Raymarine®

Constant Running Hydraulic Pump

Installation Guide

Document Number: 87039-2
Date: March 2006

Important information

Drives covered

M81126 - Raymarine Constant Running Pump (Variable flow) 12V

M81128 - Raymarine Constant Running Pump (Variable flow) 24V

Safety notices

WARNING: Product installation
This equipment must be installed and operated in accordance with the instructions contained in this handbook. Failure to do so could result in poor product performance, personal injury and/or damage to your boat.

Because correct performance of the boat's steering is critical for safety, we STRONGLY RECOMMEND that an Authorized Raymarine Service Representative fits this product.

WARNING: Navigation aid
Although we have designed this product to be accurate and reliable, many factors can affect its performance. As a result, it should only be used as an aid to navigation and should never replace commonsense and navigational judgement. Always maintain a permanent watch so you can respond to situations as they develop.

EMC installation guidelines

All Raymarine equipment and accessories are designed to the best industry standards for use in the recreational marine environment.

Their design and manufacture conforms to the appropriate Electromagnetic Compatibility (EMC) standards, but correct installation is required to ensure that performance is not compromised. Although every effort has been taken to ensure that they will perform under all conditions, it is important to understand what factors could affect the operation of the product.

The guidelines given here describe the conditions for optimum EMC performance, but it is recognized that it may not be possible to meet all of these conditions in all situations. To ensure the best possible conditions for EMC performance within the constraints imposed by any location, always ensure the maximum separation possible between different items of electrical equipment.

For optimum EMC performance, it is recommended that wherever possible:

Raymarine equipment and cables connected to it are:

- At least 3 ft. (1 m) from any equipment transmitting or cables carrying radio signals e.g. VHF radios, cables and antennas. In the case of SSB radios, the distance should be increased to 7 ft. (2 m).
- More than 7 ft. (2 m) from the path of a radar beam. A radar beam can normally be assumed to spread 20 degrees above and below the radiating element.

The equipment is supplied from a separate battery from that used for engine start. Voltage drops below 10 V, and starter motor transients, can cause the equipment to reset. This will not damage the equipment, but may cause the loss of some information and may change the operating mode.

Raymarine specified cables are used. Cutting and rejoining these cables can compromise EMC performance and must be avoided unless doing so is detailed in the installation manual.

If a suppression ferrite is attached to a cable, this ferrite should not be removed. If the ferrite needs to be removed during installation it must be reassembled in the same position. Always use the ferrites supplied by Raymarine.

Connections to other equipment

If your Raymarine equipment is to be connected to other equipment using a cable not supplied by Raymarine, a suppression ferrite MUST always be attached to the cable near to the Raymarine unit.

Waste Electrical and Electronic Equipment Directive

The Waste Electrical and Electronic Equipment (WEEE) Directive requires the recycling of waste electrical and electronic equipment. Whilst the WEEE Directive does not apply to some of Raymarine's products, we support its policy and ask you to be aware of how to dispose of this product. The crossed out wheelie bin symbol, illustrated above, and found on our products sigifies that this product should not be disposed of in general waste or landfill. Please contact your local dealer, national distributor or Raymarine Technical Services for information on product disposal.

Handbook information

To the best of our knowledge, the information in this handbook was correct when it went to press. However, Raymarine cannot accept liability for any inaccuracies or omissions it may contain. In addition, our policy of continuous product improvement may change specifications without notice. As a result, Raymarine cannot accept liability for any differences between the product and the handbook.

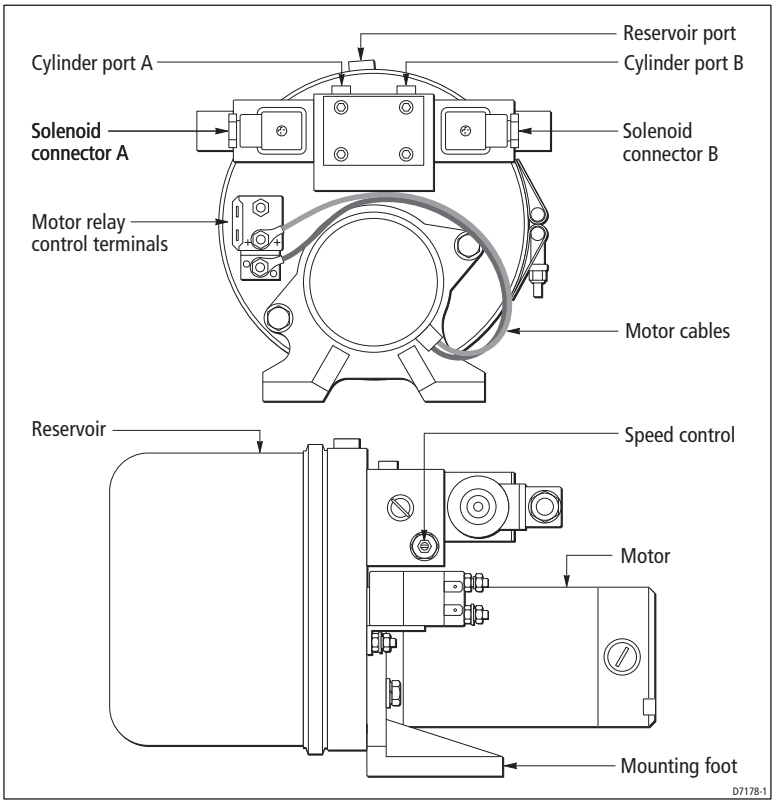
Introduction

Product description

Welcome to the installation guide for the Raymarine constant running (CR) hydraulic pump. This product is intended to operate the boat's steering mechanism as part of a Raymarine autopilot system.

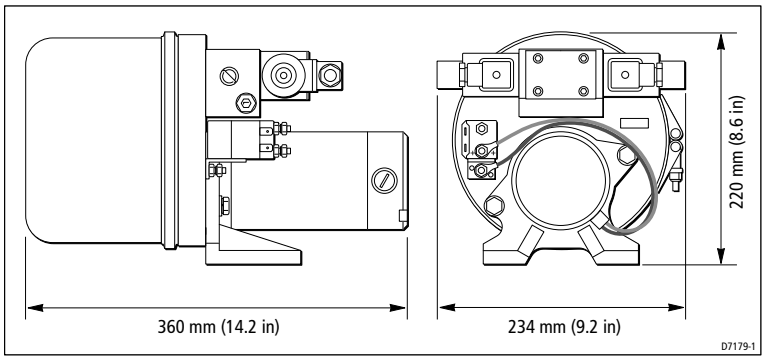
The pump provides an ideal drive system for large boats and heavy duty steering applications. It is primarily designed for use on boats with an existing hydraulic steering system. Alternatively, you can use this pump on a boat with mechanical steering in conjunction with a secondary steering ram and bypass valve.

The pump contains a built-in reservoir that holds hydraulic fluid and an integral solenoid valve that controls the flow of hydraulic fluid to the steering ram. The autopilot system steers the boat by using the solenoid control valves to control the flow of hydraulic fluid to the steering ram.



Specifications

Performance (at nominal voltage)	**CR Pump** M81126 (12 V) M81128 (24 V)
Weight	12 Kg
Ambient temperature	-20ºC to +55ºC
Current Limitation	Must be fitted with current overload protection
Maximum pressure	70 BAR
Relief Valve	Pre-set to 57 BAR
Pipework	Suitable for 70 BAR working pressure Maximum pressure 100 BAR
Recommended oils	-20ºC to +10ºC - Q8 Dynobear 10 +10ºC to +55ºC - Automatic Transmission Fluid (ATF 40 CST at 40ºC)
Filtration	Replaceable internal element. Return line - 15 micron.
Reservoir	4.0 Litre capacity



Installation

Pump mounting

CAUTION:
During installation, take care not to knock the CR pump's mounting feet on any solid structures as the impact may damage the aluminium castings.

Mount the CR pump:

- on a substantial member to avoid vibration
- on a suitable horizontal surface, feet down or vertically, tank down
- clear of spray and possible water immersion
- away from fumes, high temperatures and inflammable gases
- level or above the hydraulic steering ram to prevent air collecting in the ram
- as close to the steering ram as possible
- using suitable bolts with lock nuts/lock washers
- using the rubber mounts between the pump and the boat's structure to reduce noise transfer.

Hydraulic connections

WARNING:
Before disconnecting any pipes on pressurized systems, you MUST release the pressure at the reservoir by following the manufacturer's instructions.

CAUTION:
Absolute cleanliness is essential when working with hydraulic systems. Even the smallest particle of dirt could prevent the steering system check valves from working properly.

CAUTION:
Do not use tapered adaptors, thread sealing compound or PTFE tape on hydraulic pipe connections.

CAUTION:
Before you connect the autopilot pump to your hydraulic system we strongly recommend that you consult the steering gear manufacturer.

General guidelines

- Try to keep hydraulic fluid loss to a minimum when installing the pump. This will reduce the time and effort required to bleed the system of trapped air after installation.
- The ram ports (A & B) on the CR pump are tapped to 1/4 in (BSP) parallel threaded and the reservoir port (R) is tapped to 3/8 in parallel threaded. Use only bonded rubber or metal washers to seal the fittings.
- Ports A and B (yellow capped) are the connections to the ram. Pipework and connections must be suitable for 100 bar working pressure minimum rating.
- The reservoir port R (red capped) must be connected through a continuous rise to the help pump bottom connection If used with pressurized reservoir type systems, the pipe must be suitable for at least 7 bar.

CAUTION:
Do not plug the reservoir port. This could result in damage to the pump and steering failure.

- Three NPT adaptors are included for conversion to NPT where required.
- Follow the manufacturer's instructions if you fit any T-pieces.
- Make sure all hydraulic pipes slope upwards towards the reservoir.
- Fill the system using a good quality 40 grade automotive transmission fluid. Check for compatibility with the helm pump and ram manufacturers specification.
- A set of bleed valves near the steering ram, fitted at the highest point, will allow any air to escape upwards.

CAUTION:
Before running the pump for the first time, make sure the system contains sufficient hydraulic fluid. You will damage the pump if you let it run when 'dry'.

Check valves

For single-steering position boats:

- Consult the steering gear manufacturer to determine whether the helm pump is fitted with reversing check valves:
  - without check valves, the autopilot pump will drive the helm pump (sometimes referred to as 'motoring the wheel') instead of moving the steering ram.

- If the boat has a single helm pump system without check valves, you must incorporate a double pilot check valve (part number: M81166) as shown in Figure 3.
- A double pilot check valve may also be necessary on long pipe runs - otherwise pipe expansion may cause poor autopilot performance. Install the check valve as shown in Figure 3.

Note: *If the boat has two steering positions, it will already have check valves installed so the two wheels can operate independently.*

Hydraulic steering systems

There are three basic types of hydraulic steering systems:

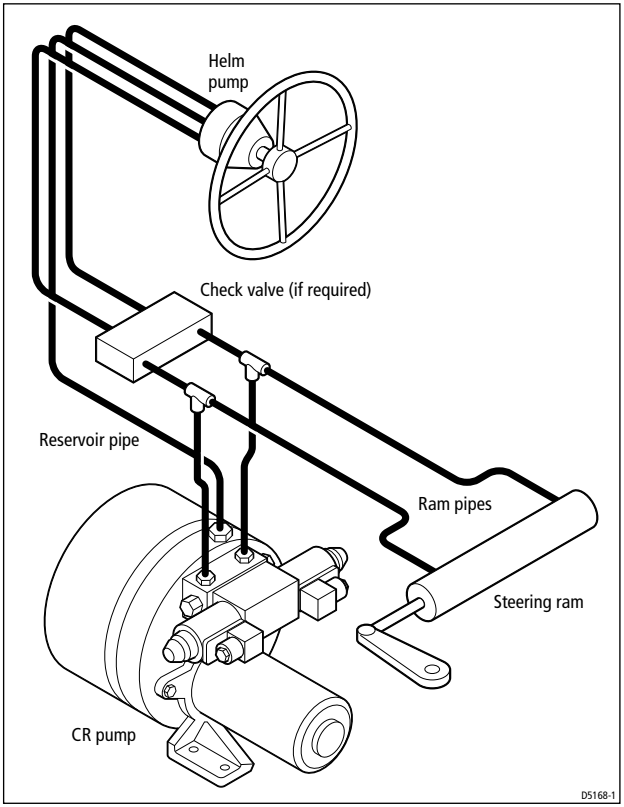
- two line system
- three line system
- two line pressurized system

On the following pages we describe each type of system and typical connection points for the autopilot pump. For all of these systems you will need to connect a third hydraulic pipe as shown between the autopilot pump and the helm pump or dedicated system reservoir.

Two line systems

Figure 3 shows a typical two line steering system. Hydraulic fluid flows into the ram in either direction, depending on the direction the helm pump rotates.

Connect the autopilot pump to the steering system as shown below

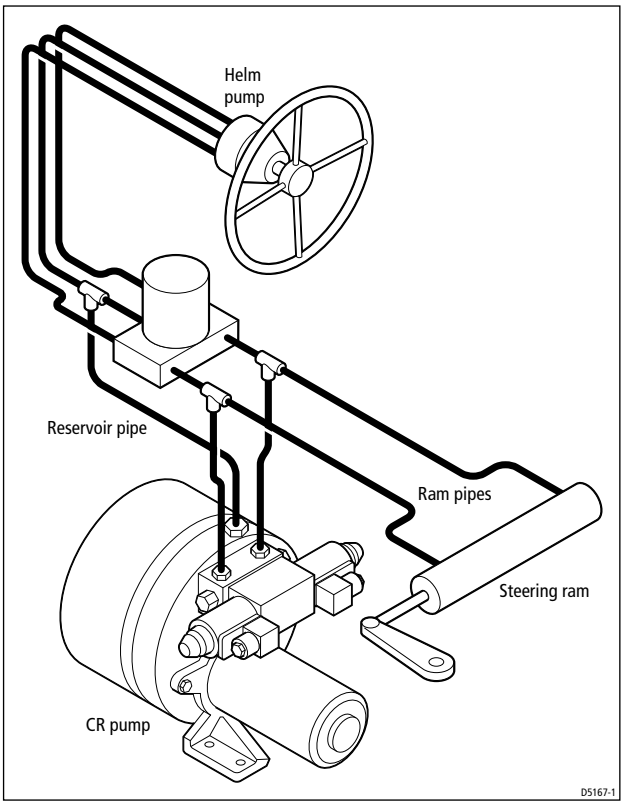


Two line pressurized systems

Two line pressurized systems have an external pressurized reservoir. This reduces the possibility of introducing air into the system and reduces any steering 'sponginess' caused by pipe expansion.

Connect the autopilot pump to the steering system as shown below

Note: *Refer to the manufacturer's instructions for de-pressurizing and re-pressurizing the system.*



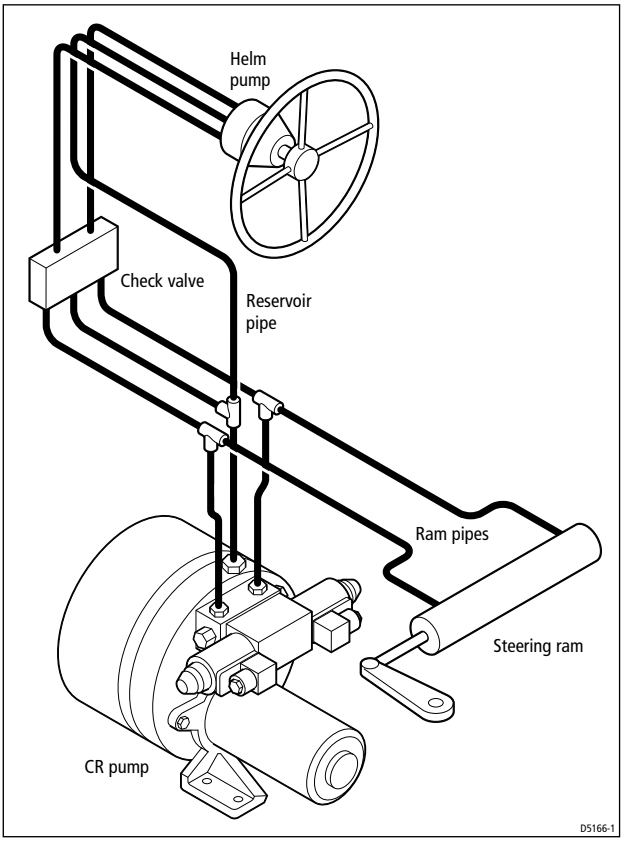
Three line systems

In a three line system, the hydraulic fluid flows in only one direction:

- out of the helm pump to the ram
- returning from the other side of the ram to the reservoir via a common return line

The system will include a check valve block to direct all returned fluid from the ram back to the reservoir.

Connect the autopilot pump to the steering system as shown below



Electrical connections

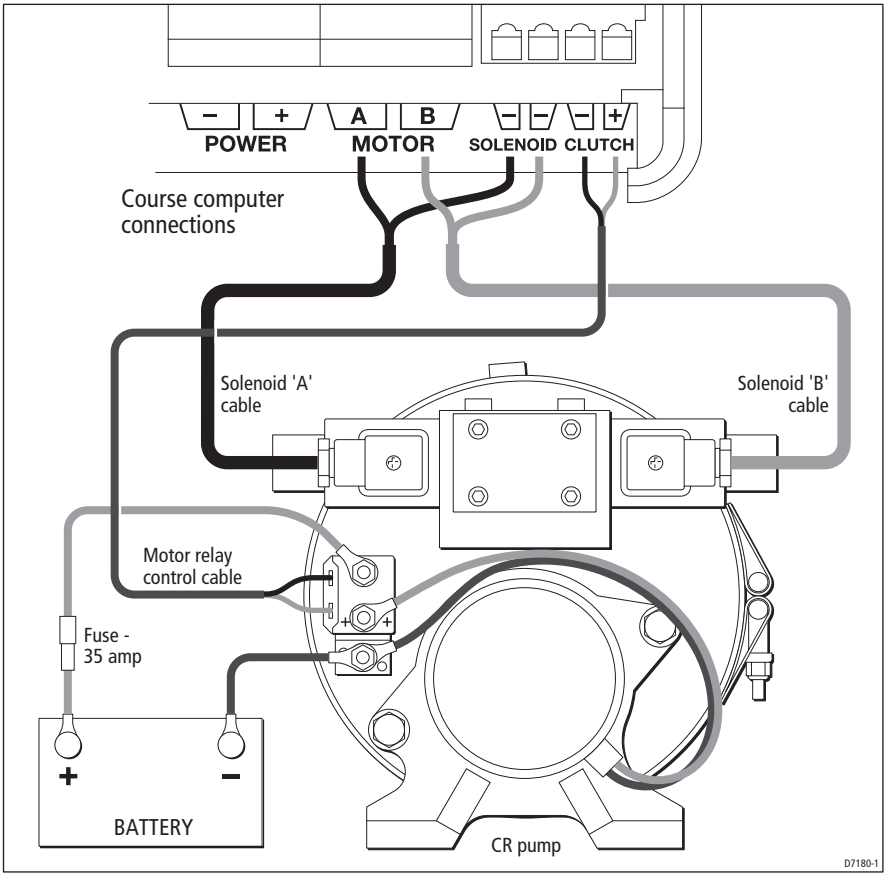
CAUTION: Electrical safety
Make sure the power supply is switched off before you make any electrical connections.

The CR pump has electrical connections for:

- motor supply: two single-core cables
- solenoid control valve supply: two plug-in connectors (supplied)
- clutch connection: two cables

Note: *When routing cables, refer to the EMC installation guidelines.*

Connecting to S2 and S3 course computers



Make the following connections:

1. CR pump motor supply:
   - using appropriate cables connect the CR pump motor to the boat's power supply, via an appropriate circuit breaker and fuse. (see Table below)

Pump motor cable length (distribution panel to pump)	Cable gauge (AWG)	Copper area (mm^2)	Fuse Rating
12v CR pumps			
up to 3 m (10 ft.)	10	6	70 A
up to 7 m (23 ft.)	8	10	
up to 16 m (52 ft.)	6	16	
24v CR pumps			
up to 3 m (10 ft.)	12	4	40 A
up to 5 m (16 ft.)	10	6	
up to 10 m (32 ft.)	8	10	
up to 16 m (52 ft.)	6	16	

2. Solenoid control valves – using suitable cable (at least 16 AWG or 1.5 mm2 for runs up to 16 m/52 ft.):
   - for the "A" side: connect the positive core to the **MOTOR A** terminal and the negative core to one of the **SOLENOID (-)** terminals at the course computer
   - for the "B" side: connect the positive core to the **MOTOR B** terminal and the negative core to the other **SOLENOID (-)** terminals
3. Using a pair of cables, connect the motor relay control terminals on the pump to the course computer **CLUTCH** terminals

WARNING: CLUTCH VOLTAGE
To avoid damaging your CR pump, you MUST set the CLUTCH VOLTAGE fuse on your course computer to 12 v. This applies even on 24 v motor systems.

Note: *If installing the pump on a boat with mechanical steering, you also need to connect a bypass valve to the* **CLUTCH** *terminals (see page 15).*

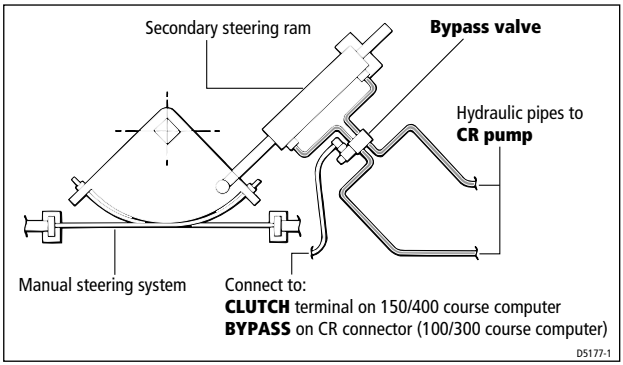
Mechanical steering

If you are fitting the pump to a boat with mechanical steering you will need to connect it to a secondary steering ram, along with a solenoid-operated bypass valve (part no. M81167). The bypass valve allows you to switch between autopilot course control and manual steering.

To fit to a mechanical steering system:

1. Use suitable hydraulic pipes to connect the pump to the secondary steering ram and a suitable reservoir.
2. Install the solenoid-operated bypass valve across these pipes (as shown in Figure 8).
3. Connect the bypass valve to the CLUTCH terminals on the course computer

Note: *Follow the manufacturer's instructions for mounting the hydraulic ram.*



Commissioning

System Check

WARNING:
Keep clear of moving steering systems at all times. Protect moving parts from access during normal use.

Check the following points after installing the pump:

1. Is the pump installed as close to the steering ram as possible?
2. Is the pump secured to a substantial structure on the boat?
3. Have you connected a third hydraulic pipe between the helm pump and autopilot pump?
4. Have you fitted check valves where appropriate?
5. Are the hydraulic pipes made of a suitable flexible material (i.e. rubber or nylon) with a suitable pressure rating?
6. Have you sealed all hydraulic connections and checked for leakages?
7. Are power cables correctly routed and securely connected to the course computer?

You have now finished installing the pump. After installing the rest of the autopilot you must bleed all air from the system (see below).

Note: *When you have installed the entire autopilot system, you will also need to complete an autopilot steering check. Refer to the control unit handbook for more details.*

Bleeding the system

Bleeding the hydraulic system correctly is one of the most important steps when installing the autopilot hydraulic pump. If there is any air in the system the steering will feel spongy, particularly when you turn the wheel to hardover.

CAUTION:
Any air in the hydraulic system will greatly reduce the performance of the autopilot and the overall steering system.

In addition to the manufacturer's instructions for bleeding the steering system, follow these steps to bleed the autopilot pump when you have installed and set up the rest of the autopilot system:

1. With the system in auto mode, press the -10 button ten times:
   - the autopilot pump will try to drive the rudder to port
   - counter this rudder movement by turning the helm to starboard to keep the rudder stationary

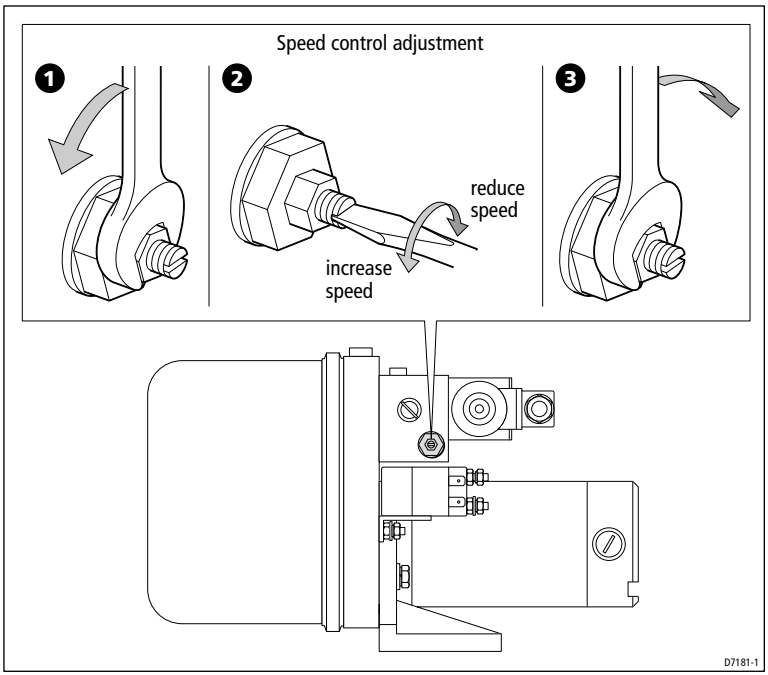
- you will be able to feel any air in the helm pump: any air in this side of the pump will rise to the helm pump and exhaust into the reservoir
- continue until all of the air is out of this side of the pump

2. Clear any air on the other side of the pump:
   - press the +10 button ten times
   - the autopilot will try to drive the rudder to starboard
   - counter the rudder movement by turning the helm to port
   - continue until all of the air is out of this side of the pump
3. Repeat in both directions until both sides of the help pump are totally free of air.

Note: *Monitor the reservoir at all times and top up with the manufacturer's recommended hydraulic fluid as required.*

CAUTION:
After installation and bleeding, leave the system for 24 hours then check for any air in the system or leaks at the joints and around the pump.

Setting the pump speed



Set the speed control to achieve the desired hard-over to hard-over time (nominally 12 seconds).

To adjust:

1. Loosen the locking nut using an 8mm spanner
2. Adjust the speed control using a flat-blade screwdriver. Screw in to reduce speed.
3. Once the desired speed is achieved, tighten the locking nut

Maintenance

On a regular basis:

- check all connections and mountings are secure
- check pipes and cables for any signs of wear or damage
- check hydraulic pipes and connections for leaks

Product support

Raymarine products are supported by a worldwide network of distributors and Authorized Service Representatives. If you encounter any difficulties with this product, please contact either your national distributor, service representative, or the Raymarine Technical Services Call Center.

Contacting Raymarine in the US

You can contact Raymarine in the US using the previously detailed world wide web or by calling one of the telephone numbers below:

1-800-539-5539, extension 2333, or

(603)- 881 - 5200

You can use these numbers Monday through Friday 0815 hrs to 1700 hrs Eastern Standard Time or Eastern Daylight Savings Time.

Contacting Raymarine in Europe

You can obtain technical support, service and accessories from your authorized Raymarine dealer, or by contacting:

Tel: +44 (0)23 9271 4713

Fax: +44 (0)23 9269 4642