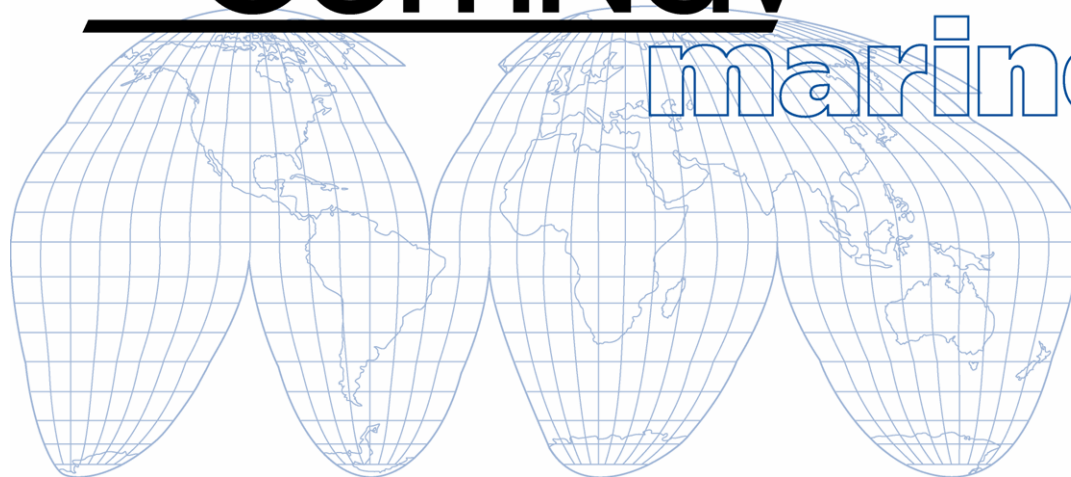


ComNav[®]

marine ltd



Admiral P3 Wheelmark Autopilot System

Installation & Operation Manual



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COMPLIES WITH
CE REGULATIONS

PN 29010075

Welcome

Congratulations on your purchase of ComNav Marine's Admiral P3, a Wheelmark Autopilot System! At ComNav, we are proud of our prominence as a leader in the design and manufacture of marine autopilot systems. Our dedication to performance and reliability will ensure your satisfaction with the ComNav Admiral P3. Developed as a result of ComNav's many years of experience in autopilot design, the Admiral P3 Wheelmark Autopilot System provides better performance and more features than any other autopilot in its class.

ComNav Marine Ltd.

Warranty Notice

Prior to the installation and/or operation of the equipment, ensure that you read, understand, and accept the conditions of the warranties as detailed in the **Warranty Information** document that accompanies this manual.

Operator's Warning

The Admiral P3 Wheelmark Autopilot System will steer your vessel, however it is only an aid to navigation. Its performance can be affected by many factors including equipment failure, environmental conditions, and improper handling or use. The system does not reduce your responsibility for the control of the vessel when underway. You must always be in a position to monitor the course, supervise the autopilot, and resume manual control if the need to do so arises.

Whenever underway, your vessel must be under the control of a qualified and alert person.

General Notice

This document, ComNav part number 29010075 Version 3 Revision 1, is the approved Installation and Operation Manual for use with ComNav's Admiral P3 Autopilot System. Where versions of this manual exist in other languages, the English version shall be considered authoritative.

Document History

Revision	Date	By	Description
1R1	07 August 2005	DC	First Release
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3R1	30 November 2007	DTO	<ul style="list-style-type: none">- added Compass Safe Distance information, Table 14- re-organized “modes & menus” information for easier use- moved all “using the Head” information into one area

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Introduction

About this Manual

This manual provides essential information for the safe and reliable operation of the ComNav Admiral P3 Wheelmark Autopilot System. You are urged to read this manual in its entirety before you use your autopilot for the first time, and to keep it handy until you become thoroughly familiar with the operation of your autopilot.

Typefaces, Common Phrases & Terms

Throughout this manual, you will see a number of different typefaces used, and several commonly-used words & phrases with very specific meanings, to describe concepts & actions that are fundamental to the operation of the autopilot. Please take a moment to become familiar with the following items:

Modes of Operation

Specific “modes of operation” are placed in bold uppercase lettering.

Example: **POWER STEER** mode.

Button

Admiral P3 Control Head buttons and controls are placed in uppercase lettering.

Example: the **TURN** button.

System Component

Specific System Components are capitalized.

Example: The Control Head, or a Fluxgate Compass

LCD Display

Text that appears in the LCD display is in quotation marks.

Example: “Waypoint Arrival”

press or momentary press

Press and release the indicated button.

double-press

Press and release the indicated button twice in rapid succession.

Although this sounds a little complicated, it is actually very easy to do. Many users familiar with desktop computers perform a similar function when they “double-click” their mouse pointer.

press and hold

Press and hold the indicated button for a minimum of one-half of a second.

This time delay is purposely programmed into the system’s response to some buttons, to prevent casual or accidental activation of the button function. For example, pressing the **Fn** button can, depending on system configuration, drastically alter the steering performance of the Autopilot.

maintain

Hold the indicated button for as long as required to achieve a given result.

Example: To dodge an obstacle in the water, press either the **PORT ARROW** or **STARBOARD ARROW** button, and maintain it in that position until the vessel has dodged clear of the obstacle in its path.

Manual Format

This manual has been formatted to be printed on both sides of the pages of the manual, and on standard Letter-sized paper (8.5" x 11"). If you have obtained this manual as a soft-copy, please note that it is in Adobe® Portable Document Format ("pdf"), and so may be viewed & printed with Adobe Reader®, or compatible pdf-format viewers.

When printing this manual with Reader, you should select "duplex printing" (or the equivalent term used by your printer's software driver), in order to print it double-sided on the paper. If your printer does not have built-in duplexing capability, you can still print this manual double-sided by following the instructions that came with your printer for doing "hand duplexing".

How Autopilots Work

The purpose of this section is to briefly describe what an autopilot does and some of the things you should expect when using an autopilot with your boat. The information in this section can be applied in general to any ComNav autopilot, and is not specific to the Admiral P3 Autopilot.

Basic Autopilot System

Figure 1 is a block diagram of the major components of an autopilot system.

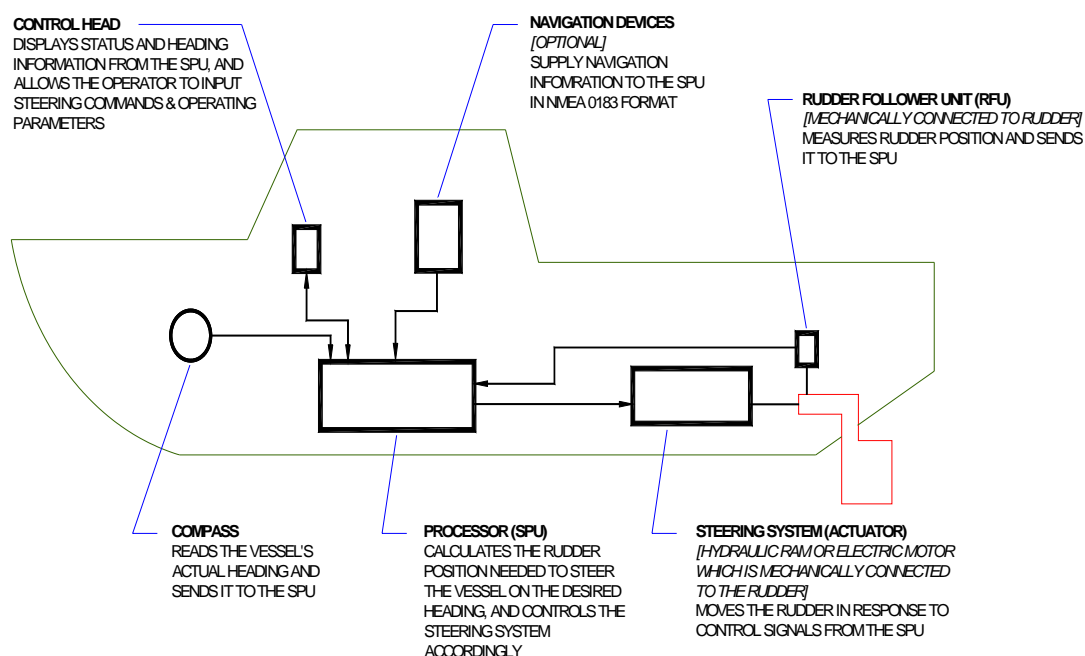


Figure 1 – Basic Autopilot System

The Compass indicates the direction in which the boat is pointed – often referred to as the *Actual Heading*. Depending on the type of boat & installed equipment, the Compass may be a magnetic compass, an electronic fluxgate compass, a gyroscopic compass, or a GPS Compass. A reliable compass is absolutely vital to the autopilot – because, without a compass, the autopilot has no way of knowing which way the boat is headed.

The actual heading is fed electronically from the Compass to the Processor (SPU), which is the heart of the autopilot. The SPU contains the microprocessor(s) & other electronic hardware, and the sophisticated control software necessary to steer the boat on any *Desired Heading*.

The Control Head, normally located in the wheelhouse, is the interface between the user (that's you ...) and the autopilot. The Control Head displays information about what the autopilot is doing. It has various controls (buttons &/or knobs) that allow the user to give commands to the Autopilot.

The final part of the picture is the Steering System. In order for the autopilot to steer the boat, there must be some a steering system (i.e., actuator) capable of moving the rudder independently of the ship's wheel. This might be a hydraulic ram that is connected to the rudder post or tiller quadrant, or an electric motor connected to the steering cables. Electronic signals from the SPU signal the steering system to move the rudder. Your autopilot also will have a Rudder Follower Unit (RFU), a device that tells the SPU what position the rudder is in at any given time.

Autopilot Operation: Maintaining a Heading

Say, for example, the autopilot was steering your boat Southwest, and you wished to change direction to Southeast.

That's easy – if you are using your ComNav Autopilot in **AUTO** mode.

To initiate the turn, you would turn the knob on the Control Head to set the Desired Heading (as shown on the Control Head's display screen) to 135° – i.e., Southeast.

The SPU then would compare this to the boat's current Actual Heading of 225° (Southwest), as indicated by the Compass, and determine that the Desired Heading is 90° to Port of the Actual Heading. This in turn would cause the SPU to send a signal to the steering system to move the Rudder to Port – so that the boat turns to Port. The SPU verifies that the Rudder has moved by reading its position from the Rudder Follower Unit.

As the boat turns, the difference between the Desired Heading and the Actual Heading gets smaller, and as it does, the SPU then starts to 'back off' the rudder – i.e., move it back to centre – so that the boat does not overshoot the Desired Heading.

Eventually, the Actual Heading will match the Desired Heading. The SPU will keep steering the boat on a heading of 135°, until new instructions are received from the Control Head.

Figure 2 shows a vessel making that Southwest-to-Southeast turn in **AUTO** mode.

ComNav Autopilots provide an important safety feature in **AUTO** mode: when you first select the mode, the autopilot will use the current Actual Heading as the Desired Heading. This feature prevents the autopilot from executing an unexpected turn when you first select **AUTO** mode.

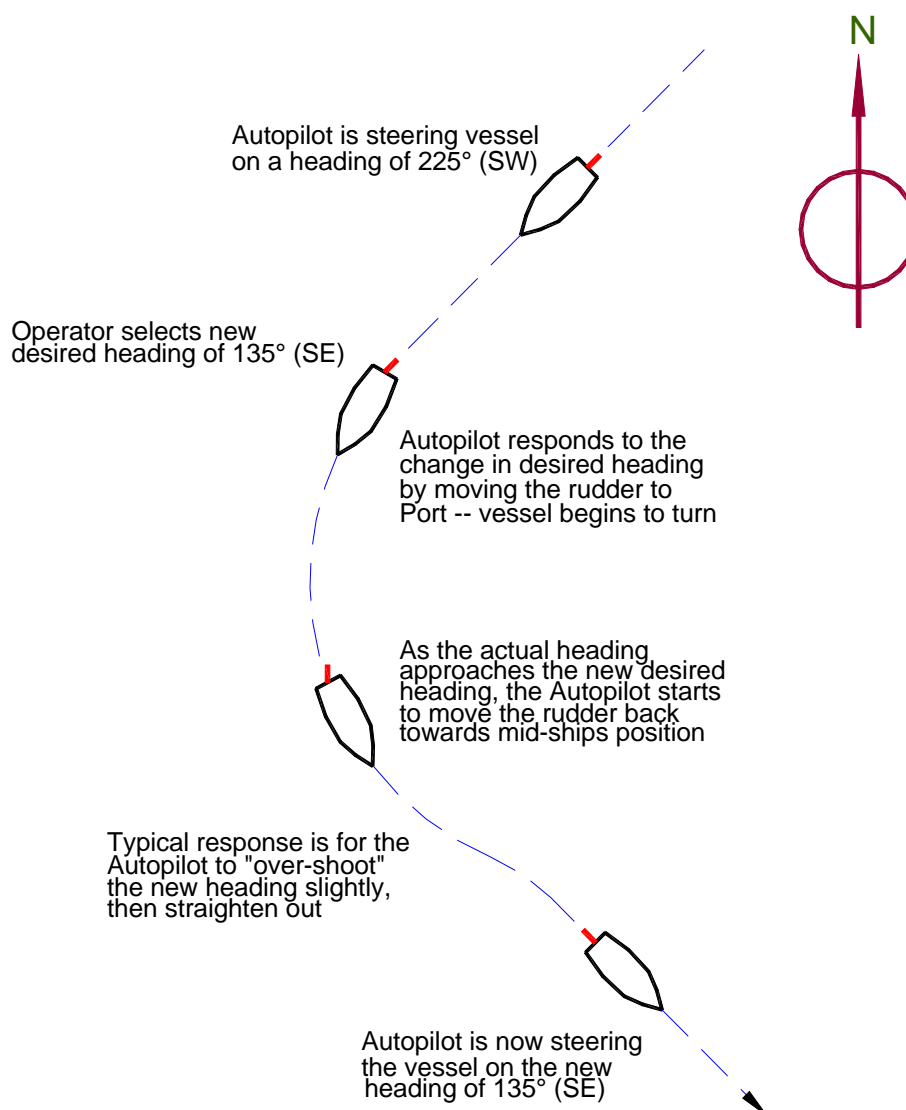


Figure 2 – Heading Change in AUTO Mode

Wind and Current Effects

If your boat encounters a crosswind, and/or a tidal current, at some angle to the Desired Heading, it will be constantly pushed away from that heading, in the direction of the wind or current. So the autopilot will constantly be making course corrections.

As that condition persists, the SPU will gradually begin to maintain the rudder a few degrees to Port or Starboard of the centred position, to counter the effect of wind, and/or current. This feature, known as *trim*, will keep your boat pointed in the right direction, despite the wind or current.

However, one side-effect of trim is that your boat may not follow the *Track* you want – it will maintain your Desired Heading, but the track will “slip” sideways in the direction of the crosswind and/or current. This potential problem can be solved by using another mode that ComNav Autopilots provide: **NAV** mode, described next.

Autopilot Operation: Following a Track – NAV Mode

So far, we have seen how an autopilot operates in **AUTO** mode: a new *desired Heading* must be selected on the Control Head each time you wish to change direction. This is handy for short trips or when you know the direct course to your objective.

But for longer trips, which might involve a number of legs at different headings, it would be useful to be able to have your autopilot steer your boat along all the legs, in sequence.

ComNav autopilots allow you to do just that, with **NAV** mode.

Before using **NAV** mode:, the autopilot must be connected to an external source of navigation information (commands & data) – such as a chart plotter, or a Navigation program running on a PC. A source of position data is required, too; it may be built into the external Navigation System, or it may be another device or system: a GPS receiver (such as a ComNav Vector GPS Compass), a LORAN C receiver, etc.¹

ComNav Autopilots implement the industry-standard NMEA 0183 protocol for reception & transmission of navigation information. Fortunately, almost all of today's Navigation Systems & Devices do comply with NMEA 0183, so interfacing those systems & devices to a ComNav autopilot is relatively simple.

A long passage will consist of a series of *waypoints*, which are specific locations on the Earth's surface (hopefully on the water!) defined by their Latitude & Longitude. These waypoints are entered into the external Navigation System by the user. That system determines the current location of the boat (from the source of position data), and then calculates the course that must be steered in order to reach the next waypoint.

When the Autopilot is switched into **NAV** mode, it begins to look for some specific navigation information from the Navigation System: the course to steer to the next waypoint, and the Cross-Track error (which is the distance from the boat to the desired Track from the last waypoint to the next one). Using these two pieces of information, the autopilot steers the boat on the shortest possible course to the next waypoint.

Crosswinds and/or currents are compensated for automatically each time the Navigation System updates the cross-track error. This is why **NAV** mode is the answer to the "track slip" problem that can occur in **AUTO** mode, when a crosswind/current exists.

When a waypoint is reached, the Navigation System sends the SPU the next set of navigation information – for the next waypoint – and the SPU then turns the boat to head to that next waypoint.

When the last waypoint is reached, the boat typically (depending on how the Navigation System is set up) will orbit that waypoint, until the autopilot either is switched out of **NAV** mode or is given new navigation information by the user, via the Navigation System.

Because the boat will turn automatically turn – without input from the user – at each waypoint, when planning the trip it is crucial that the user verify that there will be sufficient room to execute the turn at each waypoint.

The autopilot can be set to alert the user – by activating an alarm – as the boat nears a waypoint.

¹ ... all such external devices are in general referred to in this manual with the generic term **Navigation System**.

Autopilot Operation: Following a Track – AUTO/ALC Mode

Some ComNav autopilots – including the Admiral P3 – provide another way to keep your boat on a specific *Track*: Automatic Leeway Correction. This feature – an element of the P3's **Intelligent Steering Technology** – can be turned on in **AUTO** mode.

ALC is similar to **NAV** mode, in that it uses NMEA 0183 Latitude/Longitude data to sense if the boat is following the desired Track.

Unlike **NAV** mode, however, the Admiral P3 only needs Latitude/Longitude data in **AUTO/ALC** mode. It does not need Cross-Track error data from the external Navigation System, nor that there be any waypoints set in the system. The P3's IST feature calculates the Cross-Track error on its own, using the *desired heading* active at the point in time when **AUTO/ALC** mode is first engaged.

Power Steer

Most ComNav autopilots have a **POWER STEER** mode, which provides a way for the user to directly control the rudder. Basically, the autopilot acts as a sort of “electronic steering wheel”, allowing the operator to steer the vessel manually, in a similar way as when using a standard manual steering wheel or tiller, but from the autopilot's Control Head or any remote controls it is equipped with.

Steering, when using the autopilot in this mode, is done with two buttons and/or a knob on the Control Head. One button, and/or a clockwise turn of the knob, will move the rudder to Starboard; the other button, and/or a counter-clockwise turn of the knob, will move the rudder to Port.

Using the buttons/knob, the rudder can be placed in any desired position where it will remain. This feature is useful when docking or manoeuvring, because the person steering the vessel can take their hands off the controls between rudder movements.

System Overview

System Overview

This chapter gives a brief description of the major elements of the Admiral P3 Wheelmark Autopilot System, their functions, and their relationships to each other.

Below is a block diagram of a typical example of the Admiral P3 system, showing the interconnections between the elements of the system:

- The Signal Processor Unit (SPU)
- The Main Control Head
- A Compass or other Heading Sensor
- Solenoid(s), Reversing Motor, or Cable Drive, which move the Rudder
- The Rudder Feedback Unit
- Optional Auxiliary Control Head(s) & Remote Controls
- Various optional accessories & external equipment
- Other Navigation equipment

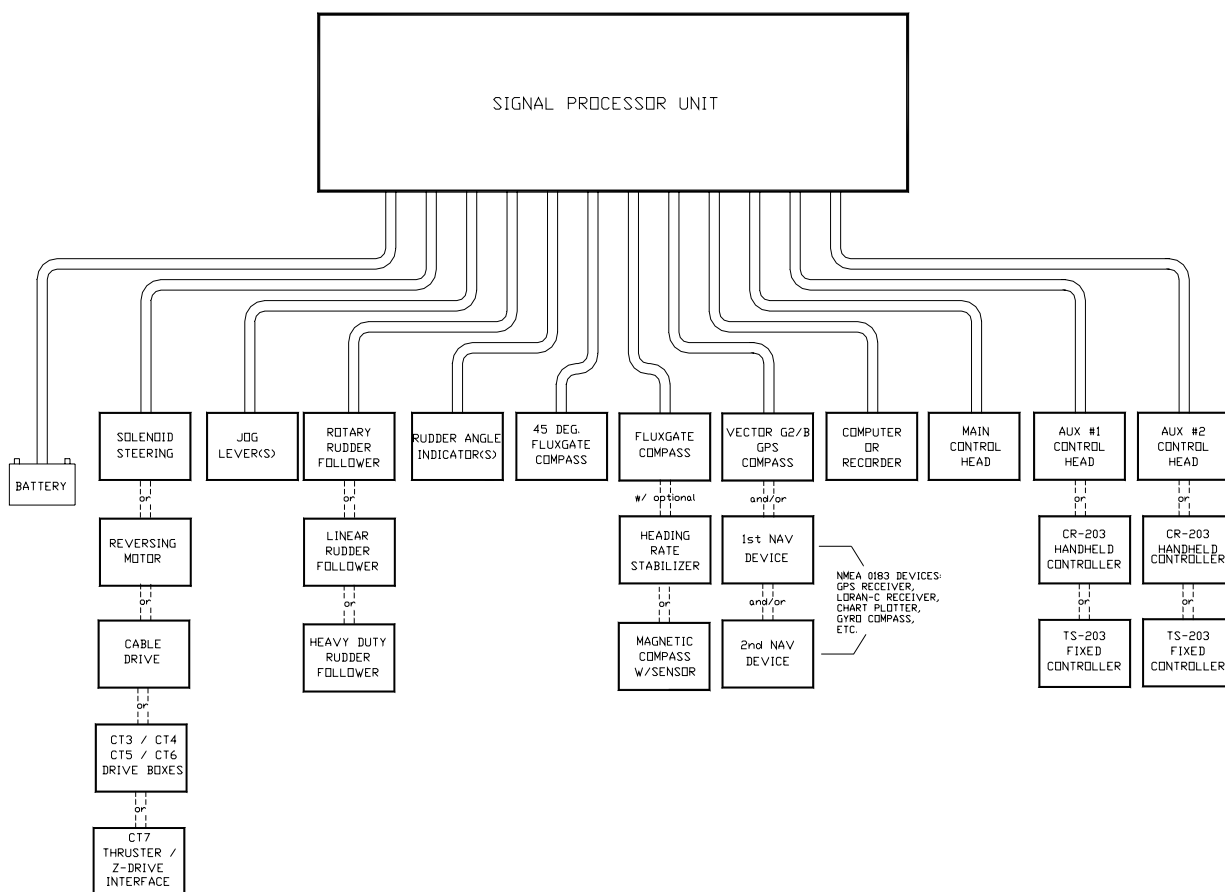


Figure 3 – Admiral P3 System Block Diagram

Note: all the main elements of the Admiral P3 Autopilot System shown in the block diagram above are Wheelmark compliant, and passed IMO testing as a part of the “autopilot system” (see **Wheelmark Compliance Certificate** on page 157). However, some of the optional components shown above are not IMO/Wheelmark compliant. Contact your ComNav Dealer for specific information.

Control Head

PN 20110005

The Admiral P3 Control Head connects directly to the Signal Processor Unit (SPU), via a nine-conductor cable that plugs into the rear of the Head. This cable wires onto a connector supplied with the SPU; that connector in turn can quickly and easily be plugged into the **CONTROL HEAD** receptacle on the SPU.

The Admiral P3 Control Head incorporates a state-of-the-art, sunlight-viewable, high resolution QVGA TFT colour LCD display.



Figure 4 – Control Head

The Control Head, when shipped as part of a complete Admiral P3 system, is a “core” module, with accessories for three mounting options: a snap-on sleeve for surface mounting, a separate snap-on sleeve for flush mounting, and a two-piece bracket for bracket mounting. All required hardware is included, except for two fasteners needed to fasten the bracket to a mounting surface.

Signal Processor Unit

PN 20110001

The Signal Processor Unit (SPU), as its name suggests, accepts a number of signals from the other components of the autopilot system, and processes them as necessary to control the movement of the vessel's rudder so as to maintain a given heading. As well as steering the vessel, the sophisticated software within the SPU continually checks all aspects of the autopilot's performance, and will advise the user via the Control Head if any problems are encountered.



Figure 5 – The Admiral P3 SPU with Wiring & Diagnostic Covers Removed

Compasses

The Compass is a critical component in the proper operation of the Admiral P3 Autopilot System. *The autopilot system's ability to steer the vessel to a given Heading desired by the Operator can only be as accurate as the Compass.*

The Admiral P3 system is capable of using a variety of different compasses. These are discussed below. Various combinations of these compasses, and related accessories, are often required.

It is always a wise and safe choice to have at least two compasses, and/or other Heading sensing devices, on board!

Vector G2 and G2B GPS Compasses

PN 11210001 (G2)

PN 11210004 (G2B)

The ComNav Vector GPS Compasses are state-of-the-art devices which provide accurate 2D Heading & Position data to autopilots, sonar, chartplotters AIS transponders, and other NMEA 0183 devices.



Figure 6 – Vector G2 GPS Compass

Built-in DGPS processing capability provides sub-meter Position accuracy. DGPS source options in the G2 & G2B include standard SBAS systems (WAAS, EGNOS, MSAS, etc.), and external RTCM SC-104; the G2B can also use terrestrial DGPS Radiobeacon signals (IEC 61108-4), via an internal Beacon receiver module.

The Vectors feature fast start up times (< 1 minute), heading updates up to 20 times per second, and continue to work correctly at sustained turn rates up to 90° per second.

The Vectors come with a choice of mounting styles: a flat-surface base, or a pole-mount base. The entire unit is fully waterproof. The Vectors provide dual, independently configurable, NMEA 0183 data outputs, each available at both NMEA 0183 standard output voltages, and PC-friendly serial “COM port” voltages.

One feature of the Vectors is especially useful in marine applications: Heading is determined by mathematical computation, directly from the RF signals from the GPS satellites, rather than sensing the Earth's magnetic field – and thus there are no local magnetic deviation effects from metal objects, electrical devices & wiring, and so on.

The Vectors contain a solid-state Gyro sensor, which is used to provide Heading data in situations where GPS signal reception is subject to transient interference. A Tilt sensor measures the vessel's Pitch (or Roll, depending on which way the unit is mounted), and the data is used to remove any effects of Pitch/Roll on the Heading computation.

The Vector is connected to the Admiral P3 at one of the SPU's two NMEA Input ports. The standard cable length is 15 metres (50'); 30 metres (100') is also available.

Fluxgate Compass

PN 20320004

Specifically designed for ComNav autopilots, the ComNav Fluxgate Compass directly senses the Earth's magnetic field. The unit incorporates a heeling coil for better performance when the vessel is either rolling or heeled. The Fluxgate Compass is a sealed, waterproof unit which may be mounted on a deck, shelf, or bulkhead. This compass outputs the traditional analog compass signals – Sine & Cosine signals. It is supplied with a 12 metre (40') cable; an adapter cable (PN311100024) is required to wire it into the Admiral P3's SPU.



Figure 7 – Fluxgate Compass

Magnetic Compass Sensor

PN 20320002

The ComNav Magnetic Compass Sensor detects the position of the compass card of an externally gimballed magnetic compass. The sealed unit can be attached to the bottom of any of ComNav's Magnetic Compasses, or the bottom or top of many other brands of externally gimballed magnetic compasses. It is wired directly to the SPU, with the attached 25' cable.



Figure 8 – Magnetic Compass Sensor

Magnetic Compasses

ComNav offers several high quality externally gimbaled Magnetic Compasses, of either 5" or 6" diameter, which are directly compatible with the ComNav Magnetic Compass Sensor. These compasses are available in either bracket mount or binnacle mount. Compensating spheres and arms are also available. Consult your ComNav Dealer for part numbers.



Figure 9 – Externally Gimbaled Magnetic Compass with Binnacle

45° Compass Transducer

PN 20640006

The ComNav 45° Compass Transducer contains a fluid-damped fluxgate sensor and works at heeling angles up to 45°. This compass puts out a proprietary digital Sine/Cosine signal. It is wired directly to the SPU.



Figure 10 – 45° Compass Transducer

Heading Rate Stabilizer

PN 20320005

Perhaps the single greatest factor affecting Autopilot performance is the quality of the compass heading information it receives. Compass error due to pitch and roll, high turn rates and high-speed turns are common to both fluxgate and magnetic compasses.

Northerly turning error is another phenomenon that affects both types of compasses, particularly at higher latitudes, due to an increase in the earth's vertical magnetic field component.

The sideways acceleration of a vessel in a high speed turn will also affect the accuracy of compasses.

ComNav's Heading Rate Stabilizer minimizes the effect of these factors.



Figure 11 – Heading Rate Stabilizer

The Heading Rate Stabilizer measures the horizontal component of the rate of change in the vessel's heading, and adjusts the compass reading to minimize the effects of pitch and roll, fast turn rates and northerly turning error.

The heading output provided to the Autopilot is dramatically improved in terms of dynamic responsiveness and stability, enabling the Autopilot to perform more accurately and efficiently.

The ComNav Heading Rate Stabilizer is designed to work with ComNav's Fluxgate Compass (PN 20320004).

Other Compasses

ComNav recommends the use of ComNav's own compasses for the best performance of the Admiral P3 Wheelmark Autopilot system – but you certainly may decide to use either a fluxgate compass or a magnetic compass from another manufacturer. See your ComNav Dealer or consult the factory for information on interfacing these compasses with the Admiral P3 system.

Rudder Followers

Standard Rotary Rudder Follower & Rudder Linkage

PN 20330008 & 20330007

The ComNav Admiral P3 is normally supplied with a ComNav Medium Duty Rotary Rudder Follower.

The Rudder Follower is used to transmit the position of the vessel's rudder to the SPU. It should be connected to whichever part of the steering system the autopilot controls. Normally, this is the vessel's rudder. However, if the vessel has two-stage steering, where the autopilot drives a control or servo ram, the Rudder Follower should be mounted to the servo ram rather than the rudder.



Figure 12 – Rotary Rudder Follower

Heavy Duty Rotary Rudder Follower

PN 20330012

A Heavy Duty Rotary Rudder Follower is available for special applications. Check with your ComNav Dealer to determine whether this product is suitable for your vessel. Separate installation instructions are provided with this Rudder Follower.



Figure 13 – Heavy Duty Rotary Rudder Follower

Auxiliary Controllers

Up to two Auxiliary Controllers may be added to the standard Admiral P3 system. These may be any combination of Admiral Control Heads, CR-203 Handheld Remotes, and TS-203 Fixed Remotes.

CR-203 Remote

PN 20310026 – 12m (40') cable

PN 20310028 – 18m (60') cable

The CR-203 Handheld Remote is specifically designed to operate with the Admiral P3 Wheelmark Autopilot System. The CR-203 Remote provides selection of **STANDBY**, **TILLER**, **AUTO**, and **NAV** mode. In **TILLER** mode, the vessel's rudder position is tied to the position of the CR-203's Tiller knob. In **STANDBY**, **AUTO** & **NAV** modes, the CR-203 operates identically to the Admiral P3's Control Head. The CR-203 Remote supports **WORK** mode (Refer to **WORK Mode** in the **Advanced Operations** chapter for an explanation of that mode).



Figure 14 – CR-203 Handheld Remote

TS-203 Remote

PN 20310025 – 12m (40') cable

PN 20310030 – 18m (60') cable

PM 30310011 – Ball Knob Kit

The TS-203 Fixed Remote is a heavy duty Full-Follow-Up (FFU) Lever control which allows the operator to control the tiller steering and autopilot functions from any work station, flying bridge or remote location on the vessel.

The optional Ball Knob Kit is a replacement for the TS-203's standard tapered-handle Tiller lever. It is intended to be used where a "ball handle" is preferable, or in installations where there is limited space in which to mount the TS-203. The kit's ball & shaft are the same as used on ComNav Jog Levers. The total ball-shaft length is 12 cm (5"), as compared to the TS-203's standard handle-shaft length of 18 cm (7").



Figure 15 – TS-203 Fixed Remote

Other Controls, Indicators & Sensors

Jog Levers

PN 20310002 (1 set of switches)

PN 20310003 (2 sets of switches)

ComNav's NFU (Non-Follow-Up) Jog Lever is a permanently mounted, watertight, electrical switch specifically designed for marine use. The spring-centered lever is moved port or starboard as desired to provide non-follow-up (time dependent) electrical control of the vessel's steering system.



Figure 16 – Jog Lever

Rudder Angle Indicator (RAI) – 3"

PN 20360014

The ComNav RAI is a backlit 3" (76 mm) diameter gauge that displays the actual position of the vessel's rudder. The RAI is flush mounted, encased in high impact resistant polycarbonate plastic with a water resistant front face, and requires a lighting voltage supply of 12, 24 or 32 VDC.

An optional Bezel Kit (Part # 30360004), Wheelhouse Case (PN 20360017) and Watertight Case (PN 20360016) are available.



Figure 17 – External Rudder Angle Indicator - 3" Model

Rudder Drives and Interfaces

CT7 Thruster Interface

PN 20350008

The optional CT7 Interface is highly recommended when the Admiral P3 Autopilot System is being used on a vessel equipped with Bow and/or Stern Thrusters, or when the vessel is equipped with Azimuth Drives (as known as Z-Drives) of various types.

The CT7 is specifically designed to be directly compatible with, and complementary to, the Admiral P3 system, in features, operation, and appearance. It connects directly to the Admiral P3's SPU with a dedicated cable that carries power and all control/data signals.

The CT7 can operate a number of different solenoid valves, including on/off and proportional types.

It has standard voltage outputs, current loop outputs and optically-isolated analog outputs.

The CT7 also contains circuitry for interfacing an Electric Wheel to the Admiral P3 system, and a Rudder Simulator which is used when the CT7 is interfaced to Azimuth Drives.

The Admiral P3's SPU has built-in setup & operational firmware support for the CT7; the firmware activates automatically when a CT7 is plugged into the SPU at the **J7 - THRUSTER INTERFACE** connector.

See the CT7 Installation & Operation Manual for full details, and setup & operating instructions.



Figure 18 – CT7 Interface

Other Drive Boxes

The Admiral P3 system is capable of directly operating steering systems utilizing reversing DC motors or single speed solenoids.

ComNav also manufactures a complete line of Drive Boxes that will interface the steering outputs from the Admiral P3 system to almost any type of steering system.

Contact your ComNav Dealer for information and specific part numbers.



Figure 19 – Drive Boxes to meet all needs

Pumps & Drives

ComNav offers several types of electric-motor Hydraulic Pumps, matching Solenoid Valves & related equipment, as well as a number of high-quality Cable Drives and accessories.

Each drive comes with its own Installation Manual.

Please contact your ComNav Dealer for information and details.



Figure 20 – Hydraulic Pump & Solenoid Valve



Figure 21 – Cable Drives

Other Equipment

Besides the optional equipment described above, there is a wide choice of other equipment available for use with the Admiral P3 Wheelmark Autopilot system.

Contact your ComNav Dealer for information and details.

Installation

Installation

This chapter describes all the steps you must follow while doing the physical installation of the Admiral P3 Wheelmark Autopilot System on your vessel.

Each of the standard components of a P3 system is described – both physical mounting & electrical wiring – and then some final checks. Commonly-used accessories are also described. Many components come with their own specific instructions, and you should pay attention to those, as well.

Technical Requirements

*Please refer to the **Warranty Information** document that accompanies this manual before proceeding with installation.*

Hazard warning!

CAUTION!

*Extreme caution is advised when using tools powered by alternating current (AC) from main AC supply circuits, regardless of whether the supply circuits are “indoor”, “outdoor”, “marine” or “industrial” rated. Water, especially sea water, is an **EXCELLENT** conductor of electricity, and can complete a path to AC Ground through a person’s body, causing injury or death, if a tool malfunctions or short-circuits.*

⇒ Battery powered tools are STRONGLY recommended ⇐

*If AC tools are used, they **MUST** be plugged into a circuit that is adequately protected against Ground Faults and other safety hazards, in accordance with local electrical codes.*

Steering System

To obtain the best performance from your Autopilot, your vessel's steering system must be in good working order. The hydraulic system should be bled, and should be operating with minimal play.

When installing a Reversing Motor Pump, a Constant Running Pump, or an Engine Driven Pump, it is recommended that you install shutoff valves on all hydraulic lines between the Pump and the steering system.

Power Supply

For reliable operation of your Autopilot, your vessel's power supply system must have an adequately-breakered, or fused, DC (direct current) power supply at a nominal voltage of either 12 or 24 volts. If the circuits are fused, a switch should also be provided. Ensure that adequate wire sizes are used to handle the expected maximum currents.

Special Tools

A slot screwdriver with a tip size of ~2.5 mm (0.1”) is required, for tightening the small screws of the wire clamps in the plugs which mate with the SPU's pin-receptacle connectors.

Other general-purpose tools such as a portable drill, pliers, wire cutters, screwdrivers, wire, mounting bolts and wrenches will also be required.

Control Head

The Control Head is normally mounted in the vessel's wheelhouse. It can also be mounted in more exposed locations, such as on a flying bridge, since it is fully waterproof. Note that, although it is waterproof, it is not submersible, nor should it be exposed to prolonged direct sunlight. The Control Head comes with a 7.65 metre (25') cable. The cable has a 9-pin circular connector on one end and flying leads on the other. These leads are wired into a push-on connector that mates with the SPU. The cable and Head-end connector are fully waterproof.

Mounting

Each Control Head is supplied (when ordered as part of Admiral P3 system kits) with three mounting kits -- one for bracket mounting (PN 30110006), one for surface mounting (PN 30110004), and one for flush-mounting (PN 30110003). Each one is packaged in a separate bag.

Complete instructions, including drilling/cutting templates for each type of mounting are contained within the bag for each kit.

In addition, there is a fourth bag containing a number of screws, washers, and nuts (PN 30110005). The fasteners in this bag are to be used with either the surface mount kit or the flush-mount kit. They are not used for bracket-mount installations.

Electrical Connection

Route the Control Head Cable from the Control head to the location where the SPU will be located. Avoid running the cable parallel to antenna cables, AC power, or DC wires/cables carrying heavy current.

Excess Control head Cable can be coiled up, or the cable can be trimmed to a more appropriate length.

See **Control Head** on page 50 for details on connecting the cable to the SPU.

Compasses

The ComNav Admiral P3 is usually supplied with either a ComNav's Fluxgate Compass (optionally with a Heading Rate Stabilizer), a 45° Compass Transducer, or a Magnetic Compass Sensor (for use with an externally-gimballed traditional magnetic compass).

System packages with the ComNav Vector G2 (or G2B) GPS Compass are also available.

The choice of compass depends on the type and intended use of the vessel. Refer to the appropriate section below for installation instructions for your magnetic compass.

If you have a Vector G2 or G2B Compass (or other NMEA Compass), please refer to the Installation & Operation Manual that came with it.

When first installed, most magnetic compasses will have Deviation. Deviation is the error between the compass reading and the vessel's actual Magnetic heading. Deviation is a result of magnetic fields induced in the vessel's hull (on steel vessels), and fields from objects such as engines, davits, galley equipment, etc., and electrical/electronic systems & wiring.

If you have a ComNav Fluxgate Compass (with or without HRS) or a 45° Compass Transducer, the Admiral P3 can electronically compensate for the Deviation. The compensation procedure is done during the Sea Trials. If you have a magnetic compass, it will have to be manually compensated. A professional compass adjuster often does this job.

If you intend to use a fluxgate compass other than a ComNav Fluxgate Compass, or if you are using a magnetic compass not supplied by ComNav, you should contact the dealer you purchased it from, or the manufacturer, for instructions on how to install and set up your compass.

Note: Do not permanently install any compasses until sea trials are complete. Depending on the outcome of the sea trials, it may be necessary to relocate the compass(es).

ComNav Fluxgate Compass

Mounting

Choose a location for the Fluxgate Compass. For best performance, the Fluxgate Compass must be mounted as close as possible to the vessel's center of pitch and roll. This is typically low in the vessel, at or about the waterline, and slightly aft of the center of the vessel.

You must keep the compass as far away as possible – at least 2 metres (about 6') – from engines, electric motors, and other magnetic objects.

Holes are provided to attach the Fluxgate Compass to either a bulkhead or to a horizontal shelf or deck. The compass must be mounted parallel to, and as close as possible to the centerline. The compass must be mounted with the correct side up (that is, with the cable coming out of the top of the unit). The arrow labelled "BOW" should point forward.

Electrical Connection

Route the Fluxgate Compass cable from the Fluxgate Compass to the location where the SPU will be. Avoid running the cable parallel to antenna cables, AC power, or DC wires/cables carrying heavy current.

Excess cable should be coiled up; ComNav recommends that the cable NOT be shortened. If the cable is too short, plug-in Compass Extension Cables are available in various lengths from your ComNav Dealer. Cutting and splicing the Fluxgate Compass cable is NOT recommended.

See **Compasses** on page 52 for further details on connecting the Fluxgate Compass cable to the SPU.

Heading Rate Stabilizer

The HRS is an optional accessory for the ComNav Fluxgate Compass.

Please refer to the **All Models** information in the Installation Instructions that come with the HRS, for mounting & electrical wiring information.

See **Compasses** on page 52 for further details on connecting the HRS cable to the SPU.

45° Compass Transducer

Mounting

Choose a location for the Compass Transducer. For best performance, it should be mounted as close as possible to the vessel's center of pitch and roll. This is typically low in the vessel, at or about the waterline, and slightly aft of the center of the vessel.

You must keep the compass as far away as possible, at least 2m (about 6') away from engines, electric motors, and other magnetic objects.

Holes are provided to attach the Compass Transducer to a bulkhead. The compass must be mounted parallel to the centerline. The compass must be mounted with the correct side up (the label that says "Compass" must be on top), and the arrow should point forward.

Electrical Connection

Route the Compass Transducer cable from the compass to the location where the SPU will be. Avoid running the cable parallel to antenna cables, AC power, or DC wires/cables carrying heavy current.

Excess cable should be coiled up. The cable may be shortened if desired to avoid excess coils. If the cable is too short, additional cable may be ordered from your ComNav Dealer.

See **Compasses** on page 52 for further details on connecting the cable to the SPU.

Magnetic Compass and Sensor

The ComNav Magnetic Sensor can be mounted to ComNav's standard Magnetic Compasses, and also to a wide variety of other brands of externally gimballed compasses.

The advantage of using a Magnetic Compass with a Magnetic Compass Sensor attached to it is that the Autopilot is sensing the position of the magnets on the compass card rather than sensing the earth's magnetic field directly.

Since the card of the compass has physical inertia, it does not react immediately to the changes in the magnetic field it is immersed in, but only to those changes which persist long enough to overcome the resistance of the compass card to movement. This means that the compass is a more stable heading reference than a Fluxgate Compass. The Magnetic Compass will largely ignore changes in the magnetic field in the plane of the compass card caused by vessel motion to which the Fluxgate Compass may react.

This is particularly important in high latitudes, (such as Alaska, Labrador or the North Sea), where the horizontal component of the earth's magnetic field (which is the portion that the compass is trying to detect) is very small relative to the magnetic field of the vessel.

The disadvantage of the Magnetic Compass is that in very rough weather with the vessel going to windward, it is possible for the vessel motion to upset or "tumble" the compass card, disabling the Autopilot.

Because of the relative insensitivity of the Magnetic Compass to both the earth's and the vessel's vertical magnetic fields (due to its inertia), it is recommended for use at latitudes higher than 50° (North or South), and for use on steel vessels when optional quadrantal spheres are included.

Locate and mount the compass in a position that minimizes magnetic interference. The compass should be at least 1 metre [about 3'] away from such equipment as radios, radars, depth sounders, and engine instruments.

To reduce the possibility of the card 'tumbling' in rough weather, mount the compass as close as practical to the center of pitch and roll. Mounting the compass far forward under a bunk or similar location is a poor choice for rough weather performance.

Important! *It is important to remember that the compass is a vital part of the autopilot system. Locating it properly, particularly on steel-hulled vessels, is essential to ensure proper operation of the autopilot. We strongly recommend that the services of a qualified compass adjuster be used to select the best installation location and to compensate the compass properly for deviation, including that caused by heeling error.*

Care must be taken not to place compensating magnets too close to the compass, as this will cause the Compass Sensor, mounted underneath the compass, to read incorrectly. To correct compass deviation on steel vessels, or on other vessels with magnetic compensating problems due to interference from adjacent ferrous masses such as an engine block or winches, the use of a pair of compensating quadrantal spheres is recommended.

Note: the ComNav Magnetic Sensor SHOULD NOT be attached to an internally gimballed compass (that is, where the compass card is gimballed and the bowl of the compass is not), as this will result in large errors between the compass and the autopilot. This is because the compass card does not remain parallel to the sensor when the vessel rolls or pitches.

Mounting

The Sensor can be mounted to the bottom of the compass using the brass screw supplied, or it may be bonded directly to the compass bowl using a suitable adhesive. The Nylon Washer should be placed between the Compass Sensor and the bottom of the compass bowl.

When the Sensor mounts to the bottom of the bowl, the magnetic compass may be used as a steering compass, if desired.

It is also possible to mount the Sensor above the compass. This reduces the possibility of interference from the compensating magnets, but also reduces the visibility of the compass.

Optimum positioning of the sensor can only be accomplished once the Autopilot system has been installed and powered up. See the **Getting Started** chapter of the manual to perform this procedure.

Electrical Connection

Route the Magnetic Compass Sensor cable from the Compass to the location where the SPU will be. Avoid running the cable parallel to antenna cables, AC power, or DC wires/cables carrying heavy current.

Ensure that there is sufficient slack in the cable to allow the compass bowl to tilt and rotate freely in all directions.

Excess cable should be coiled up; ComNav recommends that the cable NOT be shortened. If the cable is too short, plug-in Compass Extension Cables are available in various lengths from your ComNav Dealer. Cutting and splicing the Magnetic Sensor cable is NOT recommended.

See **Compasses** on page 52 for further details on connecting the cable to the SPU.

Rudder Follower

The Rudder Follower is used to transmit the position of the rudder back to the Autopilot. It should be connected to whatever parts of the steering system the Autopilot controls.

Normally, this will be the vessel's rudder. However, if the vessel has a two-stage steering system where the Autopilot drives a control or servo ram, the Rudder Follower should be mounted to the servo ram rather than to the rudder.

Normally the Rudder Follower is mounted in the stern of the vessel, close to the rudder post. A mounting base may have to be fabricated to position the Rudder Follower properly. Mount the Rudder Follower in a location where the possibility of damage from any equipment stowed in the area is minimized.

Note: If you are connecting the Admiral P3 to a mechanical Cable Drive (for vessels that use cable steering instead of hydraulic steering) the rudder follower is built into the Cable Drive.

Rotary Rudder Follower

Mounting

Mount the Rudder Post Arm on the rudder post using a stainless steel band clamp (not supplied). Bolt the ball joint to the hole in the Rudder Post Arm corresponding to the diameter of the Rudder Post in inches, making sure the ball is facing upwards.

Mount the Rudder Follower so that the Rudder Follower Arm is the same height as the Rudder Post Arm. The Rudder Follower is centered when the arm is directly above the cable gland (see Figure 22).

The distance between the centerline of the Rudder Post and the Rudder Follower must not exceed 24 inches. Make sure that the ball joints on the Rudder Arm and Rudder Follower arm are facing upwards as shown in Figure 3.

Snap the rod assembly onto the ball joints. Be sure to close the release clamps on each socket. Refer to Figure 22, and adjust the length of the rod to get the correct geometry with the rudder dead-ahead.

If the locking screw in the Rudder Follower arm has been loosened, or the arm removed from the Rudder Follower, re-attach the arm and check the potentiometer center position.

When the rudder is dead-ahead, the electrical resistance between the wires of the black & green wire pair, and the wires of the white & green wire pair, should be equal (approx. 600 ohms each).

Be careful to check the installation for any mechanical obstructions or binding of the linkage, and correct it now, before it becomes a problem.

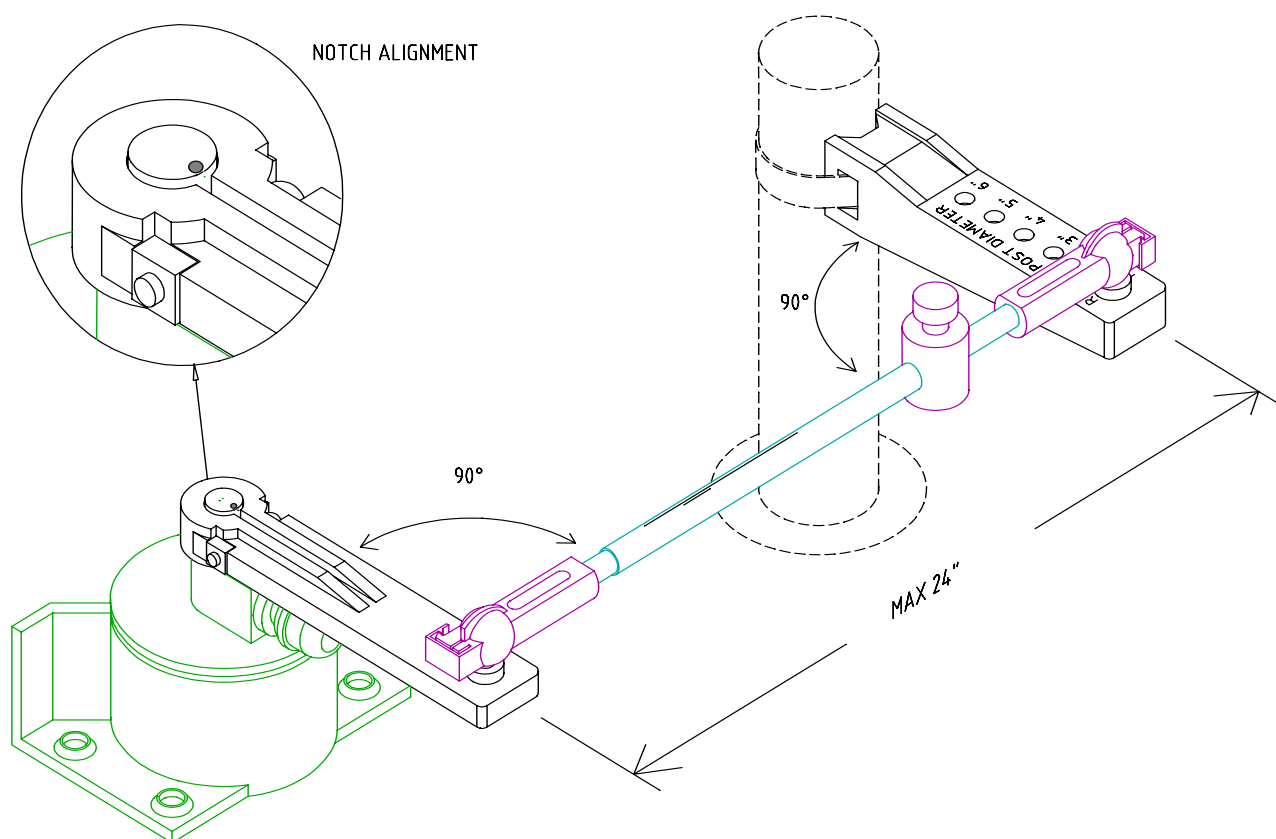


Figure 22 – Rudder Follower Linkage Geometry

Electrical Connection

The Rudder Follower is normally supplied with approximately 15.5 metres (50') of cable. Run the cable from the Rudder Follower towards the SPU, ensuring that a hose or conduit protects it wherever it passes through bulkheads, holds, or any other area where it could be damaged.

If the length of cable supplied is too short to reach all the way to the SPU, obtain a terminal strip and sufficient additional cable from your ComNav Dealer. Mount the terminal strip in a convenient DRY location where it will not be subjected to moisture of any kind.

See **Rudder Follower** on page 53 for further details on connecting the cable to the SPU.

Heavy Duty Rotary Rudder Follower

The ComNav Heavy Duty Rotary Rudder Follower is also compatible with the Admiral P3 Wheelmark Autopilot System. If you have purchased one of these devices, follow the installation instructions supplied with the unit.

See **Rudder Follower** on page 53 for further details on connecting the cable to the SPU.

Signal Processor Unit

Mounting

The SPU should be mounted in a clean and DRY area, away from heat, moisture, and water of any kind. The SPU should be centrally located, and mounted far enough away from your vessel's compasses so as to minimize any possible electrical interference; a good rule-of-thumb is at least 1 metre (3') – but see **Compass Safe Distances** on page 156 for specific values, if you do not have that much space.

The SPU can be mounted vertically on a bulkhead or horizontally on a deck or shelf.

- If mounted vertically, it should be positioned so that all wires and cables will exit from the bottom of the SPU (after running sideways, left &/or right as appropriate, from the SPU connectors under the SPU's wiring cover).
- If mounted horizontally, all wires and cables should have a drip-loop formed in them.

Each SPU is shipped from the factory with a package of four mounting feet and a separate instruction sheet that includes dimensions for drilling holes to fasten the feet to the vessel.

Wiring the SPU - General

Due to the relatively high current requirements of an autopilot compared to many other types of electronic equipment, the size of wire used to connect the various components is very important. Undersized wiring will result in power losses which can affect overall efficiency and performance. Refer to the table below. If in doubt, contact your ComNav Dealer for help.

Function / Use	Type / Gauge
SPU Power Supply	2 X 12 AWG
Steering Drive: 12/24/32 VDC Solenoid Valve	3 X 18 AWG
Steering Drive: Reversing Motor	2 X 14 AWG (refer to the instructions supplied with the Drive Motor)
Rudder Follower	3 X 18 AWG Shielded cable
GPS, Chartplotter, Navigation Computer	2 X 24 AWG Shielded cable
Rudder Angle Indicator	2 X 24 AWG

Table 1 – Minimum Recommended Wire Gauges

Once the SPU is securely mounted, begin wiring the various components of the system one at a time.

Start by removing the Wiring Cover from the SPU. It is held in place by two knurled plastic nuts (see Figure 23).

Also remove the cover over the Diagnostic section of the SPU, so that you can observe the Diagnostic/Status LEDs during installation.

Set the covers, nuts & screws aside – they will be re-installed once all the wiring of the SPU is complete.



Figure 23 – Removal of SPU Wiring & Diagnostic Covers

Connectors on the SPU

With the wiring cover off, all the SPU's connectors are visible (see Figure 5 & Figure 24).

Each connector is a pin receptacle, with the pins sized according to how much current will be carried (bigger pins for higher current). Each pin has a signal name, rather than a number, to make it easier to match wires with pins (see connector label, below).

Each pin receptacle mates with a matching plug, which in turn has screw-clamp terminals, into which the wires from the external equipment & devices (battery, drive system, compasses, etc.) are inserted. The plugs allow quick installation & removal of system wiring, yet are fully secure, once the various cables are strain-relieved and the wiring cover is re-installed.

The SPU is shipped with all the plugs required, pre-installed on the matching receptacles.

Note that the plug screws must be turned counter-clockwise several turns (using the small slotted screwdriver mentioned on page 39 – Special Tools), to open up the plug's wire clamp, before a wire is inserted into that clamp; the screw must then be turned clockwise until the wire is tightly held in the clamp.

All connectors and pins are labelled, as shown in the figure below.

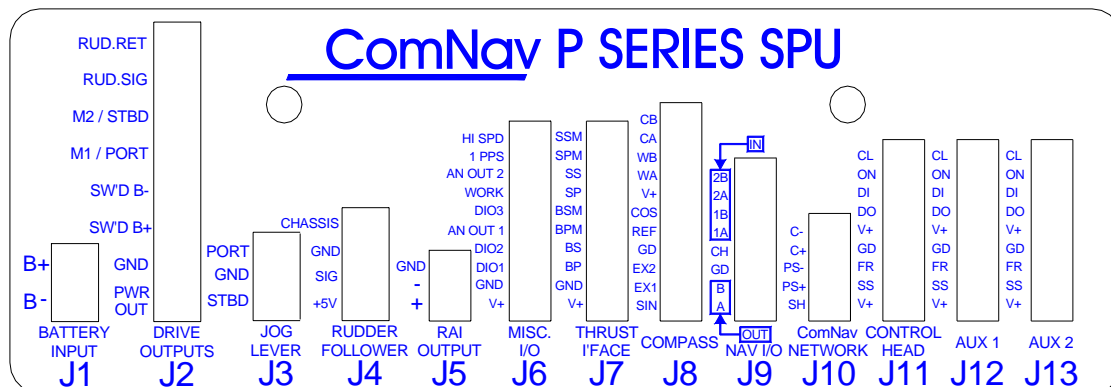


Figure 24 – SPU Connector Wiring Label

Power Supply

The ComNav Admiral P3 will operate on any voltage between about 11 VDC and 30 VDC. This allows operation with vessel battery systems of nominal voltages from 12 to 24 VDC.

Caution: *do not power up the SPU until you have completed the installation, and performed the steps outlined in “Post-Installation Checks”.*

Generally, wiring for the positive leg of a DC system will be red or white, while wiring for the negative leg (usually referred to as Ground) will be black.

Power to supply the autopilot should be taken directly from a breaker or distribution panel. The autopilot should be wired into its own individual breaker or fuse. Using appropriately sized wire or cable (see Table 1 – Minimum Recommended Wire Gauges on page 46), wire the battery connections to the connector plug and receptacle labelled **J1 - BATTERY INPUT**. Double-check the wiring polarity before inserting the plug into the receptacle.

CAUTION: *the Admiral P3 SPU is NOT reverse-polarity protected.*

⇒ ***If you wire the wrong voltage polarity at J1, you WILL damage the SPU and Head! ⇐***
 ⇒ ***This will also void the Warranty. ⇐***

Refer to the following diagram of a typical power supply circuit:

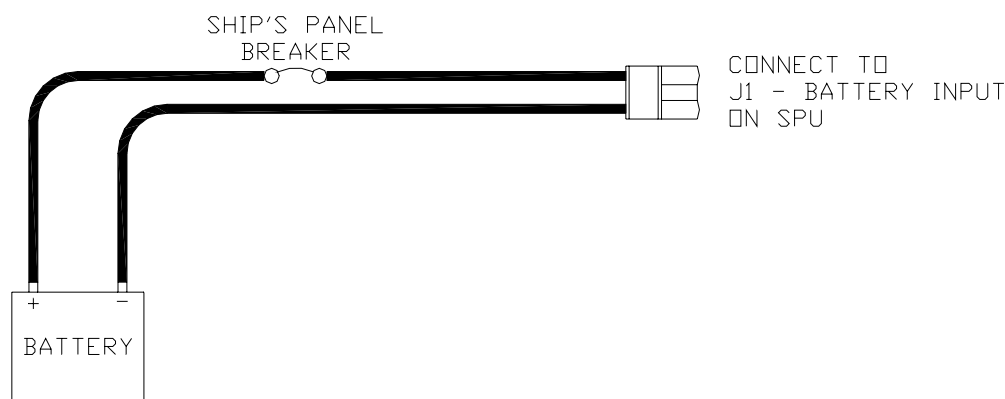


Figure 25 – Typical Battery Connection to SPU

Note: If your autopilot system utilizes one of ComNav's CT Drive Boxes, it should be wired back to the breaker or fuse separately from the rest of the autopilot system. Do not "daisy-chain" the power wires.

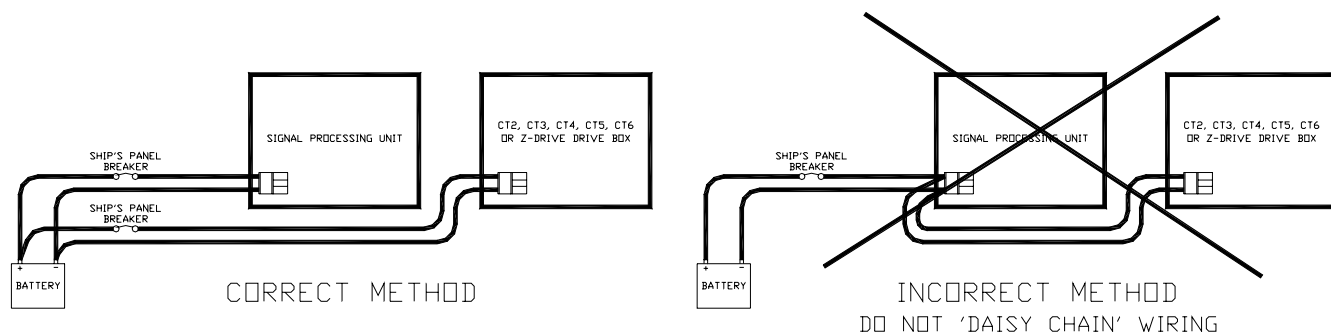


Figure 26 – Typical Battery Connection to Drive Boxes

If the SPU is mounted a long distance from the ship's breaker panel, it is recommended that heavy gauge wire be routed between the breaker panel and a terminal block mounted in close proximity to the SPU. #12 AWG wire can then be used between the terminal block and the SPU. This minimizes any voltage drop between the breaker panel and the SPU.

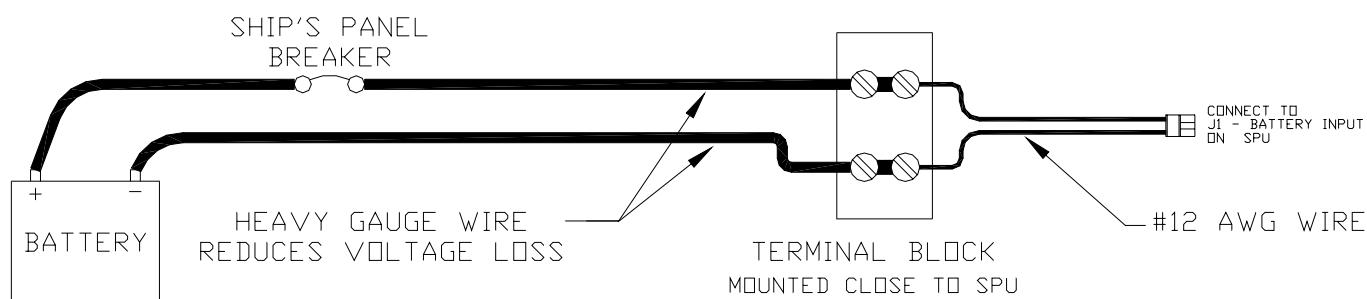


Figure 27 – Reducing Supply Voltage Losses

Input & Output Connections

Control Head

Two types of control cable are used in manufacturing Admiral P3 systems. The only difference between them is the colour-coding of the wires. Wire the cable from the main Control Head onto the nine-position plug-in connector according to the following diagram:

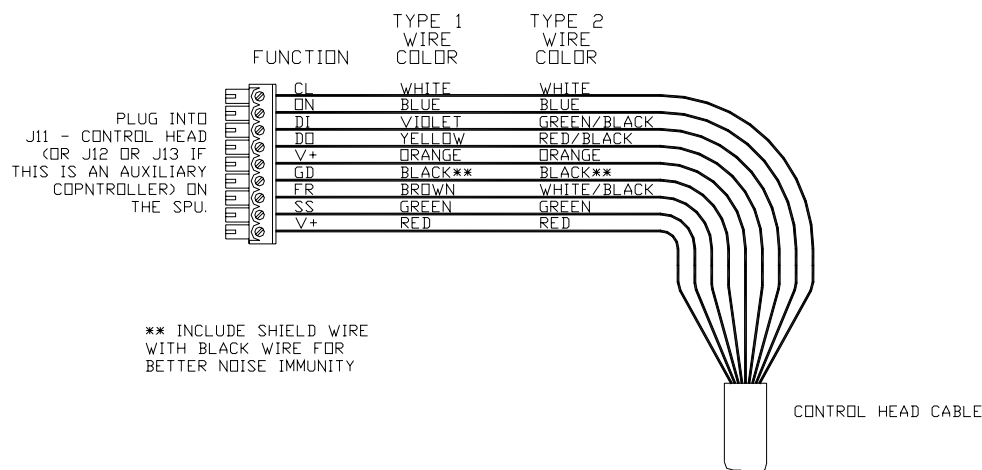


Figure 28 – Wiring Connections for Control Head, Handheld Remotes, and Fixed Remotes.

Plug the nine-position plug-in connector into the SPU receptacle labelled **J11 - CONTROL HEAD**.

Auxiliary Controller(s)

All Control Heads, Handheld Remotes, and Fixed Remotes designed to work with the Admiral P3 Wheelmark Autopilot system utilize the same wiring diagram as the Main Control Head. See Figure 28, above. The only difference is that these devices are plugged into the receptacles **J12 - AUX 1** or **J13 - AUX 2** instead of **J11 - CONTROL HEAD**.

Note: Auxiliary Head Power On/Off

*The Admiral P3 SPU is shipped from the factory configured so that power can only be turned on or off from the Main Control Head. The Main Control Head is designated as the Head which is plugged into the SPU receptacle labelled **J11 - CONTROL HEAD**.*

*However, the Admiral P3 system can also be configured so that it can be turned on or off by any Control Head plugged into the receptacles **J12 - AUX 1** or **J13 - AUX 2** (note: power cannot be turned on from CR-203 or TS-203 Remotes). If reconfiguration is desired, follow the instructions for enabling **Auxiliary Head / Remote Power On** (see page 149).*

Jog Levers

Any number of Non-Follow-Up (NFU) Jog Levers can be connected to the Admiral P3 SPU. They are simply wired in parallel to each other. Connect them to the terminal labelled **J3 - JOG LEVER** as per the following diagram:

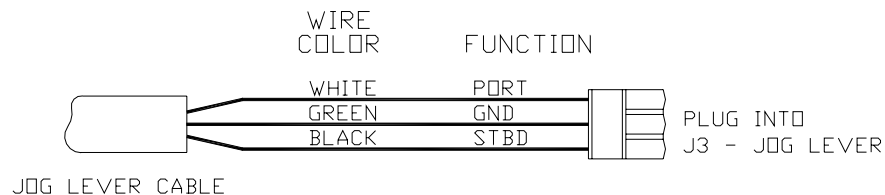


Figure 29 – Wiring Connections for Jog Levers

In order to use the Jog Levers connected in the above manner, the autopilot must be turned on. The autopilot will then move the rudder either port or starboard for as long as the Jog Lever is held activated. However, the autopilot will stop the rudder when it gets to the (user-adjustable) rudder limits programmed into the autopilot. This reduces stress on the steering system.

Four-Way Valves, Used with Jog Levers

If the Admiral P3 is being used with four-way solenoid-activated valves (see page 55), it is also possible to wire Jog Levers so that they may be used even when the autopilot is not powered on.

Caution! This configuration is **NOT RECOMMENDED**. It is possible to damage the drive output circuits in the SPU when this configuration is used, which may void the warranty on your Admiral P3 system, and/or the warranty of other equipment.

Also, in this configuration, the Jog Levers will force the rudder hard-over to the physical stops, and keep pushing for as long as any Jog Lever is activated. This may cause a hydraulic seal to blow, and/or damage the rudder mechanism.

Bearing in mind the cautions above, if you wish to be able to use Jog Levers to activate Four-Way Valves with the autopilot powered off, this is the wiring connection for it:

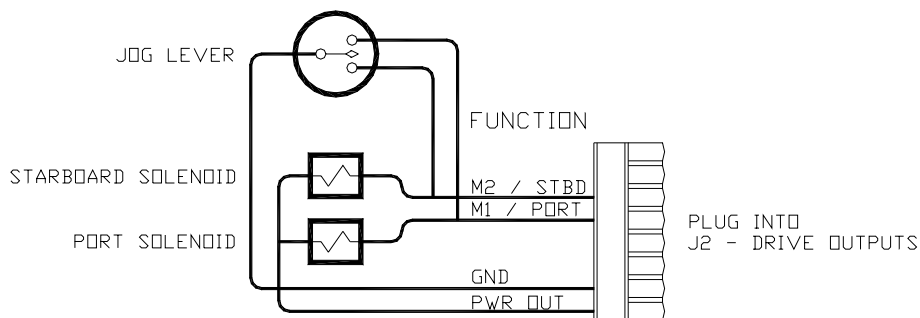


Figure 30 – Wiring Connections for Four-Way Valves with Jog Levers

Compasses

All compasses, other than NMEA 0183 compasses, are connected to the SPU receptacle labelled **J8 – COMPASS** (see page 61 for how to connect NMEA compasses).

If you ordered your Admiral P3 system with a ComNav Fluxgate Compass (with or without the optional Heading Rate Stabilizer), a short Compass Interface Cable (PN 31110024) will have been supplied with the system. Plug this interface cable onto the cable coming from the Fluxgate Compass (or the Heading Rate Stabilizer), and then wire the other end into the eleven-position plug which mates with the **J8** receptacle, as per the following diagram.

If you ordered your system with the Magnetic Sensor, and mounted it on the bottom of your magnetic compass, wire the flying-lead end of the sensor cable as per the following diagram. If you mounted the sensor of top of the compass, exchange the blue & yellow wires.

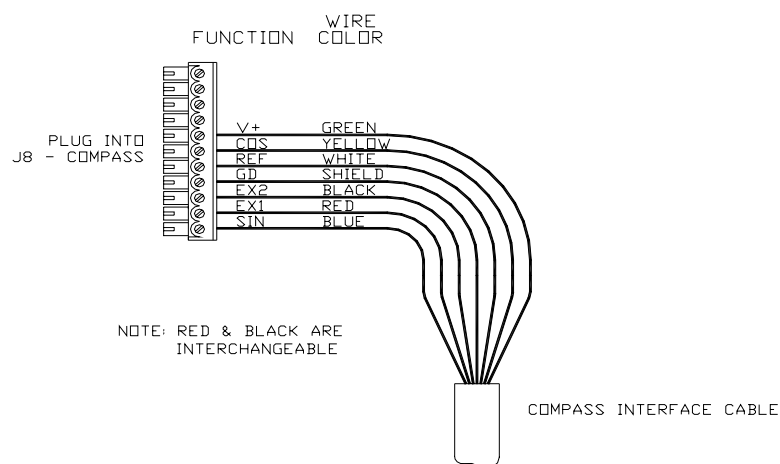


Figure 31 – Wiring Connections for Analog Compasses

If you have a 45° Compass Transducer with your Admiral P3 SPU, it is also connected to the eleven-position plug that fits into the **J8** receptacle. Wire as per the following diagram.

Note: more than one wire will fit into the V+ and GND connections, so you can connect a 45° Compass Transducer and an analog compass at the same time. You may then select either as the “Compass Source” (see page 100) at any time during operation.

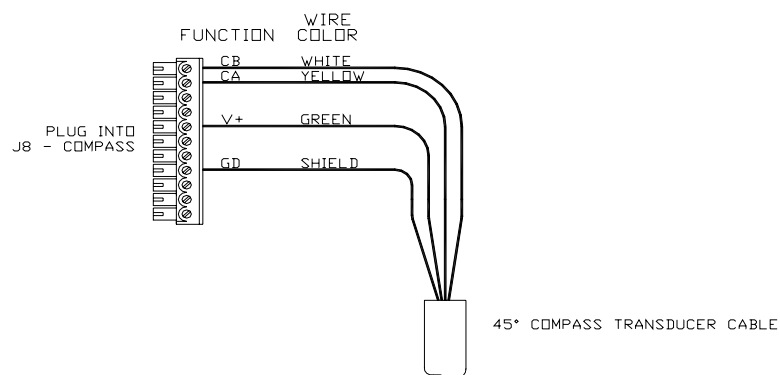


Figure 32 – Wiring Connections for 45° Compass Transducer

Rudder Follower

The Rudder Follower is connected to the four-position receptacle on the SPU labelled **J4 – RUDDER FOLLOWER**. Wire the Rudder Follower to the plug-in connector as per the following diagrams:

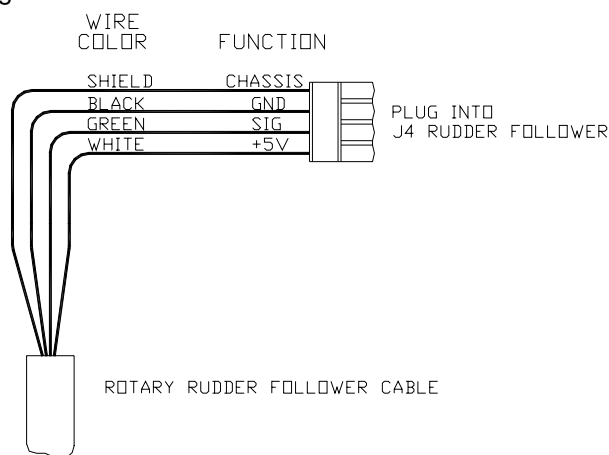


Figure 33 – Wiring Connections for Rudder Followers

Rudder Angle Indicators

The Admiral P3 system will drive up to five 500 microampere Rudder Angle Indicator (RAI) meters – such as those supplied by ComNav (PN 20360014). Mounting instructions are included with each meter. Wire the meter to the plug for the SPU receptacle labelled **J5 – RAI OUTPUT**. If you have more than one RAI meter, they should all be wired in series, as shown below:

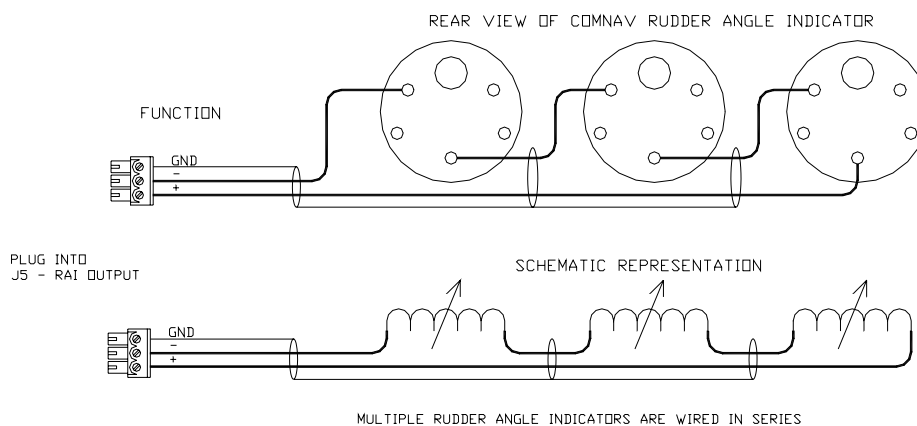


Figure 34 – Wiring Connections for Rudder Angle Indicators

Drive Outputs

The Admiral P3's SPU is capable of directly driving a variety of steering systems. Optional Drive Boxes are available for those systems not handled directly by the Admiral P3. Contact your ComNav Dealer for more information.

Reversing DC Motor Hydraulic Systems

The Admiral P3 SPU can directly handle reversing DC motor hydraulic² pumps drawing up to approximately 20 amps. For larger current requirements, the ComNav CT2 Drive Box should be used. To connect the pump motor directly to the SPU, use the following diagram. Note that wire polarity is not important, since the Admiral P3 will automatically make the necessary adjustments internally when the system is set up.

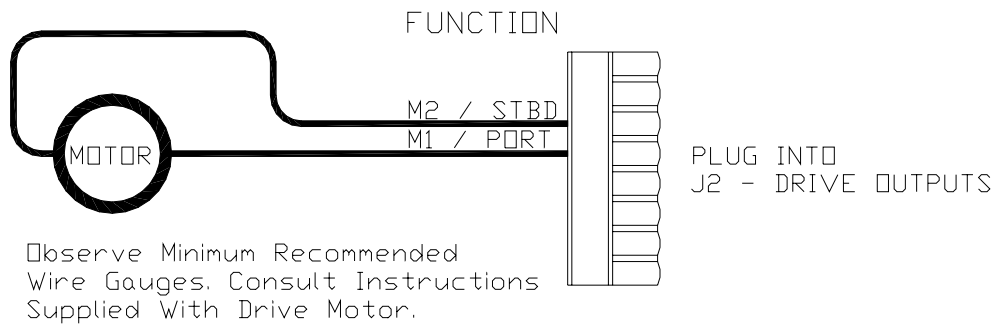


Figure 35 – Wiring Connections for Reversing DC Motors

Linear Actuators or Mechanical Rotary Drives

Some Linear Actuators incorporate a Bypass Valve. To operate properly, the Bypass Valve should be activated by the SPU's **SW'D B+** output. Similarly, most mechanical drives incorporate a solenoid-activated clutch. The clutch solenoid should also be activated by the **SW'D B+** output. Refer to the following diagram:

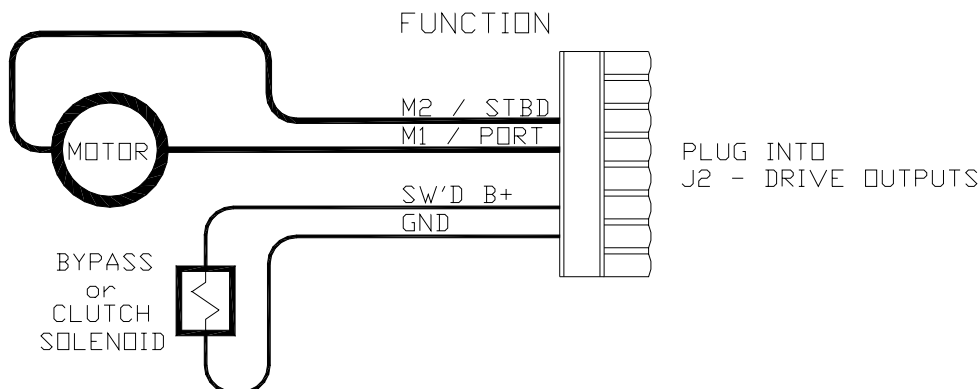


Figure 36 – Wiring Connections for Linear Actuators or Mechanical Rotary Drives

² Two very important steps when installing any hydraulic system are to bleed it of any air trapped in the fluid, and to check for fluid leaks. These will be done later – see **Hydraulic Checks** on page 65 and **Bleeding** on page 83.

Shunt-Field Reversing Motors

For shunt-field reversing motors, connect the shunt field coil positive terminal to **SW'D B+** and the coil negative terminal to **SW'D B-** as per the following diagram:

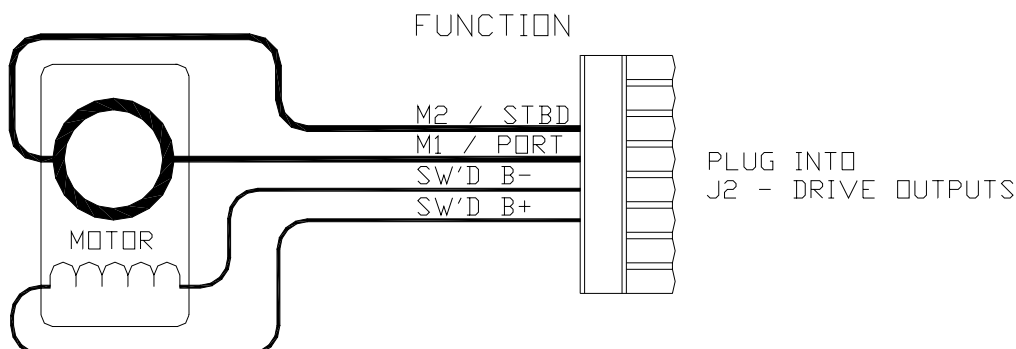


Figure 37 – Wiring Connections for Shunt Field Reversing Motors

Standard Four-Way Solenoid-Activated Hydraulic Valves

Connection to 12 VDC or 24 VDC solenoids should be made as per the following diagram.

In this configuration, the autopilot supplies the positive voltage (**SW'D B+**) whenever the autopilot is in **POWER STEER**, **AUTO**, or **NAV** modes. **SW'D B+** is turned off in **STANDBY** mode, thus providing an extra measure of safety.

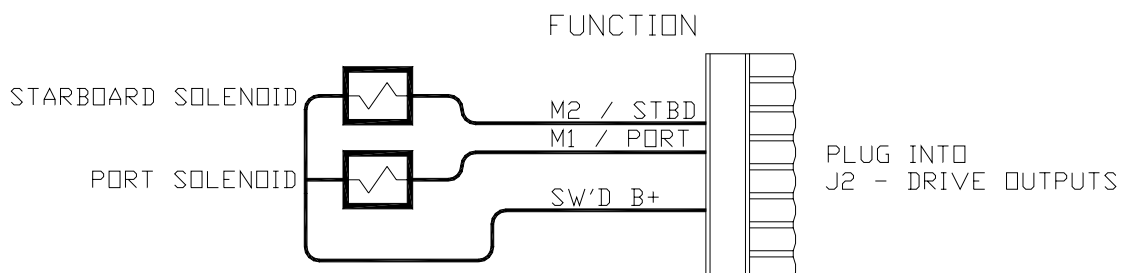


Figure 38 – Wiring Connections for Standard Four-Way Solenoid Valves

Note: wiring of Jog levers directly to standard 4-way valves is possible. However, doing so is **NOT RECOMMENDED**. See the description of the proper way to wire Jog Levers, on page 51.

The above diagram assumes that an engine driven pump is used for the hydraulic system. In the case of an electrically powered constant running pump, use the following connection:

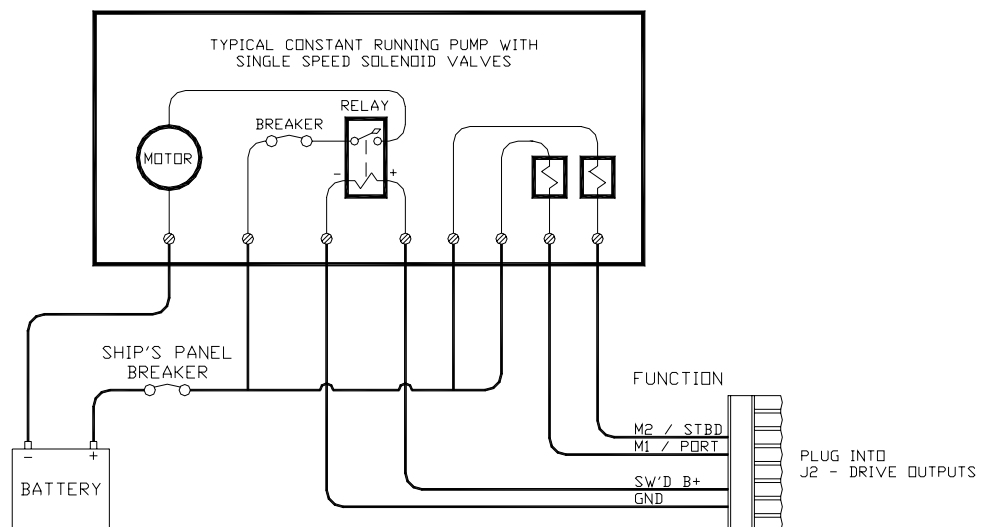


Figure 39 – Wiring Connections for Constant Running Electric Pump.

Two-Speed Solenoid Valves

ComNav's CT5 Drive Box (PN 20350004) should be used to interface between the Admiral P3 SPU and two-speed solenoid systems. Connect the CT5 to the SPU as per the instructions shipped with the CT5, and the following diagram:

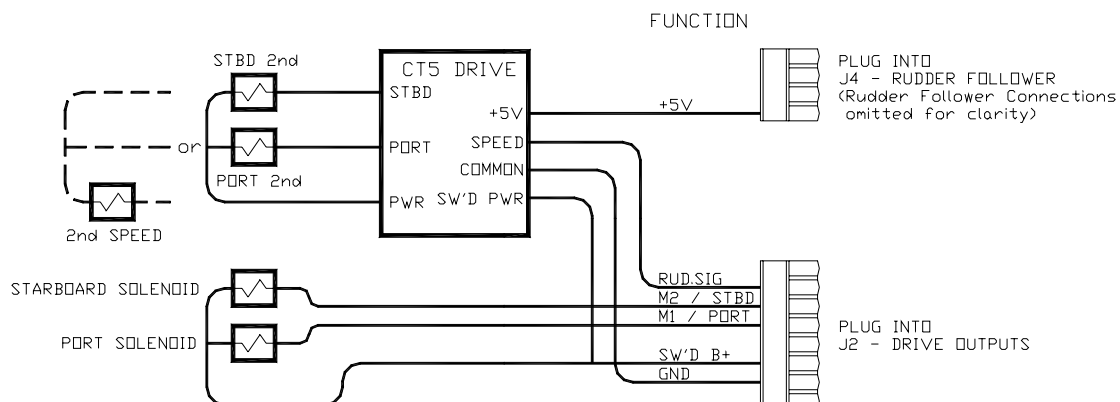


Figure 40 – Wiring Connections for Two-Speed Solenoid Valves

A.C. Solenoids

ComNav's CT4 Drive Box (PN 20350003) should be used to interface between the Admiral P3 SPU and A.C. solenoid systems. Connect the CT4 to the SPU as per the instructions shipped with the CT4, and the following diagram:

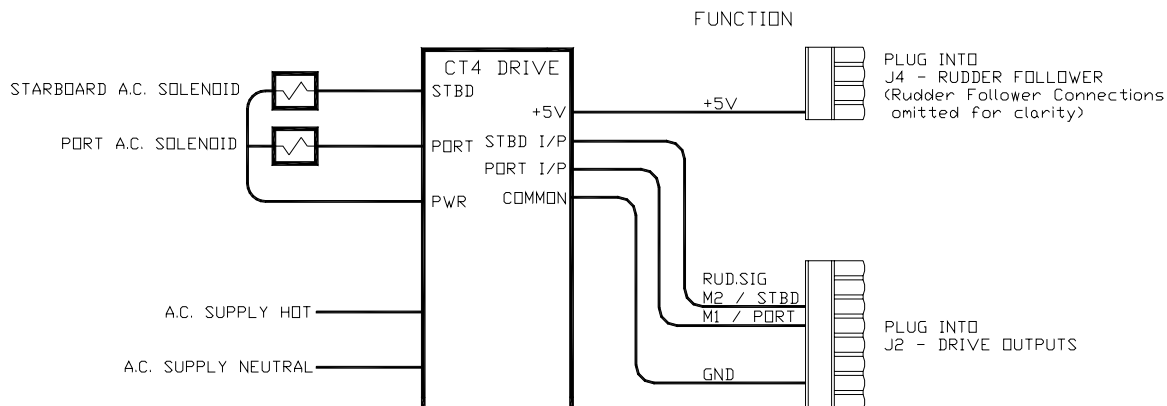


Figure 41 – Wiring Connections for A.C. Solenoids

Proportional Solenoid Valves

ComNav's CT6 Drive Box (PN 20350005) should be used to interface between the Admiral P3 SPU and proportional valves. The CT6 is custom configured to match the requirements of the particular valve it is to be fitted to.

Please note: ComNav's Production Department requires information about the make and model of the proportional valves, in order to correctly configure the drive box.

Instructions for connecting the CT6 to proportional valves are shipped with the CT6 unit. Connection between the CT6 and the Admiral P3 SPU should be made as per the following diagram.

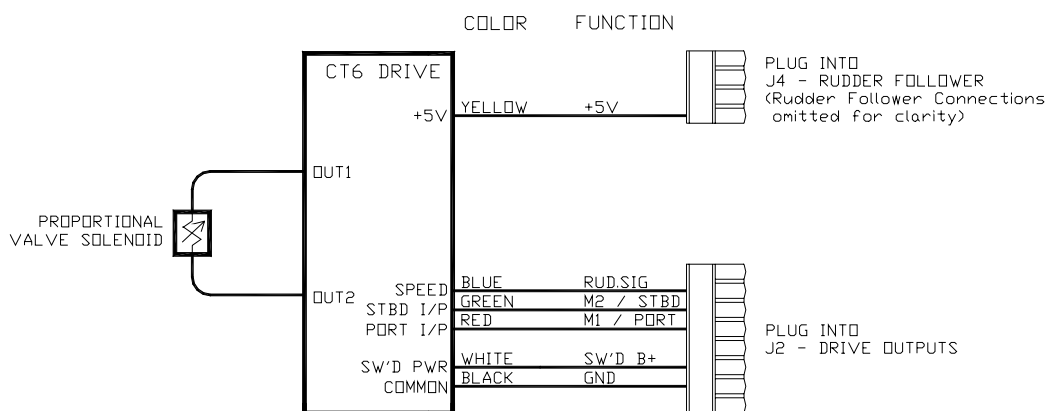


Figure 42 – Wiring Connections for Proportional Solenoid Valves

Azimuth Drives, Surface Piercing Drives and Jet Drives

Newer models of these types of drives are often supplied with an electronic Autopilot Interface, to which the Admiral P3 SPU can directly connect.

Older versions of these drives, however, may require the fitting of ComNav's one or two-channel Isolation Amplifier (PN 20350006 and 20350007, respectively). Instructions for connecting the Isolation Amplifier to the steering system are shipped with the Amplifier.

Connection between the Isolation Amplifier and the Admiral P3 SPU should be made as per the following diagram.

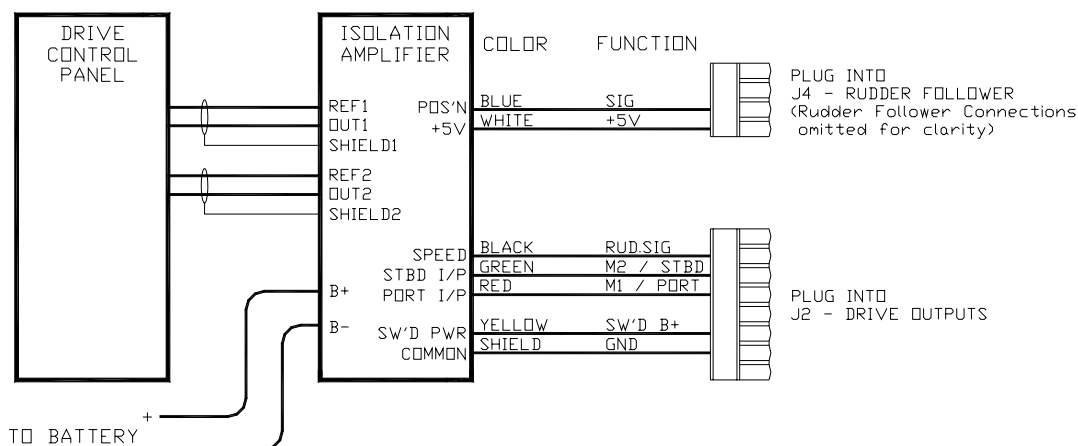


Figure 43 – Wiring Connections for Isolation Amplifiers

The ComNav CT7 Thruster Interface can also be used with some of these types of drives; see page 34. See the CT7's Installation & Operation Manual for wiring instructions..

External Alarm Output

An external alarm can be connected to the Admiral P3 SPU. The autopilot can be configured to activate the external alarm whenever an alarm or error message appears on the Control Head. You can modify the configuration to activate the external alarm only if the Watch Alarm is not answered (as opposed to activating it for all alarms). See the description of the **Alarm O/P (Alarm Output)** parameter on page 76 for information on how to choose these options.

One of two outputs can be used for the external alarm. Typically, you would choose to connect the external alarm between Battery Positive (**PWR OUT**) and the Switched B- (**SW'D B-**) outputs on J2, as in the following diagram:

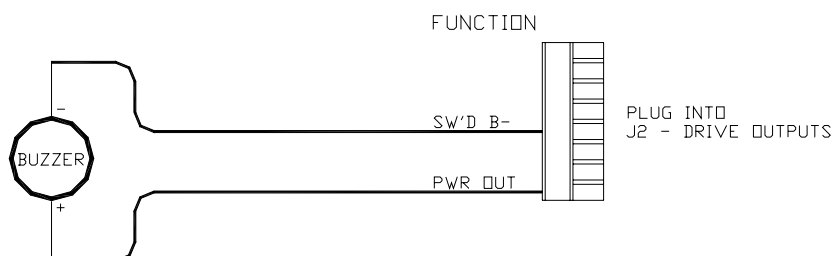


Figure 44 – External Alarm, using SW'D B- Output

Alternatively, you may choose to use the **SW'D B+** and **GND** outputs as shown here:

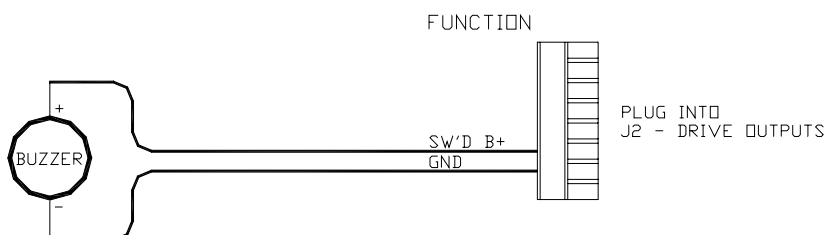


Figure 45 – External Alarm, using SW'D B+ Output

Note: when using the External Alarm configuration shown in Figure 44, there is a small current which will be flowing constantly between the pins, even when the alarm is OFF. This will not be a problem with many types of alarms; however, with certain types of sensitive Piezo-electric audible alarms, the leak current can cause a constant low-level tone from the piezo device.

An Application Note is available which describes this potential problem in detail, with suggested remedies. The Note also lists a number of Piezo alarms which are known to work well with Admiral P3 system.

Please ask your ComNav Dealer (or go to ComNav's web site) for Application Note 2007-01.

Some installations require separate monitoring for power failures. This can be accomplished with the following circuit, which utilizes two relays. The coil voltage of the relays should match the supply voltage for the autopilot. The Alarm Supply, which must be a separate, dedicated supply from the autopilot supply, should match the voltage of the alarm.

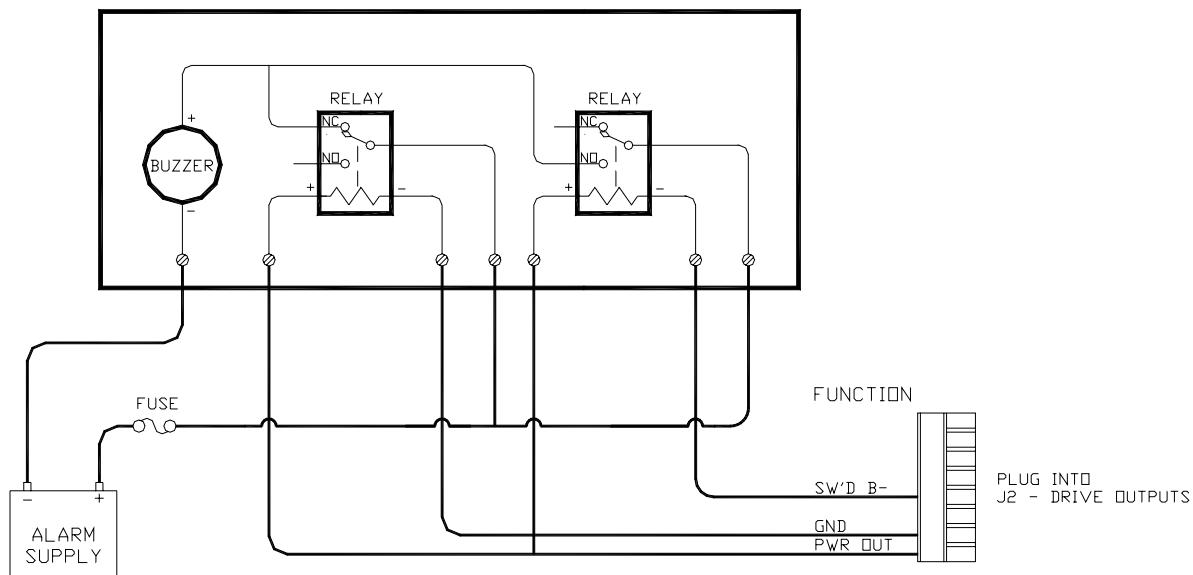


Figure 46 – External Alarm, SW'D B- Output – with Power Fail Option

The alternative circuit, using Switched B+ as the alarm output:

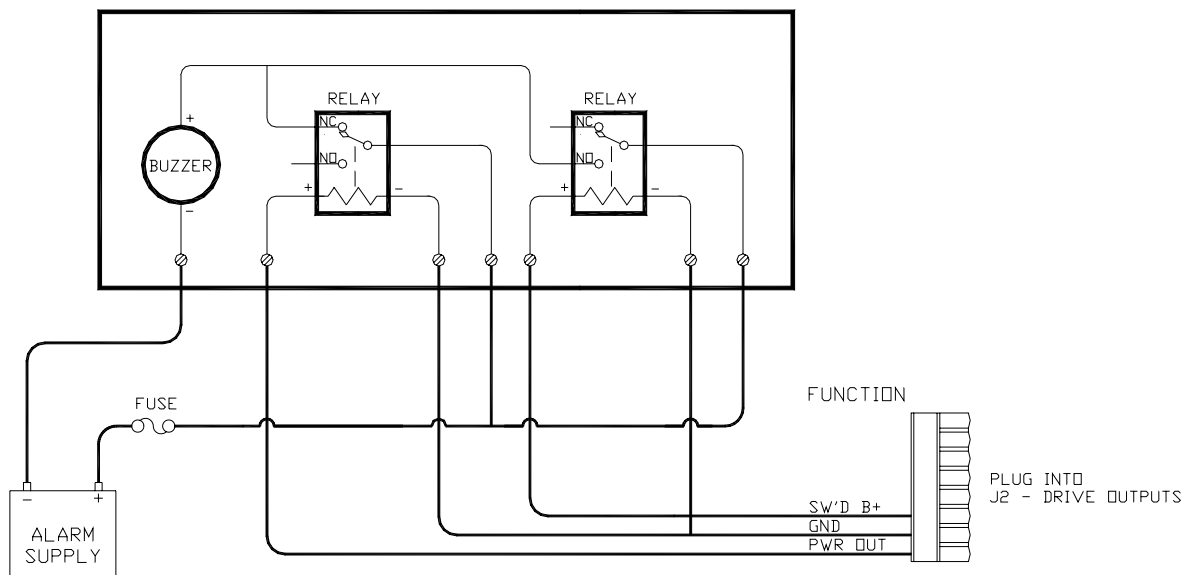


Figure 47 – External Alarm, SW'D B+ Output – with Power Fail Option

NMEA 0183 Input & Output

The Admiral P3 has ability to accept digital information formatted according to the NMEA 0183 standard. Many marine electronics devices – such as digital compasses, GPS receivers, chartplotters, and electronic charting systems, to name a few – have outputs complying with NMEA 0183.

Two such devices can be connected directly to the Admiral P3 SPU, by wiring them into the plug mated to the receptacle labelled **J9 – NAV I/O**.

The Admiral P3 SPU also has an NMEA output, to allow the autopilot's real-time Heading data to be sent to devices such as radar, a chart plotter or a navigation program on a PC.

The diagram below shows typical wiring for the **J9** connector.

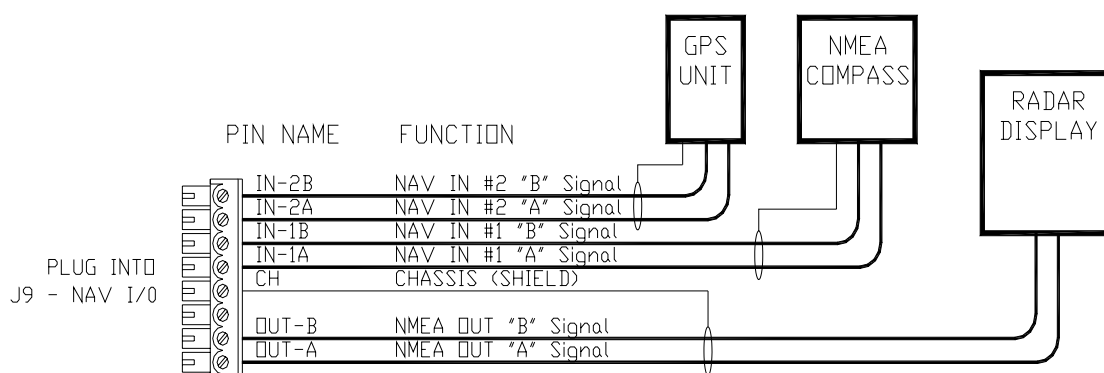


Figure 48 – Typical NMEA 0183 Connections

When the autopilot is turned on, the Status LED labelled **NMEA 0183 IN #1** in the SPU's Diagnostic section will be lit whenever the autopilot is receiving data on the **NAV1** input. Note that this indicator only shows that data was received. It does not mean that the data received is valid.

Typically, this LED will flash at a rate of about once per second for regular data from a GPS or Chartplotter. It will typically flash at a rate of about ten times per second when connected to a heading source such as the Vector G2 GPS Compass. If the LED does not flash, and you are sure the sending device is in fact sending data, try reversing the wires connected to **NAV1 - IN**.

Similarly, the LED labelled **NMEA 0183 IN #2** will be lit whenever the autopilot is receiving data on the **NAV2** input. If the LED does not flash and you are sure the sending device is sending data, try reversing the two wires connected to **NAV2 - IN**.

Refer to **Appendix 1** for more information on the NMEA 0183 sentences accepted and sent by the Admiral P3 system.

Other manufacturers may have used different names, for the NMEA 0183 serial data lines, than those used by ComNav. Refer to the following table for some typical equivalents:

ComNav Name	J9 Connector Label	Function	Alternative Names
'A' signal	1A IN or 2A IN A OUT	Negative voltage with respect to 'B' should produce a logical 1 (mark)	+ or NMEA + SIG or SIGNAL POS or +VE
'B' signal	1B IN or 2B IN B OUT	Negative voltage with respect to 'A' should produce a logical 0 (space)	- or NMEA - RTN or RETURN NEG or -VE

Table 2 – NMEA Signal Translation Guide

PC Input & Output

The Admiral P3 system can be connected to a desktop or laptop Personal Computer which is running navigation software. The following diagrams show how to do this:

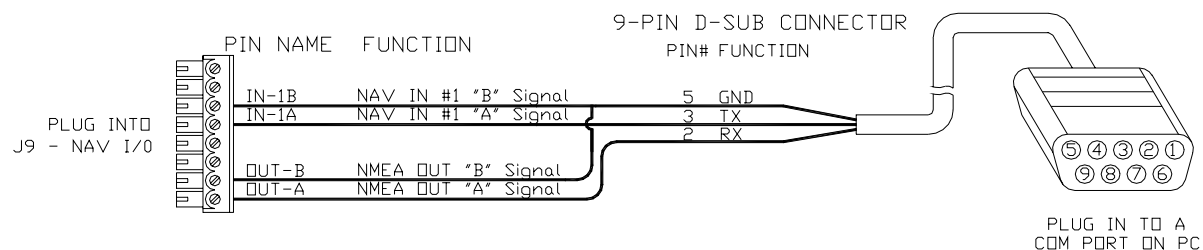


Figure 49 – Connection to a PC with a DE-9 Connector

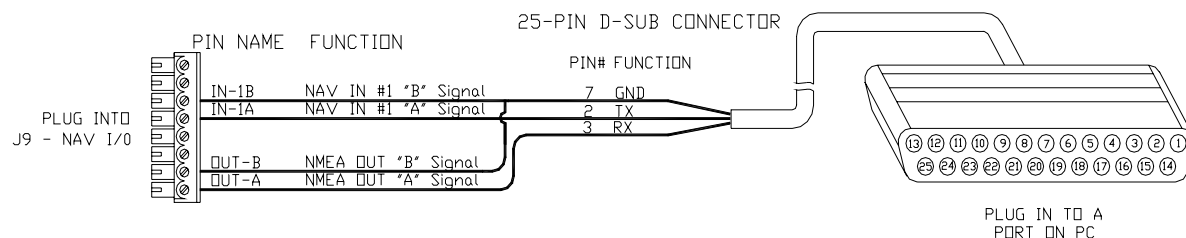


Figure 50 – Connection to a PC with a DB-25 Connector

Note: this method mixes the RS-232 electrical levels of a PC's COM port with the RS-422 levels of the SPU's NMEA 0183 NAV ports. Nonetheless, this method usually works fine. However, should you encounter any problems, RS-232 ↔ RS-422 Converters are available. Contact your ComNav Dealer for details.

Other Connections

Miscellaneous I/O

The **J6 – MISCELLANEOUS**³ connector is reserved for possible future use. The receptacle is supplied with a 10-pin mating plug.

Thruster Interface

The **J7 – THRUSTER I' FACE** connector is used with the CT7 Thruster Interface. The receptacle is not supplied with a mating plug, since the required plug is supplied with the CT7.

ComNav Network Connection

The **J10 – COMNAV NETWORK** connector is reserved for possible future use. The receptacle is not supplied with a mating plug.

³ This connector was labelled **J6- ENGINE I' FACE** in earlier Admiral P3 SPUs.

Post-Installation Checks

Be sure to perform all of the Electrical and Hydraulic checks listed below before using the Admiral P3 Wheelmark Autopilot System for the first time.

Electrical Checks

Once you have completed the wiring of the Autopilot System, perform the following checks to ensure that the installation is complete and that the autopilot has been installed in a safe and secure manner.

- 1) Check the power supply wiring (from the battery/breaker). Verify that the polarity and voltage are correct (use an accurate voltmeter for this). Also check for correct wire size, tightness of all connections, fusing, and proper operation of the battery power switch. Only after all checks are passed should you plug the power plug into the **JI – BATTERY INPUT** receptacle on the Signal Processor Unit.
- 2) Check the connections from the compass to the SPU.
- 3) Check the connections from the Rudder Follower to the SPU.
- 4) Check that when the rudder is manually moved from full Starboard to full Port, and vice-versa, the Rudder Follower has fully free movement and is not being restricted in any way.
- 5) Check the connection from the Control Head(s) to the SPU.
- 6) Check the connections to the drive equipment from the SPU.
- 7) Check that the cables are neatly placed and secured.
- 8) Ensure that extraneous materials (wire strands, etc) have been removed.

Route all the wires and cables sideways out from the SPU (to the left &/or right, as appropriate); use external tie-downs or cable grips to keep the wires & cables secure, with no excess strain on them or on the plugs that are mated to the SPU's receptacles.

Carefully re-install the Wiring cover on the SPU. Be sure not to pinch any of the wires or cables between the Wiring Cover and any other part of the SPU. Secure the Wiring Cover with the two knurled thumb-nuts

You may wish to leave the Diagnostic section cover off until you have completed the **Setup Procedures** (see page 80) and (page 118), so that you can observe the Diagnostic & Status LEDs (see page 151) during setup.

The cover must remain installed during normal operations, however. Use the 10 screws you put aside at the start of installation.

Hydraulic Checks

- 1) After installing the autopilot system, check to ensure that your manual steering system is still fully functional. Be sure to individually check each steering station on the vessel.
- 2) Check that when turning the steering wheel to starboard, the rudder actually moves so as to turn the vessel to starboard.
- 3) Check that when the steering wheel is turned to port, the rudder moves so as to turn the vessel to port.
- 4) If you have installed a ComNav Marine Reversing Motor Pump, a Constant Running Pump or an Engine Driven Pump:

⇒ *During the first few weeks of usage, check for residual air and leaking fittings in order to prevent poor or dangerous steering performance.*

Residual air in the steering system

Following the initial installation and bleeding of any hydraulic pump, some residual air may remain suspended in the hydraulic oil. During the first few weeks, this air will gradually bleed out through the header tank or the highest helm pump and the oil level may go down. Check the fluid level several times during this period, and add more oil as required.

Leaking fittings or equipment

Following the initial installation and bleeding of a hydraulic pump, continuously monitor the oil level at the reservoir, or the highest helm pump in your steering system, and add oil if required. If you find that you are often adding oil, it may be an indication of leakage in your steering system. Check all hydraulic steering fittings and equipment for leakage.

Getting Started

Getting Started

This chapter describes all the basic concepts you need to be familiar with when using your Admiral P3 Wheelmark Autopilot System, and the steps needed to prepare it for use.

Autopilot Operations

After it is installed, almost all of your interaction with your autopilot system will be done by means of the Control Head:

- selecting an operating mode
- setting up the parameters you each mode to use
- monitoring your vessel's Heading
- setting a desired Heading to be followed
- making Special Turns
- monitoring the various system status items
- and so on

Power On/Off

The first step in using your Admiral P3 system is to **turn it on** ...

To turn on the Admiral P3 system, press & hold the Control Head's red STANDBY/ON/OFF button, until the introductory display (see Figure 52) appears, then release the button.

The initial introductory display remains for a few seconds. Then, the software versions of both the Control Head and the SPU are listed on the display, below the **Admiral P3** line on the screen. You may find it helpful to record those version numbers, to refer to should your Admiral P3 System ever require servicing.

To turn off the Admiral P3 (at any time), press and hold the red STANDBY/ON/OFF button. The autopilot will switch first to **STANDBY** mode, if it was not already there.

But then, if you keep pressing the button, the autopilot will start a 3-second power-down sequence. Once the countdown has expired, the display will prompt you to release the STANDBY/ON/OFF button ... and once you do, the whole autopilot system will immediately shut off.

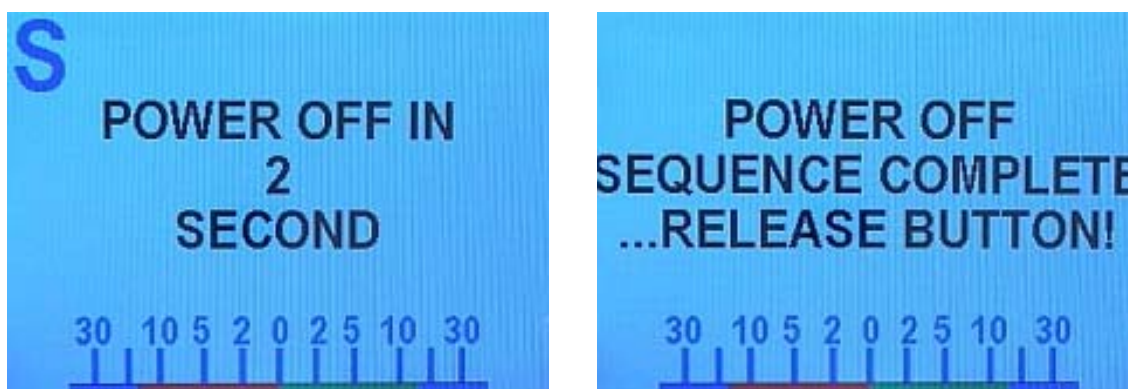


Figure 51 – Power Off Sequence

If you release the STANDBY/ON/OFF button before the 3-second countdown has completed, the autopilot will abort the countdown, and remain in **STANDBY** mode.

Using the Control Head – LCD Screen & Buttons



Figure 52 – Using the Control Head

The elements of the Control Head (with reference to the identifiers above) are:

- 1) **LCD Screen.** As long as the Admiral P3 system is powered on, the LCD screen normally displays the compass heading, rudder angle, and mode of operation; it can also be displaying desired heading, system status, other information, and various menus. The overall set of items being displayed changes in response to the various command buttons listed below (the screen shown above is the initial screen, which appears for a few seconds after Power-On).
- 2) **STANDBY/ON/OFF button.** To power on the system, press and hold this button until the LCD screen lights up (with the introductory display shown above), and then release the button. The autopilot always powers up in **STANDBY** mode. **STANDBY** mode can always be accessed, regardless of what the autopilot is doing, by pressing and holding this button for approximately ½ second. While in **STANDBY** mode, the autopilot will not exert any control over your vessel. This button will also turn off the autopilot when pressed and held for approximately 2 seconds. During regular operation, double-pressing this button brings up (or cancels) the Standby menu.
- 3) **PORT ARROW button.** Pressing and holding this button while in **POWER STEER** mode moves the rudder to port for as long as the button is held. Pressing this button while doing a Dodge Special Turn in **AUTO** or **NAV** modes allows you to avoid obstacles in the vessel's path by turning to port. Releasing the button automatically recovers your original heading or track.

- 4) **TURN** button. Pressing this button once while in **AUTO** mode queues the default pre-programmed turn. Subsequent presses of the **TURN** button scroll through all of the available turn-types. The pre-programmed turn sequence is then initiated by pressing either the **PORT** or **STARBOARD ARROW** button to indicate the direction in which the turn will be executed. See **Default Turn** on page 100 for more details on setting the default turn from the Special Turns available.
- 5) **STARBOARD ARROW** button. Pressing and holding this button while in **POWER STEER** mode moves the rudder to starboard for as long as the button is held. Pressing this button while doing a Dodge Special Turn in **AUTO** or **NAV** modes allows you to avoid obstacles in the vessel's path by turning to starboard. Releasing the button automatically recovers your original Heading or Track.
- 6) **FUNCTION (Fn)** button. This is a multi-function button:
 - The **Fn** button invokes **WORK** mode while in **AUTO** or **NAV** modes. Double-pressing the button will bring up the **WORK** mode menu.
 - Pressing this button when an alarm condition occurs in the autopilot suppresses the alarm.
 - This button is also used during **SETUP** to initiate the automatic learning features of the autopilot.
- 7) **COURSE CHANGE** knob.
 - In **POWER STEER** mode, one 'click' changes the rudder angle by approximately $\frac{3}{4}$ of a degree. A quick spin moves the rudder approximately 7 degrees.
 - In **AUTO** mode, turning the knob one 'click' will change the commanded course by 1 degree. A quick spin of the knob changes the course by 10 degrees.
 - The **COURSE CHANGE** knob is also used to change parameters in the various menus.
- 8) **POWER STEER** button. Pressing & holding this button places the autopilot in **POWER STEER** mode. This mode allows you to steer the vessel by using the **COURSE CHANGE** knob or by pressing and holding the **PORT** or **STARBOARD ARROW** buttons. A double-press of this button brings up (or cancels) the **Power Steer** mode menu.
- 9) **AUTO** button. Pressing & holding this button places your vessel's steering system under the control of the Admiral P3. You can control the vessel's heading by using the **COURSE CHANGE** knob. Obstacles can be avoided by using the **PORT** and/or **STARBOARD ARROW** buttons. A double-press of this button brings up (or cancels) the **AUTO** mode menu.
- 10) **NAV** button. If your vessel is equipped with a GPS or Chartplotter, or another Navigation System, pressing & holding this button enables the autopilot to steer your vessel from NMEA 0183 data provided by that system. A double-press of this button brings up (or cancels) the **NAV** mode menu.

Operating Modes & Menus

Your ComNav Admiral P3 Wheelmark Autopilot System has four basic operating modes, known as **STANDBY**, **POWER STEER**, **AUTO**, and **NAV**; a fifth operating mode, known as **WORK**, is a sub-mode of **AUTO** & **NAV** modes.

Each of these modes has its own set of parameters that you can adjust, to configure and fine-tune how your Admiral P3 system behaves in the respective mode. These parameters are stored in the system's non-volatile memory; you can view & change them with the Control Head, via sets of menus that appear on the LCD screen.

There is one more menu, called Dockside Setup, which is used for setting up a number of the parameters that are common to all the operating modes.

In total, there are six different menus. The menus of the four basic operating modes (**STANDBY**, **POWER STEER**, **AUTO**, and **NAV**) are accessed by using the respective mode buttons: the **STANDBY/ON/OFF** button, the **POWER STEER** button, the **AUTO** button, and the **NAV** button. The **Fn** button is used to access the **WORK** mode's menu.

- To access a particular operating mode menu, double-press the button associated with that menu (e.g., the **NAV** button for the **NAV** mode's menu).
- To quit viewing a particular operating mode menu, double-press the associated button again, or wait about 10 seconds. The display will then revert to the active display of whatever mode the Admiral P3 is operating in.

Using the operating mode menus is fully described in the related sections, later in this manual; see the **Basic Operations** chapter for **Standby Mode**, **Power Steer Mode**, **Auto Mode**, & **NAV Mode** (pages 99, 102, 104 & 109 respectively), and the **Advanced Operations** chapter for **WORK Mode** (page 121).

Accessing & using the Dockside Setup Menu is described in the next section.

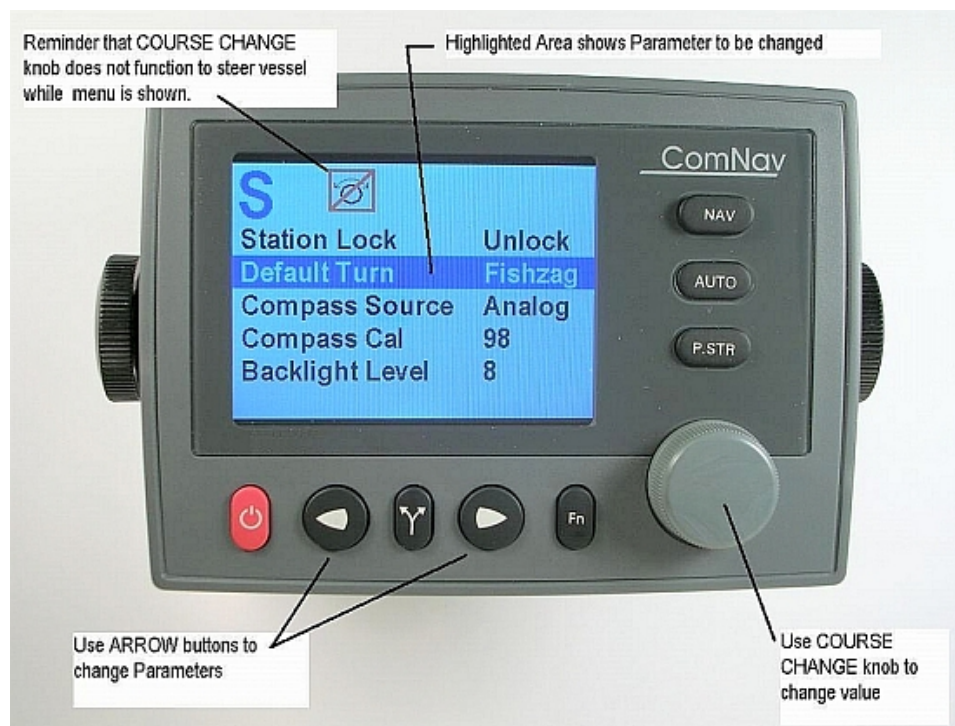


Figure 53 – A Typical Menu

All menus are arranged with parameter names on the left side of the screen, and the current value for each parameter on the right side.

Note that in each menu, one item is always highlighted – it indicates which parameter is currently selected (for example, see the “Default Turn Fishzag” line in the figure above).

You can move the highlight to other items on the menu by pressing the PORT ARROW button (moves the highlight up) or STARBOARD Arrow button (moves the highlight down).

Some menus have more items than can be shown on a single screen. In this case, when the highlight has been moved to the last item on a screen, each subsequent press of the STARBOARD button will cause the menu will scroll up by one item, revealing a new high-lit item. Similarly, when the highlight has been moved to the first item on a screen, each subsequent press of the PORT button will scroll the menu down one item. These long menus are arranged in a circular fashion, so that the scrolling action can be carried on indefinitely.

Use the COURSE CHANGE knob to change the value of the currently high-lit parameter. For parameters with numbered values, a clockwise turn of the knob will increase the value; counter-clockwise movements will decrease the value. Non-numerical values are generally arranged in a circular list for ease of use.

Note that every time a menu is accessed, there is a little icon at the top of the display that looks like the COURSE CHANGE knob, but with a line drawn through it. This is a reminder that the COURSE CHANGE knob is not available for its normal function of changing the vessel's course – because the knob is now being used to change parameter values.

All menus – except Dockside Setup – have a time-out feature that triggers after about 10 seconds, if no button presses, or movements of the COURSE CHANGE knob, are detected during that time-out interval.

When a menu times out, the display reverts to the previously active display, just as though you had double-pressed the menu button again.

Alarm Clear

Whenever an alarm or error message occurs on the Admiral P3, an audible alarm will sound, both at the SPU & at the Control Head, and a message will be displayed on the LCD.

The alarm will remain activated until the condition that caused it is remedied, or the alarm is cleared manually by you.

To clear the alarm manually, press the **Fn** button once. If the condition that caused the alarm remains, the alarm will reappear after approximately 20 seconds.

Dockside Setup Menu

Accessing the Dockside Setup menu is always necessary during the initial setup of the autopilot. Typically, it is used only infrequently after initial setup.

A special button sequence must be used to access the Dockside Setup menu:

- 1) Start with the Admiral P3 system powered off.
- 2) Press and hold the **Fn** button and the TURN button. Then press & hold the STANDBY/ON/OFF button. Power will turn on.
- 3) Hold all three buttons activated until the software version numbers are displayed, then release the buttons.



Figure 54 – Entering Dockside Setup

- 4) After a second or two, the display will show the Dockside Setup menu. Note that a large D (which is the indicator that the system is in Dockside Setup) appears in the upper left portion of the display.

The Dockside Setup menu is unlike other menus:

- there is no time-out feature associated with it.
- when you exit it, the P3 system performs a full Power-On sequence, which ends up in **STANDBY** mode.

Many of the items listed in the Dockside Setup menu are not simple *parameters*, but instead are *automated scripts* (sequences of pre-defined steps) that perform a variety of functions and system tests. The letters **Fn** on the right hand side of the display identify the items that are scripts. To activate the associated script, press the **Fn** button.



Figure 55 – Dockside Setup menu, page 1

Reset

Caution: pressing the **Fn** button when this item is highlighted will reset **ALL** parameters in the entire autopilot system back to the factory default settings. This means any configurations or adjustments you have already made **WILL BE LOST**. Use this feature only on the advice of an authorized ComNav service representative.

Vessel Type

Set this to most closely match the type of vessel that the autopilot is installed on. The system then automatically uses a set of steering parameters that have been found to work reasonably well with typical vessels of the chosen type.

Setting	Vessel Type	Comments
Displ	Full Displacement	Choose this setting for full displacement vessels that do not plane or rise out of the water at cruising speed.
Semi	Semi-Displacement	Choose this if your vessel rises partially out of the water at cruising speed.
Plane	Planing Hulls	Choose this for vessels that are mostly out of the water at cruising speed.
Stern	Stern-drive	Choose this for planing-hull vessels with outboards or stern-drive legs. If you are using a reversing motor pump, the pump will operate at a slower speed when the autopilot is using the Hi steering parameters. This will result in smoother steering and rudder movements.
Large	Large, with a slow Helm response	For large vessels that are slow on the Helm, typically over 125' LOA &/or 100 GRT (e.g., freighters, tankers, dredgers, car/truck ferries, fish processors, etc.).

Table 3 – Vessel Types

An. Comp. Type (Analog Compass Type)

The Admiral P3 can work with a variety of different compasses. Many of these are Analog Compasses that output DC sine and cosine signals. The An. Comp. Type parameter tells the Admiral P3 what specific type of analog compass is connected to the SPU (or if none is). Analog compasses are always connected to J8 on the SPU. Refer to the following table for help in identifying and selecting the correct type for the compass in your system.

Setting	Compass Type	Comments
None		Choose this setting if your Admiral P3 system is utilizing a ComNav 45° Compass Transducer, or any type of NMEA 0183 Compass (such as the ComNav Vector G2 or G2B GPS Compasses).
Mag		Choose this setting if you have an externally gimbaled magnetic compass fitted with a ComNav Magnetic Sensor, such as the one shown to the left.
Flux		Choose this if you have a ComNav Fluxgate Compass like the one shown to the left. <i>If you have a ComNav Heading Rate Stabilizer connected in series with the Fluxgate Compass, you must use the HRS setting (below).</i>
Fixed	-----	The Admiral P3 can accept a variety of Analog compasses. Consult the manufacturer's documentation, or contact the manufacturer, to determine whether the reference signal is fixed or floating, and set the An. Compass Type to match.
Float	-----	
HRS		Choose this setting if you are using a ComNav Heading Rate Stabilizer like the one shown at the left.

Table 4 – Analog Compass Types

Compass Setup

Pressing the **Fn** button when this item is highlighted tells the Admiral P3 to verify the Analog Compass connections. If the connections are found to be correct, the autopilot will then query whether you want it to do an automatic compensation of the compass for Magnetic Deviation. See the **Setup Procedures** on page 80, and the **Compass Compensation** procedures on page 88 for full details.

Drive Setup

Pressing the **Fn** button when this item is highlighted starts a script in which the Admiral P3 automatically determines the orientation of the rudder follower, measures the physical rudder limits, figures out what kind of steering system (i.e. reversing motor, solenoid, etc) is installed, and then tests all these to make sure everything is operating properly. This is explained more fully under **Setup Procedures** on page 80.

Exit

Press the **Fn** button to exit the Dockside Setup menu and restart the autopilot in **STANDBY** mode. Alternately, you can press and hold the red STANDBY/ON/OFF button to shut off the autopilot.



Figure 56 – Dockside Setup menu, page 2

Alarm O/P (Alarm Output)

This parameter controls the functioning of the External Alarm Output. The value shown indicates which output will be used to activate the external alarm.

When set to “None”, the external Alarm Output is deactivated.

When Set to “SW'D B-“, the Switched B- output (J2-pin 4) will be used to activate the External Alarm, which should be wired as per Figure 44 or Figure 46 in the **Installation** chapter.

When Set to “SW'D B+“, the Switched B+ output (J2-pin 3) will be used to activate the External Alarm, which should be wired as per Figure 45 or Figure 47 in the **Installation** chapter.

To configure the External Alarm Output, follow these steps:

- 1) Highlight "Alarm O/P" on the screen.
- 2) Use the COURSE CHANGE knob to select the Alarm O/P that you want to use.

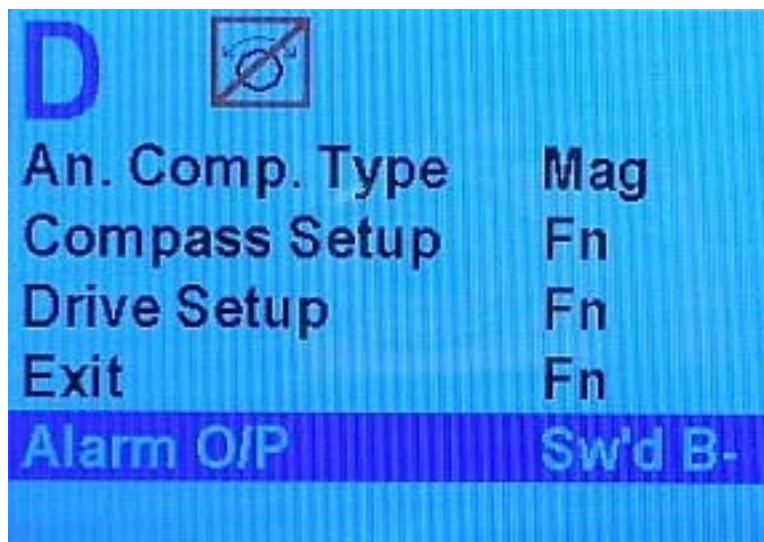


Figure 57 – External Alarm Configuration

- 3) Press the **Fn** button. A new screen will appear. This is where you choose whether you want to activate the External Alarm Output for all alarms and error messages, or just when the Watch Alarm has not been answered. Note: The autopilot will not allow you to change the Alarm O/P without choosing either "All" or "Watch". If necessary, it will bring up the option screen before it allows you to move the highlight off of "Alarm O/P".

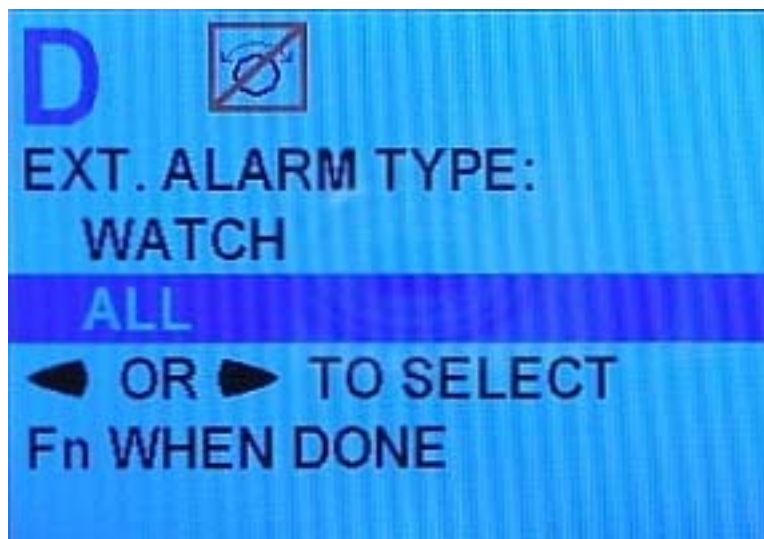


Figure 58 – External Alarm Type Configuration

- 4) Press the **Fn** button to get back to the Dockside Setup menu. You can now move the highlight to a different parameter.

Thrust Type***Thrust MIN******Thrust MAX***

If the optional CT7 Thruster Interface is installed with your Admiral P3 system, you will need to make adjustments to these settings. Complete instructions are included with the CT7 Thruster Interface.

Language

This parameter allows you to set the language used for almost all menus & messages that appear on the Control Head.

Note that a few items remain in English at all times, typically where there is no simple translation for that item. Also, the word “Language” on the menu is always shown in English.

Choices are as follows:

- English
- Français
- Español
- Íslenska
- Italiano

Note: other languages may be added in future Firmware Upgrades (see ***Appendix 5*** on page 153).


Setup Procedures

Once your Admiral P3 autopilot system is installed, you must set it up, before you can use it.

- First, you must tell the P3 what type of vessel you have, and then have the P3 determine the characteristics of the Rudder Drive mechanism on the vessel.
- Then, you must tell the P3 what type of Compasses it will be using, and have it verify that it can use those compass(es). Then you must compensate & calibrate all your compasses.

Vessel Type

- 1) Access the Dockside Setup menu
 - First, ensure that the Admiral P3 system is turned off.
 - Press and hold the Fn button and the TURN button. Then turn the power on by pressing the STANDBY/ON/OFF button.
 - Hold all three buttons activated until the software version numbers (see page 69) are displayed, then release them.
 - After a second or two, the display will show a large “D” in the upper left portion of the display, and the Dockside Setup menu will be shown on the screen.
- 2) Set the Vessel Type according to the chart given in the **Vessel Type** table (page 75).



Reset	Fn
Vessel Type	Displ.
An. Comp. Type	Mag
Compass Setup	Fn
Drive Setup	Fn

Figure 59 – Set Vessel Type

Drive Setup

3) Begin the Drive Setup function

In the first part of this automated script, the Admiral P3 determines the orientation of the rudder follower, and where the physical limits of the rudder travel are.

- If you are not still in the Dockside Setup menu, enter it.
- Move the menu highlight to “Drive Setup”, and then press the **Fn** button, to start automated script.
- Begin by manually moving the rudder all the way to starboard when prompted. Do not be concerned if the rudder angle indicator shown on the display appears to go in the opposite direction. The Admiral P3 will sort that out shortly.

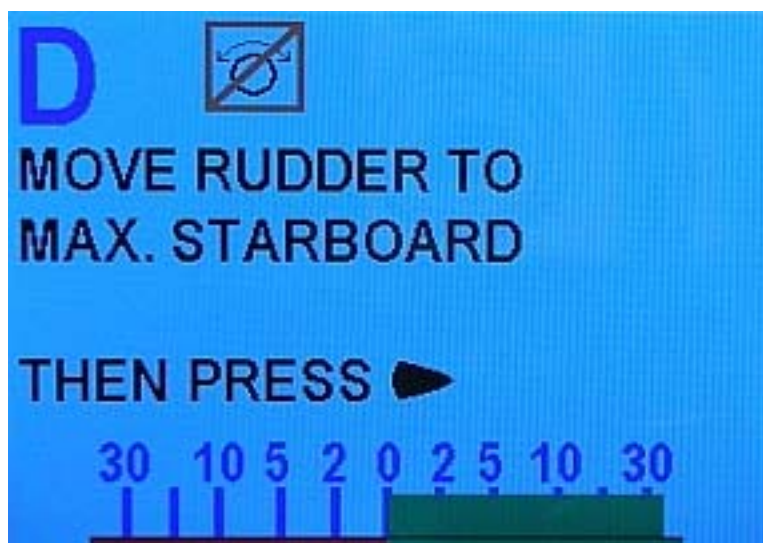


Figure 60 – Move Rudder to Starboard

Be sure to move the rudder all the way to the physical stops.

The speed at which you move the rudder does not matter, nor does it matter if you move the rudder back and forth a bit when it reaches the physical stops, so as to be sure it *has* reached those stops.

The autopilot will record the “all the way” position – as measured by the Rudder Follower – and will ensure, in normal operation, that the rudder is always stopped a couple of degrees shy of this position, to avoid pounding against the stops.

4) Once the rudder is hard-over, press the STARBOARD ARROW button.

Next, the Admiral P3 will prompt you to move the rudder all the way over to the port side.

- Do so – again, all the way to the physical stops, at any speed you like – then press the PORT ARROW button.

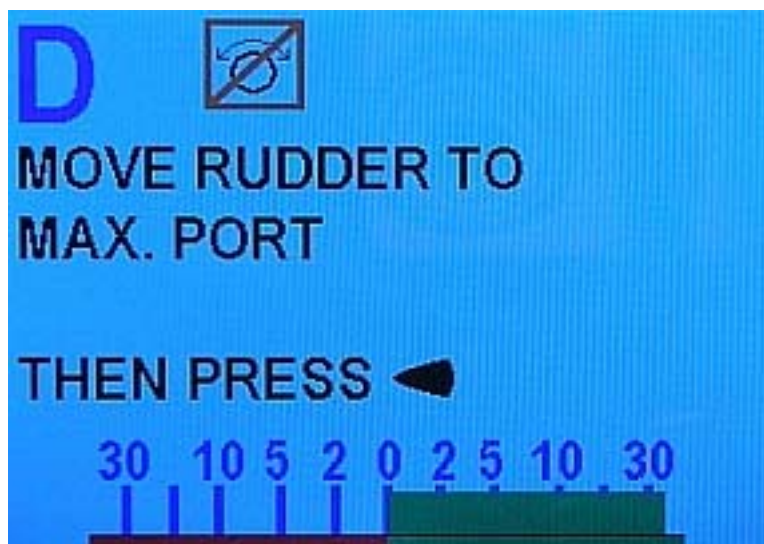


Figure 61 – Move Rudder to Port

The Admiral P3 will quickly measure the rudder position again, and then prompt you to move the rudder to the centre position.

- Do so - again, the speed at which you move the rudder does not matter, nor does some back & forth movement at the centre position. Be sure the rudder is at the centre position, this time.

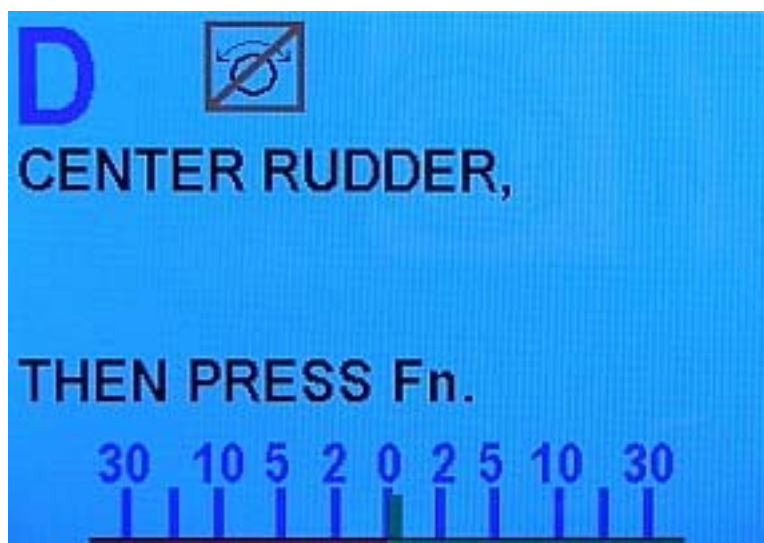


Figure 62 – Center the Rudder

Note: these tests also tell Admiral P3 how you have wired the Rudder Follower input, so that the rudder angle indicator on the screen will display correctly port-wise & starboard-wise movements & positions of the Rudder.

- 5) Now press the **Fn** button on the Control Head, to go to the next phase of the Drive Setup process.

Bleeding a Hydraulic Steering System

The Admiral P3 will pause the Drive Setup process at this point, and prompt you to bleed your hydraulic steering system.

Note: *If you do not have a hydraulic system, just press the **Fn** button on the Control Head, to carry on with the Drive Setup, and go to Drive Setup step 6) on page 85.*

Whether you have installed an entirely new hydraulic system, or added a hydraulic pump controlled by the Admiral P3 onto an existing mechanical or hydraulic system, the **ENTIRE** hydraulic system must be bled of any air trapped in the hydraulic oil, **otherwise the steering system will not perform properly.**

Bleeding a typical system using a P3-controlled Reversing Motor hydraulic pump added onto an existing manual steering system is done in the following steps; other systems will be similar.

Caution: SAFETY GLASSES SHOULD BE WORN DURING THE STEPS BELOW.

1. First, bleed the manual portion of the steering system (Helm pump, lines & steering cylinder), according to the manufacturer's instructions. When you have completed bleeding the manual system, leave the equipment that you used (funnels, catch cans, etc.) attached to the hydraulic system.
2. Check that the highest hydraulic reservoir in the system is completely filled; top it up, if necessary. If possible, use a bottle of your system's hydraulic oil & a piece of plastic tubing to add extra capacity to the highest reservoir (see the figure below). If you have a helper, have them watch the oil level in the highest reservoir, and refill it when necessary.

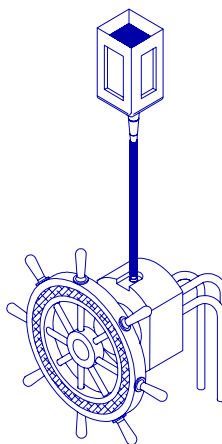


Figure 63 – Adding Fluid Capacity

3. Turn the steering wheel hard against the stop, to press as much oil as possible into the system. The hydraulic cylinder rod should now be fully extended in one direction.
4. To bleed the Reversing Pump, you will need to extend – using the autopilot – the cylinder rod in the other direction, and back again, repeatedly, until all air is removed. Open one bleed screw (or nipple) on the hydraulic cylinder and close the other. Normally, you close the bleed screw closest to the end of the rod that is now retracted, and open the bleed screw closest to the rod end now extended (see Figure 64). Be sure to position the catch can under the open bleed screw, first.

5. Position yourself so that you can see the hydraulic cylinder while operating the Admiral P3 Control Head. You can move the steering cylinder rod with the P3's Drive outputs, by pressing either the PORT or STARBOARD ARROW button on the Control Head.
6. Using Control Head, extend the rod as far as it will travel in the other direction. The Autopilot should stop driving the cylinder shortly after the rod fully extends.
7. Check the steering system's highest reservoir; re-fill, if necessary.
8. Close the opened bleed screw, re-position the catch can, and open the other screw, so that the cylinder will be bled when the rod is extended in the original direction.
9. Use the Control Head to fully extend the cylinder rod to the other side.
10. Check/re-fill the highest reservoir.
11. Repeat steps 6 through 10 at least ten times, until all air has been removed from the cylinder and lines – that is, no air bubbles appear along with the oil coming out of the opened bleed screw, or trapped in the oil.
12. Close all bleed screws. Clean up any spills of oil and wipe fittings clean. Move your funnels, catch cans, etc. away from the steering system.
13. Use the Control Head to extend the rod fully in one direction and then the other.
14. Check for leaks by looking for spilled hydraulic fluid near, or on, fittings and cylinders.

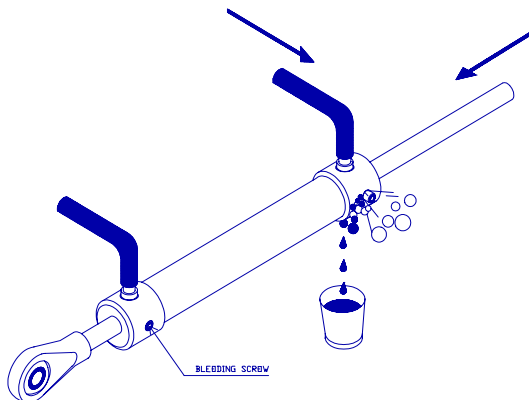


Figure 64 – Bleeding Cylinder, Rod moving left

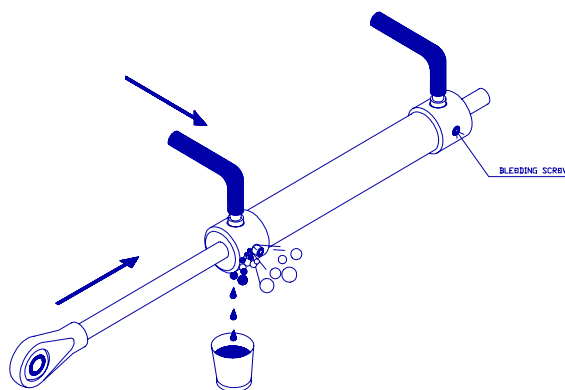


Figure 65 – Bleeding Cylinder, Rod moving right

When all Bleeding is done, press the **Fn** button on the Control Head, to carry on with the Drive Setup.

Drive Setup (continued)

- 6) When you press the **Fn** button (when the “Bleed?” screen was displayed, after bleeding the hydraulic system, or if you skipped that step), the Admiral P3 will fully test the drive system. This involves the autopilot automatically running the rudder from hard-over to hard-over a number of times, and possibly making some speed adjustments to the reversing motor pump-set (if one is installed on your system). The autopilot will also make a series of short starts and stops of the rudder (pump, motor, etc.) in order to determine a base reference for how the steering system responds.

Note: if your steering system is very slow – with a Hard-Over to Hard-Over time greater than about 22 seconds – the Drive Setup procedure will give you a warning message, but it will still be completed. You may wish to consider upgrading your steering system in this case, so that the heading/course/track-keeping performance of the autopilot is not degraded by the slowness of the steering system.

If the HO-HO time is greater than ~32 seconds, the Drive Setup procedure will fail. In this case, you will definitely have to improve your steering systems’ performance.

When the HO-HO time is too slow, it is usually an indication (on hydraulic systems) that the hydraulic pump is too small, the cylinder is too large, or that there may be a faulty valve in the system.

On the other hand, if your steering system is extremely quick – with an HO-HO time of less than ~5 seconds – the autopilot will deliberately slow it down, by using Pulse Width Modulation of the Drive output voltages, during autopilot-controlled Rudder movement. PWM in effect lowers the voltage “seen” by your Rudder Drive motor(s), and thus slows down the resulting Rudder HO-HO time.

When the HO-HO time is too fast, it is usually an indication that the hydraulic pump is oversized.

- 7) Once the Admiral P3 has finished measuring the drive, it will display the following message:

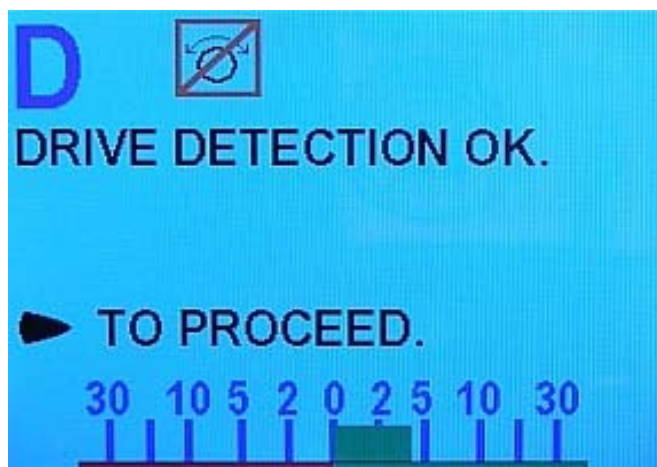


Figure 66 – Drive Test OK

- 8) Press the STARBOARD ARROW button to return to the Dockside Setup menu.
9) Exit the Dockside Setup menu.

Compass Setup – Dockside

The first steps in setting up your compasses are to select which type (or types) you have, and to verify that they are properly wired to the SPU.

These steps should be done while tied up to the dock, in case any re-wiring needs to be done, or if it turns out that some elements of the P3 system need to be moved.

Note: if you are using only an NMEA compass (such as a Vector G2 GPS Compass), you should select “None” in step 1), and then skip the rest of these steps (both the at-the-dock steps here, and the on-the-water steps in the next section) entirely.

Instead, you should follow the Compass Setup instructions that were supplied with the NMEA compass.

Note: during these steps, the autopilot may issue an INVALID HEADING alarm (see page 146). These alarms can be ignored, or cancelled by hitting the **Fn** button.

Once a compass is found in this procedure, the alarms should cease.

1) If you are not already in the Dockside Setup menu, enter it.

- Select the compass type(s):

Move the highlight to “An. Compass Type”, and set the type according to your system configuration (see Table 4 on page 76).

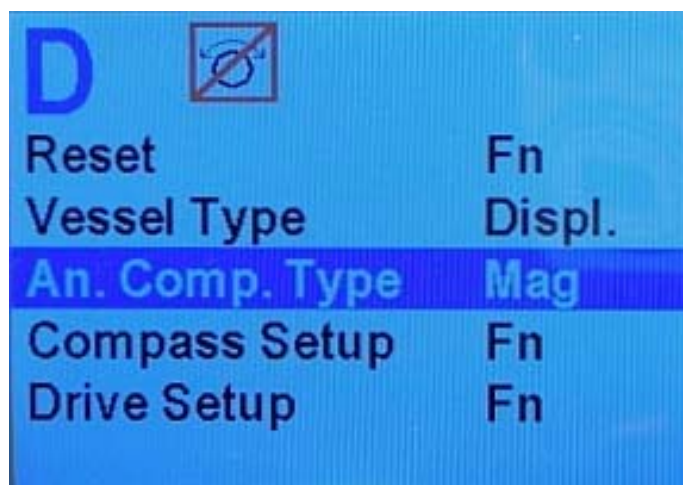


Figure 67 – Set Compass Type

2) Verify that the selected compass type is properly connected, and can be read.

Select “Compass Setup” on the menu, then press **Fn**. A “Wait ...” screen will be displayed on the screen for a few seconds, and then the results of the “search” will be displayed, along with an option to “compensate now ...” or “set North now ...” (the type of compass shown & the “compensate” option will depend on what you entered for “An. Comp. Type”).

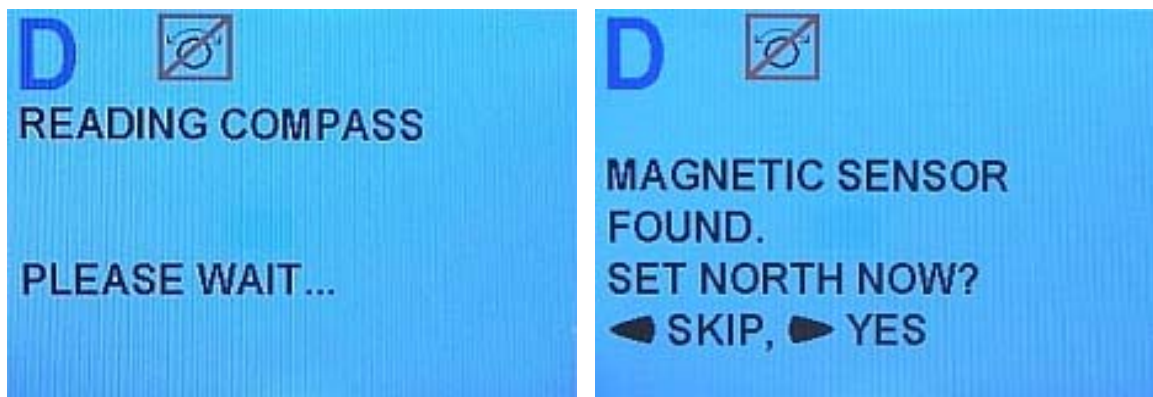


Figure 68 – Compass Verification (Mag Sensor shown)

- If the Admiral P3 system could not find a compass that matches with the type you have selected in step 1), it will give the following error message at this point (the type of compass shown will depend on what you entered for “An. Comp. Type”):

Check your installation to be sure that the compass is wired correctly. Fix any problems, and re-start at step 1).

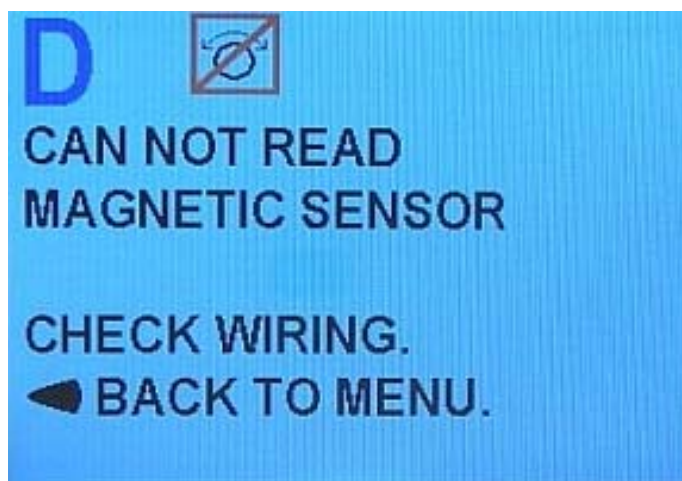


Figure 69 – Compass Verification Failed

- If the Admiral P3 system still cannot find any installed analog compasses, contact your ComNav Dealer for help.
- 3) Press the PORT ARROW button, to skip the compass compensation & calibration process (this can not be done while still tied up at the dock).
 - 4) If you have installed more than one type of Analog Compass, and/or a 45° Compass Transducer, repeat steps 1) through 3) for all such compasses.
 - 5) Exit the Dockside Setup menu.

Compass Setup – On the Water

The final part of compass setup is normally performed after all other installation and setup procedures for the Admiral P3 system are completed, so that all net electrical and magnetic effects of the installation on the compass(es) are taken into account.

Note: *some of the steps performed here require that you be familiar with the **STANDBY** mode & menu of the Admiral P3 system (see page 99).*

This part of compass setup requires taking your vessel away from the dock, and out onto a body of open water (the sea, a lake, a river, etc.), and should be done in relatively calm conditions.

It is important that there be sufficient sea room to put the boat through a series of fairly slow & wide circle turns, and to run the boat for several minutes in a straight line at various headings, without encountering obstacles, other marine traffic, etc. You should also avoid areas around bridges, underwater power lines, and pipelines, as these can affect your compasses.

CAUTION! *Be sure to keep a proper lookout for other vessels, and any hazards, while doing any of the circle turns & other manoeuvres described below.*

Compass Compensation

The specific procedure you will follow depends on the type(s) of compasses you have installed. Each is described below.

Note: *during all these procedures, the **INVALID HEADING** alarm may occur. You can cancel any such alarm, or leave it active.*

Magnetic Compass Sensor

If you have a magnetic compass with a ComNav Magnetic Sensor attached, the compass must be properly compensated for deviation. It is recommended that a professional compass adjuster do this.

Once the compensation is completed, follow the instructions below to synchronize the Magnetic Sensor with the Earth's Magnetic North direction:

- 1) Power up the autopilot. Double-press the **STANDBY/ON/OFF** button to bring up the Standby menu. Select "Compass Source", and make sure it is set to "Analog".
- 2) Shut off the autopilot, then power it up in the Dockside Setup menu.
- 3) Ensure that the "An. Compass Type" is set to "Mag".
- 4) Select Compass Setup & press the **Fn** button.
- 5) After the Admiral P3 has auto-detected the compass, it will ask you if you want to SET NORTH NOW? (see Figure 68). Press the **STARBOARD ARROW** button.

Manually steer the vessel so that it is pointing to Magnetic North. Hold it on that heading and push the **Fn** button. The Admiral P3 will store the current heading and reference it as 000° Magnetic. When this is done, the Admiral P3 will automatically return to the Dockside Setup menu.
- 6) Highlight "Exit" and then press the **Fn** button. After a brief pause the autopilot will restart and automatically go into **STANDBY** mode.
- 7) Now do the **Compass Calibration** procedure, on page 92.

Heading Rate Stabilizer

If you have a ComNav Heading Rate Stabilizer with your Fluxgate compass, you must first compensate the HRS, and then compensate the compass.

- *If you do not have an HRS with your Fluxgate Compass, skip to the Fluxgate Compass procedure, on the next page.*
 - 1) Power up the autopilot. Double-press the STANDBY/ON/OFF button to bring up the Standby menu. Select "Compass Source", and make sure it is set to "Analog".
 - 2) Shut off the Autopilot system.
 - 3) Loosen the white plastic screw on the top of the Heading Rate Stabilizer, by approximately 3 turns. This tells the HRS, the next time it is powered up, that you want it to perform its own internal auto-compensation procedure.
 - 4) Power up the autopilot, in the Dockside Setup menu.
 - 5) Ensure that the "An. Compass Type" parameter is set to "HRS".
 - 6) Select Compass Setup & press the **Fn** button.
 - 7) You will see the words Reading Compass on the display, and then CAN NOT READ HRS.
 - 8) Manually steer the vessel in a circle. You will need to do at least 2 full circles.

You may choose to steer either to port or to starboard. It doesn't matter which way, as long as you do not reverse direction during the procedure.

Boat speed does not matter either – instead, the speed should be high enough to hold a constant rate of turn of about 2 to 3 degrees per second, meaning that the full circle should take between 2 & 3 minutes.
 - 9) After 2 or more full circles, press the PORT ARROW key, to end the HRS compensation procedure, and go back to the Dockside Setup menu.
 - 10) Screw the plastic screw on the top of the HRS all the way in again. Be cautious not to over-tighten it.
 - 11) Proceed on to step 4) of the Fluxgate Compass compensation procedure (see the next page).
- If, during the Fluxgate procedure, a CAN NOT READ HRS message appears, then the HRS did not successfully auto-compensate.
- You should first try repeating the procedure above, but go through more turns than you did on the first try. You may also have to relocate the compass and/or HRS, and then repeat the steps above.
- If you continue to encounter difficulties, please contact your ComNav Dealer for assistance.

Fluxgate Compass

- 1) Power up the autopilot. Double-press the STANDBY/ON/OFF button to bring up the Standby menu. Select "Compass Source", and make sure it is set to "Analog".
- 2) Shut off the autopilot, then power it up in the Dockside Setup menu.
- 3) Ensure that the "An. Compass Type" is set correctly for the type of Fluxgate Compass that you are using.
 - *If you have a Heading Rate Stabilizer, the parameter should always be "HRS", no matter which type of Fluxgate you have.*
- 4) Select Compass Setup & press the **Fn** button.
- 5) After the Admiral P3 has auto-detected the compass (or HRS), it will prompt you whether or not you want to compensate it. Press the STARBOARD ARROW button.

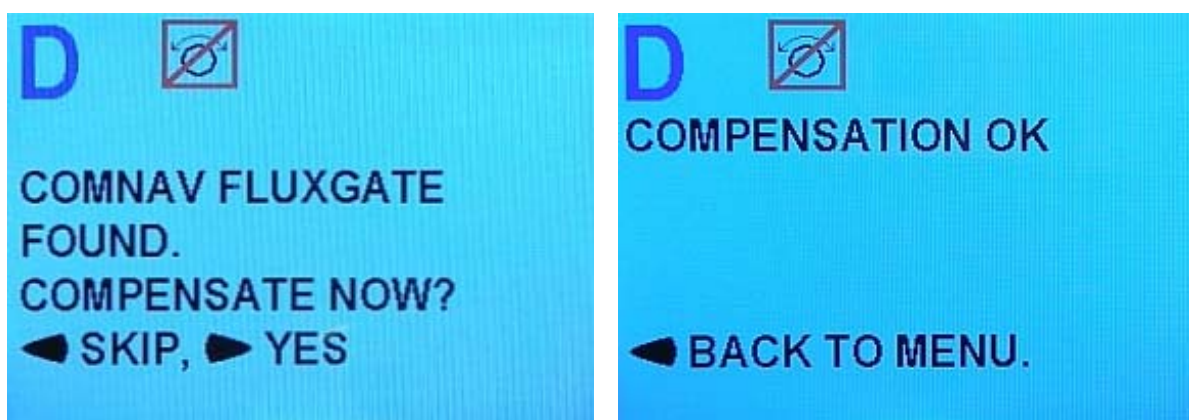


Figure 70 – Fluxgate Compass Verification & Compensation

- 6) Manually steer the vessel in a circle.

You may choose to steer either to port or to starboard. It doesn't matter which way, as long as you do not reverse direction during the procedure.

Boat speed does not matter either – instead, the speed should be high enough to hold a constant rate of turn of about 2 to 3 degrees per second, meaning that the full circle should take between 2 & 3 minutes.

Keep turning until the display reads COMPENSATION OK, as shown above.
- 7) Press the PORT ARROW to go back to the Dockside Setup menu. Highlight "Exit" and then press the **Fn** button. After a brief pause the autopilot will restart and automatically go into **STANDBY** mode.
- 8) Now do the **Compass Calibration** procedure, on page 92.

- If after several turns, the display does not say “Compensation OK”, or if the following message is displayed, relocate the compass and begin the procedure over.
- If you continue to encounter difficulties, please contact your ComNav Dealer for assistance.

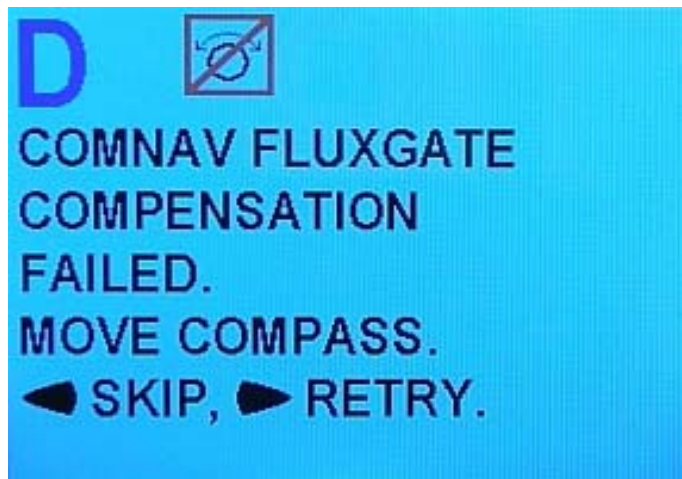


Figure 71 – Compensation Failed ... Move Compass

45° Compass Transducer

- 1) Enter the Dockside Setup menu.
- 2) Ensure that the “An. Compass Type” is set to “None”.
- 3) Select Compass Setup & press the **Fn** button.
- 4) After the Admiral P3 has auto-detected the Compass Transducer (shown as NX2 COMPASS FOUND), it will prompt you whether or not you want to compensate it. Press the STARBOARD ARROW button.

- 5) Manually steer the vessel in a circle.

You may choose to steer either to port or to starboard. It doesn't matter which way, as long as you do not reverse direction during the procedure.

Boat speed does not matter either – instead, the speed should be high enough to hold a constant rate of turn of about 2 to 3 degrees per second, meaning that the full circle should take between 2 & 3 minutes.

Keep turning until the display reads COMPENSATION OK.

- 6) Press the PORT ARROW to go back to the Dockside Setup menu. Highlight “Exit” and then press the **Fn** button. After a brief pause the autopilot will restart and automatically go into **STANDBY** mode.
- 7) Now do the **Compass Calibration** procedure, on page 92.

Compass Calibration

Although your compass(es) are now compensated for Deviation, they may not be giving a correct reading just yet. Any or all of your compasses may still have an individual fixed offset, so you must tell the Admiral P3 SPU what each one's *calibration* value is.

Calibration is a simple matter of synchronizing each compass's directional readings, as seen by the SPU, to the actual Magnetic direction values of the Earth's magnetic field.

Note: *NMEA compasses (e.g., the ComNav Vector G2/G2B GPS Compass) typically do not require on-the-boat calibration. You should refer to the Installation & Operation manual that came with your NMEA compass to verify this, however.*

Even if yours does, the calibration value will not be set or stored in the Admiral P3, but rather in the compass itself, so you should skip the steps below, and follow the instructions that came with the NMEA compass.

To do calibration:

- 1) Bring the vessel onto a known bearing and maintain it there by steering manually. The autopilot should be in **STANDBY** mode.
- 2) Double-press the STANDBY/ON/OFF button to bring up the Standby menu. Select "Compass Source", and set it to the correct value for the first of your compasses:
 - ANALOG for Magnetic Sensor
 - FLUX for Fluxgate Compass (with or without HRS)
 - DIGITAL for a 45° Compass Transducer
- 3) Move the highlight down one position to "Compass Cal". Using the COURSE CHANGE knob, adjust the reading so that it agrees with the known bearing that the vessel is on.
- 4) Repeat steps 2) & 3) for all your compasses.
- 5) Double-press the STANDBY/ON/OFF button to exit the Standby menu.
- 6) Verify that the compass heading shown agrees with the actual heading of the vessel, and stays steady, by holding a number of constant-heading courses for a few minutes each.

At this point, the entire Compass Setup procedure is complete.

All compass settings will be retained, when the autopilot is turned off. You should not need to re-compensate any of your compasses again, unless the electrical/magnetic environment on your vessel changes substantially.

Sea Trials

Sea Trials allow you to test out the basic functions of the autopilot under way, and to fine-tune the steering parameters for best performance. The goal is to achieve accurate course keeping, and smooth, timely changes of heading without excessive movements of the rudder.

Every vessel has unique design dynamics. These change depending on speed, loading, and sea conditions. The Admiral P3 Wheelmark Autopilot System uses advanced steering control software – ComNav's unique & powerful **Intelligent Steering Technology**, or **IST** – which has a number of parameters that can be tailored to suit different vessels. Collectively, these are often referred to as “the steering parameters”.

There are two parameter groups, one group for “Lo” vessel speeds and one group for “Hi” vessel speeds. These group labels are chosen because speed is often the single biggest factor in vessel dynamics.

The Admiral P3 has been tested on a wide variety of vessels of different types and sizes. The default settings for the steering parameters – for each Vessel Type listed in the Dockside Setup menu – are average values derived from testing, and provide a good starting place for most boats of the same type.

During Sea Trials you will make adjustments to some of these parameters to suit your particular vessel.

Initial Sea Trials should be done in relatively calm conditions.

Note: *most of the steps performed here require that you be familiar with basic operation of the Admiral P3 system (see page 99).*

Familiarize yourself with the typical response of an autopilot to a heading change, as shown in Figure 2 on page 17. Then follow the steps below to begin tuning your autopilot.

Note: *All of the parameters that are adjusted below are found in the Auto menu (see page 105).*

Once the Admiral P3 is steering satisfactorily, make a note of the steering parameters in use and record them at the back of this book in the **User Notes & Settings** chapter.

Adjust Rudder Gain & Counter Rudder for Low Speed

- 1) Adjust vessel speed appropriately for low speed running.
- 2) Bring up the Auto menu, highlight “Parameter Set” and select “Lo”.
- 3) Highlight “Seastate” and set it to “1”.
- 4) Highlight “Turn Rate”. Select a setting that is approximately 3/4 of your vessel's ‘comfortable capability’. You may have to time a complete circle while the vessel is turning at a comfortable rate. This turn should occur at the vessel speed most appropriate for low speed operation. Then calculate ‘comfortable capability’ as 360 degrees divided by number of seconds it took to complete the turn.
- 5) If “ALC” is set to “On”, highlight it and set it to “Off”.
- 6) Exit the Auto menu.
- 7) Switch to **AUTO** mode. The Admiral P3 will automatically take the current vessel heading and use that as the course to steer.
- 8) Run for about 5 minutes. If the vessel “esses” back and forth more than about 3 degrees, bring up the Auto menu and reduce the “Rudder Gain” setting by 1 step and test again.

- 9) Make a 40° course change.
 - If the vessel stops turning before the new heading is reached and then approaches it slowly, either
 - ◇ increase Rudder Gain by 1 level
 - or
 - ◇ decrease the Counter Rudder setting by 1 level
 - If the vessel overshoots the new heading, and then makes several turns across the new heading before settling down, either
 - ◇ decrease the Rudder Gain by 1 level
 - or
 - ◇ increase the Counter Rudder setting by 1 level
 - If the vessel approaches the new heading, shies away, then approaches & shies away again
 - ◇ decrease the Counter Rudder by 1 level.
- 10) Continue making 40° course changes and adjusting Rudder Gain and Counter Rudder until the vessel settles smoothly onto the new course without excessive overshoot.
- 11) Repeat the above adjustments on several different headings until you get consistent results.

Adjust Seastate for Low Speed

Change the Lo speed Seastate setting to your desired setting. See the description of the **Seastate** parameter on page 106 for details of the effects of this parameter.

Adjust Turn Rate for Low Speed

Adjust the Lo speed Turn Rate setting (see page 106) to suit. Make a few course changes of 20° or more to ensure that the rate of turn is comfortable.

Adjust Rudder Gain & Counter Rudder for High Speed

- 1) Adjust vessel speed appropriately for high speed running.
- 2) Bring up the Auto menu, highlight "Parameter Set" and select "Hi".
- 3) Repeat steps 3) though 11) in the Lo speed Rudder adjustment process above (but at the Hi speed you have chosen).

Adjust Seastate for High Speed

Change the Hi speed Seastate setting to your desired setting.

Adjust Turn Rate for High Speed

Adjust the Hi speed Turn Rate setting to suit. Make a few course changes of 20° or more to ensure that the rate of turn is comfortable.

Adjusting for Sea Conditions

Adjusting the steering parameters in calm conditions – as you do during the initial part of the Sea Trials – gives a base reference for all other conditions.

As you get the overall setup of the Admiral P3's operating parameters closer to being **perfect**, you can then venture into rougher conditions.

Take all the time necessary to ensure that you are getting the best performance from your Admiral P3!

Some suggestions:

- Observe the wake of the boat while maintaining a straight course in **AUTO** mode. This is one of the best indications of how well the autopilot is steering.
- The vessel should come on to course smoothly after course changes are made. Any undershoot or overshoot can usually be observed in the wake.
- Once the Admiral P3 system is performing well in calm conditions, you will find that you will only need to make small changes to the steering parameters to handle a wide variety of sea conditions.
- Generally speaking, Rudder Gain and Counter Rudder settings for High speed will be less than those for Low speed.
- As the seas get rougher, you will probably need to increase the Rudder Gain one or two levels.
- In very rough conditions, you may want to reduce the Counter Rudder setting as well as increasing the Rudder Gain.
- In quartering seas, you may wish to increase Rudder Gain and the Seastate setting. This will allow the boat to yaw a bit more as it comes off of the waves, but typically the vessel will come back onto course with minimal rudder movement. Increasing the Seastate setting can reduce wear on the steering system, because it will not be working so hard.
- Change Turn Rate as required to maintain safe turning rates for given sea conditions.

Basic Operations

Basic Operations

This chapter describes the basic modes of operation of the Admiral P3 Wheelmark Autopilot system, and shows you how to use them.

Standby Mode

The autopilot always turns on in **STANDBY** mode. In this mode, the autopilot displays the vessel's heading and the rudder angle, but has no control over the steering of the boat.

Beside the heading value is an indicator as to whether the directional value is in Degrees Magnetic or Degrees True. This is determined automatically by the Admiral P3, based on the type of Compass Source – all analog compasses are in Magnetic, while NMEA compasses may be in Magnetic or True, depending on how they are configured (see page 142 for more details).

⇒ This indicator appears in **all** operating modes.



Figure 72 – Typical Standby Mode Screen

The large “S” in the upper left corner of the display indicates that the system is in **STANDBY** mode.

To switch to **STANDBY** mode from any other mode, press the red STANDBY/ON/OFF button for approximately ½ second. As soon as the large “S” appears, the vessel will be under manual control.

Standby Menu

The Standby menu consists of a number of items that have a general bearing on how the autopilot operates. To access the Standby menu, double-press the red STANDBY/ON/OFF button.

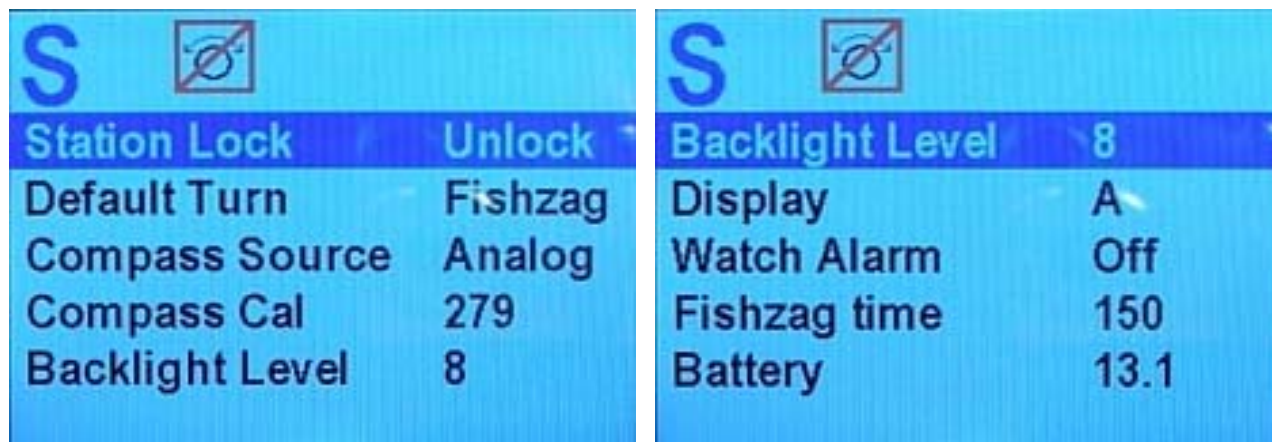


Figure 73 – Standby Menu (pages 1 & 2)

Station Lock

The Admiral P3 system can accommodate up to three Control Stations – one main Control Head, and any combination of Control Heads & Remotes on the two AUX ports.

One of these Control Stations is always in control, and the others are simply repeater stations. You can take command with any of the repeater stations by simultaneously pressing the PORT and STARBOARD ARROW buttons on the repeater.

However, to prevent unauthorized personnel from doing this, the main Control Head can lock out all of the others. Station Lock must be changed to Unlock before the repeater stations can take command.

For more detail, refer to **Station Lock/Unlock** in the **Advanced Operations** chapter of this manual.

Default Turn

The Admiral P3 System has a number of Special Turns pre-programmed into it. The variety of turns available depends somewhat on the system configuration and what mode you are operating in.

Set the Default Turn parameter to the type that you are likely to use most often. Then, when you press the TURN button to initiate a Special Turn, the default turn will be the first one offered. See **Special Turns** in the **Advanced Operations** chapter for more details.

Note: in NAV mode, only “Dodge” will be shown when a Special Turn is started, no matter what the Default Turn parameter is set to.

Compass Source

There are a number of separate inputs for different types of compasses that may be used with the Admiral P3 system. You may elect to have more than one type connected at the same time. This menu item allows you to switch from one to the other at any time.

Compass Cal (*Compass Calibration*)

This item allows you to synchronize the compass on the autopilot with an external source. Simply turn the COURSE CHANGE knob until the Compass Cal value reads the same as your reference source.

Note: *for safety reasons, Compass Cal may not be adjusted in **AUTO** or **NAV** modes; thus, it does not appear in the Standby menu, if you enter the menu from either of those modes.*

*Compass Cal may be safely adjusted in **STANDBY** or **POWER STEER** modes.*

Backlight Level

There are 9 levels of backlighting available, numbered 0 through 8.

Level 8 offers the brightest possible backlight. Each level below 8 offers a correspondingly lower level of backlight.

Level 0 is completely off (no backlighting). To change from Level 0 to any other level, double-press the STANDBY/ON/OFF button to bring up the Standby menu. The screen will temporarily light up with level “3” brightness, so that you can see the menu.

The screen automatically changes to a “night” colour scheme (see scheme “C” below), whenever the backlight level is set to “1”, “2”, or “3”. These backlight levels should be used at night-time, to avoid impairing the vessel operator’s night vision.

Display

There are three built-in colour schemes for the colour LCD panel in the Admiral P3’s Control Head.

The standard is scheme is “A” – a white background with most text in black, and various red, green & blue colours to emphasize important elements of the various displays.

Colour scheme “B” is an alternate that you may prefer – a light blue (cyan) background, with suitably-contrasting colours for text & the various display elements & information.

Colour scheme “C” utilizes red colours on a black background, and was developed for best night-time vision.

Watch Alarm

The Admiral P3 has a built-in Watch Alarm. This menu item allows you to turn on the Watch Alarm and set how much time is allowed to elapse before the alarm goes off. This menu item is “password protected” to prevent unauthorized personnel from changing the Watch Alarm parameters. See **Watch Alarm** in the **Advanced Operations** chapter of this manual for complete details on setting the Watch Alarm, and the password.

Fishzag Time

This sets the time interval between course changes while executing the special Fishzag turn. The units are seconds, and each click of the COURSE CHANGE knob will change the interval by thirty seconds. See **Special Turns** in the **Advanced Operations** chapter.

Battery

This is a read-only display that cannot be changed. The number shown is the battery voltage as measured at the Signal Processor Unit.

Power Steer Mode

To enter **POWER STEER** mode, press and hold the P.STR button for about a half-second, until the large “P” mode indicator appears in the upper left corner of the display.

In this mode, the display shows the actual compass heading and the rudder angle. The PORT and STARBOARD ARROW buttons are used to control the rudder. Press one or the other to move the rudder in that direction. The rudder will keep moving for as long as the button is pressed until it gets to the physical rudder limits.

You can limit the maximum amount of rudder travel in **POWER STEER** mode by turning on the Power Steer limits. Turning on these limits, and adjusting them to suit, is done in the Power Steer menu (see below).



Figure 74 – Typical Power Steer Mode Screen

The COURSE CHANGE knob can also be used to move the rudder in **POWER STEER** mode. Each “click” of the knob will move the rudder a finite amount.

Power Steer Menu

The Power Steer menu contains the “mechanical” steering parameters (which are common to all modes). To access the Power Steer menu, double-press the P.STR button.

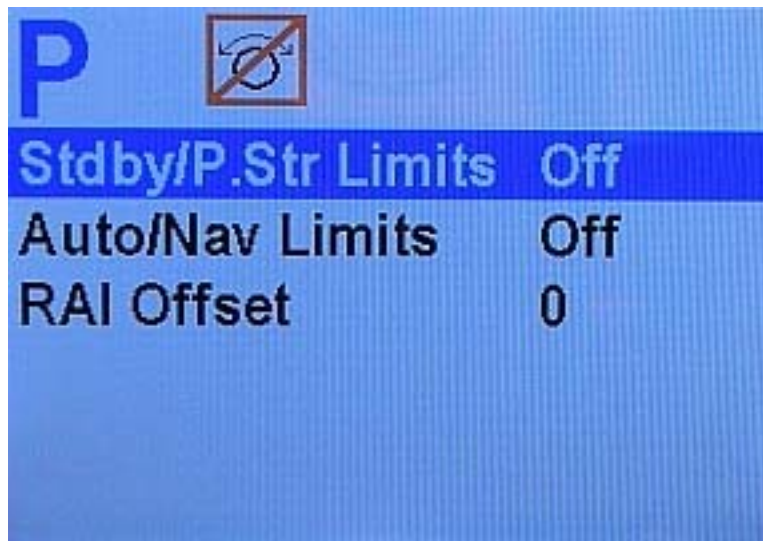


Figure 75 – Power Steer Menu

Stdbby/P.Str Limits (Power Steer Rudder Limits)

When you set up the Admiral P3 system (see **Setup Procedures** on page 80), you will move the rudder from hard over port to hard over starboard so that the autopilot can measure these positions. These hard over positions are known as the “physical limits”, beyond which the rudder simply cannot be turned. However, you can artificially limit the rudder travel through the autopilot software.

Set the Power Steer⁴ Limits to the number of degrees port and starboard that you would like to limit the rudder movement to. These rudder limits will be in effect whenever the autopilot is in **POWER STEER** mode. The minimum setting is 5°; the maximum is the same as the physical limits measured in Dockside Setup. Setting the limits to “Off” means that the full range – up to the physical limits – will be allowed. The limits selected will be shown on the bottom bar of the Rudder Angle Indicator display during normal operation, in red and green.

Auto/Nav Limits

The Auto/Nav Limits are essentially the same as the Power Steer Limits detailed above, but they are in effect only when the autopilot is in **AUTO** or **NAV** modes.

RAI Offset

The RAI (Rudder Angle Indicator) display at the bottom of the autopilot display may require a slight offset adjustment in order to read zero degrees when the vessel is moving in a straight line. This is a fairly common scenario and may be due to vessel loading or design, rudder design or function, or the installation of the Rudder Feedback Unit. For example, if the vessel is traveling in a straight line, but the RAI reads 2° to starboard, adjust the RAI Offset to port so that the RAI display reads zero.

⁴ SPU firmware versions before 3.05 allowed the Rudder to be moved in Standby mode, with a Jog Lever, but this feature was disabled in that version & onwards, for safety reasons. The parameter name was not changed, however.

Auto Mode

In **AUTO** mode, the Admiral P3 will steer the vessel on your commanded heading.

To enter **AUTO** mode, press and hold the AUTO button for about a half- second, until a large letter “A” is shown in the upper left portion of the display. At this point the Admiral P3 will steer the vessel to the heading that the vessel was on at the moment the autopilot entered **AUTO** mode.



Figure 76 – Typical Auto Mode Screen

When in **AUTO** mode, the vessel's actual heading is still shown in large letters in the middle of the LCD screen, but now there is also another heading display in smaller digits shown in the top-center portion. This is the “commanded” course.

To change the commanded course, use the COURSE CHANGE knob. A clockwise turn will result in an increase of your heading, and a counter-clockwise turn will decrease the vessel's heading. The Admiral P3 will bring the vessel around to the new commanded course at the rate of turn specified for Turn Rate in the Auto menu.

Each click of the knob will change the commanded course by one degree. Rapidly spinning the knob will result in 10-degree jumps in the commanded course.

In **AUTO** mode, you can “dodge” quickly around obstacles and automatically return to your original course. See **Dodge**, on page 125, for more information.

You can limit the maximum amount of rudder travel in **AUTO** mode by turning on the Auto/Nav rudder limits. Turning them on, and adjusting them to suit, is done in the Power Steer menu (see page 103).

Auto Menu

The Auto menu contains the main “autopilot-control” steering parameters. To access the Auto menu, double-press the AUTO button.



S			
Rudder Gain	8,	5	
Counter Rudder	3,	3	
Seastate	A,	A	
Turn Rate	8,	5	
Parameter Set	Lo		

S			
Parameter Set	Lo		
Speed Trip Pt.	10		
Speed Source	NAV1		
Off-course Limit	20		
ALC	Off		

Figure 77 – Auto Menu, pages 1 & 2

Rudder Gain

Rudder Gain is a measure of the amount of corrective rudder that will be applied for a given course error. The Admiral P3 is able to accommodate a wide range of rudder gains, but restricts the user to a certain portion of this range, depending on the type of vessel the autopilot is installed on.

Note that there are two numbers shown for Rudder Gain. The number on the left is the value used when the autopilot is operating in LO speed. The number to the right is the value used when the autopilot is operating in HI speed.

Note that if the autopilot is in LO speed, only the low speed rudder gain will change when you rotate the COURSE CHANGE knob; the high speed rudder gain value will be shown in a grey tone. Similarly, if the autopilot is operating in HI speed, the COURSE CHANGE knob will only affect the high speed rudder gain value, and the low speed value will be shown in grey.

The parameter values do not have any units.

The following diagram provides a general guide to setting Rudder Gain:

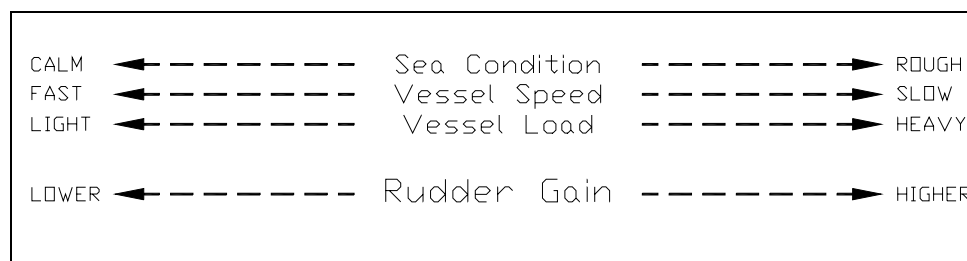


Figure 78 – Guidelines for setting Rudder Gain

Counter Rudder

Counter Rudder is a measure of how much rudder is applied for a given rate of change in course error. If the course error is increasing, the counter rudder adds to the rudder correction, and if the course is decreasing the counter rudder subtracts from the rudder correction applied.

Like Rudder Gain described above, there are two numbers shown; one for LO speed, and one for HI speed.

The parameter values do not have any units.

The following diagram provides a general guide to setting Counter Rudder:

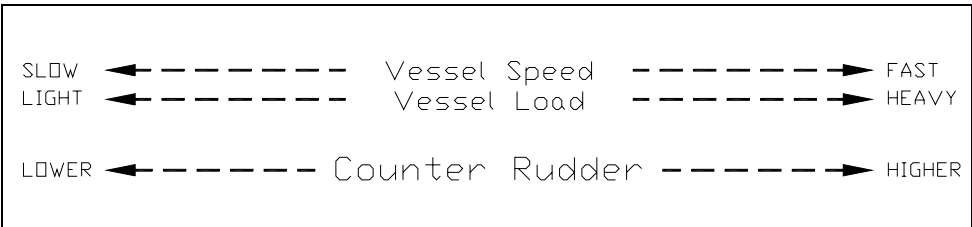


Figure 79 – Guidelines for setting Counter Rudder

Seastate

The Seastate control tells the autopilot how much deviation from the set course to allow before taking corrective action.

Seastate should be set according to sea conditions. As conditions worsen, the Seastate setting can be increased. This may result in slightly worse steering performance, but will reduce the amount of rudder movement and strain on the steering system.

This parameter’s units are in total degrees on either side of the set course, so a value of 1 will allow the vessel to change up to 0.5° of heading on either side of the set course before bringing it back on course. The maximum value is 10°.

There is also an Automatic Seastate Control feature that will monitor and adjust the Seastate setting for you. To activate this, highlight “Seastate” in the menu and turn the COURSE CHANGE knob counter-clockwise until the value reads “A”.

There are two Seastate settings; one is for LO speed operations and one is for HI speed operations.

Turn Rate

Varying the Turn Rate parameter controls the maximum rate at which the vessel may make a course change (in **AUTO** or **NAV** modes), return to its original heading after a dodge manoeuvre, or execute a Special Turn. Factors such as speed, load, hull characteristics and weather conditions may limit the maximum achievable turn rate.

This parameter’s units are in degrees per second. Up to 1.5 °/sec, the value increments by 0.1° per click of the COURSE CHANGE knob; between 2.0 °/sec to the maximum of 20.0 °/sec, it changes by 1° per click.

There are two Turn Rate settings; one is for LO speed operations and one is for HI speed operations.

Parameter Set

The Admiral P3 gives you the ability to store two sets of steering parameters, labelled “Hi” (high) and “Lo” (low). This allows for best performance under varying vessel speeds and/or loading conditions.

The autopilot can be set manually to use either the Lo or the Hi settings. There is also a selection for “Auto”. If “Auto” is chosen, the autopilot will automatically switch from Hi to Lo, or vice-versa, depending on the vessel’s speed. For “Auto” to work, the autopilot must be connected to an NMEA 0183 Navigation System that outputs speed information. The Speed Trip Point, described below, governs the point at which the switch is made.

When the Admiral P3 is in **AUTO** or **NAV** mode, it always indicates which steering parameter set is in effect. This is shown just to the left of the Rudder Angle Indicator, and consists of a small box shape with either H for Hi or L for Lo in it. If the parameter set is set to Auto, then the word “AUTO” also appears in the box.

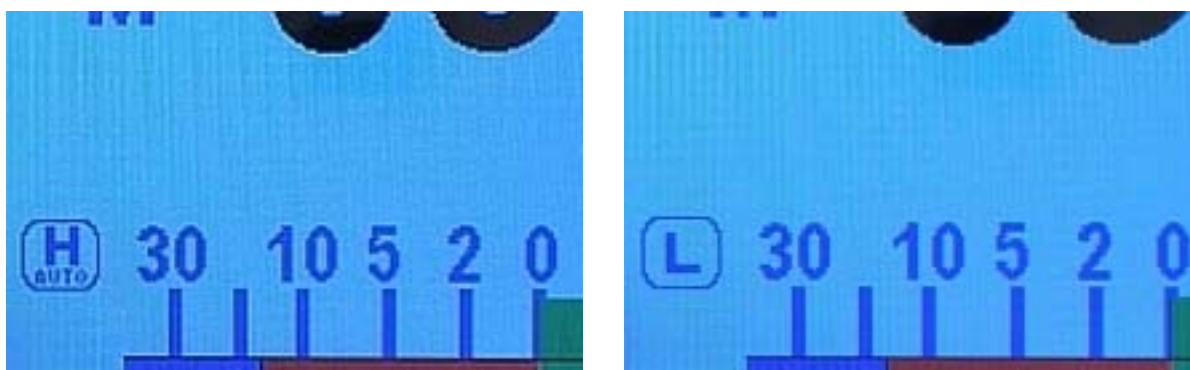


Figure 80 – HI and LO Speed Icons (Left of Rudder Angle Indicator)

Speed Trip Pt (Speed Trip Point)

The Speed Trip Point governs the point at which the autopilot automatically transitions from the Lo steering parameters to Hi. For automatic transition to take place, the “Parameter Set” must be set to “Auto”.

Speed Source

The Admiral P3 can obtain information about the vessel’s speed from a variety of sources that provide NMEA 0183 data outputs, at either the **NAV1** or **NAV2** inputs on connector J9. This menu item is used to select which of the two inputs the autopilot will use.

Off-Course Limit

The Admiral P3 has an Off-Course Alarm that will be activated should the vessel fall off course by more than the limit set here. The range of settings is 5° to 20°. There is a 32 second delay on this alarm.

ALC (Automatic Leeway Correction)

The P3’s ALC function is turned on or off with this parameter. It is active only in **AUTO** mode. See the description of ALC on page 19 for details of what it does.

Thruster (Thruster Assist)***Thruster Gain***

If the optional CT7 Thruster Interface is installed with your Admiral P3 system, you will need to make adjustments to these settings. Complete instructions are included with the CT7 Thruster Interface.

Helm Delay

This parameter is only available when the Vessel Type is set to “Large”.

When a Large vessel is slow on the Helm, this parameter can be used to “slow down” the Admiral P3’s IST steering processing responses to match. The range of values is 2 to 60.

The correct value of this parameter depends on the vessel’s Helm characteristics, and also on the type of Heading sensor in use, and must be determined by careful testing during Sea Trials.

For the standard ComNav magnetic compasses & sensors used with the Admiral P3 system (see pages 27 to 29), a good rule of thumb for finding the correct value is to start by setting it to 10 times the number of seconds of Helm delay (i.e., the time span from initial movement of the Rudder until the vessel’s Heading starts to change) the vessel exhibits: for example, if the Helm delay is 2 seconds, set it to 20.

For NMEA 0183 compasses, the correct value depends on what Heading update rate the compass is set to; for example, with a Vector G2/G2B GPS Compass set to a Heading update rate of 5 Hz, a value of 10 would be a good value to start with.

After the initial value is entered, adjust it in small steps until satisfactory steering performance is obtained.

Counter Helm

This parameter is only available when the Vessel Type is set to “Large”.

When a Large vessel is very slow on the Helm, it can often exhibit a tendency to overshoot the target Heading – whether being steered manually or by an autopilot – when there is a large change of Heading involved.

An experienced Pilot on such a vessel, when steering manually, will typically set a Heading that is a few degrees less than the desired Heading, knowing that the vessel’s inherent overshoot will result in the vessel ending up on the actual desired Heading.

When the Admiral P3 is steering the vessel, it will always bring the vessel onto the desired Heading. But there may be some “essing” of the Heading – and that may not be acceptable. In most situations, it is better to come directly, even if gradually, onto the target Heading.

And so, this parameter can be used to set the Admiral P3 to act in much the same way as an experienced Pilot. This parameter sets the amount of “undershoot” that is automatically applied to the P3’s target Heading value, when a large change of Heading is required. The range of values is 0 to 80, and is in degrees.

The correct value of this parameter depends on the vessel’s Helm characteristics, and must be determined by careful testing during Sea Trials. A good rule of thumb for finding the correct value is to start by setting it to 0, and then make a large change of Heading in **AUTO** mode. Note the amount of overshoot that occurs during the initial turn, and then set the Counter Helm parameter to one-half that overshoot. Repeat the test, adjusting in small steps until satisfactory steering performance is obtained.

NAV Mode

The Admiral P3 Wheelmark Autopilot system has the capability to use steering information from an external NMEA 0183 Navigation System .

NAV mode allows the autopilot to steer to a waypoint destination or along a route of waypoints. In **NAV** mode the Admiral P3 uses its own compass (which may also be the Navigation System) as its primary source of heading for course keeping, while the steering data received from the Navigation System is used to calculate the commanded heading to the destination waypoint.

To activate **NAV** mode:

- Turn on your Navigation System and activate a waypoint.
- Press the NAV button on the Control Head until the letter “N” appears in the upper left portion of the display, indicating **NAV** mode (shown below is the Normal **NAV** mode display – see page 117 for the Alternate display).



Figure 81 – NAV Mode (Normal Display)

- The Waypoint ID, Range, Bearing, and cross-track error (XTE), as provided by the Navigation System will be shown on the Control Head display.

Note: some Navigation Systems do not provide all of this information. If such cases, the display will show dashes (- - -) or “NONE” in place of any missing data.

In **NAV** mode, you can “dodge” quickly around obstacles and automatically return to your original track. See **Dodge**, on page 125, for more information.

You can limit the maximum amount of rudder travel in **NAV** mode by turning on the Auto/Nav rudder limits. Turning them on, and adjusting them to suit, is done in the Power Steer menu (see page 103).

Nav Menu

The Nav menu contains a number of parameters used when operating the autopilot in **NAV** mode. To access the Nav menu, double-press the NAV button.



N  281°	N  281°
Nav Source NAV2	XTE Limit 0.25
XTE Limit 0.25	Waypoint Arrival Manual
Waypoint Arrival Manual	Correction Both
Correction Both	XTE Sense Norm
XTE Sense Norm	Max Correction 60

Figure 82 – Nav Menu, pages 1 & 2

Nav Source

Set Nav Source to the SPU's input connection (NAV1 or NAV2) that the external Navigation System is connected to. The autopilot will then look at that input when in **NAV** mode to obtain the bearing and course-to-steer information.

XTE Limit (Cross-Track Error Limit)

The autopilot can be set to raise an alarm while in **NAV** mode if the vessel's cross-track error exceeds the limit set here.

WayPt. Arrival (Waypoint Arrival)

When the autopilot arrives at a waypoint or end of a route, a special message is sent to the autopilot from the Navigation System. This menu item tells the Admiral P3 how you want to deal with the arrival message.

Manual (manual sequencing):

- display "Waypoint Arrival" on the Control Head screen, accompanied by an audible alarm. The autopilot will maintain its present course and NOT automatically turn the vessel to the next waypoint in a route until the alarm has been acknowledged by pressing the **Fn** button.

Auto (automatic sequencing):

- display Waypoint Arrival on the Control Head screen, accompanied by an audible alarm. However, the autopilot will automatically turn the vessel to the next waypoint in a route even if the alarm is not acknowledged by pressing the **Fn** button.

Silent (silent sequencing):

- automatically turn the vessel to the next waypoint in a route. **Caution! No waypoint arrival alarm will be displayed.** Choose this option if your Navigation System has its own waypoint arrival alarm that cannot be turned off, and you do not wish to acknowledge the same alarm on multiple devices.

Correction

If the vessel is not directly on track when in **NAV** mode, there are three ways it can arrive at the waypoint:

Setting	Description	Comments
CTS	Course-To-Steer	The autopilot picks out the Course-To-Steer information from the Navigation System. This results in a straight-line course to the destination waypoint. Cross-track error, while displayed, is not used by the autopilot.
XTE	Cross-Track Error	The autopilot steers from its current heading so as to minimize Cross-Track Error. No Course-To-Steer information from the Navigation System is used.
Both	Course-To-Steer plus Cross-Track Error	The autopilot steers a modified course taken from the Navigation System's Course-To-Steer. The amount of modification is proportional to the amount of Cross-Track Error. This method is generally best for normal usage.

Table 5 – NAV Mode Correction

XTE Sense (Cross-Track Error Sense)

Cross track error (XTE) contains two pieces of information. First, it contains the *amount* of the error. Secondly, it gives information about the 'sense' of the error (i.e. whether the vessel is to the left or the right of the line between the beginning and ending waypoints).

The NMEA (National Marine Electronics Association) has specified how the cross track error should be identified; a (L)eft indicator in the data sentence means the vessel should steer to the left and a (R)ight indicator meaning the opposite.

However, some manufacturers of GPS, chartplotters, etc. have used the (L)eft indicator to mean that the vessel is to the left of the line, so the vessel should steer to the right, and the (R)ight indicator to mean the opposite.

Because of this confusion, the Admiral P3's handling of XTE can be switched from "Norm" (normal) to "Rev" (reverse). In "Norm", the autopilot will respond normally to the sense of the cross-track error. In "Rev", the autopilot will respond in the opposite way in response to the same information.

Max Correction

When activating pre-stored routes with a large amount of initial cross track error, the autopilot will steer the boat at almost 90° to the track, in order to get back on track as fast as possible. In certain circumstances, this can appear as though the vessel is moving away from the desired waypoint. Setting Max Correction to something less than 90° can minimize this phenomenon.

Commanded Heading Displayed

The commanded heading shown on the display in **NAV** mode may not be the same as the bearing given by the Navigation System. This is because there are three different methods that the Admiral P3 can use to process and react to the navigation data from the Navigation System. You select which method you want the Admiral P3 to use by specifying “XTE”, “CTS”, or “Both” for the “Correction” parameter in the Nav menu.

Correction set to CTS – Steering a Direct Bearing

In this method, Cross-Track Error is not factored into the calculation that the Admiral P3 uses to determine the heading to steer. The autopilot therefore steers directly to the destination waypoint, as depicted in the following diagram:

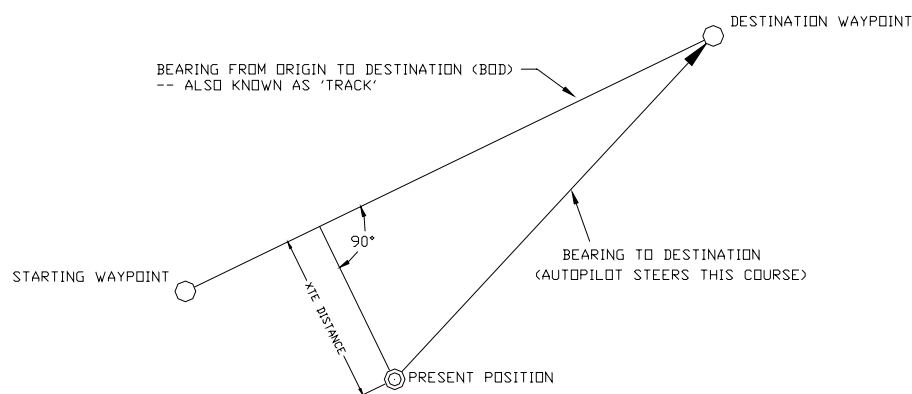


Figure 83 – Autopilot Steering for Correction Set to "CTS"

Test this out so as to be familiar with it by performing the following steps:

- 1) Change “Correction” in the Nav menu to “CTS”
- 2) Make sure the Navigation System is turned on and that a waypoint is programmed in.
- 3) Switch the autopilot to **STANDBY** mode and manually steer the vessel *away from* the waypoint track by a few hundred meters or more.
- 4) Place the Admiral P3 into **NAV** mode by pressing and holding the NAV button until the unit beeps and the letter “N” appears in the upper left portion of the display.
- 5) Observe the commanded heading on the Admiral P3 display. It should match the bearing reported by the Navigation System.

Caution! *Be sure to maintain a sharp lookout to ensure that there are no obstacles between the vessel and the destination waypoint when steering directly to a waypoint.*

Correction set to XTE – Cross-Track Error Steering

Cross-track error is the perpendicular distance from the track to the vessel's position.

When using Cross-Track Error Steering, the autopilot initially steers on its present heading, and monitors the Cross-Track Error reported by the Navigation System. The autopilot changes the heading so as to minimize the cross-track error.

If the initial cross-track error is large, the autopilot will steer a course almost perpendicular to the original track, so as to get back on the track as quickly as possible.

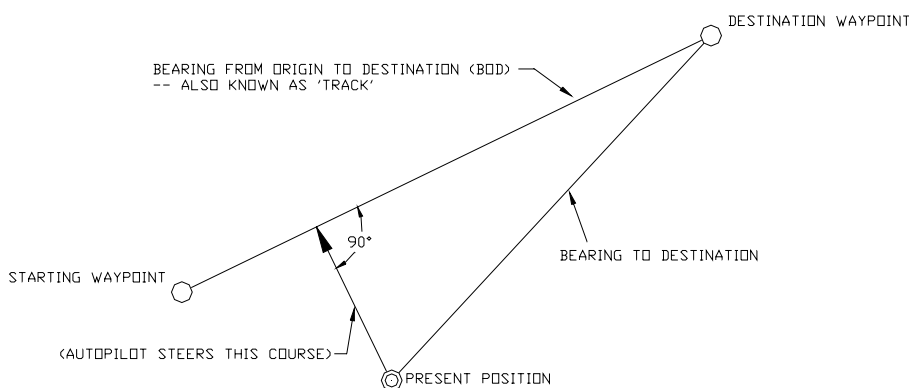


Figure 84 – Autopilot Steering for Correction Set to "XTE"

Test this out so as to be familiar with it by performing the following steps:

- 1) Change "Correction" in the Nav menu to "XTE"
- 2) Make sure the Navigation System is turned on and that a waypoint is programmed in.
- 3) Switch the autopilot to **STANDBY** mode and manually steer the vessel onto the track.
- 4) Place the Admiral P3 into **NAV** mode by pressing and holding the NAV button until the unit beeps and the letter "N" appears in the upper left portion of the display.
- 5) Observe the vessel's heading and the cross-track error. The autopilot should be steering so as to minimize cross-track error.
 - If the vessel seems to be continually falling off course away from the track, you need to change "XTE Sense" (cross-track error sense) in the Nav menu from "Norm" (normal) to "Rev" (reverse).

The course steered when Correction is set to “XTE” may not be the most efficient in terms of overall distance traveled.

If there is a large cross-track error, the autopilot may overshoot the intended track. This is a function of turn rate, vessel speed, and position updates received from the Navigation System. For best performance, it is always best to minimize any cross-track error before putting the autopilot into **NAV** mode.

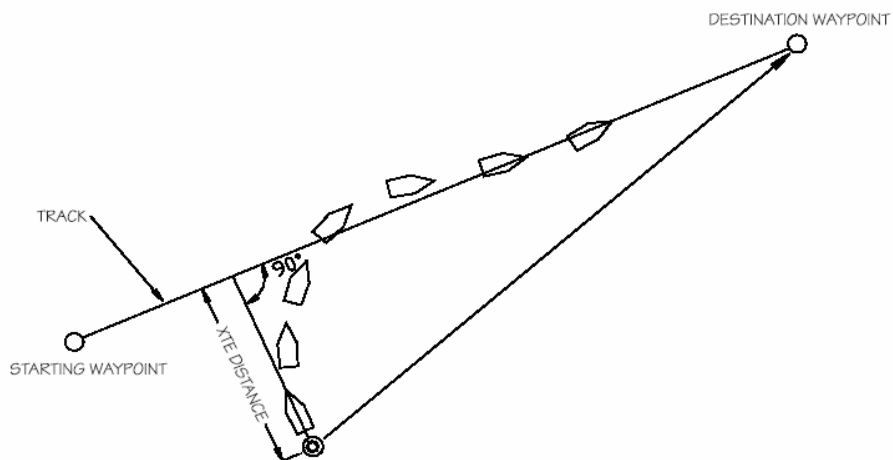


Figure 85 – Response of Vessel to Large Cross-Track Error

The total number of degrees that the autopilot will correct the heading received from the Navigation System as it tries to bring the vessel back on track is limited to the value set for “XTE Limit” in the Nav menu.

Caution! *Be sure to maintain a sharp lookout to ensure that there are no obstacles between the vessel and the original track.*

Correction set to Both – Steering To/Along a Track

In this method, the Admiral P3 will bring the vessel onto the track as smoothly and efficiently as possible. It does this by combining aspects of steering, using cross-track error, bearing from original to destination, and bearing directly to the waypoint.

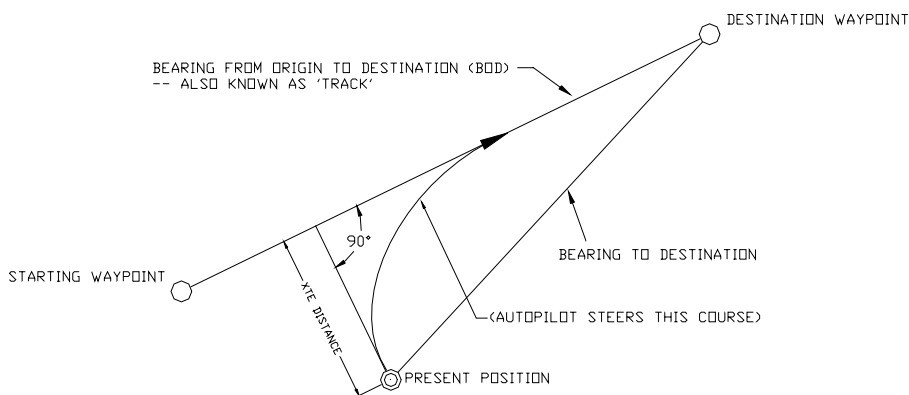


Figure 86 – Autopilot Steering for Correction Set to "Both"

When steering along a track, the Admiral P3 tries to minimize cross-track error by steering to a heading that lies between the perpendicular to the track and the destination waypoint. The farther you are off track, the closer to the perpendicular the heading will be. As you come closer to the track, the heading of the vessel will change closer to the heading of the track. When you are on-track, the vessel's heading and the track heading will be identical.

The total number of degrees that the autopilot will correct the heading received from the Navigation System as it tries to bring the vessel back on track is limited to the value set for "Max Correction" in the Nav menu.

You can test out how well the Admiral P3 steers along a track by following these steps:

- 1) Make sure the Navigation System is turned on and that a waypoint is programmed in. Usually this means selecting a waypoint from a list and pressing the "GOTO" button.
- 2) Steer the boat close to the waypoint track.
- 3) Put the Admiral P3 in **NAV** mode by pressing and holding the NAV button until the unit beeps, and the letter "N" appears in the upper left portion of the display.
- 4) Observe the vessel's response for several minutes.
 - If the vessel seems to be continually falling off course away from the track, you need to change "XTE Sense" (cross-track error sense) in the Nav menu from "NORM" (normal) to "REV" (reverse).
- 5) Verify correct operation by steering back to the original track and then putting the autopilot into **NAV** mode again.
- 6) Observe the vessel's response as before. If the vessel is wandering back and forth but there are no alarms on the autopilot or Navigation System, the most common cause is poor signal quality in the sensor or antenna wiring of the Navigation System. This may be due to:
 - Improper grounding
 - Electrical noise generated in the vessel (alternators, power packs, etc.)
 - Poor antenna location

Refer to the Navigation System's manual for signal quality measurements, and ideas on making improvements.

Alternate NAV Display

An alternative display is available for **NAV** mode. To access this display, enter **NAV** mode by pressing the NAV button until the letter "N" appears in the upper left portion of the display. Release the button, and then press the **NAV** button again. The display will change to a "highway" representation as shown below:



Figure 87 – NAV Mode, Alternate Display

To change back to the normal display (see page 109), press the NAV button again.

In the Alternate NAV display, cross-track error is shown graphically by the boat icon being located to the left or right of the centerline. The position is proportional to the amount of cross-track error. Note the small numbers in the lower corners of the highway display. These indicate the scale of the display. There are four scales that can be shown on the highway display: 0.2, 0.5, 1.5, and 3.0 nautical miles. The scale changes automatically to give the best resolution.

Jog Levers

If a Jog Lever or Levers are connected to the SPU terminal block J3, the autopilot will move the rudder either to Port or Starboard – up to the user-set Rudder Limits – for as long as any Jog Lever is held activated. This will occur when the Admiral P3 is in **POWER STEER** mode, in **AUTO** mode, or in **NAV** mode.

The jog Levers are ignored when the autopilot is in **STANDBY** mode, or in **DOCKSIDE SETUP** mode.

A large “J” is displayed in the upper left corner of the Control Head display whenever a Jog Lever is activated.



Figure 88 – Jog Lever Activated Screen

When you are using a Jog Lever:

- If the autopilot is in **POWER STEER** mode and the Power Steer rudder limits are set, then the autopilot will stop the rudder when it gets to these limits.
- If the autopilot is in **AUTO** or **NAV** mode and the Auto/Nav rudder limits are set, then the autopilot will stop the rudder when it gets to these limits.
- If neither of the above applies, the autopilot will stop the rudder when it gets within a few degrees of the physical limits of rudder travel.

Important Using a Jog Lever temporarily over-rides **AUTO** or **NAV** mode, but when the Jog Lever is released, the autopilot will return to the previously commanded course (in **AUTO** mode) or track (in **NAV** mode). You should be prepared for a change in the vessel's direction when you release the Lever.

Advanced Operations

Advanced Operations

WORK Mode

WORK mode is special feature used under conditions that are different from normal autopilot operation. Prime examples are dragging, trawling, and pair trawling. It is also useful for towing or when traveling at very slow speeds. **WORK** mode can be activated in either **AUTO** or **NAV** mode. You can even switch from **AUTO** to **NAV** mode or vice-versa, while **WORK** mode is active.

Initial set up of **WORK** mode is easily accomplished. Only two parameters need to be set up: a Work Trip Point and the Rudder Scaling Factor.

Work Menu

The Work menu has all of the adjustable parameters that are involved with **WORK** mode. To access the Work menu, double-press the **Fn** button.

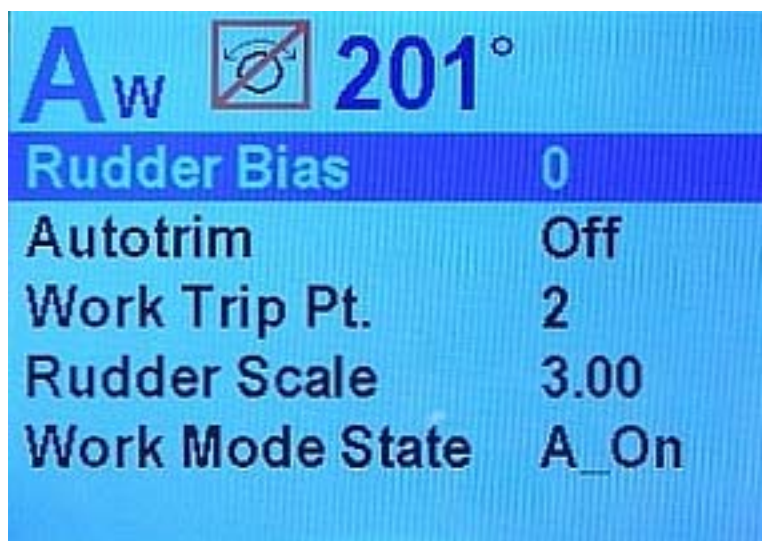


Figure 89 – WORK Mode Menu

Rudder Bias

This menu item only appears when **WORK** mode is active. It shows the current rudder bias, which can be adjusted if desired.

Autotrim

The Admiral P3's **WORK** mode can be configured to use manual or automatic rudder bias when in **WORK** mode (the default is to use automatic rudder bias).

Manual rudder bias is fixed by the position of the rudder when the autopilot first enters **WORK** mode, but can be adjusted by the user if desired (see **Rudder Bias**, above).

Automatic rudder bias is initially set to the position of the rudder when the autopilot first enters **WORK** mode, but is automatically adjusted on a continual basis thereafter to ensure that the vessel remains on course.

Work Trip Pt. (Work Trip Point)

This is the speed below which **WORK** mode can be engaged, and above which **WORK** mode will be disengaged automatically.

Rudder Scale (Rudder Scale Factor)

When **WORK** mode is engaged, the “Rudder Scale Factor” will multiply the “Rudder Gain” setting in the Auto menu. Normally the rudder is moved an amount proportional to the course error detected (i.e., the error times the Rudder Gain), but in **WORK** mode that calculation will also be multiplied by the Scale Factor, resulting in larger rudder movements for a given course error.

Work Mode State

This parameter shows the current status of **WORK** mode. It is also a means to force **WORK** mode to be active or not. Normally, **WORK** mode is engaged or disengaged depending on the speed of the vessel as given by a Navigation System. In cases where this information is not available, **WORK** mode can still be made to function by forcing it on.

The states shown are “Off”, “A_On” and “A_Rdy” for “Automatic On” and “Automatic Ready”, or “M_On” and “M_Rdy” for “Manual On” and “Manual Ready”.

Automatic WORK Mode

Although **WORK** mode can be used manually, it works best if a valid NMEA source of the vessel's speed is also interfaced to the autopilot. The speed source must also be properly configured in the Auto menu. With a valid NMEA speed source, **WORK** mode can be engaged automatically when the vessel's speed falls below the Work Trip Point, and disengaged when the vessel's speed increases beyond the Work Trip Point.

To use **Automatic WORK** mode, first go into either **AUTO** or **NAV** mode. Then press and hold the **Fn** button for approximately 3 seconds, until a confirming beep is heard. The letter “W” will appear in the upper left portion of the LCD screen to indicate that the **WORK** mode feature is enabled.

If the vessel's speed is above the Work Trip Point, the “W” will flash slowly, about once per second, indicating that **WORK** mode is enabled – but not yet engaged. If the “W” appears continuously (not flashing), the vessel speed is below the Work Trip Point, and **WORK** mode is actually engaged.



Figure 90 – WORK Mode Engaged

To disable **WORK** mode, again press the **Fn** button for approximately 3 seconds until a confirming beep is heard and the letter “W” disappears from the upper left portion of the display. **WORK** mode can also be cancelled by switching to either **STANDBY** or **POWER STEER** mode.

When **WORK** mode is engaged, the Rudder Scale Factor will multiply the Rudder Gain setting. Normally the rudder is moved an amount proportional to the course error detected (i.e., the error times the Rudder Gain); in **WORK** mode, that calculation will also be multiplied by the Scale Factor, resulting in larger rudder movements for a given course error. The Rudder Scale Factor is entered on the Work menu (see page 122).

- Other effects take place in **WORK** mode too.
- Counter Rudder is reduced to a minimum, enhancing the effect of the Rudder Gain and Rudder Scale Factor.
- Turn Rate is not governed while **WORK** is active.
- Particularly useful for pair trawling, the autopilot also disables the automatic course trim unless Autotrim (in the Work menu) is specifically turned on.
- Finally, the built-in course alarm will be disabled the entire time **WORK** mode is engaged.

If the user is not satisfied with the fixed helm bias determined by the Autopilot at the onset of **WORK** mode, manual adjustments can be made “on-the-fly” while **WORK** mode is engaged. A double-press of the **Fn** button will bring up the regular Work menu, but with an additional item. Rudder Bias will be the first item on the list, and will show the current helm bias. You can change this value to suit using the COURSE CHANGE knob. This feature is useful in order to accommodate changing load or sea conditions.

As mentioned earlier, **WORK** mode will automatically be disengaged if the vessel’s speed rises above the Work Trip Point set by the user. While it is disengaged, all normal features such as automatic trim and course alarm will be operational.

Manual WORK Mode

Caution! When **Manual WORK** mode is engaged, large rudder movements may occur. If your vessel is traveling too fast, these rudder movements may affect the stability of the vessel. Do not engage **Manual WORK** mode without first ensuring that it is safe to do so and that the vessel speed is appropriate for using **WORK** mode.

Even if no NMEA source of speed data is available, **WORK** mode can still be used. To do so, switch to **AUTO** or **NAV** mode and press the **Fn** button for approximately 3 seconds until the letter “W” appears in the upper left portion of the display. Then, double-press the **Fn** button to bring up the Work menu. Highlight “Work Mode State”. Then use the COURSE CHANGE knob to change the selection to “M_On” (Manual On). **WORK** mode is now engaged.

To disengage **WORK** mode, again select “Work Mode State” in the Work menu and change it to “A_Rdy” (Automatic Ready). To cancel **WORK** mode completely, press and hold the **Fn** button for 3 seconds, or switch to **STANDBY** or **POWER STEER** mode.

You can also manually disengage **WORK** mode, if it has been engaged in the automatic mode. Double-press the **Fn** button to bring up the Work menu. If **WORK** mode is engaged, the “Work Mode State” will show “A_On” beside it. Highlight “Work Mode State”, then use the COURSE CHANGE knob to change it to “M_Rdy” (Manual Ready).

Special Turns

There are a number of Special Turns pre-programmed into the Admiral P3 system.

Special Turns can be executed only in **AUTO** and **WORK** mode; one Special Turn (Dodge) can also be executed in **NAV** mode.

To execute a Special Turn (with the autopilot in the appropriate mode):

- 1) Press the TURN button. The default special turn will be displayed, along with a query for a direction.

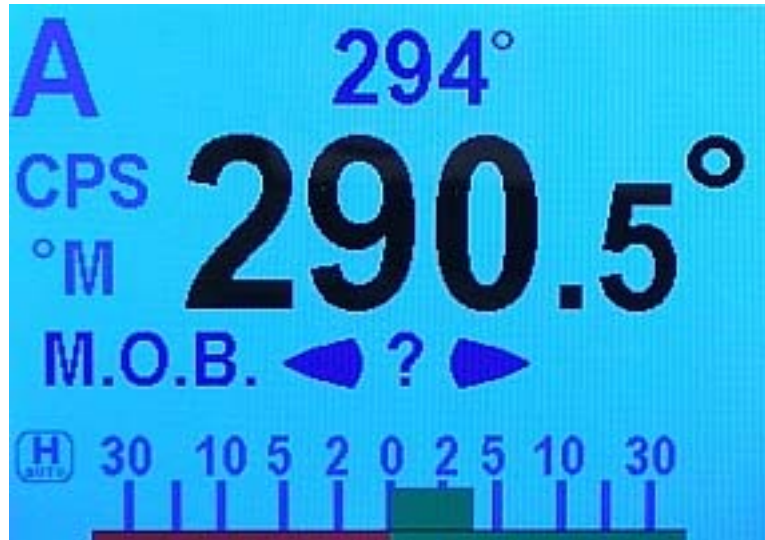


Figure 91 – Typical Special Turn Query

- 2) If a different special turn other than the default shown is desired, press the TURN button again. The next special turn in the available list will be shown (in **NAV** mode, the only choice shown will be Dodge). Press the TURN button again and again until the desired special turn is shown.
- 3) Press either the PORT or STARBOARD ARROW button to select the direction in which to execute the Special Turn. For the Dodge turn, it is necessary to hold the PORT or STARBOARD ARROW button for as long as it is desired to turn (see next page).

The default Special Turn can be changed as desired by adjusting the “Default Turn” in the STANDBY menu.

Special Turns can be aborted by pressing the TURN button once more while the Special Turn is executing, or by changing modes.

Dodge

When in **AUTO** or **NAV** modes, you can use the Dodge Special Turn to avoid (“dodge around”) an obstacle in the water.

After initiating a Special Turn (and selecting Dodge if necessary), pressing & maintaining either the PORT ARROW button or STARBOARD ARROW button will cause the Admiral P3 to turn the vessel in that direction.



Figure 92 – Dodge Query

Important: during a Dodge turn (i.e., while one of the ARROW buttons is maintained), the autopilot will not limit the rate of turn of the vessel, and the Rudder will eventually move all the way to its maximum limit.

Once an ARROW button is released, the autopilot will begin turn the vessel back to the commanded Heading or Track, but this time the turn will occur at no greater than the maximum turn rate that is set in the Steering Parameters.

Using Jog Levers for Dodging

A Jog Lever provides another, quicker way to do a Dodge turn.

Unlike a Special Turn, it is only necessary to activate the Jog Lever; there is no need to press the TURN button first. The rudder will move immediately in the requested direction, and continue moving for as long as the Lever is held activated, up to the Auto/Nav Rudder Limit, or to within a few degrees of the physical rudder travel limits (see page 109).

When you release the Jog Lever, the autopilot will return the vessel to the current Heading, if in **AUTO** mode, or the current track to the next waypoint, if in **NAV** mode. You must be prepared for the Heading change, before you release the Lever.

To hold at a specific Heading part-way through a Dodge:

- Once the Heading is reached, press the other ARROW button (PORT if you are dodging to Starboard, and vice-versa), without releasing the button already being pressed.
- Maintain both the ARROW buttons simultaneously for as long as the specific Heading is desired.



Figure 93 – Holding at a Heading Part-way Through a Dodge Turn

Important: if you dodge the vessel in **AUTO** mode, then when you release the PORT or STARBOARD ARROW button, the vessel will return to the same Heading – but **not** the same Track. The new Track will be offset from the original Track by the distance traveled during the Dodge manoeuvre. This is illustrated below:

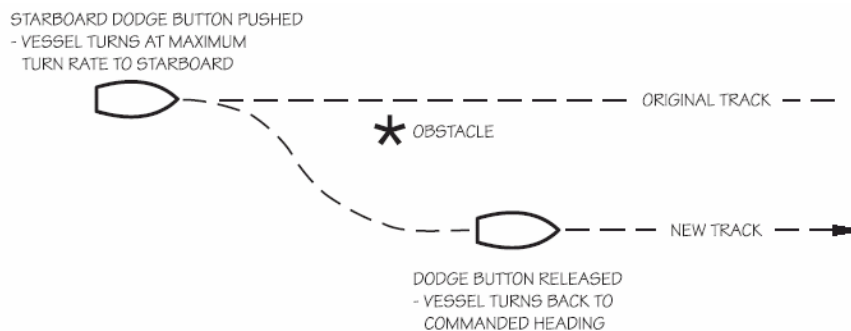


Figure 94 – A Dodge Manoeuvre in Auto Mode

In contrast, when you execute a Dodge in **NAV** mode, the autopilot **will** return the vessel to the original Track, once you release the PORT and/or STARBOARD buttons.

U-Turn



Figure 95 – U-Turn Query

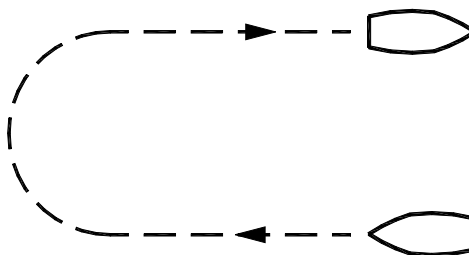


Figure 96 – U-Turn Vessel Path

The autopilot calculates a reciprocal course to the vessel's heading and turns to it in the appropriate direction once the PORT or STARBOARD ARROW button is pressed.

Circle Turn

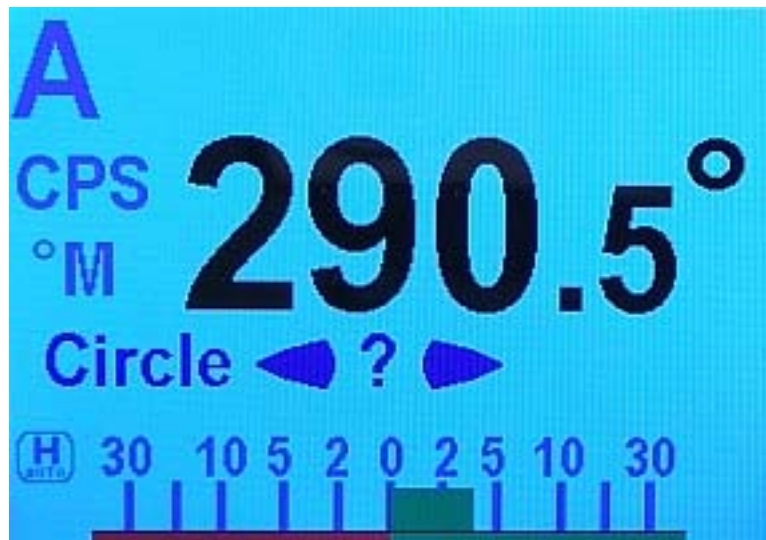


Figure 97 – Circle Turn Query

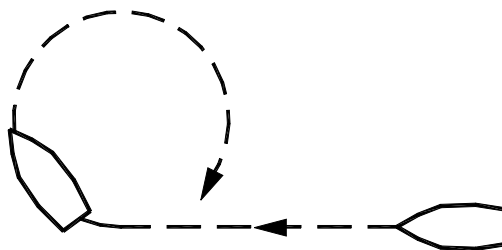
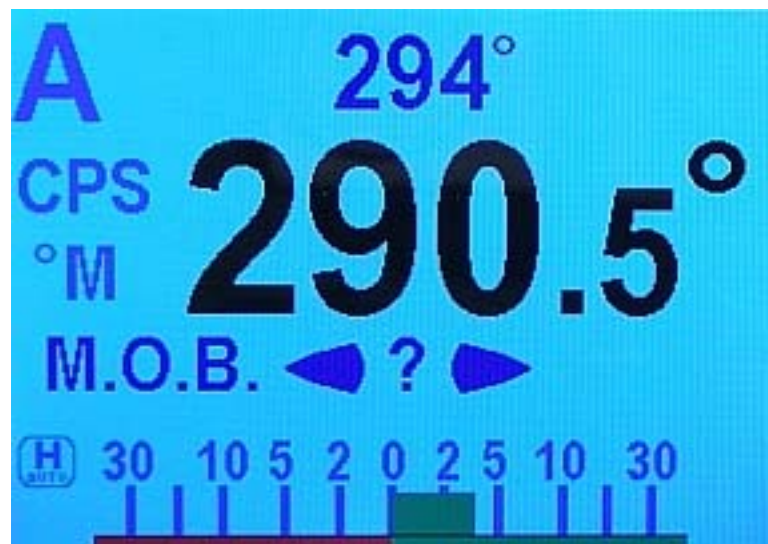
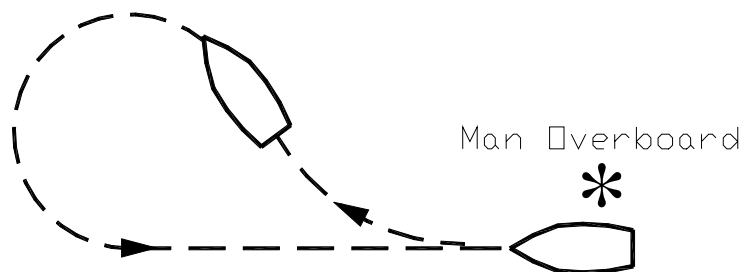


Figure 98 – Circle Turn Vessel Path

The autopilot steers a never-ending circle in the appropriate direction once the PORT or STARBOARD ARROW button is pressed. The Turn Rate setting in the Auto menu governs the rate of turn. To stop the circle, press the TURN button again, or switch modes.

M.O.B. – Man Over-Board**Figure 99 – M.O.B. Turn Query****Figure 100 – M.O.B. Turn Vessel Path**

The autopilot will perform a Williamson Man Overboard turn, sometimes known as an Emergency or E-turn. This will bring the vessel onto a reciprocal heading; typically right down the vessel's own wake. The PORT or STARBOARD ARROW buttons are used to determine the initial turning direction.

For best accuracy, do not adjust vessel speed once this turn has been initiated.

Fishzag



Figure 101 – Fishzag Turn Query

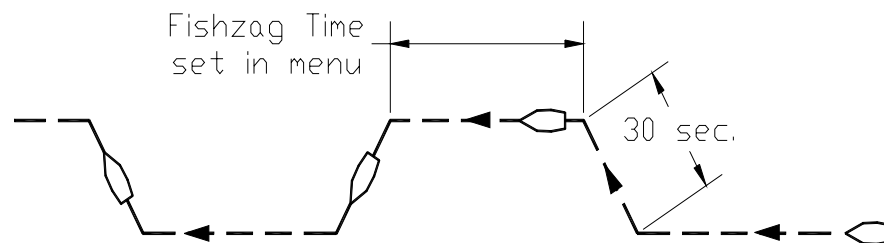


Figure 102 – Fishzag Turn

As its name implies, the Fishzag turn was developed specifically for fishing. When this Special Turn is executed, the autopilot maintains the present course for the time interval specified by the Fishzag Timer in the Standby menu. Once the timer has expired, the autopilot will make a 60° course change in the direction specified when you pressed the PORT or STARBOARD ARROW button. After 30 seconds, the autopilot will return to the original course, and start the timer over again. This time, when the timer goes off, the autopilot will make a 60° course change in the opposite direction. Again, after 30 seconds, the autopilot will return to the original course where the cycle repeats itself.

The Fishzag turn has the effect of dropping the fishing gear behind one side of the boat, and raising the gear slightly on the other side while the boat is turning. This has been shown to be an effective means of further luring fishing to strike.

To cancel the Fishzag turn, press the TURN button again, or switch modes.

Multiple Control Heads & Auxiliary Controllers

Two additional Control Heads or Auxiliary Controllers may be added to the standard Admiral P3 system. These may be any combination Admiral Control Heads, CR-203 Handheld Remotes, or TS-203 Fixed Remotes.

Only one Control Head or Auxiliary Controller may be *In-command* at any given time. When the autopilot system is first powered on, the main Control Head, connected to J11 of the SPU will always be In-command.

The other Control Heads and/or Auxiliary Controllers are said to be Repeaters. As a Repeater, the unit simply repeats the display information from the In-command unit, but does not affect the operation of the autopilot. You can always tell whether a particular controller is a Repeater because it will display a large letter “R” in the upper right corner of the display.

Command can be transferred from an In-command controller to a Repeater. To do so, press and hold the PORT and STARBOARD ARROW buttons on the repeater until the audible alarm beeps and the letter R disappears. The Repeater now becomes the In-command controller, while the previous controller becomes a Repeater.

Station Lock/Unlock

Setting the Station Lock parameter in the Standby menu to Lock prevents the Repeaters from being able to take command. When station lock is set to Lock, the image of a key will be shown in the upper right corner of the display, next to the repeater R.

The key image will either be outlined or filled-in, depending on whether the station lock is for the main Control Head or an Auxiliary.



Figure 103 – Station Lock Icons on Main (left) and Aux. Control Head, when In-command (right)

The “outline” key icon because you can always take command back with the main Control head. This unconditional return of command is an important safety feature.

The controller In-command shows a solid key icon. The solid key signifies that all stations, except for the main Control Head and the controller which is currently In-command, are locked out.

Controllers that are Repeaters, except for the main Control head, will show the solid key icon, indicating that they are locked out and cannot take command.

Important! If your Admiral P3 system is equipped with Jog Levers, be aware that they can be activated any time the autopilot is turned on. They **can not** be locked out. Ensure that appropriate measures are taken to ensure that they cannot be activated by unauthorized persons.

Watch Alarm

The Watch Alarm is a special timer that is built into the Admiral P3 autopilot. It measures how long it has been since any of the buttons on the Control Head have been pressed. If the time exceeds the amount set for the Watch Alarm parameter in the Standby menu, an alarm is set off to alert the helmsman.

- There are two ways that the Watch Alarm feature can be configured:
 - 1) The Watch Alarm can be set to bring up an alarm message and sound the audible alarm on the Control Head. At the same time, the audible alarm on the SPU will sound. Once the alarm is set off it can only be reset by pressing the **Fn** button.
 - 2) The Watch Alarm can be set up to operate exactly in the same manner as above, but in addition, if the alarm is not reset (by pressing the **Fn** button) within 30 seconds, an external alarm connected to the SPU will be activated. The external alarm can be used to alert ship's personnel that the helm may be unattended.

To use the Watch Alarm as per option 1) above, the Alarm O/P parameter in the Dockside Setup menu must be set to "none", Sw'd B+ and "all", or Sw'd B- and "all".

To use the Watch Alarm as per option 2) above, the Alarm O/P parameter (see page 77) in the Dockside Setup menu must be set to Sw'd B+ and "watch", or Sw'd B- and "watch". You must also have a compatible external alarm connected. See **External Alarm Output** on page 59 for more details.

The Watch Alarm timer is controlled by the Watch Alarm parameter in the Standby menu. The value may be adjusted from "OFF" (Watch Alarm completely inactive) to 30 minutes in 1-minute increments.

The Watch Alarm parameter is password protected. The autopilot will not allow you to change the Watch Alarm timer without first correctly entering a password.

- There are a few key points to remember about passwords:
 - 1) For safety reasons, only authorized personnel should be allowed to know or change the Watch Alarm password.
 - 2) The password consists of a button sequence entered on the Control Head, of from 0 to 10 button presses. For best security, we recommend choosing a password with at least a 5-button sequence.
 - 3) All of the buttons, except the STANDBY/ON/OFF button, may be used for the password sequence, and a button may be used more than once in the sequence.
 - 4) The STANDBY/ON/OFF button is reserved to signify the end of the sequence (like the ENTER key on a computer).
 - 5) The Admiral P3 autopilot is shipped from the factory with a null password – just press the STANDBY/ON/OFF button when prompted for the password.

Entering the Password

When you attempt to change the Watch Alarm timer, (highlight “Watch Alarm” in the Standby menu, then turn the COURSE KNOB in either direction), the Control Head responds by showing a special pop-up box on the LCD screen with the query “Password?”

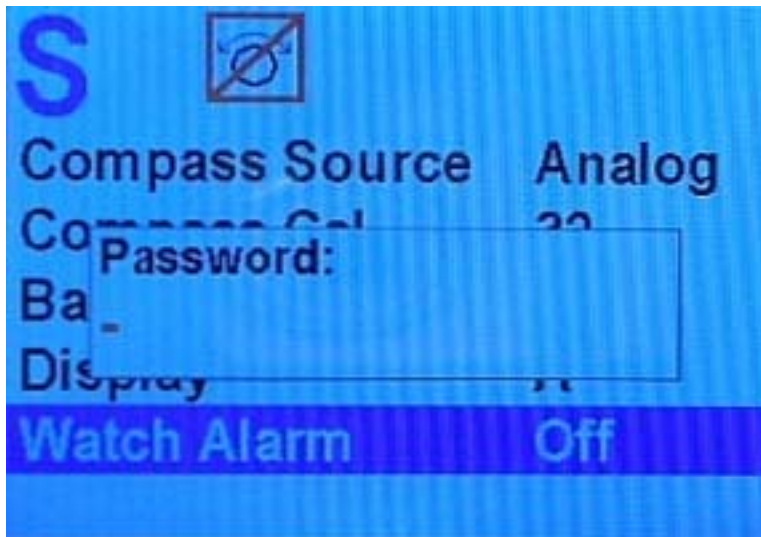


Figure 104 – Password Query Pop-Up Window

Now enter the password by pressing each button in the sequence. An asterisk (*) will appear on the screen as each button is pressed.

Complete the sequence by pressing the STANDBY/ON/OFF button.

If the sequence is correctly entered, the pop-up window will disappear, and you will be able to use the COURSE KNOB to change the value of the Watch Alarm timer.

If the sequence was not correctly entered, “Password Error” is displayed. Try the password sequence again.

The pop-up window will remain until the correct password sequence is entered, the Standby menu times out, or you press and hold the STANDBY/ON/OFF button to shut the autopilot off.

Changing the Password

As mentioned above, the autopilot is shipped from the factory with a null password, which means that the password sequence consists of simply pushing the STANDBY/ON/OFF button when prompted by the “Password?” query in the pop-up window. To prevent unauthorized personnel from tampering with the Watch Alarm, it is recommended that you change the password sequence from the default null password.

You may also wish to change the password on a regular basis, for security reasons.

To change the password, enter the old password when prompted, but instead of pressing the STANDBY/ON/OFF button to enter/confirm the password, press the **Fn** button at the same time as you press the STANDBY/ON/OFF button. The autopilot will respond with a “New Password?” prompt:

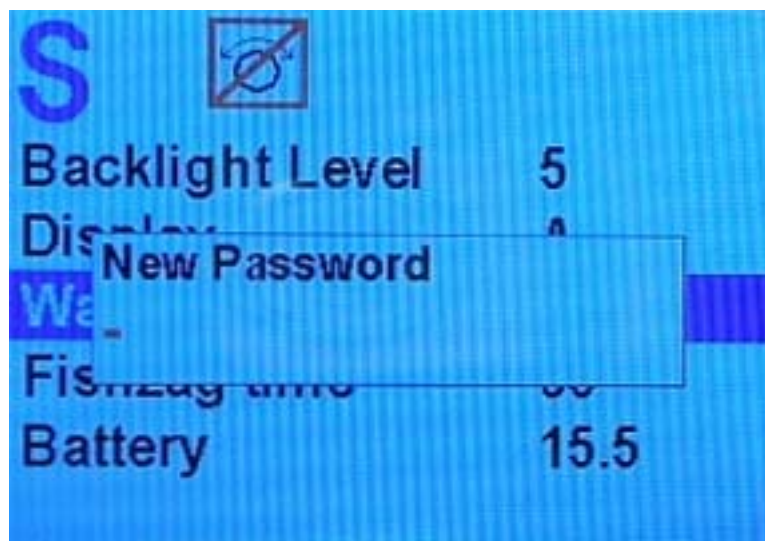


Figure 105 – New Password Pop-Up Window

Now enter a new button sequence, finishing with the STANDBY/ON/OFF button. Once the STANDBY/ON/OFF button has been pushed, the autopilot will store the new password sequence in its memory and the pop-up window will disappear.

Important! Be sure to record the new password sequence in a secure place in case it is forgotten!

The password can be changed as often as desired.

Care & Maintenance

Care & Maintenance

The Admiral P3 Wheelmark Autopilot System has been designed to provide many years of reliable service. The following periodic care and maintenance tips will help to ensure the longevity of your autopilot.

Cleaning and Appearance

Both the Control Head and SPU should be carefully cleaned with a damp cloth and mild soap. This is particularly important for the LCD screen overlay.

Do not use abrasive cleaners or chemicals.

The Control Head is designed to be weatherproof and splash resistant, but it should not be immersed in water for a prolonged period of time.

Environments exceeding a maximum temperature of 140° F (60° C) or below a minimum temperature of 5° F (-15° C) **MUST BE AVOIDED.**

Exposure to prolonged direct sunlight should be avoided in order to prevent damage to the electronics and housing, and UV-induced fading of the LCD.

Protection of Wires and Cabling

After installation, ensure that the system components are securely mounted and will not shake loose due to the vibrations that can be expected in a marine vessel.

Ensure that the cabling and wiring to all system components, **ESPECIALLY REMOTE CONTROLS**, are well secured with clamps or alternative fasteners.

Many potential problems can be avoided by ensuring that cabling and wiring do not cause strain on the connectors.

Periodic Checks

After the first six months of operation a thorough examination of the entire Autopilot system **MUST BE UNDERTAKEN**. All electrical connections, cables, clamps, mounting brackets, and mechanical connections (i.e. RUDDER FOLLOWER) must be secure. All hydraulic pumps and lines must be inspected for leakage and loose mounting.

An **ANNUAL** inspection should be undertaken thereafter.

Fuse Replacement

There are two fuses used on the SPU.

Replace fuses only with the same type and rating, as per the table below.

Should a fuse blow, determine the cause before replacing.

To inspect &/or replace a fuse, the cover over the SPU's Diagnostic section must be removed; be careful not to lose any of the cover screws. After the fuse(s) are replaced, the cover must be re-installed, and remain in place during normal operation.

Designator	ComNav Part Number	Generic Description <i>Manufacturer(s) & Part Number(s)</i>
F1	60810012	3.15 A Medium Time Delay, 125V or better, 5 x 20mm (DIN 41571, IEC 127)) <i>Bussman GMC 3.15A</i>
F2	60810009	20A, Non-Time Delay, 125V, ¼"x 1-¼" <i>Bussman ABC-20</i>

Table 6 – Fuse Replacement Guide

Appendices

Appendices

Appendix 1

NMEA 0183 Sentences Accepted and Transmitted by the Autopilot

The Admiral P3 Wheelmark Autopilot system receives and transmits serial data in NMEA 0183 format.

Messages Accepted

The Admiral P3 accepts the following NMEA 0183 sentences (the ‘*’ in front of the sentences indicates that the TALKER Identifier is ignored, in all cases):

Sentence	Description	Data Used
*APA	Autopilot Sentence “A”	Cross-Track Error, Arrival Status, Bearing from Origin to Destination, Waypoint ID
*APB	Autopilot Sentence “B”	Cross-Track Error, Bearing from Origin to Destination, Waypoint ID, Course to Steer
*BOD	Bearing – Origin to Destination	Bearing from Origin to Destination, Waypoint ID
*BWC	Bearing & Distance to Waypoint	Range to Destination
*GLL	Geographic Position (Latitude & Longitude)	Latitude, Longitude
*HDG	Heading, Deviation & Variation	Magnetic Heading, Magnetic Variation
*HDM	Heading, Magnetic	Magnetic Heading
*HDT	Heading, True	True Heading
*HSC	Heading Steering Command	Course to Steer
*RMA	Recommended Minimum Specific Loran-C Data	Speed
*RMB	Recommended Minimum Navigation Information	Cross-Track Error, Waypoint ID, Range to Destination, Bearing from Origin to Destination, Arrival Status
*RMC	Recommended Minimum Specific GNSS Data	Speed, Magnetic Variation
*VBW	Dual Ground / Water Speed	Speed
*VHW	Water Speed & Heading	Speed
*VTG	Course Over Ground & Ground Speed	Speed
*XTE	Cross-Track Error	Cross-Track Error

Table 7 – NMEA 0183 Sentences Accepted by Admiral P3

All sentences received must have valid checksums. Sentences which do not have any checksums, or have invalid checksums, will be ignored. In some cases, if the missing/invalid condition persists long enough, an INVALID CRS DATA, SPEED DATA, &/or HEADING error will occur (see page 146).

A number of the various data values used by the autopilot can be received in one or more different sentences (for example, Speed can be received in VTG, VHW, VBW, RMA or RMC). If a particular data value is received in more than one sentence, then the value in the highest-priority sentence – per the table below –will be the one used by the autopilot.

Note: the Heading value used by the Admiral P3 may be in Degrees Magnetic or True, depending on which sentences are received (assuming all sentences have valid data):

- If all of HDM, HDT & HDG are being received, or just HDT & HDG, or just HDM & HDG, then the autopilot will use Magnetic Heading (indicated on the display by an 'M' beside the Heading value – see page 99), and will use the data value in the HDG sentence.
- If only HDM & HDT are received, or just HDT, then the autopilot will use True Heading (indicated by a 'T'), from the HDT sentence.
- If only HDM is received, then the autopilot will use Magnetic Heading (indicated by an 'M'), from that sentence.

Data Used	Sentence	Sentence Priority (larger number is higher priority)
Magnetic heading	*HDM	1
True heading	*HDT	2
Magnetic heading, Magnetic variation	*HDG	3
Range to waypoint	*BWC	4
Vessel speed	*VTG	5
Vessel speed	*VHW	6
Vessel speed	*VBW	7
Bearing origin to destination magnetic and true, Waypoint ID	*BOD	8
Cross track error	*XTE	9
Cross track error, Arrival circle entered Bearing origin to destination magnetic or true, Waypoint ID	*APA	10
Course to steer magnetic and true	*HSC	11
Cross track error, Waypoint ID, Range, Bearing present to destination true, Arrival circle entered	*RMB	12
Cross track error, Arrival circle entered, Bearing origin to destination magnetic or true, Waypoint ID, Bearing present to destination magnetic or true, Course to steer magnetic or true	*APB	13
Vessel speed	*RMA	14
Vessel speed, Magnetic variation	*RMC	15
Latitude and longitude	*GLL	16

Table 8 - NMEA Sentence Priority

Messages Transmitted

The Admiral P3 outputs NMEA 0183 compliant data (at 4800 Baud, on the OUT A/B pins of the **J9 – NAV I/O** connector), which may be used by NMEA 0183 compliant LISTENERS, or may be used to observe &/or record various Admiral P3 parameters, for diagnostic purposes, while the system is running.

The Admiral P3 outputs 3 sentences:

- ***HDG** Heading, Deviation & Variation

- ***HDT** Heading, True

- ***HTD** Heading/Track Control Data

HDG & HDT are output at 9 times per second. HTD is output once per second. The TALKER Identifier is AP, in all cases. All messages have checksums.

Appendix 2

Error Messages

There are a number of different error messages in the Admiral P3 autopilot system. These messages are displayed on the Control Head screen, and are usually accompanied by an audible alarm.

The following errors are classified as warnings. Operation of the autopilot continues normally. The error messages may be temporarily suppressed by pressing the **Fn** button. They are automatically cancelled should the condition that caused them be removed.

Message	Description
COURSE ERROR	The vessel is off the commanded course by more than the Off Course Limit (see page 107) for more than 32 seconds. Adjust steering parameters to prevent this.
EEPROM ERROR	The system has detected a non-fatal error in one of the memory devices on the SPU. Contact your ComNav Dealer for repair service at your earliest convenience.
NO AUX #1 NO AUX #2	The system previously detected an auxiliary Control Head connected to J12- Aux 1 (or J13- Aux 2), but cannot detect it now. Check all wiring.
TURN RATE HIGH	The measured rate of turn of the vessel has exceeded the Turn Rate set in the Auto menu.
TURN RATE LOW	The measured rate of turn of the vessel is much lower than the Turn Rate set in the Auto menu.
WAYPOINT ARRIVED	The Navigation System used in NAV mode has sent a message to the Admiral P3 indicating that the vessel has entered the arrival circle around the active waypoint.
XTE OVER LIMIT	The Cross-Track Error limit set in the Nav menu has been exceeded. Adjust steering parameters to prevent this. Also, ensure "XTE Sense" in the Nav menu is set correctly.

Table 9 – Warning Messages

The following messages are classified as “severe” errors. Typically, these messages describe a condition that prevents normal operation in the current mode (**STANDBY**, **POWER STEER**, **AUTO**, or **NAV**) but operation in other modes may still be possible. The error messages may be temporarily suppressed by pressing the **Fn** button. They are automatically cancelled should the condition that caused them be removed.

Message	Description
COMPASS ERROR	The Admiral P3 cannot read the Analog compass specified in the Standby menu under Compass Source. Check compass wiring.
FAULTY AUX #1 FAULTY AUX #2	The Admiral P3 SPU has detected a problem in communicating with the Control Head connected to J12 – Aux1 (or J13 – Aux 2). Check all wiring.
HIGH TEMPERATURE	The SPU circuitry has heated up due to excessive current demands. Check all wiring and verify that all output loads (solenoids, pump motors, etc) are within the specifications given for the SPU. Also ensure that the SPU has adequate ventilation.
INVALID CRS DATA	Valid NMEA 0183 Course data has not been received at NAV1 or NAV2 for ~28 seconds.
INVALID SPEED DATA	Valid NMEA 0183 Speed data has not been received at NAV1 or NAV2 for ~28 seconds.
	Check that the Navigation System sending the data is turned on and functioning properly. Check the wiring between the system and the SPU.
INVALID HEADING	If an Analog Compass is selected as the Compass Source in the Standby menu, this message indicates that the signals from the compass are faulty. Check the wiring between the Compass and the SPU.
	If an NMEA 0183 Compass or other source of Heading data (NAV1 or NAV2 in the Standby menu) is selected as the Compass Source, this message indicates that no valid Heading sentences have been received for ~28 seconds. Check that the device is turned on and functioning properly. Check the wiring between the device and the SPU.
NO NAV DATA	The SPU has not been able to detect, for ~32 seconds, at the Nav Source specified in the Nav menu, the NMEA 0183 navigation information it needs to operate in NAV mode.
NO SPEED DATA	The SPU has not been able to detect, for ~32 seconds, at the Speed Source specified in the Auto menu, the NMEA 0183 Speed data it needs to operate in AUTO or WORK mode .
	Check that the device sending the data is turned on and functioning properly. Check the wiring between the device and the SPU.
WATCH ALARM	The watch alarm timer has timed out. Press the Fn button to reset the timer.

Table 10 – Error Messages

The following messages indicate a serious problem. Operation of the autopilot cannot continue until the problem is resolved.

Message	Description
AUX.STATION ERROR	One or more of the auxiliary Control Heads or Handheld Remotes connected to the SPU are not compatible with the autopilot system. Typically, this is caused by using Heads or Remotes with firmware versions that incompatible with that of the SPU. Contact your ComNav Dealer for a Firmware Upgrade.
BATTERY TOO HIGH	Battery voltage has risen above ~40 VDC. Check all wiring and charger systems.
FAULTY HEAD	The main Control Head is not responding to the SPU. Check all wiring.
FUSE F2 FAULTY	Fuse F2 on the SPU has blown. This fuse supplies current to the drive outputs. Check all wiring and verify that all output loads (solenoids, pump motors, etc) are within the specifications given for the SPU. Replace fuse with the same type only.
LOW BATTERY	The Admiral P3 has detected that the battery supply voltage is less than ~10 VDC, which is too low to continue safe operation. Check all wiring and the battery(ies).
ROM ERROR	The Admiral P3 has detected a problem in its program memory. Return the unit to your ComNav Dealer for repair.
RFU NOT FOUND	The Admiral P3 cannot detect the presence of a Rudder Follower Unit. Check all RFU wiring. If no faults are found, the RFU may be defective. Contact your ComNav Dealer for repair advice or replacement.

Table 11 – Critical Error Messages

Appendix 3

Auxiliary Head / Remote Power On

The Admiral P3 SPU is shipped from the factory configured so that power can only be turned on or off from the main Control Head. The main Control Head is designated as that which is plugged into the SPU receptacle labelled "J11 - Control Head". However, the SPU can also be configured so that it can be turned on or off by a full-function controller plugged into the receptacles "Aux 1 – J12" or Aux 2 – J13". The following instructions detail how this is accomplished.

- 1) Remove the wiring cover from the SPU and unplug all wiring connectors.
- 2) Remove ten sheet metal screws around the edges of the SPU. These screws secure the top portion of the SPU enclosure.
- 3) Lift the top portion of the SPU enclosure off and set it aside. The top of the printed circuit assembly will be visible.
- 4) On the lower right side of the printed circuit assembly are two right-angle pin headers. They are labelled JP1 and JP2. On each header is a shorting shunt.
- 5) Change the position of the shunts as shown in the pictures below. JP1 determines whether power can be turned on from the Controller attached to **J13 – Aux 2**, while JP2 determines whether power can be turned on from the Controller attached to **J12 – Aux 1**.

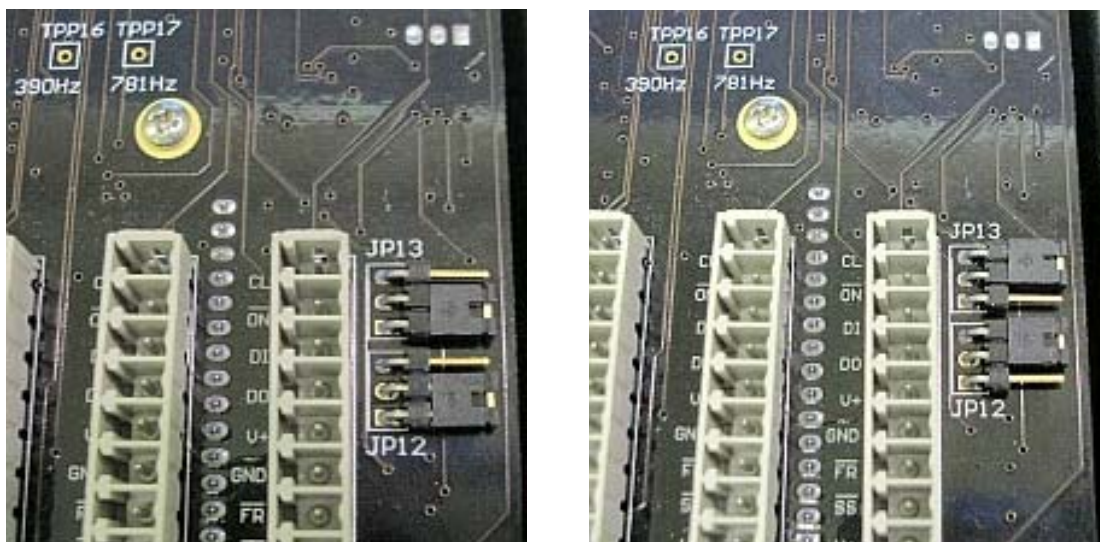


Figure 106 – JP12 & JP13 in Factory Default Position (left) and After Moving Shunts (right)

- 6) Replace the SPU enclosure top and secure it with ten sheet metal screws.
- 7) Replace all wiring plugs and the wiring cover.

You will now be able to turn on power from the auxiliary heads simply by pressing the **STANDBY ON/OFF** button. Note that the Admiral P3 always powers on in **STANDBY** mode with the main Control Head in command, regardless of which station was used to turn the power on. If power was turned on from one of the auxiliary stations, then to use that station, you must first take command by pressing the **PORT** and **STARBOARD ARROW** buttons.

Note: Power cannot be turned on from a CR-203 or TS-203 Remote.

Appendix 4

Diagnostic LEDs

The Signal Processor Unit is equipped with a number of Light-Emitting Diode (LED) lamps that can assist in trouble-shooting should a problem arise with the autopilot system. To observe the LEDs, remove the metal cover on the Diagnostic section.

LED	Description
ALARM	On whenever there is an alarm condition on the SPU. Lights in conjunction with the audible alarm.
BATT PWR	A general indication of the Battery Power supplied to the SPU. Should be on whenever the autopilot is turned on.
DRV PWR	An indication of the power available for the output Drive. Drive Power should be brightly lit whenever the autopilot is on. If it is off, check fuse F2.
VCC	VCC is the voltage supplying the logic circuits on the SPU. The voltage is nominally 5.25 VDC, and can be measured at testpoint TP3 with respect to ground (GND).
SW'D B+	This indicator will be on whenever the Switched B+ output is turned on.
SW'D GND	This indicator will be on whenever the Switched Ground output is turned on.
M1/PORT	For systems that utilize Solenoid steering valves, this LED will be lit whenever the solenoid is activated. For Reversing Motor systems, this LED will be shut off whenever the motor is activated in one direction (which direction depends on how the reversing motor was plumbed in and wired).
M2/STBD	For systems that utilize Solenoid steering valves, this LED will be lit whenever the solenoid is activated. For Reversing Motor systems, this LED will be shut off whenever the motor is activated in the opposite direction to the M1 output.
NMEA 0183 IN #1	This LED will be lit whenever the autopilot receives serial data on the NAV1 input. Note that this indicator only shows that data was received. It does not mean that the data received is valid. Typically, this LED will flash at a rate of about once per second for regular data from a GPS or Chartplotter; it will flash at a rate of about 10 times per second when connected to a heading source such as an NMEA compass. If the LED does not flash and you are sure the sending device is sending data, try reversing the wires from the device connected to J9 – NAV I/O .
NMEA 0183 IN #2	This LED operates identically to the NMEA 0183 IN #1, but shows the reception of data for the NAV2 input.
NMEA 0183 OUT	This LED flashes whenever NMEA 0183 serial data is sent out of the SPU. During normal operation, this LED will flash at a rate of about ten times per second.
ComNav Network RX	This LED is reserved for possible future use.
ComNav Network TX	This LED is reserved for possible future use.

Table 12 – Diagnostic LEDs

Appendix 5

Upgrading Firmware

The Admiral P3 Wheelmark Autopilot System is the result of extensive development and testing programs.

ComNav is constantly doing research and development related to our Autopilot Systems. From time to time, this can result in new features and benefits that can be incorporated into an existing system installation, in the field – by a ComNav Dealer, or even by the vessel operator.

For the Admiral P3 system, this is done with a Firmware Upgrade Kit (PN 30110011). The kit contains the required cable, instructions and a CD with the latest firmware & an easy-to-use program to install the Upgrade. Contact your ComNav Dealer for more information.

Important! Caution! Be sure to read all of the documentation accompanying the Firmware Upgrade Kit, so that you understand all of the operational and performance changes that may occur as a result of the Upgrade.

Appendix 6

General Specifications

Parameter	Specification
Dimensions	
SPU	257 x 184 x 78 mm (10.1 x 7.3 x 3.1")
Bracket Mount Head	157 x 118 x 73 mm (6.2 x 4.6 x 2.9") @ 20° max tilt – add 28 mm (1.1") in width for bracket knobs
Surface Mount Head	156 x 113 x 24 mm (6.1 x 4.4 x 0.9") – add 11 mm (.43") for Control Knob & 29 mm (1.1") behind surface to clear rear of Head (not incl. cable)
Flush-Mount Head	165 x 122 x 12 mm (6.5 x 4.8 x .47") – add 11 mm (.43") for Control Knob & 41 mm (1.6") behind surface to clear rear of Head (not incl. cable)
Control Head LCD Display	Sunlight viewable high resolution QVGA (320x240) TFT panel with cold-cathode fluorescent backlight (400 Cd/m ² typ.)
Operating Voltage	11 to 30 VDC
Power Consumption	
SPU	200 mADC (all outputs off)
Control Head	350 mADC (max)
Drive Output	20 Amps (max)
Navigational Interface	
NAV1 input	NMEA 0183 compliant, optically isolated, 4800 Baud
NAV2 input	NMEA 0183 compliant, optically isolated, auto-baud detecting (4800, 9600, 19.2K and 38.4K Baud)
NMEA 0183 output	Heading (10x per second) & Autopilot status (1x per second), NMEA 0183 compliant, RS-422 compliant, RS-485 compliant, 4800 Baud, 8 data bits, no parity, one stop bit
Course Detection	0.1°
Course Resolution	
AUTO mode	1°
NAV mode	0.1°
External Rudder Angle Indicator	Supports up to five 500µA instruments
Jog Lever Input	Yes
Rudder Follower Input	1.0 – 4.0 VDC centered at 2.5 VDC.
Control Head cable length	7.6 metres (25') standard Custom lengths up to 30 metres (100') available

Table 13 – General Specifications

Compass Safe Distances


The following Compass Safe Distances were determined using a UKAS calibrated 23 Axis Magnetometer, for both standard compasses and steering/emergency compasses.

ComNav PN	Description	Standard Compass Limit 5.4°/H	Steering Compass Limit 18°/H
20110001	Signal Processing Unit (SPU)	28 cm	16.5 cm
20110005	Control Head	32 cm	21 cm
20310025	TS-203 Fixed Remote	31 cm	18 cm
20310003	Jog Lever c/w 2 sets of switches	13 cm	8 cm
20330008	Medium Duty Rotary Rudder Follower	20 cm	8 cm
20330012	Heavy Duty Rotary Rudder Follower	62 cm	40 cm

H = horizontal flux density in μT

Table 14 – Compass Safe Distances

Wheelmark Compliance Certificate



GL Luxembourg

EC Type Examination Certificate


of a Notified Body within the meaning of Article 9 of the Marine Equipment Directive 96/98/EC of 20 December 1996.

This is to certify that the equipment identified below has been tested in accordance with the relevant type approval procedures of the Marine Equipment Directive (MED) 96/98/EC, as amended, and was found in compliance with requirements of the specified standards contained therein subject to any conditions on the schedule attached hereto.

Certificate No.	32 802 - 06 Lux
Applicant	ComNav Marine Ltd. 13511 Crestwood Place, Suite 15 Richmond, BC V6V 2G1, CANADA
Manufacturer	ComNav Marine Ltd. 13511 Crestwood Place, Suite 15 Richmond, BC V6V 2G1, CANADA
Product Description	Heading Control System
Product Type	ComPilot Admiral
Trade Name	None
Specified Standards	-EN/ISO 11674 (2001) , ISO 11674 (2000) -EN 61162-1 , IEC 61162-1 -EN 60945 (2002) , IEC 60945 (2002) IMO resolutions A.342 (IX) + MSC 64/67 Annex 3, A.694 (17), A.813 (19)
Related Directive	2002/75/EC
Equipment Section	Navigation equipment
Item No.	A.1/4.16
Conformity Assessment Module	B
USCG Approval No.	165.110 / EC 0801
Valid until	2011-03-23


R. Brück

Page 1 of 3
Luxembourg, 2006-03-24



GL Luxembourg
EC Identification No.: 0801

Certificate No: 32 802 - 06 Lux



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Schedule of Approval

Documents

Test report : QinetiQ/D&TS/CR0601521/1.0 (EN 60945, EN 11674)

Installation and Operation Manual : P/N 29010075

Technical Data

The Heading Control system ComPilot Admiral was especially designed for smaller ships and consists of the following equipment:

- | | | |
|----|---|-------------------------------------|
| 1. | ComPilot Admiral Control Head | Part Number: 20110005 |
| 2. | ComPilot Signal Processing Unit (SPU) | Part Number: 20110001 |
| | Software Version: V3r0 | |
| | With the following main interfaces: | |
| | Magnetic Compass Sensor 12kHz analogue input. | |
| | 2 x IEC 61162-1 inputs for an Electronic Position Fixing System (EPFS) or Transmitting Heading Device (THD) or Gyro Compass with 1 input for a baud-rate up to 38,4 kb. | |
| | 1 x IEC 61162-1 output. | |
| | Outputs for switching solenoid valves (12-32VDC) or reversing DC motor hydraulic systems up to a maximum load of 20amps. | |
| 3. | Rudder Follower | Part Number: JA-701067-1, RFU1300-1 |
| 4. | Rudder Follower | Part Number: 20330008 |

Optional manual steering gear controls:

- | | | |
|----|--|-----------------------|
| 1. | Non Follow Up (NFU) Jog Lever | Part Number: 20310003 |
| 2. | TS-203FFU Lever Remote | Part Number: 20310025 |
| | Single Follow Up (FU), Non Follow Up (NFU) Control with change over switch | |

Remarks

None


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EC Identification No.: 0801



Certificate No: 32 802 - 06 Lux

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Note:


This product has been assigned a U.S. Coast Guard Module B number 165.110 / EC 0801 to note type approval to Module B only as it pertains to obtaining US Coast Guard approval as allowed by the "Agreement between the European Community and the United States of America on Mutual Recognition of Certificates of Conformity for Marine Equipment", signed February 27th 2004.

This certificate is valid for equipment, which is conform to the approved type. The manufacturer must inform the Notified Body named on this certificate of any modifications or changes to the approved product in order to obtain a valid certificate.

Should the specified standards be amended during the validity of this certificate, the product is to be re-approved prior to being placed on board the vessel to which the amended standards apply.

The mark of conformity may only be affixed to the above type approval equipment and a Manufacturer's Declaration of Conformity issued when the production-surveillance module (D, E or F) of Annex B of the MED is fully complied with and controlled by a written inspection agreement with a Notified Body.

Wheelmark Format:


xxxx/yy


xxxx
yy

Notified Body identification number undertaking surveillance module

Last two digits of year mark affixed

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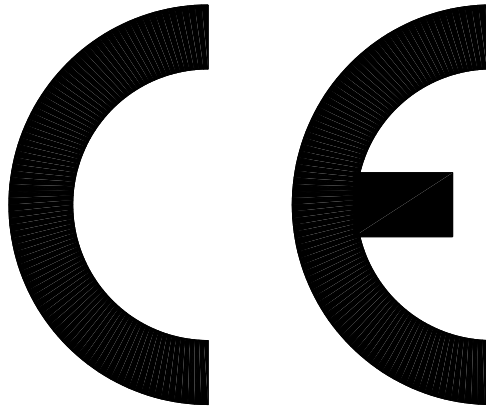
Luxembourg, 2006-03-24



GL Luxembourg

EC Identification No.: 0801

CE Compliance



This product has been tested and is in compliance with the Electro-Magnetic Compatibility (EMC) standards of the European Community, and bears the CE label. It has been tested according to the applicable sections outlined under:

Technical standard #IEC945/EN60945,
Marine Navigation Equipment,
General Requirements

Applicable sections for methods of testing and required test results are:

Section 4.5.4:	Radiated Interference
Section 4.5.4:	Immunity to Electro-Magnetic Environment
Annex A, Section A.3:	Immunity to Conducted Audio Frequencies
Annex A, Section A.4:	Immunity to Earth Lead Coupling
Annex A, Section A.6:	Immunity to Radiated Interference

Test results and a declaration of conformity are on file at the ComNav Head Office.

ComNav Marine Ltd.
#15 - 13511 Crestwood Place
Richmond, BC V6V 2G1
Canada

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User Notes & Settings

User Notes & Settings

User Settings

Once your Admiral P3 system has been installed and set up correctly, make a record of all the settings for future reference, in the table below.

Parameter	Range	Default Value	User Settings 1	User Settings 2
Dockside Setup menu				
Reset	<i>press Fn button to do</i>	<i>n/a</i>		
Vessel type	Displ, Semi, Plane, Stern, Large	Displ		
An. Compass type	None, Mag, Flux, Fixed, Float, HRS	None		
Compass setup	<i>press Fn button to do</i>	<i>n/a</i>		
Drive setup	<i>press Fn button to do</i>	<i>n/a</i>		
Exit	<i>press Fn button to do</i>	<i>n/a</i>		
Alarm O/P	None, SW'D B-, SW'D B+	None		
External Alarm Type	All, Watch	All		
Thrust Type (CT7)	None, On/Off, Prop.	None		
Thrust MIN (CT7)	0 – 70%	0		
Thrust MAX (CT7)	Thrust min to 100%	0		
Language	English, Français, Español, Íslenska, Italiano			
Standby Menu				
Station Lock	Lock, Unlock	Unlock		
Default Turn	Dodge, U-Turn, Circle, M.O.B., Fishzag	U-Turn		
Compass Source	Analog, NAV1, NAV2	NAV1		
Compass Cal	0 – 359°	<i>Set at Runtime</i>		
Backlight Level	0 – 8	4		
Display	A, B, C	A		
Watch Alarm	Off, 1 – 30	Off		
Fishzag time	30 – 300	60		
Battery	<i>Read only value</i>	<i>n/a</i>		

Parameter	Range	Default Value	User Settings 1	User Settings 2
Power Steer Menu				
Stdby/P.Str Rudder Limits	Off, or 5° up to physical limits from Dockside setup	Off		
Auto/Nav Rudder Limits	Off, or 5° up to physical limits from Dockside setup	Off		
RAI Offset	0° – 15°	0		
Auto Menu				
Rudder Gain	1 – 10	8, 5		
Counter Rudder	0 – 10	3, 3		
Seastate	Auto, 1 – 10	A, A		
Turn Rate	0.1 – 20	8, 5		
Parameter Set	Lo, Hi, Auto	Auto		
Speed Trip Pt.	1 – 20	10		
Speed Source	NAV1, NAV2	NAV1		
Off-Course Alarm	5° – 20°	20°		
ALC	On, Off	Off		
Thruster Assist (only if Thrust Type is not None)	Off, or 1 – 7 in 0.5 steps	Off		
Thruster Gain (only if Thrust Type is not None)	Low, Med. High	Low		
Helm Delay (Large boat only)	2 – 60	2		
Counter Helm (Large boat only)	0° – 80°	0		
Nav Menu				
Nav Source	NAV1, NAV2	NAV1		
XTE Limit	0.01 – 3.0, step 0.01	0.25		
Waypoint Arrival	Silent, Manual, Auto	Auto		
Correction	XTE, CTS, Both	Both		
XTE Sense	Norm, Rev	Norm		
Max Correction	30° – 90°	60°		

Parameter	Range	Default Value	User Settings 1	User Settings 2
Work Menu				
Rudder Bias	Auto/Nav rudder limit or physical limit	<i>Set at Runtime</i>		
Autotrim	Off, On	Off		
Work Trip Pt.	1 – 10	2		
Rudder Scale	0.25 – 3.00, step 0.25	1.00		
Work Mode State	A_Rdy, A_On, M_Rdy, M_On	<i>Set at Runtime</i>		

Table 15 – User Settings

User Notes

[illegible]