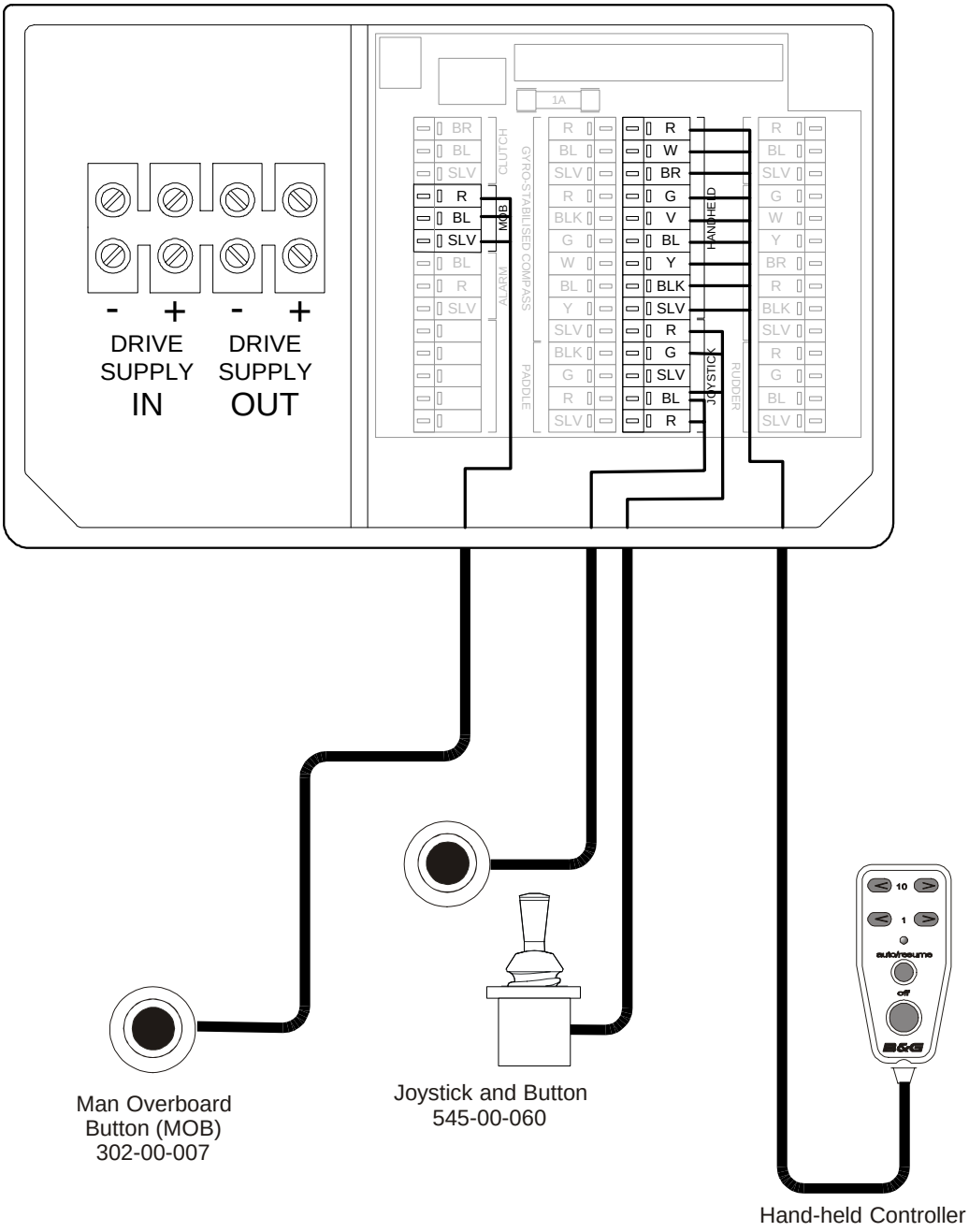



**Example 2: Single network cable. Processor swich = ON Terminated at processor unit via switch shown. Add a network terminator to the last junction box at the end.**



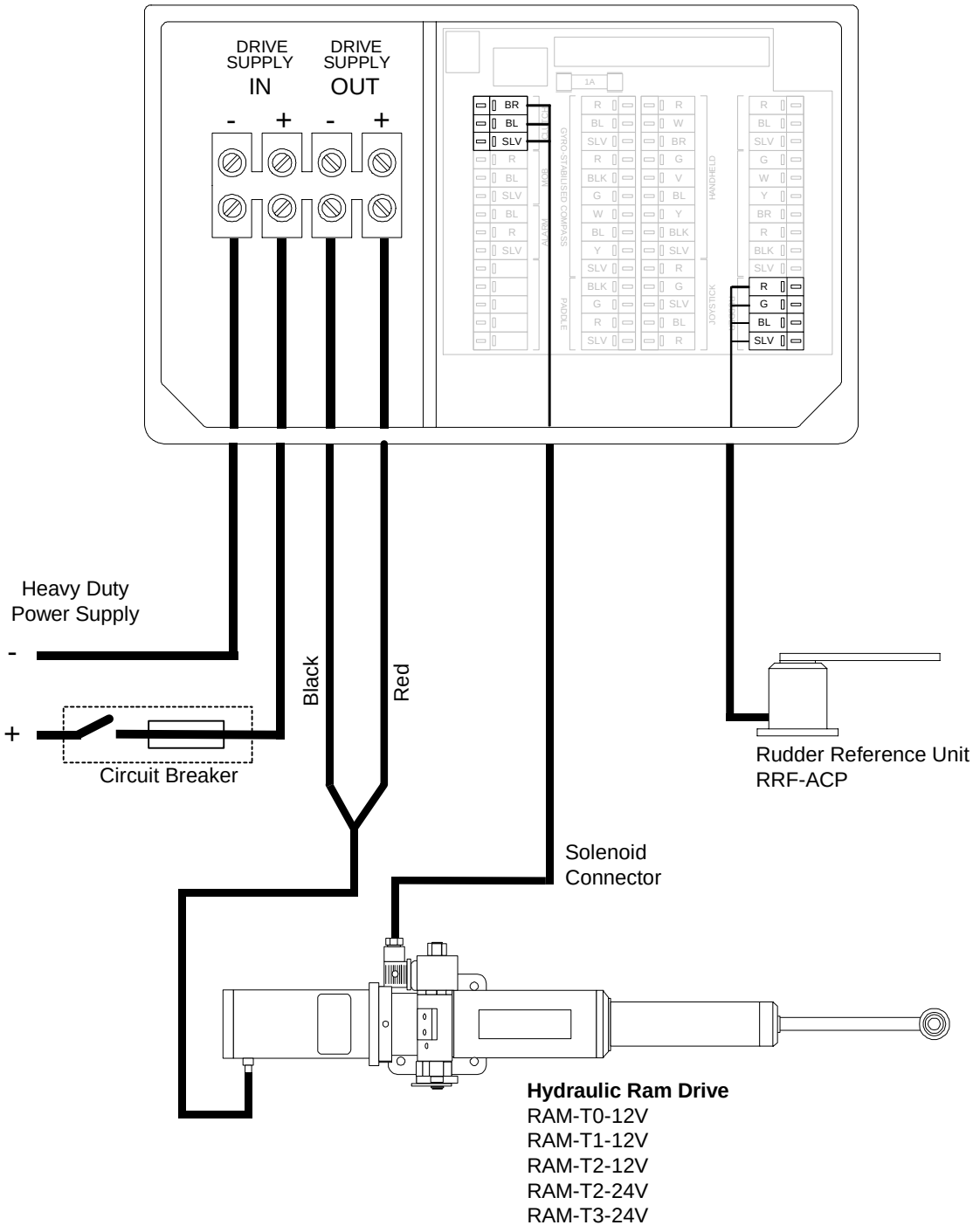

**Network Installation**

## MOB, Joystick, Hand-held Controller Connections



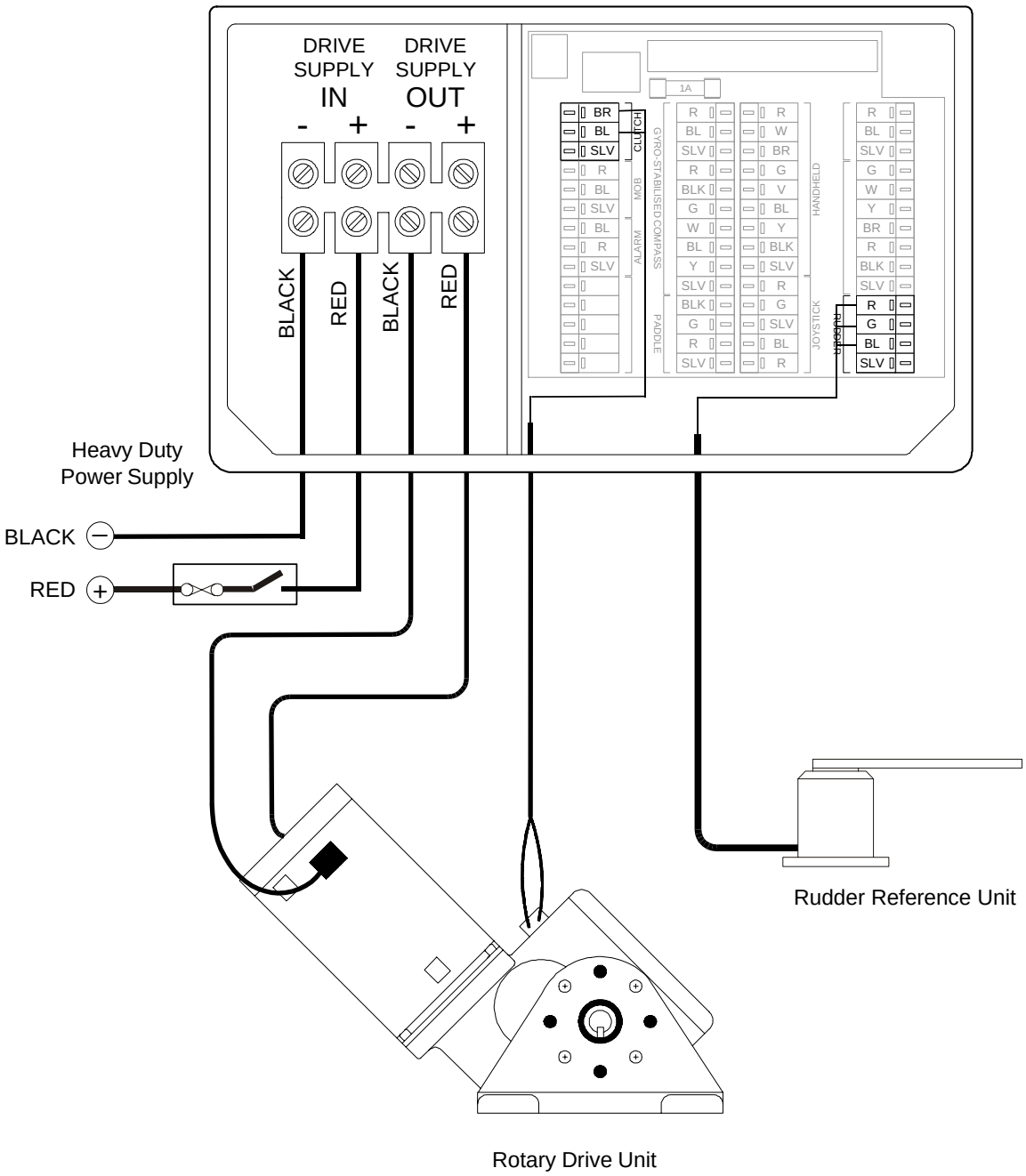

**MOB, Joystick, Hand-held Controller Connections**

## Hydraulic Ram Drive Connections



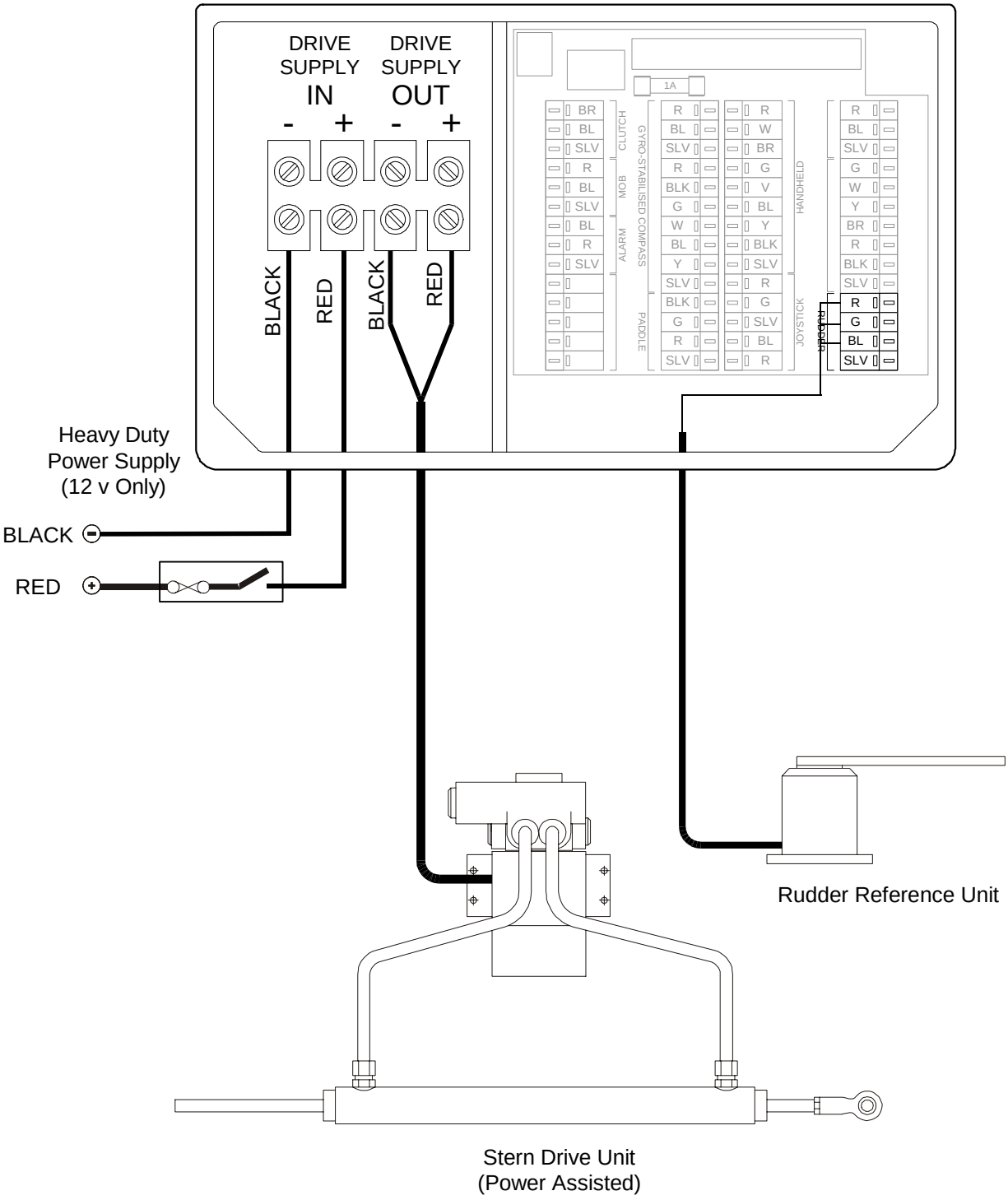

**Hydraulic Ram Drive Connections**

## Rotary Drive Connections




**Rotary Drive Connections**

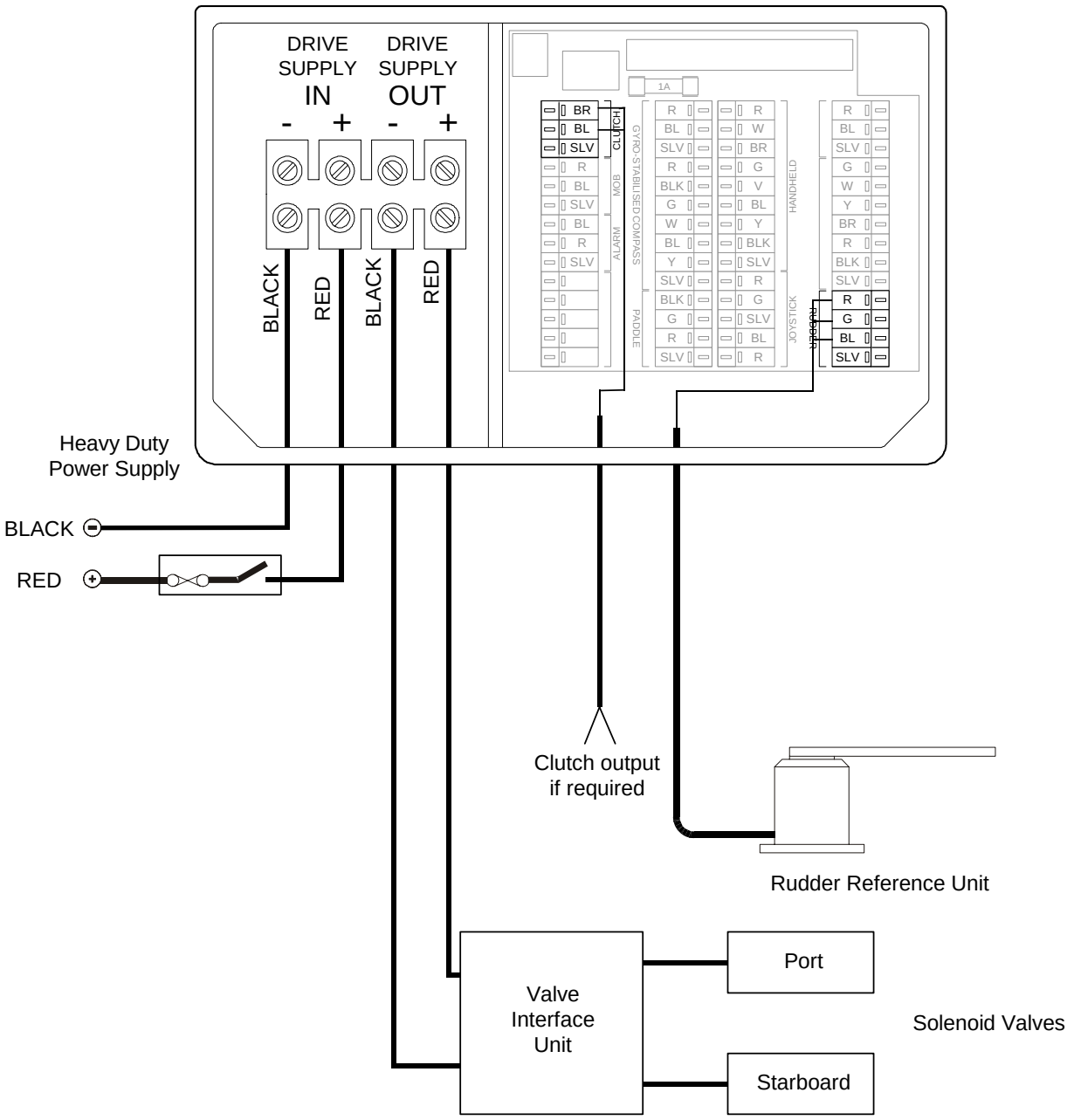
## Sterndrive Unit Connections




**Sterndrive Unit Connections**

## Proportional Solenoid Connections

These are general wiring instructions only, showing the connection of the ACP computer unit outputs to drive proportional solenoid valves. The continuous drive pump motor will also require a heavy-duty supply; this is not shown on this diagram. The clutch output could be used to control the motor supply; the clutch output is only active while the Pilot is moving the rudder.

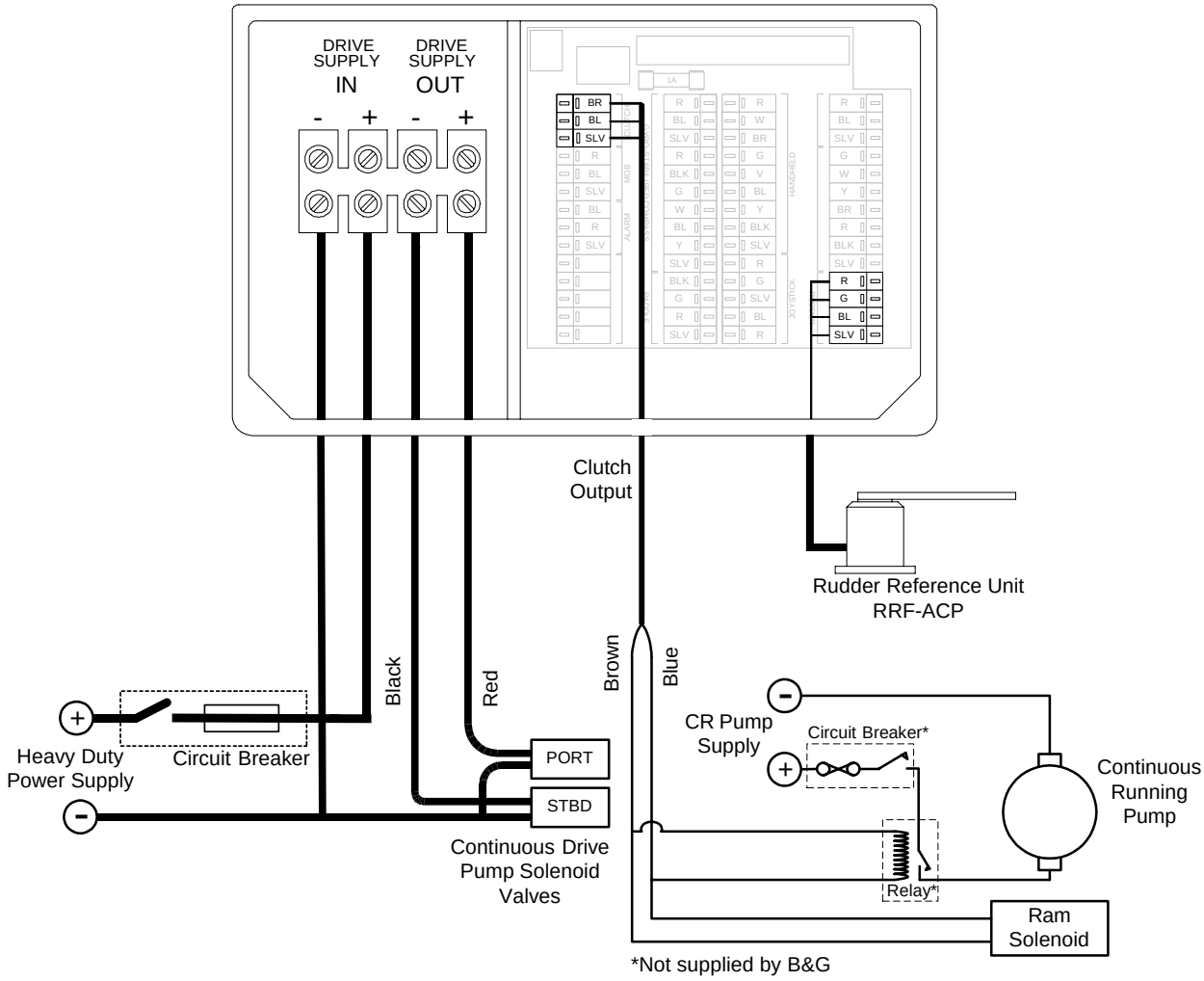



**Proportional Solenoid Connections**

## Continuous Drive Connections

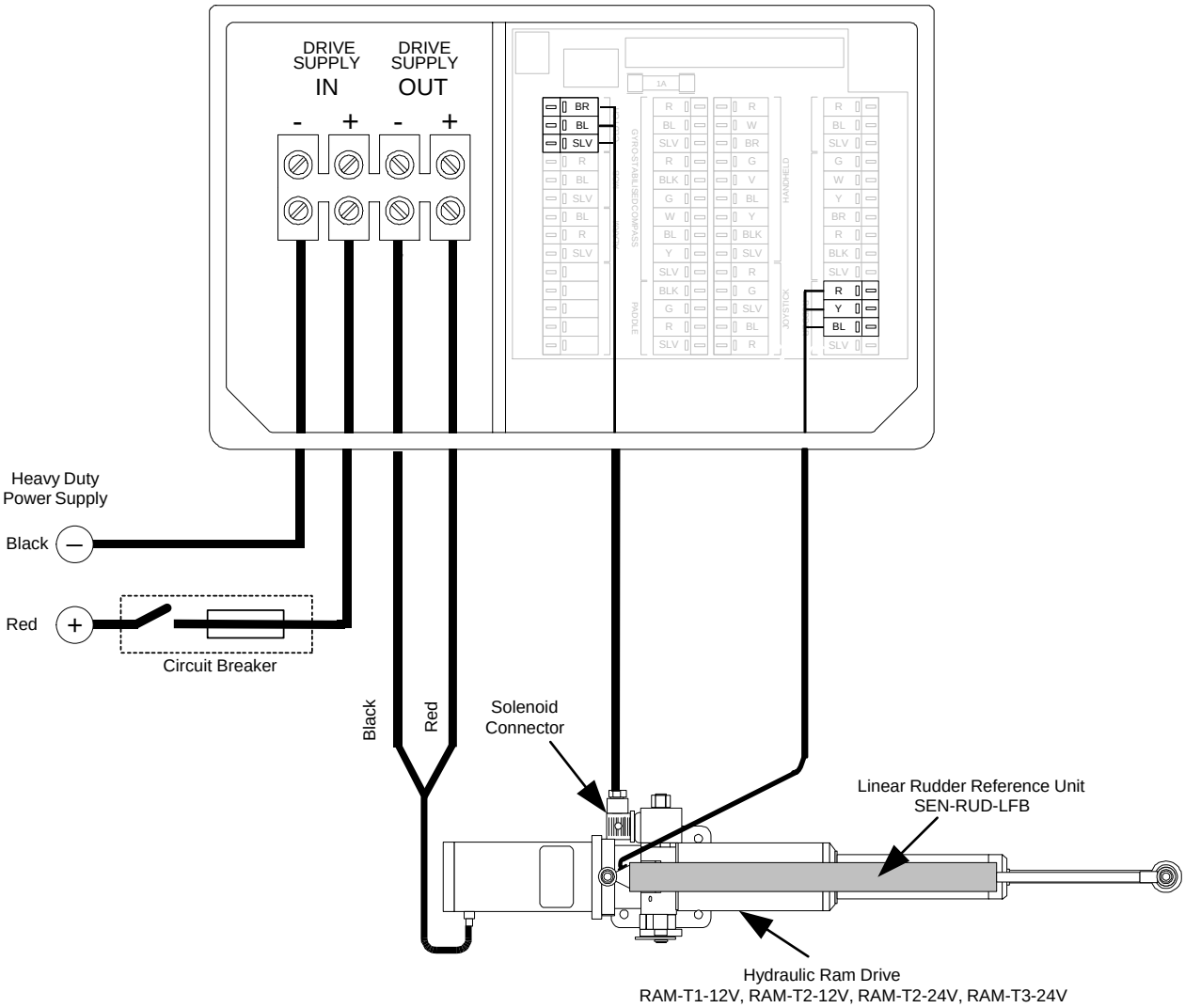
These are general wiring instructions only, showing the implementation of the ACP outputs to drive a continuous drive pump solenoid valves. The continuous drive pump motor will also require a heavy-duty supply, which is not provided. However, suitable units can be obtained from your dealer. Clutch output is used to control the motor supply.

**Note:** The ram solenoid must be designed to operate at the same voltage as the pump.




**Continuous Drive Connections**

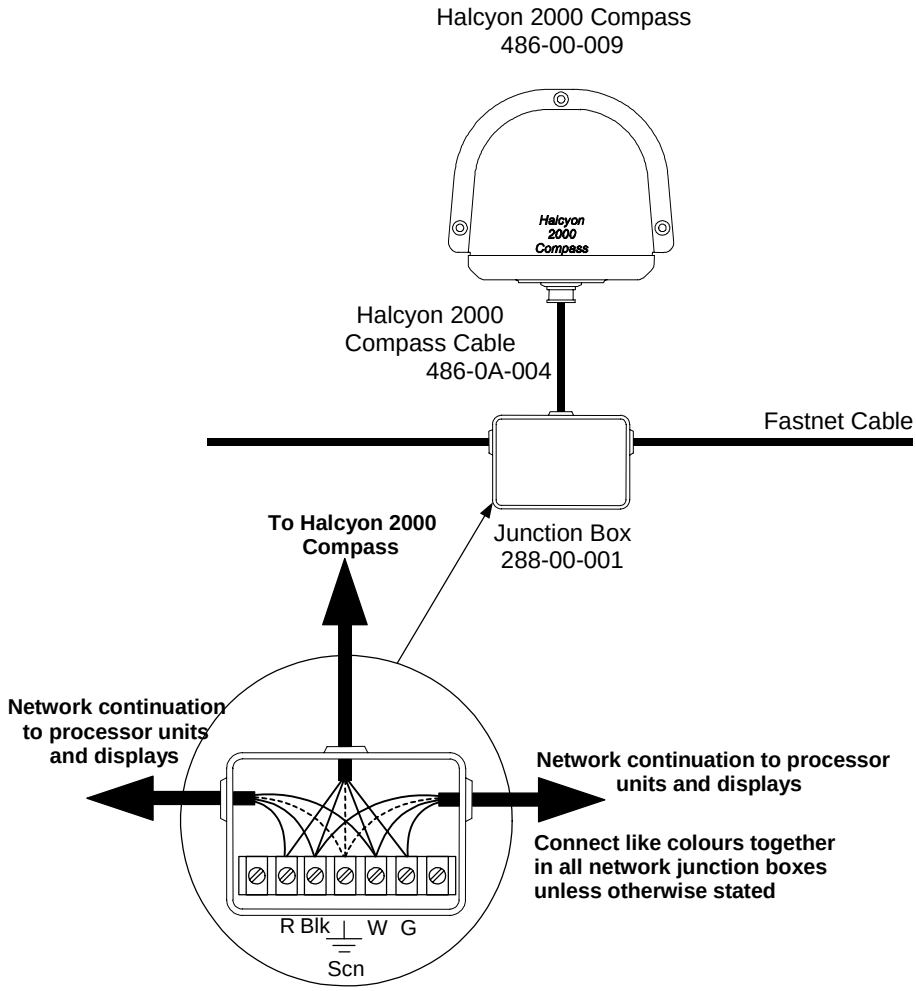
## Linear Feedback Connections



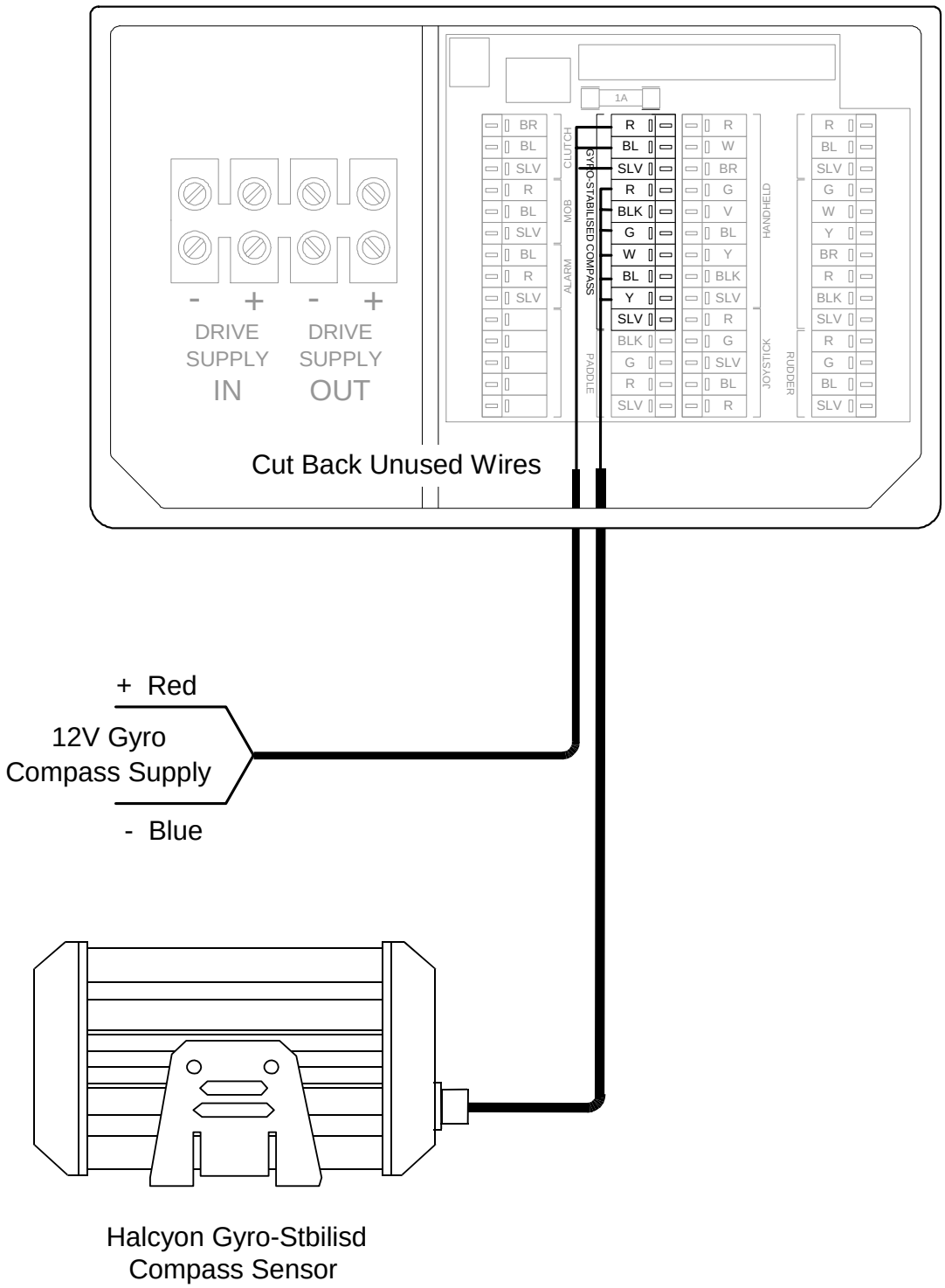

### Linear Feedback Connections

| Pilot computer Colours | Function | Linear Feedback Colours |
|---|---|---|
| Red | +5V Supply | Red |
| Blue | 0V Supply | Black |
| Green | Signal (Wiper) | Yellow |

## Halcyon 2000 Compass

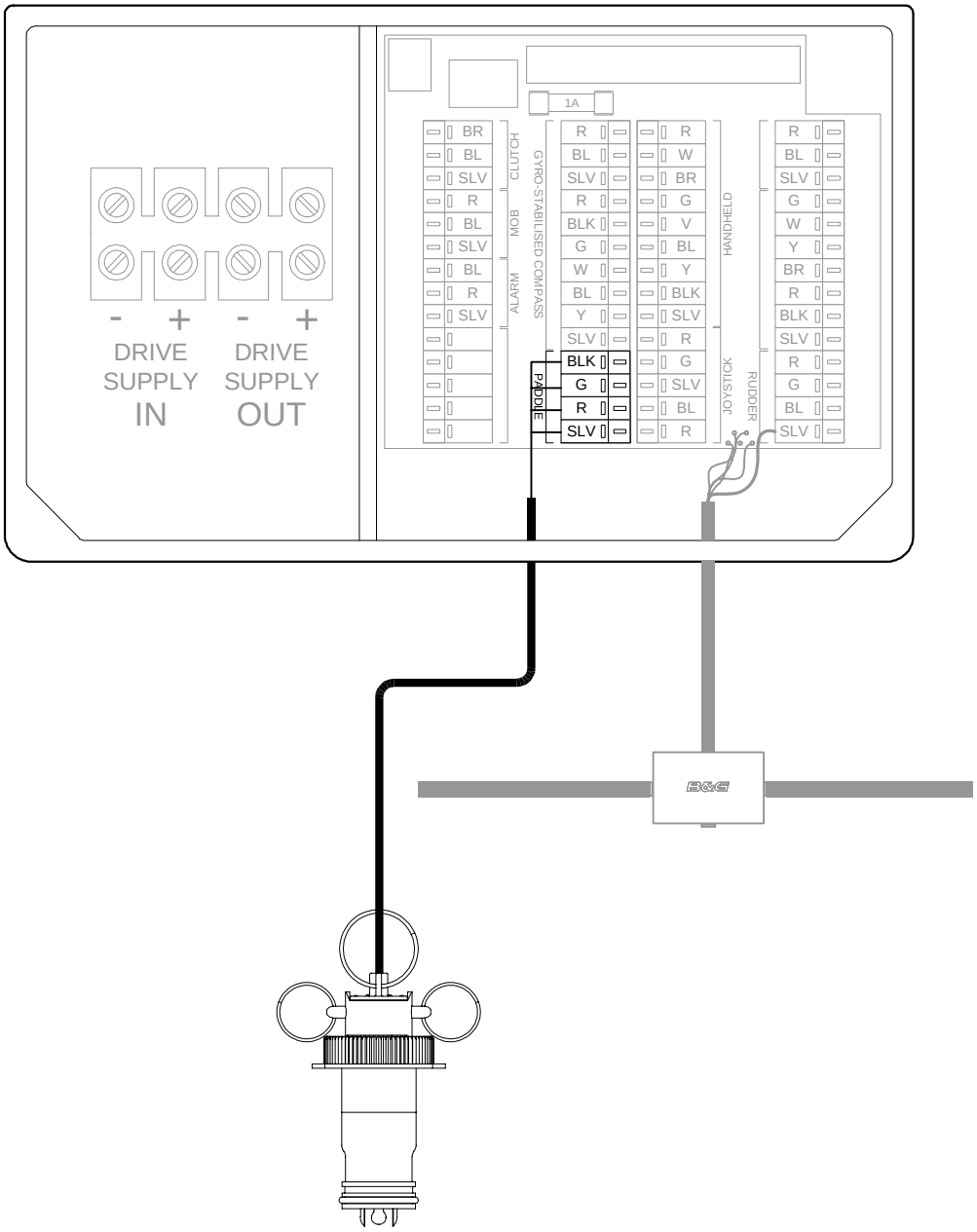


## Halcyon Gyro Stabilised Compass Connections




**Halcyon Gyro Stabilised Compass Connections**

## Direct Speed Input Connections




**Direct Speed Input Connections**

### Using a non B&G speed sensor

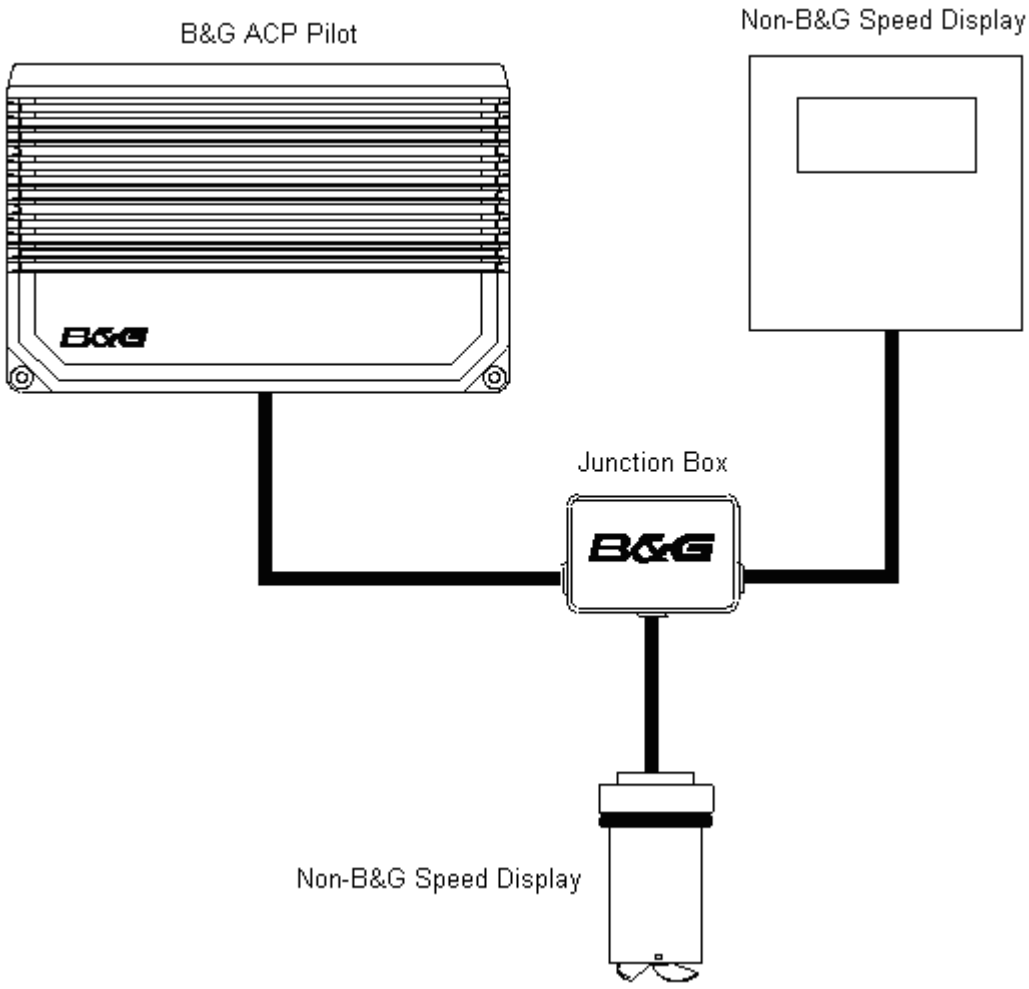
The speed sensor must have a speed signal output from a Hall-effect device giving positive pulses up to a maximum of 12V.

Locate the cable from the speed sensor to the instrument input.

Cut cable if necessary and insert a junction box. Connect like colour to like colour.

Use a length of 2-core screened cable to connect the speed signal and ground of the paddle sensor to the speed input of the Pilot computer unit.

Calibrate the speed input in accordance with the instructions given on page 65




**Non-B&G Paddle Connection**

| Pilot computer unit Boatspeed Terminals | Function | Cable 135-0B-098 |
|---|---|---|
| Green | Speed Signal Input | Red Wire |
| Red | Not Used | Not Used |
| Black | Ground | Blue Wire |
| Silver | Screen | Screen |

**Non-B&G Paddle Connection**

# ROTARY RUDDER REFERENCE SENSOR

## Installation of RRF

A number of key points must be considered for optimum performance of the unit:

Mount the unit on a flat surface next to the tiller arm or steering quadrant. Construct a small platform if necessary.

Do not lengthen the drag-link arm as this can transmit excessive vibration to the sensor.

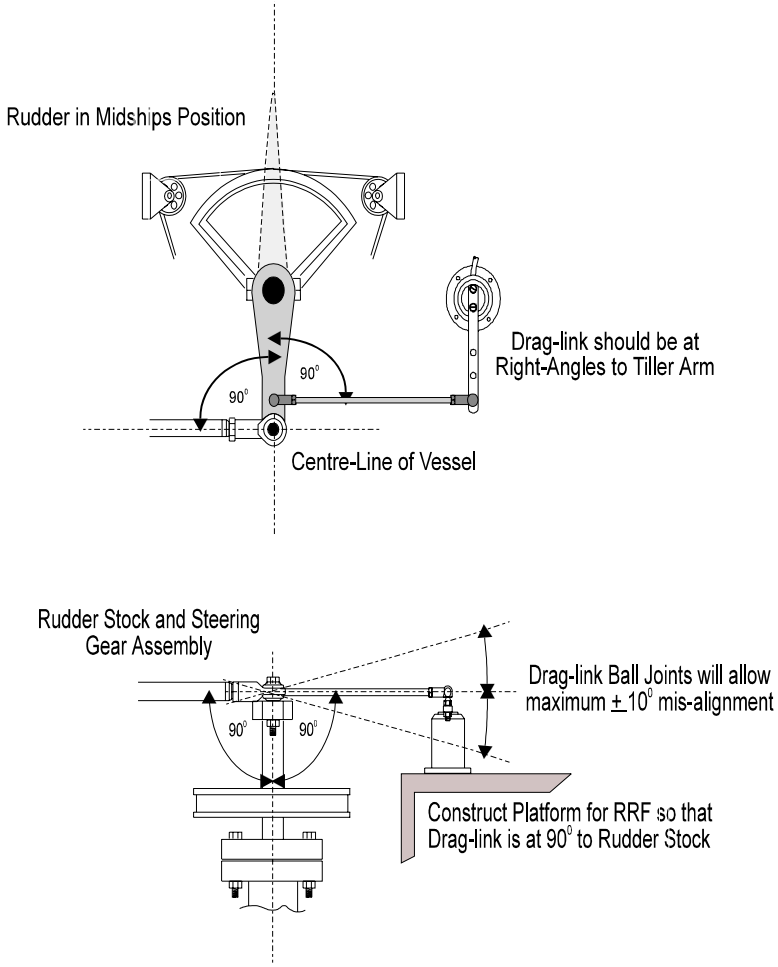
The sensor operating arm can be rotated through 360º. The mid-point of the RRF wiper travel is when the arm is opposite the cable entry point. The sensor arm should be approximately opposite the cable entry point when the helm is in the mid-ships position.

When the rudder is moved hard-over port or hard-over starboard, the RRF arm should travel through a minimum angle of 90º to ensure sufficient voltage swing. Measure the voltage difference between the blue (0V) and green (signal) wires from the RRF; there should be at least a 1V dc change from port to starboard.

After fitting and connection of the RRF test the full movement of the steering gear to ensure no fouling occurs between the ram drive, steering gear and RRF.

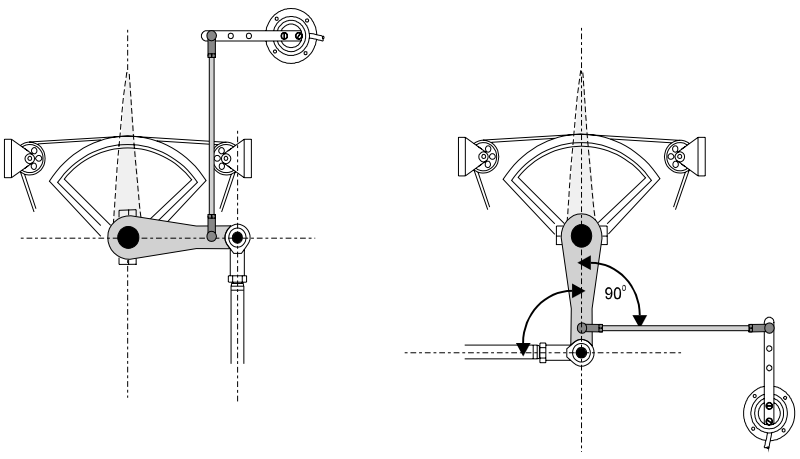
Check for backlash in the linkages. Excessive backlash will cause errors in the operation of the Pilot.

The example opposite shows a plan view of a typical system with a tiller arm and quadrant. When viewed in elevation, the ram drive arm and rudder reference unit drag-link must not be more than ±9º from horizontal. Ideally, everything should be horizontally aligned as this prevents excessive stress during operation.




**Plan View - Typical System with Tiller Arm and Quadrant**

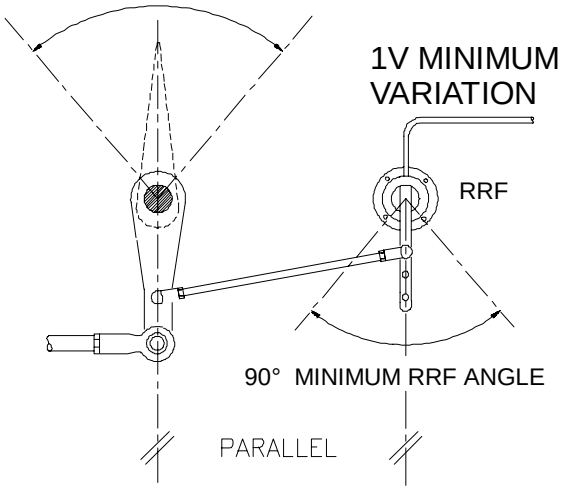
The RRF can be mounted in many different positions and orientations depending on the layout of the steering system.




**Steering System Orientation**

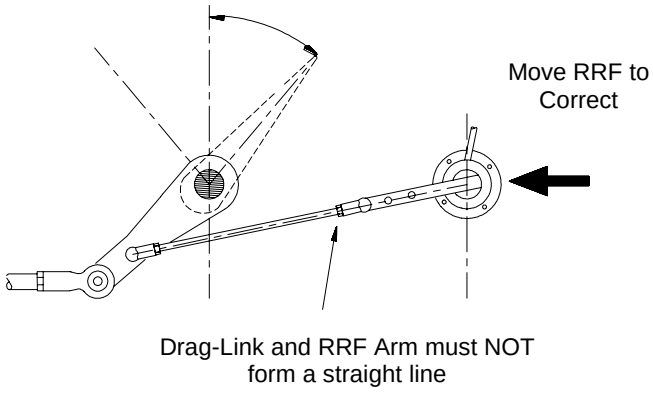
If the maximum rudder angle is less than 90º then the position of the RRF or the drag-link must be adjusted so that the operating arm of the RRF swings through a minimum of 90º and the output voltage difference is greater than 1 volt from port to starboard lock. Measure the output of the RRF between the green and blue wires.

**Note:** If there is less than 1V dc difference, the Pilot will not commission.




**RRF Position**

The rudder hard-over angle should only be limited by the rudder stops and not the RRF linkage. Check that when hard-over the RRF arm and drag-link, do not form a straight line. If this occurs, the steering system could become damaged or jammed endangering the boat and crew. Rectify this immediately by adjusting the position of the RRF.

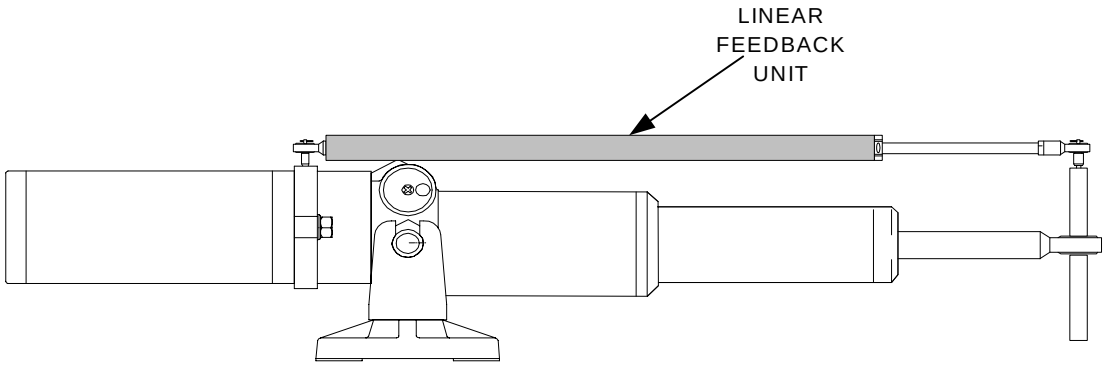



**Drag-Link and RRF Position**

# LINEAR FEED BACK UNIT

## Linear Feedback Unit

Where installation of the conventional rudder reference unit is difficult or physically impossible, a linear feedback unit (SEN-RUD-LFB) can be used. The linear feedback unit comprises of a tube approximately 23mm (7/8 inch) in diameter and 300mm (12 inch) long. This assembly is attached to the top of the B&G Ram types 1 or 2. Each end of the linear feedback unit has a small ball joint that is attached to corresponding pillars on the ram; the ball joints are retained using washers and spring clips.

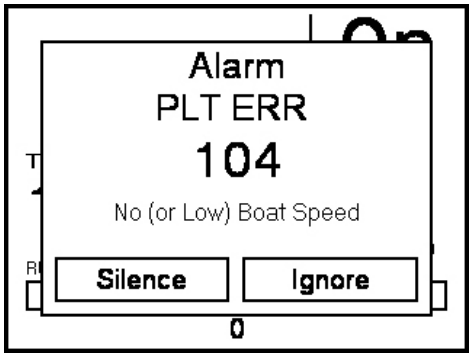



**Linear Feedback Unit**

# Diagnostic data

The Pilot computer is continually monitoring the Pilot and H3000 System for correct operation. If a fault is detected the Pilot Display will show an error message. If installed the system audible alarm will sound.

To remove the alarm window globally from all GFDs select down, then **SILENCE** and press ' ↵ ' if you wish to remove this warning from the display you are using only highlight **IGNORE** and press ↵




**Pilot Display Fault Indication**

| Code | Description on GPD/GFD |
|---|---|
| 100 | Pilot not Commissioned |
| 101 | Pilot Compass Failure |
| 102 | Rudder Sensor Out of Range |
| 103 | Rudder Drive not Responding |
| 104 | No (or Low) Boat Speed |
| 105 | System Compass Failure |
| 106 | No NMEA Data |
| 107 | <NOT USED> |
| 108 | Poor Quality NMEA Data |
| 109 | No (or Low) Wind Speed |
| 110 | No Optimum Wind Data |
| 111 | Current Trip: Drive or Clutch |
| 112 | Network Communication Error |
| 113 | Memory Card Changed - Reset End Stops |
| 114 | Memory Card Error |
| 115 | Drive Power Failure - Check Supply |
| NO PILOT | Network Communication Error - cannot detect Pilot Computer |

**Error Messages**

# FAULT DIAGNOSIS

## Fault 100 – Pilot not Commissioned

### Fault Description

The rudder end stops on the Pilot have not been commissioned, or the memory has been corrupted.

### Remedial Action

1) Has the Pilot ever been successfully commissioned?

   Yes go to step (4)
   No go to step (2)

2) Carry out the Dockside commissioning procedure (see page 56). Display the Pilot screen, move the helm, does the rudder indicator function?

   Yes go to step (4)
   No go to step (3)

3) The rudder indicator on the Pilot screen will not function if invalid rudder end and mid points have been entered. Check the rudder reference unit installation (see page 91) is such that the voltage difference between the port and starboard end stops is a minimum of 1.0 volt. After checking repeat step (2).

4) If the rudder has previously been successfully commissioned then the fault is likely to be due to memory corruption. This may be due to a recent change of software version or severe interference (e.g. lightning).

   We recommend that you reset the Pilot computer (node 18) and attempt to re-commission the Pilot. If this fails contact your local specialist dealer.

# Fault 101 – Pilot Compass Failure

### Fault Description

No valid data is being received from the Halcyon Gyro-Stabilised Compass (HGSC) sensor connected directly to the Pilot computer.

### Remedial Action

1) Is an HGSC sensor in use?

   Yes go to step (3)
   No go to step (2)

2) Ensure that the Heading Source (SETUP ▶ COMMISSIONING ▶ HEADING SOURCE to the correct value for the compass sensor in use.

3) Check all wiring connections to the compass unit. There should be both a sensor cable AND a 12V supply cable, see page 87 or 88

# Fault 102 - Rudder Sensor out of Range

### Fault Description

The signal from the rudder reference unit is outside the limits set during commissioning. This usually indicates either a worn sensor or loose components.

### Remedial Action

1) Check installation of rudder reference unit for slack or loose fittings. Replace any worn parts and secure any loose items. If the position of any part has been changed it is necessary to follow the Dockside Commissioning procedure.

2) Display the Pilot screen on a GPD, watch the rudder indicator carefully whilst turning the helm slowly from hard-over port to hard-over starboard. The indicated angle should change smoothly as the wheel is turned.

   - If the indicator does not move at all follow the Dockside Commissioning procedure
   - If the indicator is erratic move to step (3)

3) Check the voltage supply to the rudder reference is 4.5 to 5.0 volts.

4) Check the signal from the rudder reference with a voltmeter at the Pilot computer

   With someone moving the helm slowly port to starboard (as in step 2) the voltage should change smoothly. If the signal is incorrect suspect a faulty rudder reference unit. Note: The difference between the signal voltages measured at the two end stops must be at least 1V dc.

5) If the fault always occurs at the same rudder angle, suspect a faulty rudder reference unit. If the fault occurs at different rudder angles suspect a fault in the wiring connections to the Pilot computer or a fault with the Pilot computer electronics.

# Fault 103 - Rudder Drive

### Fault Description

The Pilot attempted to move the rudder, but did not sense any change in rudder position **or** when the Pilot attempted to move the rudder, it moved in the wrong direction.

### Remedial Action

If the fault occurs all the time when the Pilot is engaged:

1) Is the heavy-duty power supply circuit breaker for the Pilot drive switched on? If not the fault 103 message may be triggered alongside a fault 115 message (see below).

2) Move the helm. Does the rudder indicator work? if not check physical installation of the rudder reference unit as detailed above.

3) Select Power mode. If drive system includes a clutch or solenoid valve (normal ram drives and most mechanical rotary drives), engage the pilot and check the operation of the clutch or solenoid valve. It should not be possible to move the helm with the Pilot engaged.

   If the helm can be moved (i.e. the clutch fails to operate) disconnect the clutch from the Pilot electronics and test its operation when connected directly to the drive power supply.

4) With Pilot engaged in "Power Steer" mode use the 10º and 1º port and starboard keys to move the rudder. If the motor fails to run disconnect the motor from Pilot electronics and test the operation when connected directly to power supply.

**If the fault occurs intermittently or under heavy loads:**

1) Use power steer mode to move rudder while restricting movement by holding wheel. If the fault occurs under these conditions it could be due to:

    - Excessive motor current
    - Too much slack or backlash in drive or fixing to tiller
    - Air in hydraulic system

    Check the physical installation of the drive system for these points.

# Fault 104 - No (or Low) Boat Speed

### Fault Description

The boat is travelling at a speed below 1kt or the speed sensor is not working.

If you are testing a Pilot at the dockside, or you require the Pilot to operate at very low boatspeeds, you should set the Speed Source to a manual speed, see page 65

### Remedial Action

1) If the Pilot is taking boat speed from an instrument system check the speed shown on the instrument system display, if the instruments are showing an erroneous value then investigate the cause on the instrument system (fouled sensor etc.)

2) If the boat speed sensor is connected directly to Pilot check the wiring connections.

3) Check the functionality of the speed sensor, change the Speed Source from Boat Speed to SOG or Manual Speed if the paddle wheel sensor is inoperative.

# Fault 105 - System Compass Failure

### Fault Description

Heading data from an instrument system compass sensor has failed.

### Remedial Action

1) Check the Heading Source is set correctly for the compass in use, see page 41

2) Check the heading data on the instrument system updates normally as the boat changes course.

3) Check the wiring connections for the compass sensor in use and the connection of the Pilot ACP to the Fastnet network.

# Fault 106 - No NMEA Data

### Fault Description

XTE data from the position fixer (e.g. GPS) via instrument system network has stopped.

### Remedial Action

1) Check that the XTE data displayed on the instrument system is accurate and updating regularly.

2) Check the operation of the position fixer, if the device no longer has a position fix it is likely that the NMEA output has stopped. Refer to the troubleshooting guide in your position fixer documentation for further information.

# Fault 108 - Poor Quality NMEA Data

### Fault Description

The value of XTE data being received via the instrument system has suddenly changed by more than 0.3 nautical miles.

### Remedial Action

1) Check that the XTE data displayed on the instrument system is stable, accurate and updating regularly.

2) Check the operation of the position fixer, if the device no longer has a position fix it is likely that the NMEA output has stopped. Refer to the troubleshooting guide in your position fixer documentation for further information.

# Fault 109 - No (or Low) Wind Speed

### Fault Description

There is no valid wind data being received via the instrument system network, or the wind speed is less than 1 kt.

Do not use wind steering modes in very low wind speeds as they are likely to cause erratic steering as the Pilot attempts to follow the changes in wind direction.

### Remedial Action

1) Check the Measured Wind Speed (MWS) data displayed on the instrument system, if this is very low, and there is obviously a significant amount of wind, investigate the wind instrument wiring connections.

2) Check connections to instrument system.

# Fault 110 - No Optimum Wind Data

### Fault Description

No Optimum Wind Angle data is being received via the Fastnet network.

### Remedial Action

1) Check the Optimum Wind Angle (OPT W/A) data displayed on the instrument system.

2) Check connections to instrument system.

# Fault 111 - Current Trip: Drive or Clutch

### Fault Description

The current limiting circuit for the drive motor (25A on ACP1, 40A on ACP2) or the clutch (2A) has tripped.

### Remedial Action

1) Check the installation and wiring for short circuits or loose connections.

2) Check the current to the clutch, if this exceeds the maximum value the fault will occur immediately.

3) Check the current to the drive motor, if this exceeds the maximum value the fault will occur immediately.

# Fault 112 - Network Communication Error

### Fault Description

No regular messages are being received by the Pilot computer from the GPD via the Fastnet network, either the display is not transmitting messages or the Pilot computer is not receiving them.

### Remedial Action

1) Check the installation and operation of the Pilot display.

2) If Pilot responds to commands from other displays then the Pilot computer is operating correctly. Check installation of Fastnet network cable.

# Fault 113 – Memory Card Changed: Reset End Stops

### Fault Description

The memory card fitted is new or from another Pilot and the rudder end-stops are no longer valid.

### Remedial Action

Either reset and re-commission the Pilot or, if you are certain the memory card has come from a Pilot of the same software version, carry out the Dockside Commissioning procedure to set the new rudder end stops.

# Fault 114 – Memory Card Error

### Fault Description

Either the contents of the memory card fitted are not compatible with the Pilot, the memory card is faulty or no card is present.

### Remedial Action

1) Reset and re-commission the Pilot.

2) If a reset is unsuccessful it may be necessary to replace the Pilot memory card, consult your local dealer.

# Fault 115 – Drive Power Failure: Check Supply

### Fault Description

The Pilot processor PCB is unable to communicate with the drive PCB.

### Remedial Action

Check to ensure the high current drive supply is present and is of the correct voltage. It is normal for the drive supply to be on a separate circuit breaker to the rest of the Pilot electronics, ensure this breaker (if present) is switched on.

# Pilot Display Shows "No Pilot"

### Fault Description

No regular messages are being received by the Pilot display (GPD) from the Pilot computer via the Fastnet network, either the display is not receiving messages or the Pilot computer is not transmitting them.

### Remedial Action

If other displays show Pilot data, check the Fastnet network installation of the affected Pilot display. If the installation is correct suspect a fault with the Pilot display unit.

If no Pilot data is available on any display check the installation of the whole Fastnet network, if there is an instrument system operating on the same network is that data available on displays? If the installation is correct, and the instrument system displays are functioning on the same network, suspect a fault with the Pilot computer.

# Pilot Does Not Steer in a Straight Line

## Fault Description

The Pilot seems unable to steer straight, it continually overcorrects course errors; the wake has an "S" like appearance as the boat first steers several degrees off course to port followed by several degrees off course to starboard.

## Remedial Action

1) Drive unit: check for any slack or backlash in the drive system, see earlier section. For steering systems using hydraulics ensure that there is no air in the system.

2) Rudder reference sensor: check for any slack or backlash in the assembly and associated linkages, see earlier section.

3) Boat speed: check that the boat speed is operating correctly, if you are using a manual boat speed ensure that it is realistic - low boat speed values use more rudder movement.

4) Settings: read the commissioning section of the manual carefully and check that the settings in use are appropriate for the type of boat.

5) Rudder gain: make large course changes using the pilot, if the gain value is correct the rate of turn should be between 6 and 8 degrees per second. Adjust if necessary, see page 60

6) Boat lag: a boat lag value that is too small for the boat can cause instability, try increasing the value slightly, see page 60

# RUDDER DRIVE UNITS

www.BandG.com

# NOTIFICATION

The information contained in this document is subject to change without prior notice.

Brookes and Gatehouse Ltd. shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this document.



Tel: +44 1794 518448
Fax: +44 1794 518077
www.bandg.com
Email: sales@bandg.com
Email: support@bandg.com

B&G Ltd.
Premier Way, Abbey Park
Romsey, SO51 9DH
United Kingdom

# Liability and Safety Warnings

Brookes and Gatehouse Limited accept no responsibility for the use and/or operation of this equipment. It is the user's responsibility to ensure that under all circumstances the equipment is used for the purposes for which it has been designed.

**Warning: Electrical Hazard**

This equipment uses high voltage electrical power. Contact with high voltages may result in injury and/or loss of life.

**Warning: Calibration**

The safe operation of this equipment is dependent on accurate and correct calibration. Incorrect calibration of this equipment may lead to false and inaccurate navigational readings placing the yacht into danger.

**Warning: Operational Hazard**

The H3000 system is an Electronic Navigation aid and is designed to assist in the navigation of your yacht. It is not designed to totally replace conventional navigation procedures and precautions and all necessary precautions should be taken to ensure that the yacht is not placed into danger.

The Pilot is an aid to steering the vessel. It is the users responsibility to ensure the safe control and movement of the vessel at all times.

**Warning: Navigation Hazard**

The Pilot must be fully commissioned and a satisfactory sea-trial completed before the Pilot is used to steer the vessel. Failure to do so could endanger life and/or other vessels.

**Caution: Electrical Supply**

This equipment is designed for use with a power supply source of 12V dc. The application of any other power supply may result in permanent damage to the equipment.

**Caution: Cleaning**

The use of alcohol or solvent-based cleaners will damage this equipment and any warranty in force will be invalidated.

**Caution: Display Installation**

Displays installed into locations manufactured from conductive materials (e.g. Steel, Carbon Fibre etc.) should be insulated from the structure to prevent damage to the casings as a result of the effects of electrolysis.

**Power Off Disclaimer**

When in standby mode the H3000 system continues to consume power.
To conserve the vessels battery life switch off power at the main breaker.

# ABOUT B&G

**B&G** has welcomed the constant challenge to develop new electronic solutions for every sailor's need. Harnessing technical developments and providing proven solutions has continued to be the focus that keeps **B&G** on the leading edge of advanced marine electronics.

Proven in the worlds most testing environments, **B&G** offers the most accurate and reliable systems used by blue water cruisers, single-handed racers and record breakers alike firmly establishing ourselves as one of the leading innovators of the most highly advanced marine electronics.

**B&G** is renowned for tried and trusted solutions and is ever evolving to offer the best technology to the customer.

**B&G**s Promise.

"Uncompromising performance, precision and reliability from both our products and our people".

## RUDDER DRIVE UNITS

### Description

A compact dc driven reversible hydraulic pump cylinder assembly for boats without hydraulic steering systems. Five sizes of ram are available giving a wide thrust range to suit all sizes and types of vessel.

Size 1 and Size 2 rams combine motor, pump and hydraulic cylinder as one unit referred to as an actuator. Size 3 and 4 rams are supplied split into a separate motor/pump unit, reservoir and hydraulic cylinder, connected by 1m/3ft hoses. Longer hoses are available, please contact your dealer. The units can also be mounted on a vertical bulkhead.

## ADVANCED CONTROL PROCESSOR UNIT

The Advanced Control Processor (ACP) Unit contains all the electronics for the Pilot operation and control of the rudder drive options. It is designed to be mounted on a vertical flat, smooth surface. The unit has a hinged lid to provide easy access to the electrical connections within. There are two sizes of ACP unit available dependent on drive option requirements.

The ACP1 Computer Unit is required when the rudder drive options are:

| | |
|---|---|
| RAM-T0-12V | Type 0, 12V Hydraulic Ram Drive |
| RAM-T1-12V | Type 1, 12V Hydraulic Ram Drive |
| PMP-T1-12V | Type 1, 12V Hydraulic Pump |

The ACP2 Computer Unit is required when the rudder drive options are:

| | |
|---|---|
| RAM-T2-12V | Type 2, 12V Hydraulic Ram Drive |
| RAM-T2-24V | Type 2, 24V Hydraulic Ram Drive |
| RAM-T3-24V | Type 3, 24V Hydraulic Ram Drive |
| RAM-T4-24V | Type 4, 24V Twin Ram Constant Running |
| PMP-T2-12V | Type 2, 12V Hydraulic Pump |
| PMP-T2-24V | Type 2, 24V Hydraulic Pump |
| PMP-T3-24V | Type 3, 24V Hydraulic Pump |
| PMP-T4-24V | Type 4, 24V Constant Running Pump* |

* Special order

## RUDDER DRIVE DATA

**WARNING**: Accurate performance of the yacht's steering system is crucial to the safety of you and your crew. B&G always recommend that an Authorised B&G Dealer performs the installation of Pilot drive units.

CAUTION: In line with B&G's policy of continuous product improvement, drive units are regularly updated. Installation data included with your drive unit will replace installation data contained in this manual. Before undertaking any shipwright work onboard the yacht, it is essential that the installation data in this manual be verified against your drive unit. If in doubt, consult your authorised B&G Dealer for technical assistance. B&G cannot accept liability for differences that may occur between the drive unit and this User Manual.

Ram Drives

A compact DC driven reversible hydraulic pump and cylinder assembly for boats without hydraulic steering systems. Five sizes of drive are available giving a wide thrust range to suit all sizes and types of vessel.

Type 0, 1 and 2 Rams combine the motor, pump and hydraulic cylinder into one unit referred to as an actuator. Type 3 and 4 rams are supplied split into a separate motor/pump unit, reservoir and hydraulic cylinder.

| Ram Drive Type | RAM-T0-12V | RAM-T1-12V | RAM-T2-12V or 24V | RAM-T3-24V |
|---|---|---|---|---|
| Motor Supply | 12V dc | 12V dc | 12 or 24V dc | 24V dc |
| Solenoid Valve Supply | 12V dc 1.25A (max) | 12V dc 1.25A (max) | 12 or 24V dc 1.25A (max) | 24V dc 0.8A (max) |
| Peak Thrust | 300 kg force (660 lbs force) | 680 kg force (1496 lbs force) | 680 kg force (1496 lbs force) | 1062 kg force (2342 lbs force) |
| Peak Current | 20A @ 12V | 20A @ 12V | 25A @ 12 or 24V | 17A @ 24V |
| Maximum Stroke | 203mm (8") | 254mm (10") | 254mm (10”) | 305mm (12") |
| Full Bore Annulus Area | 776mm$^2$ (1.203"$^2$) 662mm$^2$ (1.027”$^2$) | 1208mm$^2$ (1.872"$^2$) 1005mm$^2$ (1.558”$^2$) | 1208mm$^2$ (1.872"$^2$) 1005mm$^2$ (1.558"$^2$) | 1885mm$^2$ (2.92"$^2$) 1570mm$^2$ (2.434"$^2$) |
| Rod Diameter | 12mm (0.472”) | 16mm (0.623”) | 16mm (0.623") | 20mm (0.623") |
| Tiller Arm for 70° Rudder | 178mm (7") | 214mm (8.4") | 214mm (8.4") | 257mm (10.16") |
| Maximum Torque | 545 Nm (4823.65 lb.ins) | 1427 Nm (12574 lb.ins) | 1427 Nm (12574 lb.ins) | 2688 Nm (23780 lb.ins) |
| Weight | 5.8 kg (12.7 lbs 6oz) | 7 kg (15 lbs 6oz) | 7 kg (15 lbs 6oz) | 10.3 kg (22lbs 11oz) |
| Helm to Helm Time *Extend* *Retract* | 10.1sec 9.9 sec (200kg force) | 15.7 sec 13.4 sec (200kg force) | 11.9 sec 10.2 sec (200kg force) | 14.6 sec 12.6 sec (200kg force) |

**Ram Drive Units**

The following tables may be used to determine the correct tiller arm length for a typical steering system with a maximum rudder angle of 70°.

### RAM T0 Hydraulic Linear Drive

| **RAM–T0–12V** | **Midstroke 429mm (16.9”)** |
|---|---|
| ½ Max. Rudder Angle | Tiller Arm |
| 35° | 178mm (7.0”) |

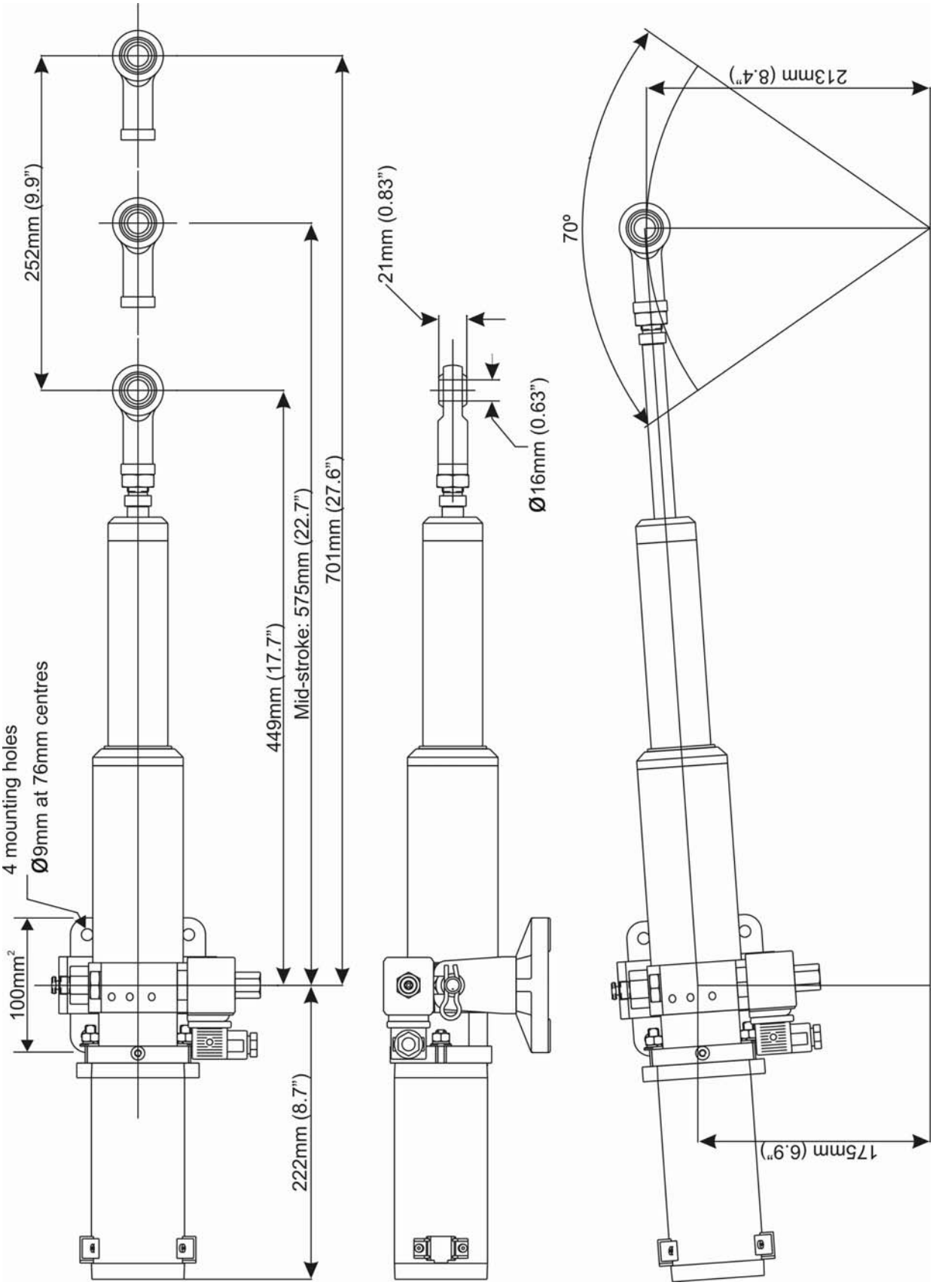
### RAM T1 and T2 Hydraulic Linear Drives

| **RAM-T1-12V RAM-T2-12V RAM-T2-24V** | **Midstroke 575mm (22.6”)** |
|---|---|
| ½ Max. Rudder Angle | Tiller Arm |
| 35° | 214mm (8.4”) |

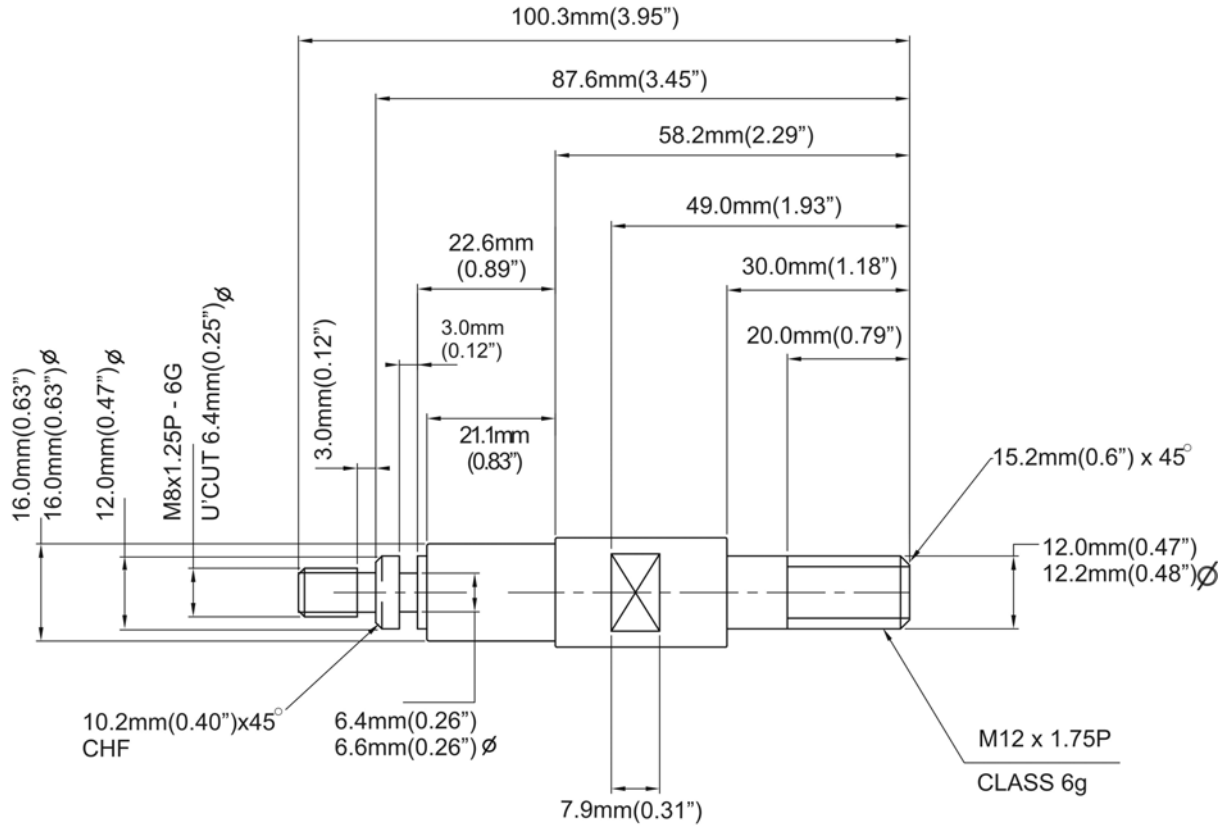
### RAM T3 Split Hydraulic Linear Drive

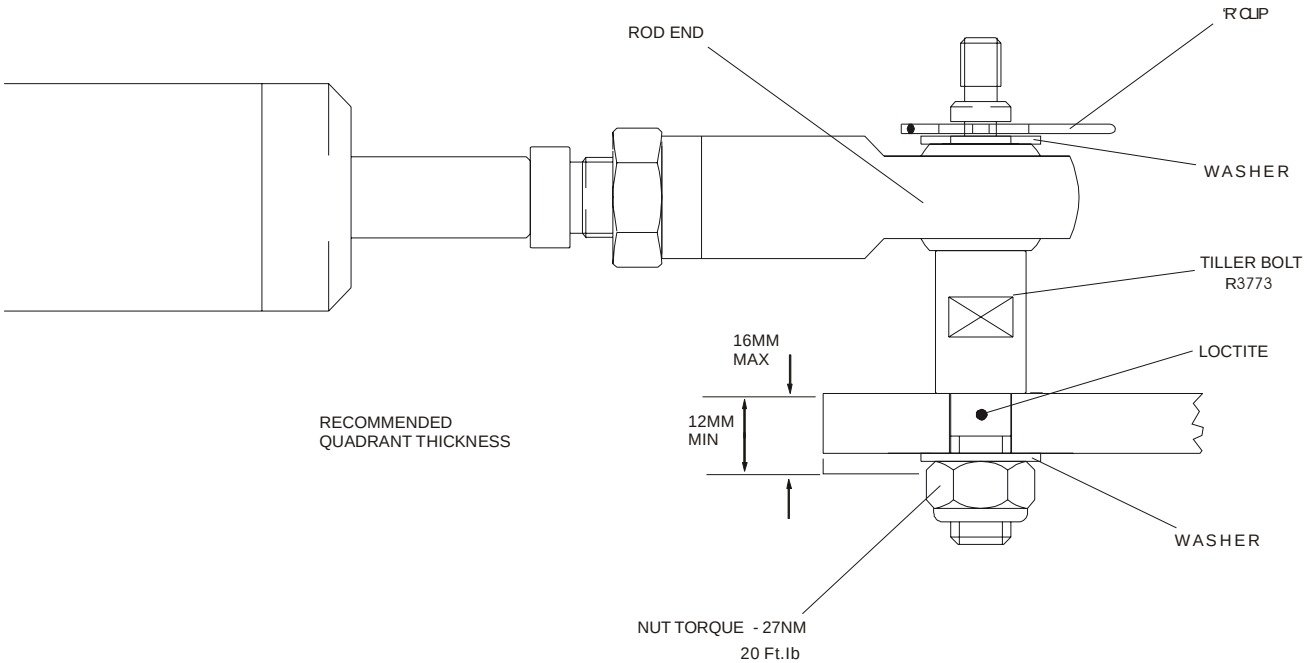
| **RAM - T3-24V** | **Midstroke 755mm (29.7”)** |
|---|---|
| ½ Max. Rudder Angle | Tiller Arm |
| 35° | 257mm (10.2”) |

## Type 1 and 2 Ram Drive Dimensions

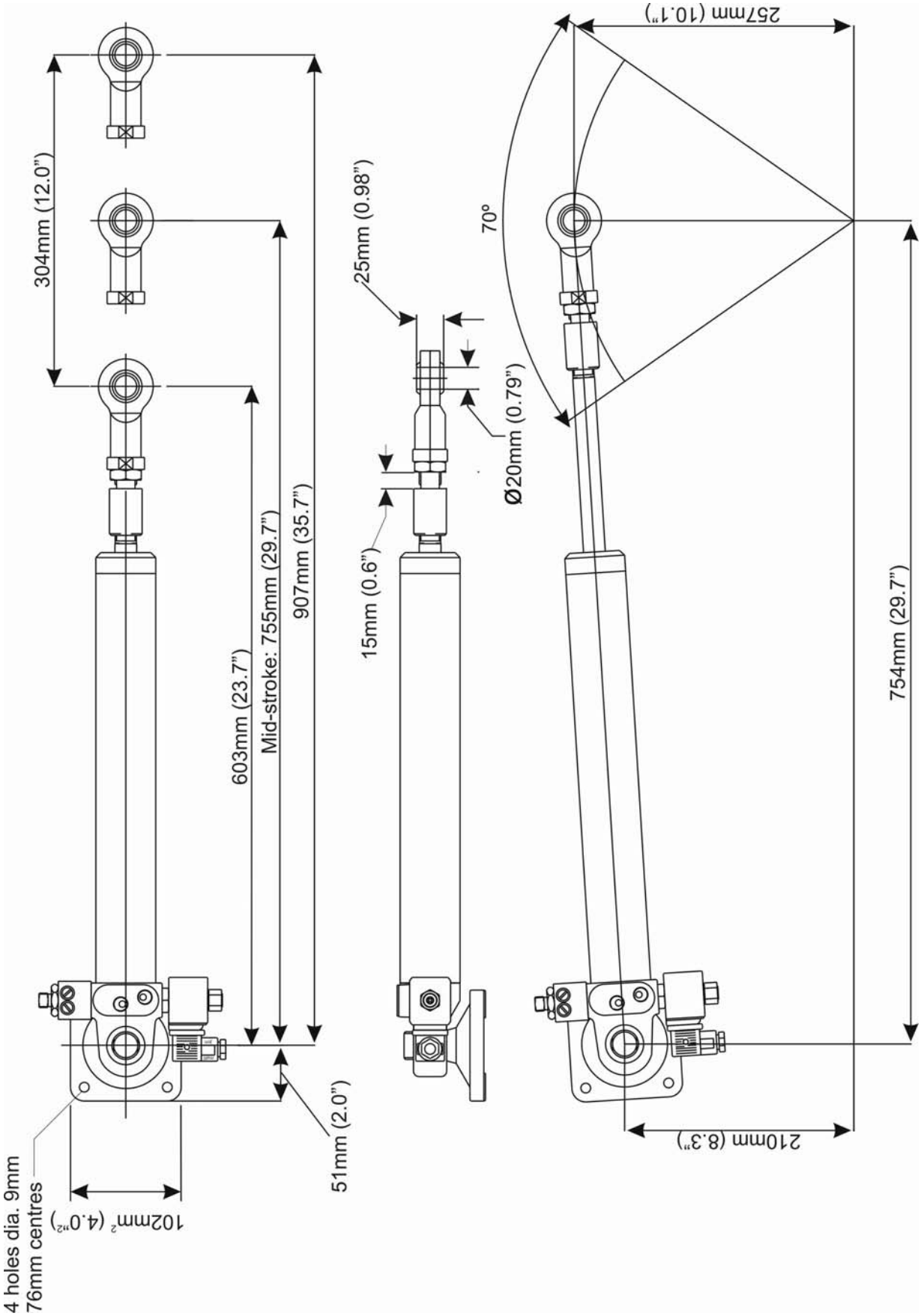


## Type 1 and 2 Rose Joint and Ram Bolt Detail

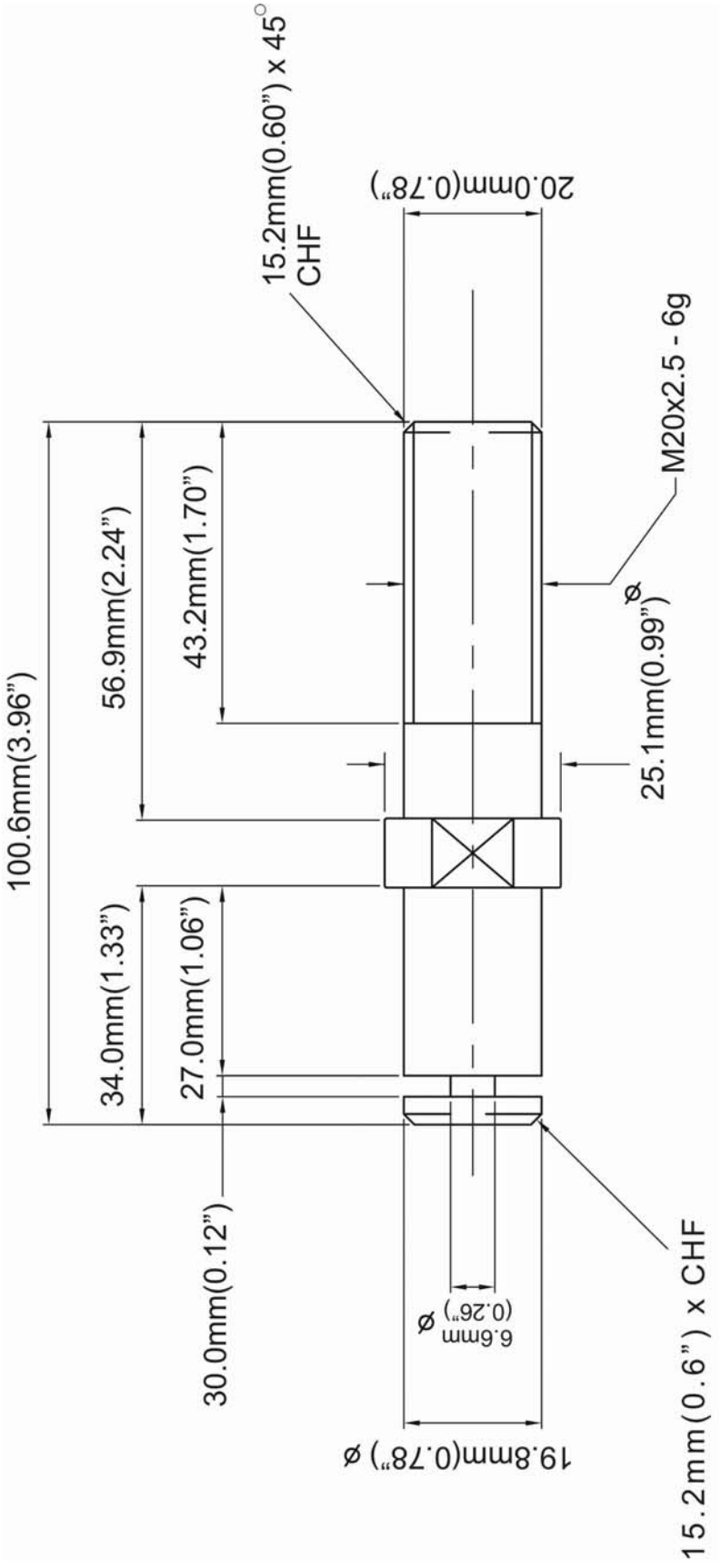


## Type 3 Ram Drive Unit Dimensions



## Type 3 Ram Bolt Detail



## Ram Drive Unit Installation

General consideration must be given to the steering system and its geometry before starting the installation. Many factors must be contemplated for a practical solution. The information given here is for guidance only, although where a maximum or minimum value is given this must be adhered to.

It is essential that the unit is only installed in a fully functional steering system, with no backlash or stiffness when operating. Rectify any steering problems before installation of the ram drive unit or the Pilot will not function correctly.

## Key Points On Installation

Check that the steering gear is in good condition. Rectify any steering defects before installation of the ram.

The ram drive unit must be secured onto a flat, rigid base; it may be necessary to construct a platform section for the mounting plate. For angled rudderstocks, an angled platform section will have to be constructed.

All setting up and aligning of the ram drive unit with the steering system should be carried out with the rudder in the amidships position and the ram arm at the centre point of its travel.

The ram arm should ideally be at right-angles to the rudderstock. The ball-joint on the end of the ram arm will allow a **MAXIMUM** of $\pm 9^{o}$ of misalignment.

**for type 3 reservoir installation**
**Do not turn the black reservoir tap on or attempt to move the piston rod until all of the following are completed:**

The base foot of the ram and pump have been bolted into position.

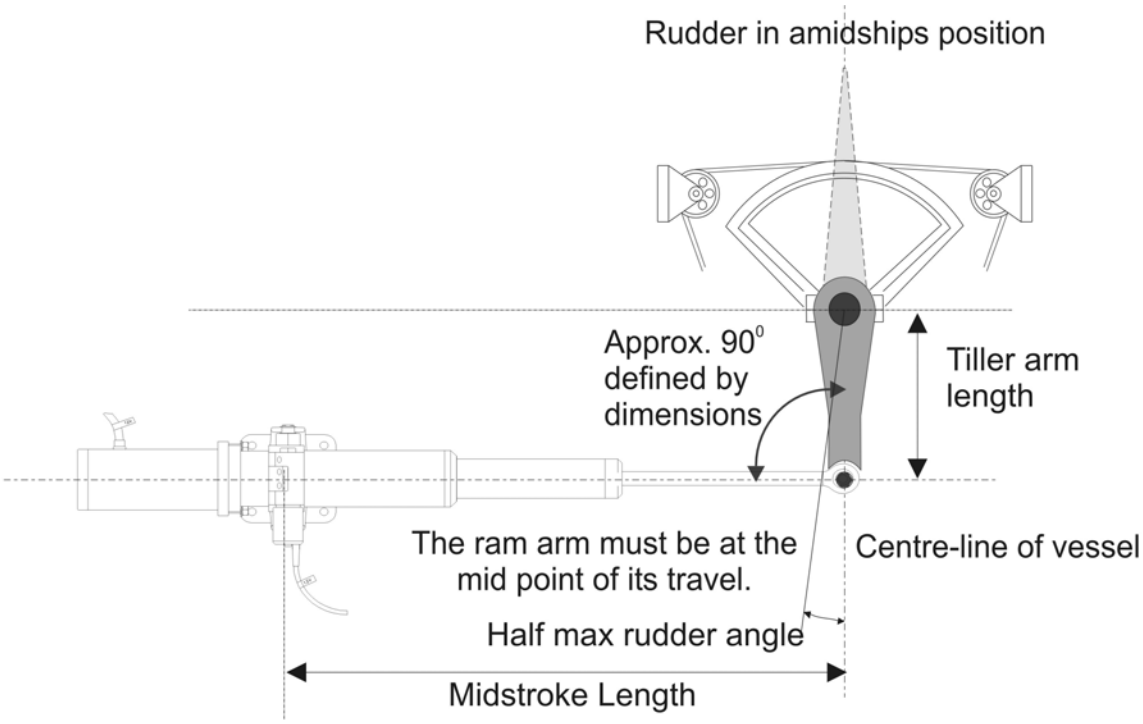
The reservoir has been fixed to a bulkhead above the ram and the pump.

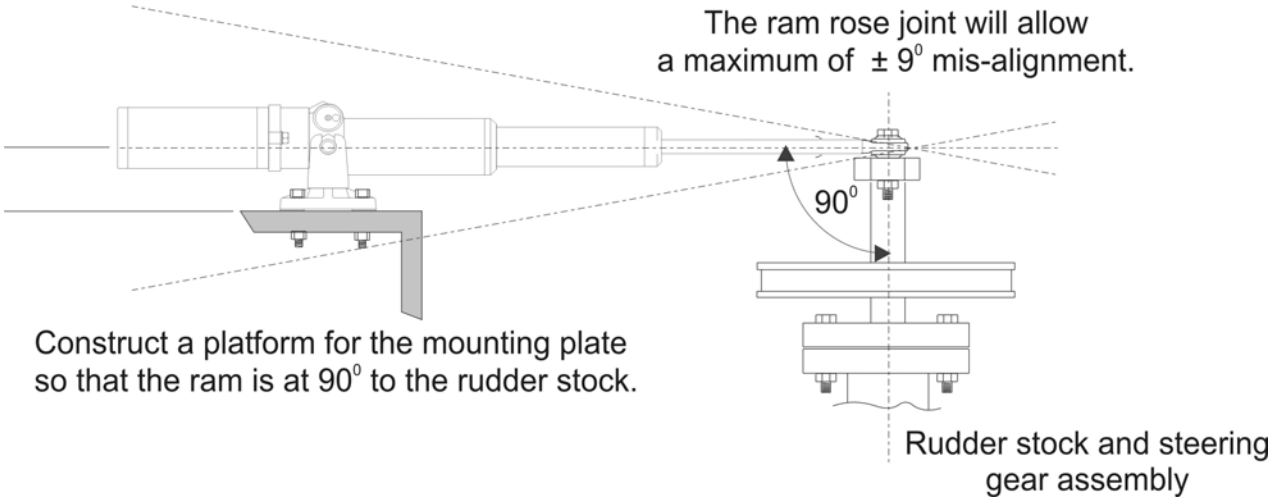
The reservoir has been filled with the oil supplied.

The reservoir tap has been switched to the ON position allowing the oil to flow between the reservoir and the pipe.

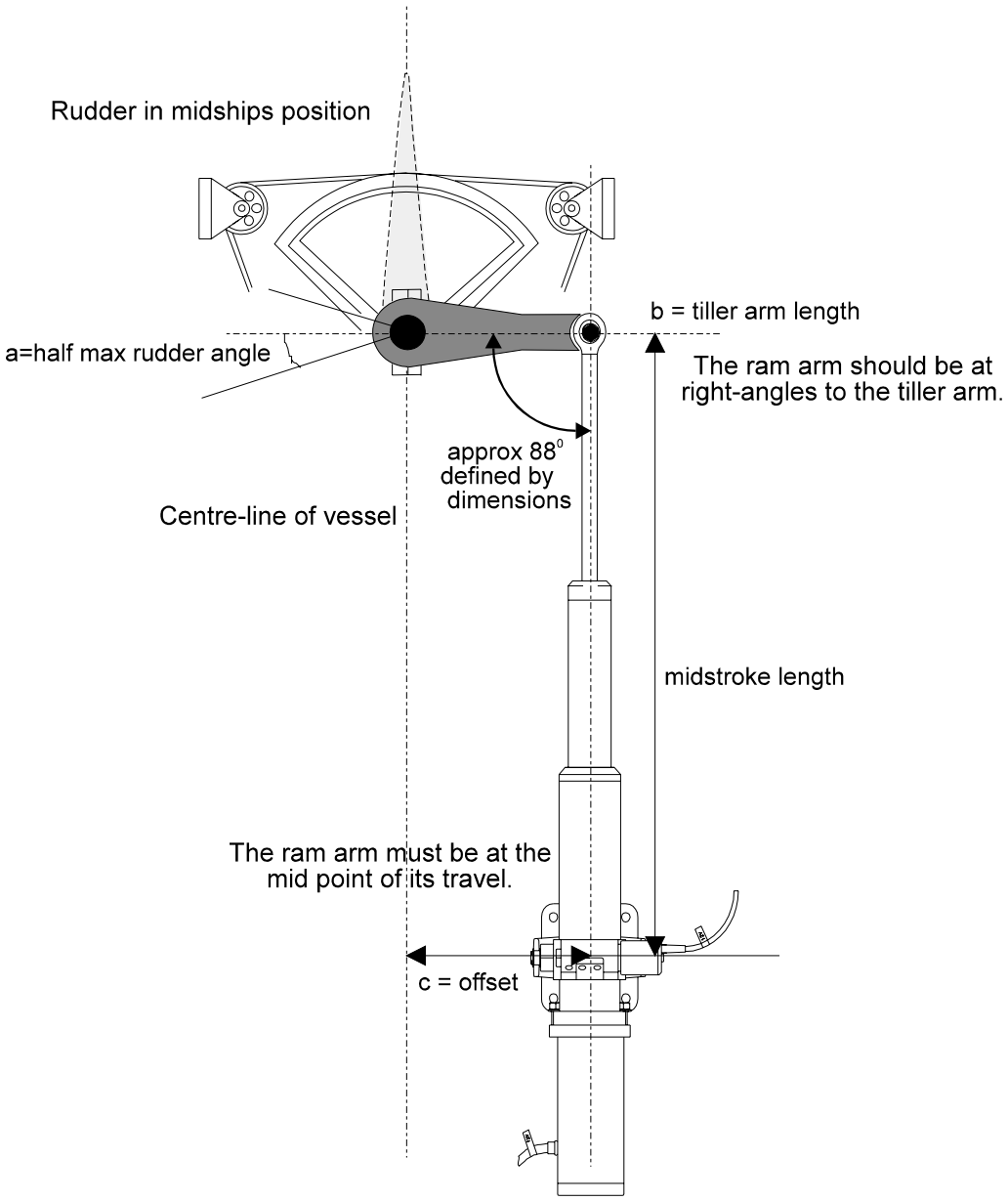
**Note:** The tap ON position is in alignment with the pipe.

**Typical Ram Drive Unit Layout**



## Ram Mounted Parallel to Vessel's Centre-line



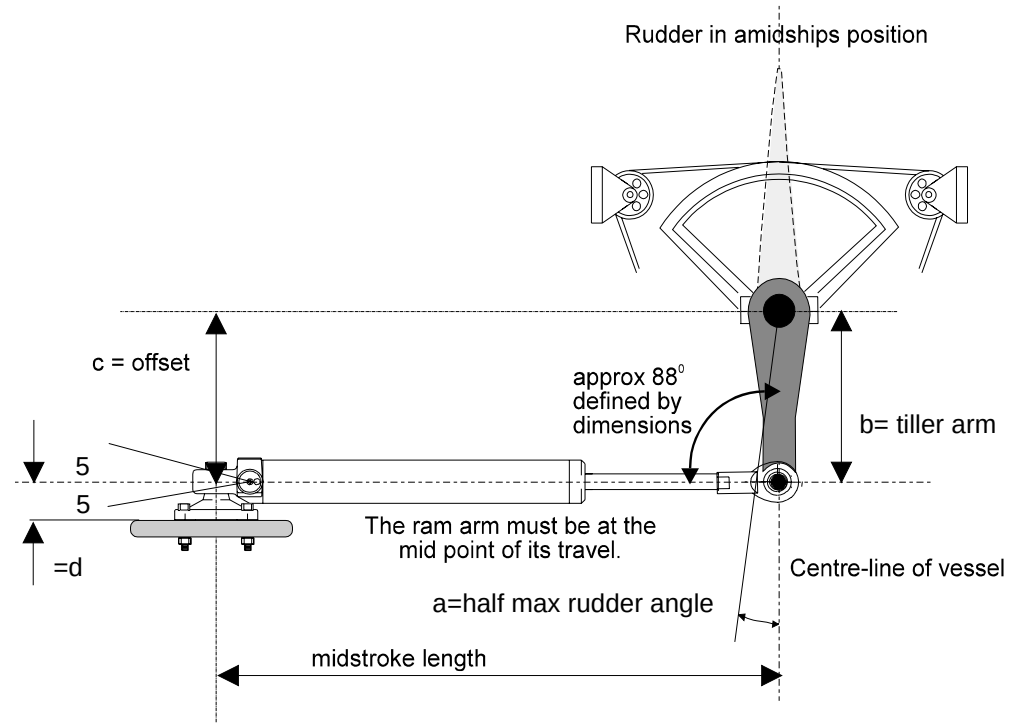

Key Points On Installation

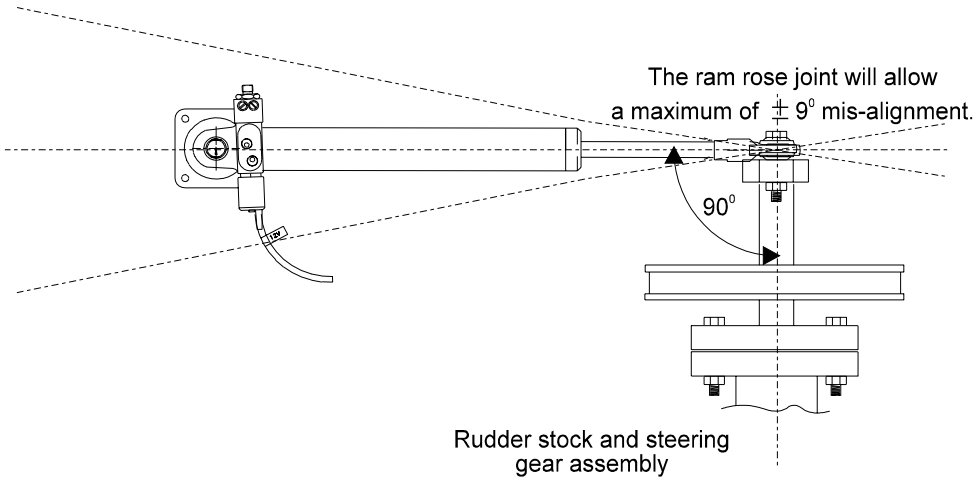
Ensure that the rudder angle is limited by the rudder stops and not the limit of travel of the ram arm. Failure to do this will damage the unit and invalidate the warranty.

Ensure that there is sufficient space at each end for the ram arm to extend fully.

Check for full movement and security of the steering gear before applying any power to the Pilot system.
+

# Vertical Bulkhead Installation



## Mounting a Ram on a Vertical Bulkhead

Due to the restricted movement of the ram of $+14^{o}$, $-10^{o}$ for the Type 0, 1 and 2 and +/- $5^{o}$ for the Type 3, it is important that the maximum rudder angle is carefully measured and the positioning of the ram, tiller arm length and offset are carefully followed.

**CAUTION: Failure to comply with these dimensions may cause premature failure of the ram and place excessive stress on the structure of the vessel.**

The Type 0, 1 and 2 Rams may be mounted in any orientation, without the need to fit an external reservoir. The Type 3 Ram requires an external reservoir that must be mounted above the unit and care must be taken to ensure that the connecting pipes are not in any way kinked or turned through any tight bends.

## Splitting the Ram Drive Unit

### Important Note

When dealing with any hydraulic system great care must be taken to ensure that a high degree of cleanliness is observed and no dirt, moisture or foreign objects are allowed to enter the system. Only the recommended fluids must be used:

Use only Q8 DYNOBEAR 10 or equivalent (10cSt at 40°C or ISO VG 10).

It is not possible to split linear actuators.

**Type 1 and Type 2** units comprising separate ram/pumps, reservoirs and hydraulic cylinders connected by hoses, are available from your dealer. These are supplied with 1-metre hoses. Units with longer hoses are available from your dealer. These can be supplied with quick connect couplings and pre-filled hoses. Such units do not need to be bled.

**Type 3** units are supplied as split units, connected by 1m (3ft) hoses. Units with longer hoses are available from your dealer. These can be supplied with quick connect couplings and pre-filled hoses. Such units do not need to be bled.

## Hydraulic Drive Pumps

The Reversible Hydraulic Drive Pump has a small high speed pump driven by a 12V or 24V dc permanent magnet motor. The pump has Pilot check valves to prevent back driving and a Pilot operated reservoir valve to enable the unit to drive balanced or unbalanced cylinders. The unit has Port and Starboard 1/4" BSP service ports and a 1/4" BSP reservoir port. Adapters for 1/4" BSP to NTP are available.

| Hydraulic Pump Type | PMP-T1-12V | PMP-T2-12V | PMP-T3-24V |
|---|---|---|---|
| Pump Type | Reversible DC motor | Reversible DC motor | Reversible DC motor |
| Supply Voltage | 12V DC | 12V DC | 24V DC |
| Typical Operating Current | 5-17.5A | 5-22.5A | 6-17.5A |
| Maximum Pressure | 1000 psi | 1000 psi | 1000 psi |
| Maximum Flow Rate | 750 cc/min, 46 $ins^3$/min | 1420 cc/min, 87 $in^3$/min | 1980 cc/min, 121 $in^3$/min |
| Cylinder Capacity | 100 - 300 cc, 6.1 - 18.3 $in^3$ | 275 - 550 cc, 16.8 - 33.6 $in^3$ | 525 - 750 cc, 32 - 46 $in^3$ |
| Weight | 3 kg 6.6 lbs | 3 kg 6.6 lbs | 4 kg 8.8 lbs |

## Hydraulic Drive Pump Data

### Key Points On Installation

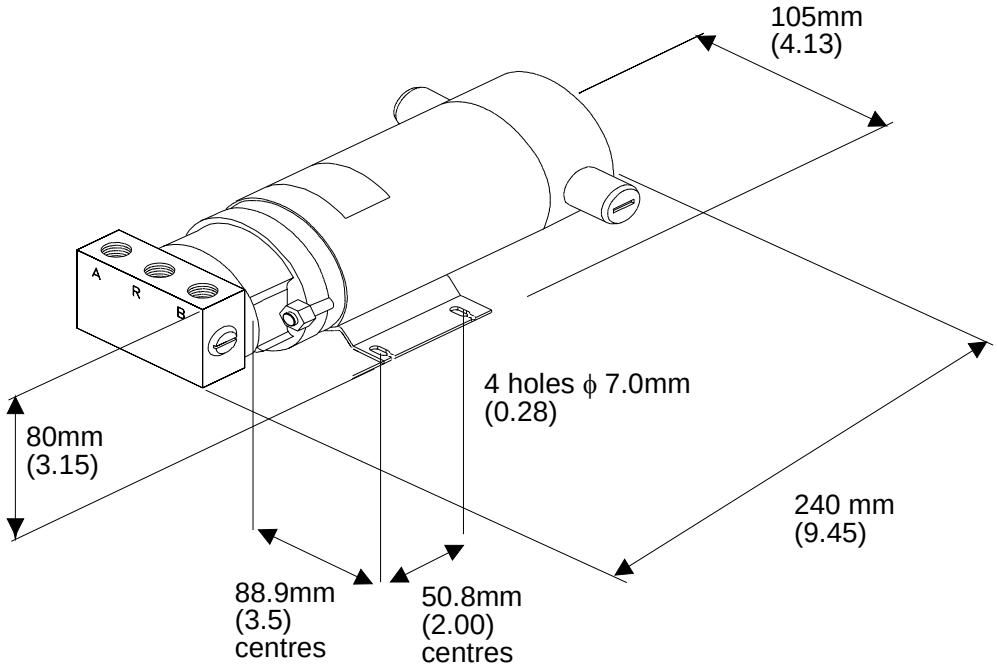
A position should be chosen convenient for the steering system hydraulic delivery lines.

The site should be rigid and flat to prevent excess vibration.

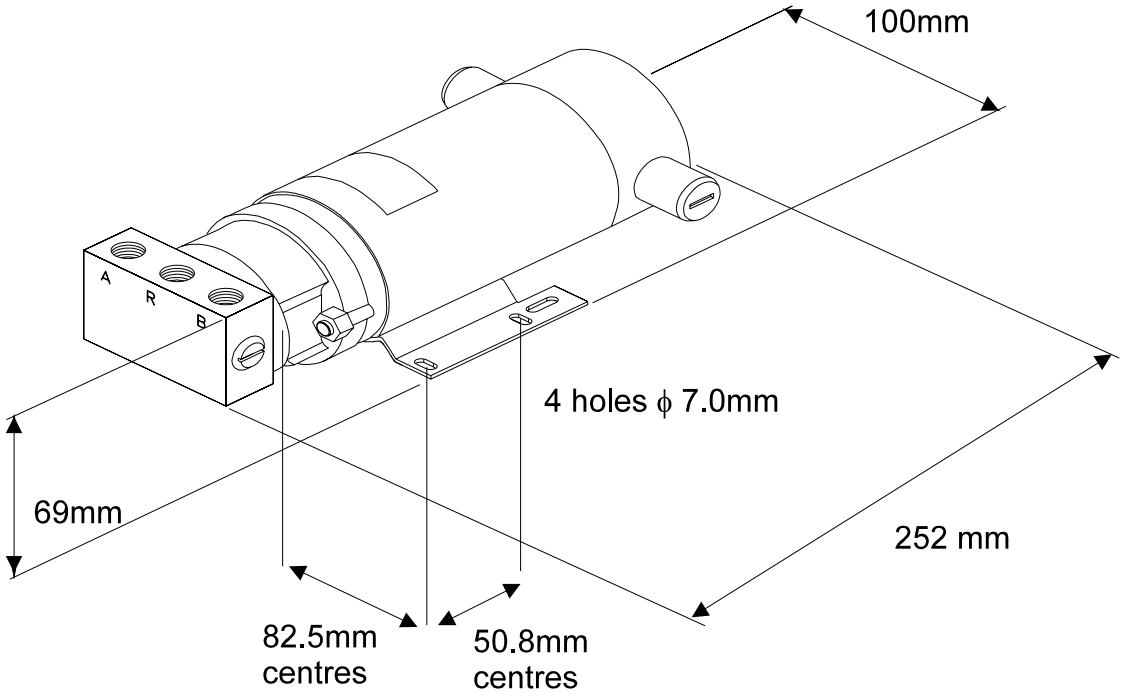
Shielded from the direct effects of the elements.

Minimise the lengths of the hydraulic lines from the pump to the cylinder and where possible the pump motor supply cables.

## Type 1 and 2 Hydraulic Pump Dimensions




## Type 3 Hydraulic Pump Dimensions



## Important Note

When dealing with any hydraulic system great care must be taken to ensure that a high degree of cleanliness is observed and no dirt, moisture or foreign objects are allowed to enter the system. Only the recommended fluids must be used. Use Q8 DYNOBEAR or equivalent (10cSt at 40° C).

Drain the steering system from the lowest point, usually at a cylinder coupling.

Fit T-pieces into the port and starboard delivery lines, couple the lines to the appropriate service ports of the pump using flexible hydraulic hose.

Couple the reservoir port to the reservoir/balance line from the helm units. A low pressure, transparent plastic tube can be used. Ensure that this line rises gradually with no down turns.

Refill the steering system as recommended by the manufacturer, using clean hydraulic fluid.

Fill the cylinder by temporarily removing the cylinder couplings and hoses at each end, refit the hoses securely.

Starting at the highest helm unit, fill the helm reservoir.

Slowly turn the steering wheel two turns to port and then to starboard, checking the level of fluid in the helm unit reservoir at all times.

Next, turn the wheel fully in one direction until a slight pressure is felt, continuously monitor the reservoir level.

Repeat in the opposite direction and continue in this manner until topping up is no longer necessary.

When satisfied that the steering is fully bled manually, apply power to the pump unit.

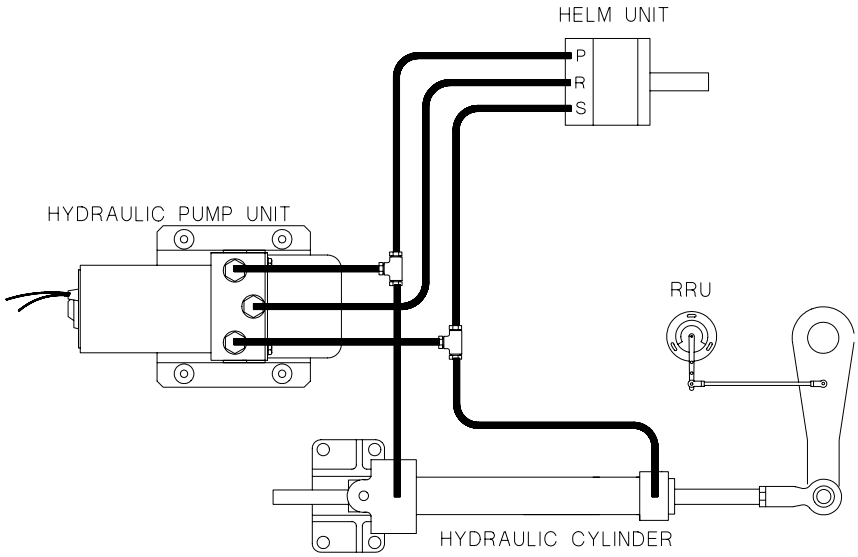
Turning the wheel fully from lock to lock will cause the pump to self-purge.

Check the fluid level in the helm unit reservoir.

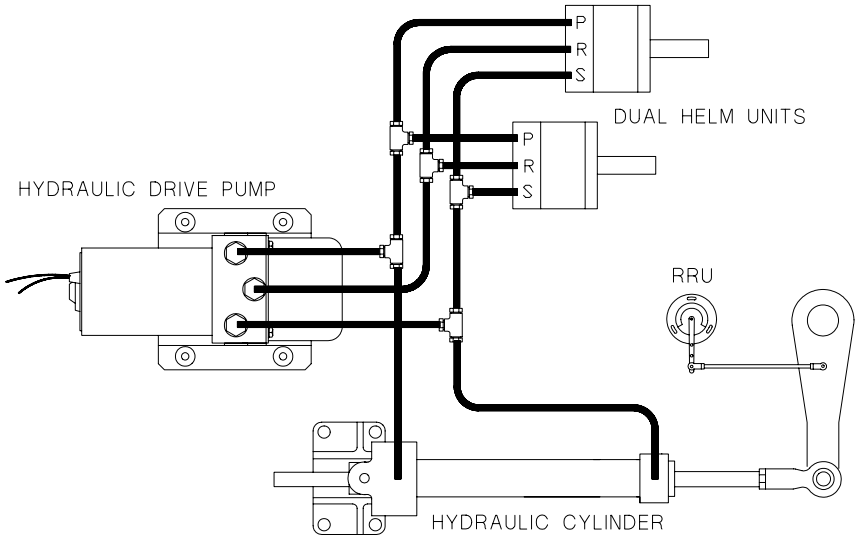
When the system appears to be fully functional, with the pump running and the helm hard over check for leaks.

Secure all hoses and cables to prevent damage.

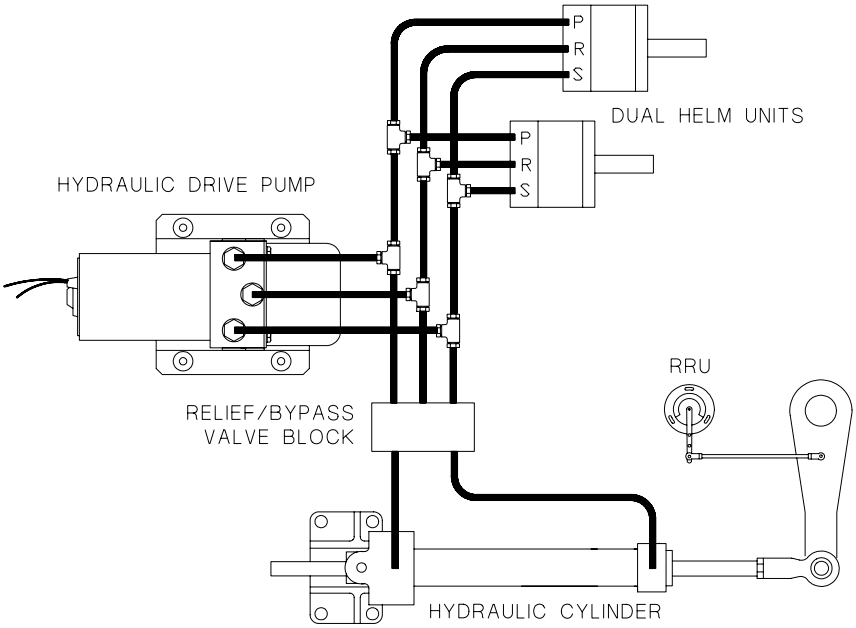
**Single Station System Example**




**Dual Station System Example**



## Dual Station System with Bypass Example




## Dual Station Pressurised System Example