

TILLERPILOT® TP5000 AND TP5500

THE WORLD'S MOST ADVANCED AUTOMATIC PILOT
FOR TILLER-STEERED YACHTS.

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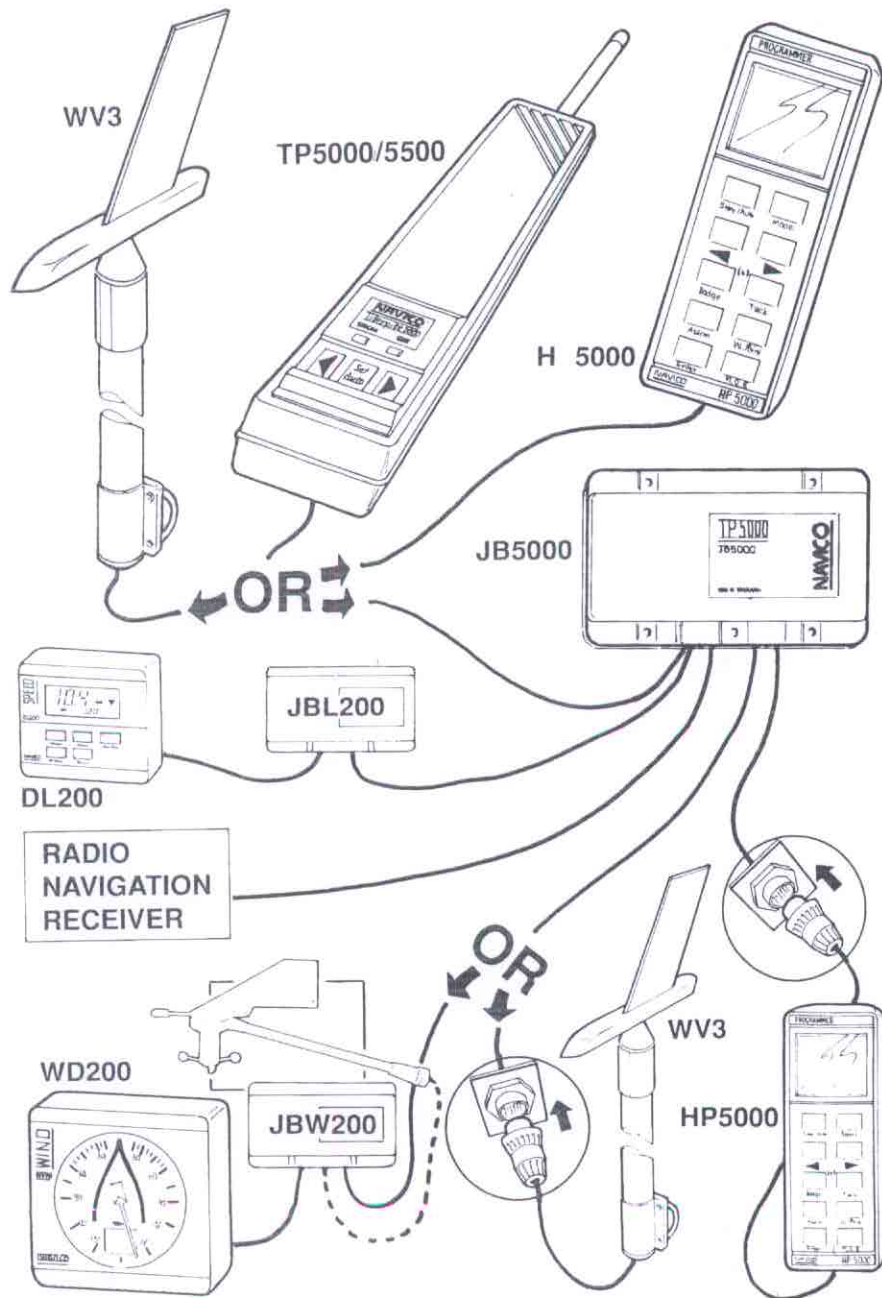
Navico Tillerpilots **TP5000** and **TP5500** are self-contained automatic pilots suitable for a wide variety of tiller steered sailing yachts. Both units have an identical outward appearance and operate in the same way. The difference between them is that the **TP5500** has a more powerful and extremely efficient drive mechanism which allows for faster movement of the tiller and greater thrust whilst keeping current consumption to a minimum.

Both Tillerpilots benefit from highly sophisticated electronics with advanced software capable of optimising the steering performance under differing conditions.

The control format of both units is simple to follow and gives precise control via three keys and two indicators.

To ensure best results the unit should be installed correctly. You are advised to read the complete manual before commencing installation and use.

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The full versatility of the Tillerpilots **TP5000** and **TP5500** can be appreciated from the complete system drawing.

In the simplest configuration the Tillerpilot is used as a stand alone unit.

A fully integrated and versatile system allows your Tillerpilot to be interfaced to your Navico Hand Programmer H 5000, WD200 Windspeed and Direction Indicator, DL200 Digital Log, and a Radio Navigator via Junction Box JB5000.

1.1 HAND PROGRAMMER

The **H 5000** offers highly sophisticated control of the Tillerpilot which rivals the best of any below deck pilot systems available. It is the most exciting enhancement to the system, and brings a completely new range of advanced features to the user.

- Duplication of all Tillerpilot controls
- Illuminated display showing status and course
- Course change by selected amount
- Dodge facility
- Steer to new heading
- Bearing to waypoint memory
- Off course alarm
- Variable compass tack
- Automatic wind tack
- Correction for magnetic deviation
- Man overboard function
- Radio navigation control (NMEA 180,182,183 - used with interface box, **JB5000**)
- plus many programmable features.

The hand programmer can be connected directly to the Tillerpilot. If other accessories are to be used at the same time then an interface box, **JB5000**, will be required.

1.2 WIND

For steering under windvane two options are possible. A low cost, easy to install unit, the **WV3** can be fitted to the after pulpit rail. For best performance under wind the **WD200** should be used. This utilises a masthead windvane.

The **WV3** can be connected directly to the Tillerpilot if used as the only accessory or can be connected into a more comprehensive system via the Junction Box **JB5000**. The **WD200** must be interfaced via the **JB5000**.

1.3 JUNCTION BOX JB5000

The **JB5000** is connected to the **TP5000/5500** to allow expansion of the system. It is supplied complete with two 6 metre cables (can be trimmed to required length) with weatherproof sockets to allow connection to the **WV3** and **H 5000**.

Connection can also be made to a radio navigation receiver, log **DL200**, and masthead wind instrument system, **WD200**. **DL200** and **WD200** are implemented by 2 wire inter-connections.

1.4 INTERFACING TO RADIO NAVIGATION RECEIVER

Interfacing to a wide variety of radio navigation receivers (Satnav, Loran, Decca, GPS) is effected by using the junction box **JB5000**, and hand programmer **H 5000**. Check that your navigation receiver provides the required output (off track error) in the format NMEA180, 182 or 183.

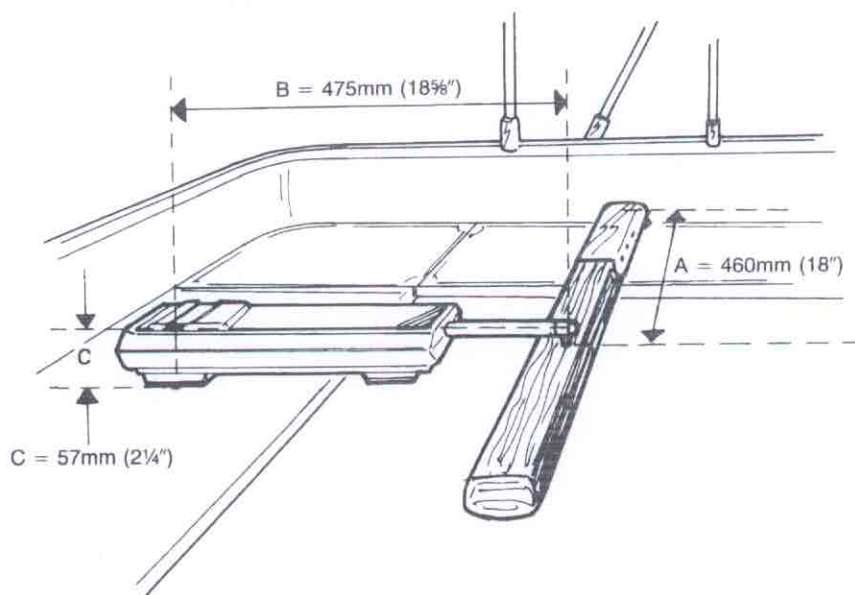
For the offtrack error compensation to work correctly the speed of the boat must be entered either via the hand programmer or automatically via log interface.

1.5 INTERFACING TO LOG

The **JB5000** can be connected to the Navico **DL200** log, to update speed information automatically. This is used for offtrack error compensation and the man overboard function of the Hand Programmer, **H 5000**.

2 INSTALLATION

2.1 MOUNTING THE TILLERPILOT



The Tillerpilot should be installed so that it is horizontal and to the dimensions indicated above (note: tiller set amidships).

The Tillerpilot is factory preset to mount on the starboard side, but can be configured for porthand mounting if required - see section 6.

If the above dimensions "B" or "C" are not practical on your boat then a full range of mounting accessories are available - see section 2.3.

Some tolerance on dimension "A" can be allowed but the unit may require a change of gain to compensate - see Section 7.

The Tillerpilot houses an internal fluxgate compass and should therefore be mounted away from sources of magnetic interference. Ensure that steering compass is at least 1 metre (3 feet) away.

Tillerpin. Drill a 6.3mm (0.25") diameter hole in the tiller - ensure this is on the centre line and vertical. Drill to a depth that allows only the top 12.7mm (0.5") of the Tillerpin to protrude. Fix with an epoxy adhesive.

Mounting Cup. Drill a 12.7mm (0.5") diameter hole in the cockpit seat and mount so that only the flange protrudes. Ensure that the mounting cup is a tight fit (using epoxy adhesive), and is supported over its entire depth. If necessary reinforce underside of cockpit seat with hardwood or marine plywood.

NOTE: Tillerpilots are powerful devices and high loads can be exerted. Do not fit the Tillerpilot to the mounting cup and tillerpin until the adhesive has completely set.

2.2 ELECTRICAL CONNECTION

For 12 Volt DC Supplies Only

The Tillerpilot is supplied with a weatherproof 2 pin plug, socket and cover. Always fit the cover to the socket when not in use.

Mount the socket on a vertical surface close to the Tillerpilot mounting. Connect the socket to the battery by a cable of suitable gauge for the length of cable run (refer to table below).

- Do not fit other electronic or electrical equipment to this cable.
- Do not tap into the supply from a nearby cable for other electrical equipment - especially motor starting circuitry.
- Ensure all connections are well made. Poor contact will result in loss of thrust from the Tillerpilot and slower speed of response.

Length of cable run	Size of Conductor.		
	X-section area	Conductor Type	A W G
Under 4 metres (13 feet)	1 mm ²	32/0.2	18
4 - 7 metres (23 feet)	1.5mm ²	30/0.25	15
7 - 12 metres (39 feet)	2.5mm ²	50/0.25	13

Trim surplus cable from the Tillerpilot and fit the 2 pin plug supplied (see separate instructions with plug/socket).

Ensure correct polarity connection:-

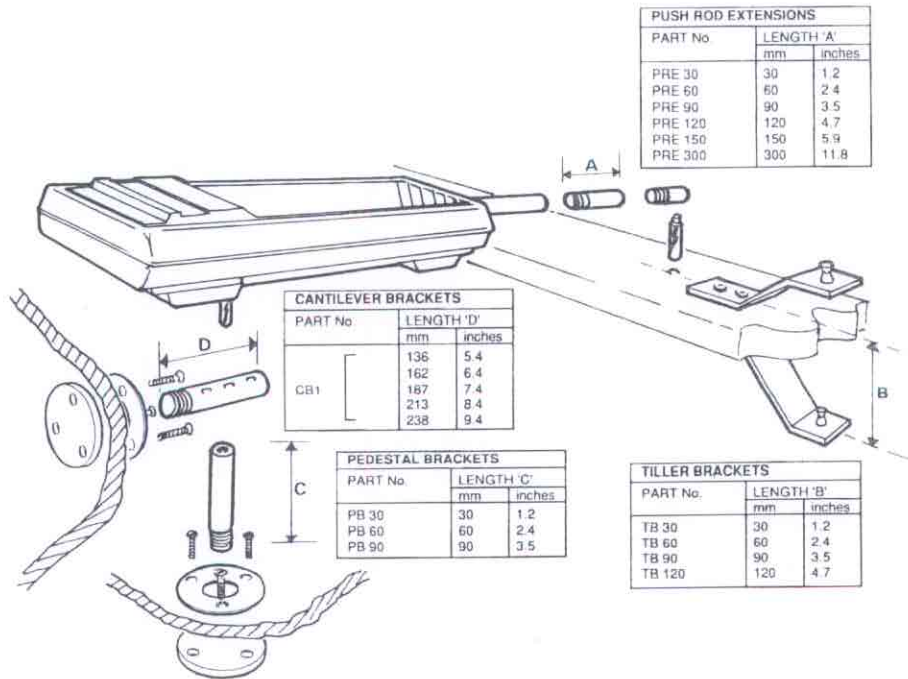
Brown	+ ve
Blue	- ve

Inadvertent reverse polarity connection will not cause damage to the Tillerpilot but the fuse will blow, (located on the underside of the unit underneath the cable entry point). Replace fuse with a 5A x 20mm fuse.

2.3 MOUNTING ACCESSORIES

The following accessories are available from Navico dealers.

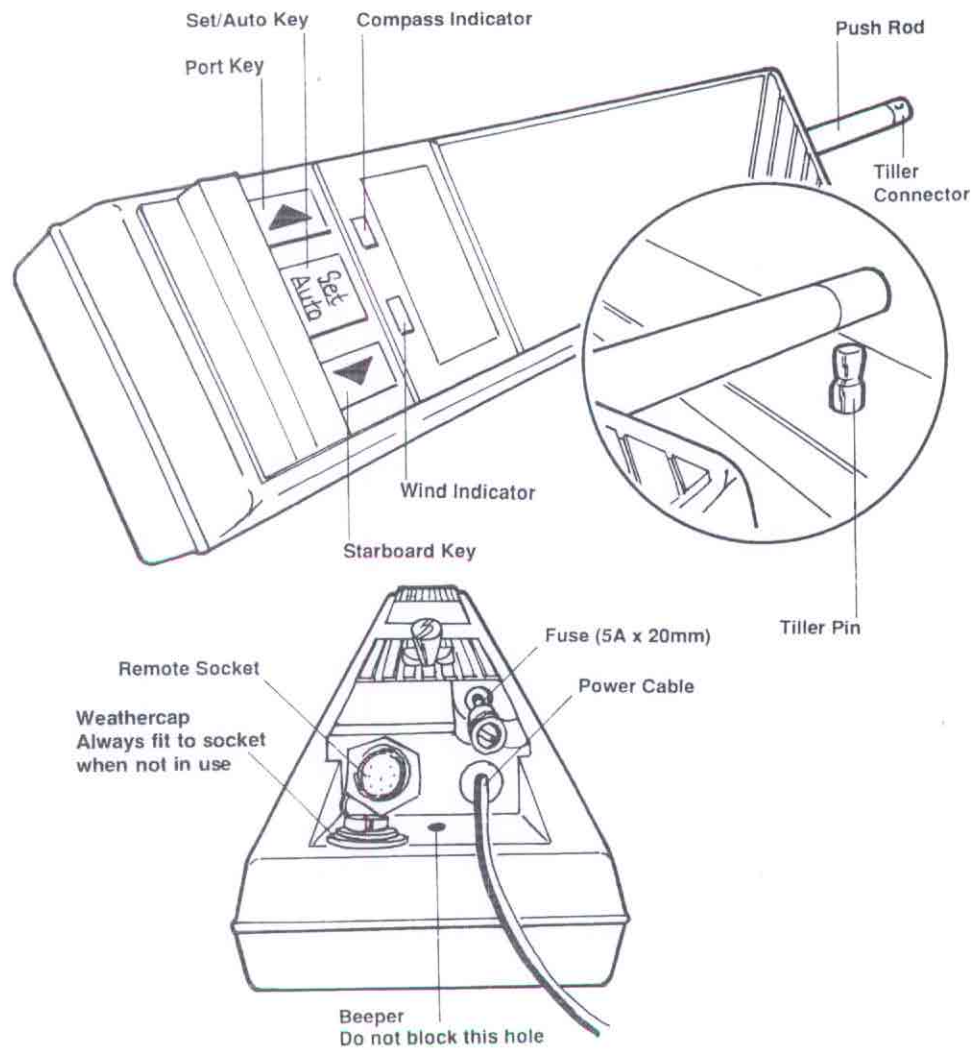
- Pushrod extensions** - to increase the distance between Tillerpilot mounting and tiller pin.
- Pedestal brackets** - to increase the height of the Tillerpilot mounting.
- Tiller brackets** - to raise or lower the attachment point on the tiller.
- Cantilever bracket** - to mount the unit from the side of the cockpit.



In all cases the mounting points should be strongly fixed to withstand the considerable forces that can be applied.

Use only Navico accessories. Other manufacturers' accessories may look similar but vary in dimension, which could have a detrimental effect on the performance of the Tillerpilot TP5000/5500.

Three keys will carry out your commands in a simple and straightforward way. All key strokes are confirmed by one or more "beeps". Wind and Compass mode are confirmed by the two LED indicators.



On connecting the Tillerpilot to a 12 Volt d.c. supply the unit will go into the standby condition with compass mode selected. This is confirmed by a flashing compass indicator. In this mode no autopilot operation takes place, but movements of the Tillerpilot's pushrod can be made by pressing the port or starboard keys.

Selection of windvane operation is only possible if a windvane has been connected (**WV3** or **WD200**) and can only be selected when in the Standby Mode.

Course change and tacking are possible when under autopilot control. There is also a "lock-onto previously selected heading" facility.

3.1 ENGAGING AUTOPILOT OPERATION

Manually steer the required heading. Using the port and starboard keys move the Tillerpilot pushrod until it is over the tillerpin. Push the tiller connector onto the tillerpin - this should have a positive "click" action to prevent accidental disengagement.

Immediately lock the Tillerpilot onto your heading by pressing the set/auto key.

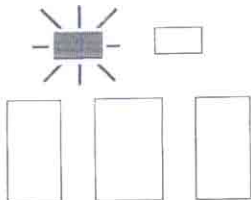
Alternatively - connect the Tillerpilot to the tillerpin and use the port and starboard keys to steer the required heading. When the required heading is being steered press the set/auto key to lock onto autopilot operation.

For either method it is desirable to ensure a straight course is being steered before the set/auto key is pressed. This will ensure the correct bias (rudder trim) to the helm for steering a straight course has been applied.

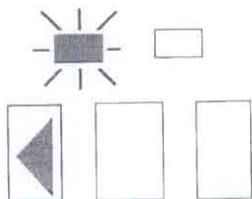
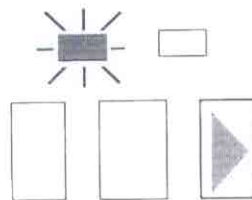
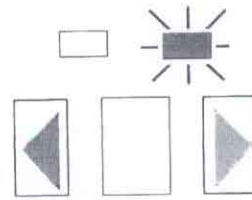
To lock onto the last selected heading, press and hold the set/auto key in Standby mode until you hear the second beep. The pilot will then steer to the previously selected heading.

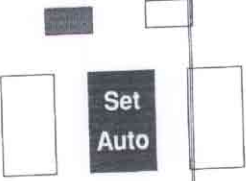
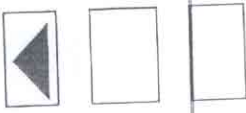
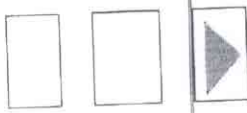
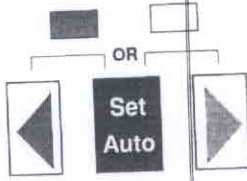
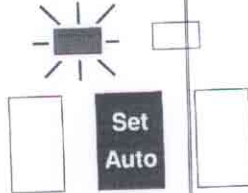
Emergency. In an emergency the pilot can be disconnected from the tiller by a sharp upwards force on the push rod. If the tiller can pivot upwards it is advisable to use one hand to hold the tiller, the other to lift the Tillerpilot off.

3.2.1 Initial power on condition.

	<p>Standby - compass mode Compass indicator flashes.</p>
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3.2.2 For either Standby Compass or Standby Wind

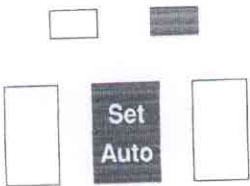
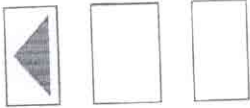

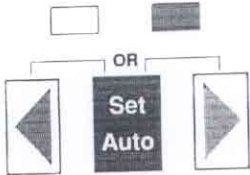
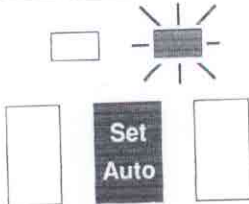
	<p>Vessel moves to port. Pushrod retracts for starboard mounted Tillerpilots and extends for port mounted Tillerpilots.</p>
	<p>Vessel moves to starboard. Pushrod extends for starboard mounted Tillerpilots and retracts for port mounted Tillerpilots.</p>
	<p>Both keys held down together until second beep is heard (after about one second). Tillerpilot goes into standby-wind mode. Wind indicator flashes. Repeat this sequence to revert to standby-compass mode.</p>

	<p>A single short press locks the Tillerpilot to the boat's current heading. The compass indicator illuminates continuously to confirm. Holding key depressed until second beep is heard - Tillerpilot locks onto previously used autopilot heading.</p>
	<p>A single press alters the course by 1° to port. Holding key down will change the course by 10° to port for every double beep heard. (Note: On pressing the key an initial beep is heard; if the key is held down then the course change occurs at the double beep).</p>
	<p>A single press alters the course by 1° to starboard. Holding key down will change the course by 10° to starboard for every double beep heard.</p>
	<p>Both keys pressed together (set/auto with port or starboard). A 100° (compass heading) tack will result in direction of outer key used.</p>
	<p>Tillerpilot reverts to the standby-compass mode.</p>

3.2.4

Autopilot Mode - Operation From Wind Vane.

NOTE: WV3 or WD200 must be connected.

	<p>A single short press locks the Tillerpilot to the current apparent wind angle - ensure that you are not sailing closer than 30° to wind.</p>
	<p>A single short press alters the course to wind by 1° to port. Holding the key down will alter the course by 10° for every double beep heard.</p>
	<p>A single short press alters the course to wind by 1° to starboard. Holding the key down will alter the course by 10° for every double beep heard.</p>
	<p>Both keys pressed. Direction of tack selected by outer key used. Boat goes to the same apparent wind angle but on the opposite tack. Apparent wind angle must be between 30° and 70°. Tillerpilot automatically prevents tacking in the wrong direction.</p>
	<p>Tillerpilot reverts to the standby-wind mode.</p>

Navico Tillerpilots when used properly can maintain as good a course, on most points of sailing, as a skilled helmsman. They also have the advantage of never losing concentration whereas the human may begin to show temporary lapses of concentration after as little as ten minutes. There are, however, certain circumstances in which the human has an advantage, in being able to anticipate events which no autopilot can sense, typically in a heavy following sea.

- When sailing close to the wind it is easy to forget to trim the mainsail and consequently allow excessively heavy weather helm to build up. A helmsman would complain, whereas a pilot will struggle on and the boat will not be sailed efficiently. The human likes to feel some weather helm, but for the pilot this is not essential and it will help (in drag reduction, wear and power consumption) to free or reef the mainsail a little sooner than you normally would when steering by hand.

- When sailing close to the wind it is wise to set a course a few degrees free of that normally sailed under manual tiller control.

- When running downwind near the gybe, a helmsman has the advantage of extra visual signals. When under autopilot operation do not sail as close to the gybe as you would when under manual tiller control.

- When broad reaching or running fast, particularly with quartering waves, a helmsman will naturally begin to apply periodic larger angles of helm than when beating or sailing slowly. This is the equivalent of increasing "rudder gain" and it may help to adjust the gain on the pilot. Many people find a compromise setting and use this for all sailing, but with practise it can be optimized for different conditions, eg: low for motoring in a calm and high for running fast. If gain is too low, the boat will understeer, ie: yaw because insufficient rudder is applied in time: if gain is too high, the boat will oversteer, ie: be overcorrected on each deviation from course.

Keeping Watch. The Tillerpilot is an invaluable aid to sailing. However, do not become complacent. Always keep a good look out - the Tillerpilot cannot see obstacles and danger!

Automatic pilots for sailboats have evolved considerably since their introduction some years ago. With advances in technology greater sophistication has been incorporated which allows more precise steering yet with much simpler control formats. This operating simplicity masks the hidden tasks which the pilot carries out. A knowledge of this will help you to understand what is going on, and why. It will also assist in knowing what to expect in certain conditions and how to set the sails to help operation and obtain optimum performance rather than hinder it.

The following explanation, whilst by no means complete, is a simple overview of the essential parameters.

5.1 TILLER MOVEMENT

Movements of the tiller are applied to compensate for heading variations, the amount of movement being proportional to the heading error detected by the internal compass. The amount of movement is set by the **Gain**. (sometimes known as the rudder ratio).

The following sketch shows the effect of gain setting.



Gain too low.
Boat takes
a long time
to come back on
to heading



Ideal.
Errors from
heading are
quickly
corrected



Gain high.
Boat continually
oscillates through
required
heading



Gain Excessive.
Tendency to
instability of
course, with
increasing error

It is important not to confuse too high a gain with the natural yawing of the boat allowed in heavy seas. Always allow a minute under autopilot operation before making any assessment of gain as the correct bias (rudder trim) of the helm for steering a straight course may not have been fully applied, and could lead to the false conclusion of too low a gain.

5.2 SEASTATE

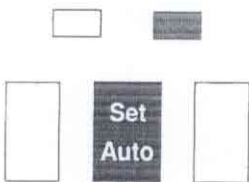
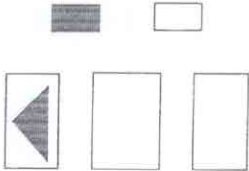
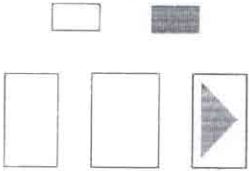
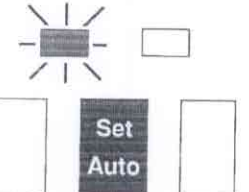
The rougher the weather the more variations in heading will be detected. If no account of this were made then overworking of the pilot would result, causing unnecessary drain on the batteries. The Navico Tillerpilot continuously monitors corrections applied to the tiller and allows a "dead band" within which the boat can go off course without corrections being applied. The "dead band" is selected automatically by the built in microcomputer to give the best compromise between course steered and battery consumption.

5.3 AUTOTRIM

Under differing conditions a bias of the tiller (sometimes known as standing helm, or rudder trim) to port or starboard will be required to steer a straight course. The amount of bias depends on many factors such as strength of wind, speed of boat and amount of sail set. If no account were made of this then the boat would tend to veer off to one side or the other eventually oscillating about a heading offset by a number of degrees to that required.

The internal computer of the Navico Tillerpilot continuously monitors the average course error and applies a bias to the tiller to compensate until the ideal condition is reached. It applies the bias gradually so as not to upset the normal automatic pilot performance, and may take up to a minute or so to fully compensate for changing tack. Once the compensation is applied the computer will continue to monitor even small changes in condition that take place and continue to apply trim automatically.

The Tillerpilot is factory set for mounting on the starboard side. If you require port hand mounting then the unit can be reconfigured by following the procedure below. You will only need to do this once as the setting will be memorised by the unit and retained even after disconnection from the power supply.

6.1 CHANGING MOUNTING CONFIGURATION OF TILLERPILOT.	
	Hold down the set/auto key and connect Tillerpilot to 12 Volts (ensure key is held down before and during power connection). Wind indicator confirms Tillerpilot set for starboard mounting (note: if port hand mounting had previously been set, then compass indicator would confirm).
	Press the port key if port hand mounting required. Compass indicator confirms Tillerpilot now set for port hand mounting.
	Press the starboard key only if starboard mounting is to be reselected. Wind indicator will confirm.
	When correct mounting has been selected press set/auto to revert the Tillerpilot to normal operation - standby-mode, compass selected.

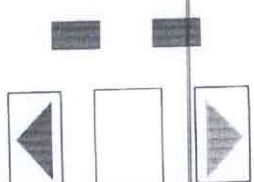
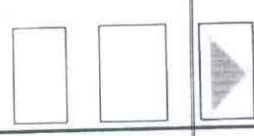
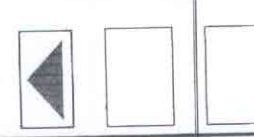
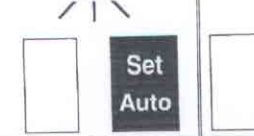
The Tillerpilot gain has been factory pre-set to give the best compromise for steering a large range of yachts provided that the unit has been mounted at the recommended distance from the rudder pivot point. However, there may be occasions where a particular installation may benefit from a change of gain. Unless the function is fully understood it is advisable to leave as factory set (refer to Section 5.1 for detailed explanation of gain).

The Tillerpilots **TP5000** and **TP5500** have 9 settings of gain.

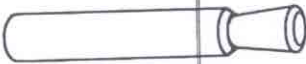

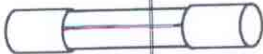
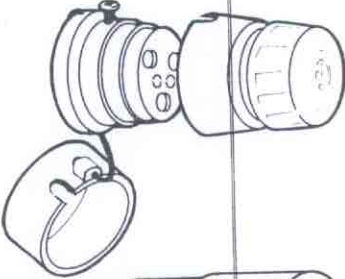
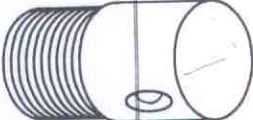
1 = lowest ie: smallest movements of actuator

9 = highest ie: largest movements of actuator

The Tillerpilot is factory pre-set to gain = 5.

7.1 CHANGING GAIN OF TILLERPILOT	
	<p>Hold down port and starboard keys and connect Tillerpilot to 12 Volts (ensure keys held down before and during power connection). A repeated sequence of beeps is emitted. The number of beeps in the sequence indicates the gain. Both indicators will illuminate continuously to confirm this mode has been selected.</p>
	<p>Increases gain by one for every press of the key.</p>
	<p>Decreases gain by one for every press of key.</p>
	<p>When correct gain has been selected press set/auto to revert pilot to normal operation - standby-mode, compass selected. The setting of gain will now be memorised by the Tillerpilot, even after disconnection from power supply.</p>

SYMPTOM	PROBABLE CAUSE	REMEDY
When engaged, pilot immediately applies large tiller angle and increases course error.	Wrong (port or starboard side) installation setting	Read Section 6 for correct installation
After working normally course suddenly lost and Tillerpilot goes into standby-mode, compass selected.	Power interrupted and restored or low voltage. Cable to batteries too small a size. Intermittent connection.	Increase size of cable. Check all connections. Charge batteries.
Helm is hard over and alarm is continuously on.	Steerage way insufficient to control course, or sails are aback. Pulsing is a correct safety feature when rod is at full travel.	Reset the vessel on course
Power socket live but no indicator light.	Fuse blown	Check polarity. Change fuse.
Loss of course under vane control (when motor sailing).	Wind has become too light relative to boatspeed to give consistent direction.	Change to compass mode.
Cannot select wind vane operation.	Windvane not connected. Boat steering into wind.	Move boat to 30° or more relative to wind.

	Description	Navico Part Number
	Tiller pin	E00098
	Mounting cup	E00099
	Fuse 5A x 20mm	270001
	2 pin plug and socket (dri-plug)	170020
	Push rod end	E00111

Your Tillerpilot should seldom need servicing, but will benefit from a seasonal smear of silicone grease on the pushrod and connectors, and keeping all connector covers in place when not in use.

The instrument is guaranteed for 12 months from date of retail sale. If it is necessary to have the unit repaired, return it, carriage prepaid to the agent in the country of purchase with a copy of the receipted invoice showing date of purchase. Where possible return all the components unless you are certain that you have located the fault. If the original packing is not available, cushion well; the shock loading of freight handling can be very different from the marine environment for which the instrument is designed.

If a fault occurs outside the country of purchase, return the unit to the official NAVICO agent in the country of use. The appointed agent will rectify the fault and make a charge for labour, return carriage and packing. Any component that has failed under the terms of the warranty may be replaced free of charge.

A list of official NAVICO distributors and service centres is available upon request.

Navico Limited

Star Lane, Margate, Kent CT9 4NP, UK
telephone: (0843) 290290
facsimile: (0843) 290471

Navico INC

11701 Belcher Road, Suite 128, Largo, FL 34643, USA
telephone: (813) 524 1555
facsimile: (813) 524 1355

Navico France SARL

Urba Parc 3, 75 Rue Rateau, 93210 La Courneuve
telephone: (1) 48.35.48.05
facsimile: (1) 48.35.38.83