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Radio Navigation Interface
Installation & Operating Handbook

Autohelm

RADIO NAVIGATION INTERFACE

The Radio Navigation Interface provides the link between a Radio Navigation Receiver with an NMEA 180 autopilot output and your Autohelm.

It receives cross track error information from the Navigation Receiver and computes and outputs course adjustments to enable the autopilot to steer to a selected waypoint irrespective of wind and tide.

The Navigation Interface is extremely simple to operate and thanks to its sophisticated microprocessor based control algorithm provides acccurate track keeping under all conditions.

When the autopilot is being supervised by the Navigation Interface, full control is retained by all of the Autohelms keypad control units. Two versions of the Navigation Interface are available, one for use with the Autohelm 6000 (Z043) and one for use with the Autohelm 2000 and 3000 (Z050).

Your main distributor or Nautech's Technical Sales Department will be able to advise you on Navigation Receivers with a suitable autopilot output to the NMEA 0180 specification.

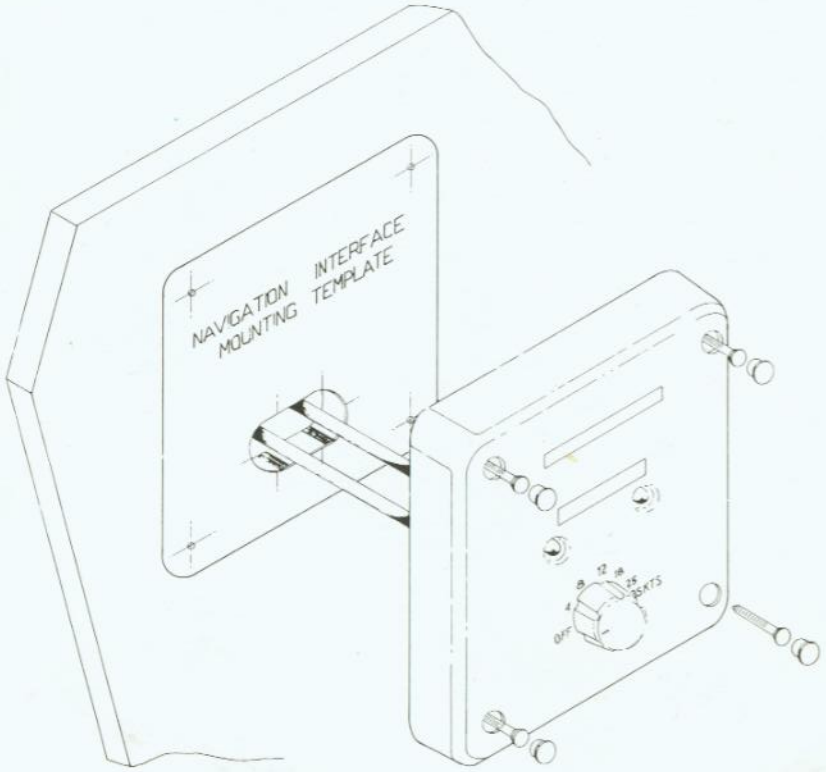
MOUNTING THE INTERFACE

The interface is designed for surface mounting and would normally be situated in the navigation area adjacent to your Radio Navigation System.

A printed template is provided to assist marking out fixing hole positions and the locating hole for the interconnecting cables.

The version for use with the Autohelm 2/3000 is provided with a plug on the end of one cable which is to be connected to the control unit. This cable has to be led into the cockpit and connected to the **Remote** socket on the control unit.

After threading through the interconnecting cables the Navigation Interface is screwed into position using the four self tapping screws provided. Four blanking plugs are supplied to conceal the fixing screw recesses in the facia, and these should be firmly pressed into position to complete the installation.



CABLING AND POWER SUPPLIES

The cable interconnections for the two Navigation Interface versions differ slightly as follows:

Autohelm 6000

- The three core screened cable should be led back to the connector unit of the course computer for connection to one of the serial bus connector blocks A1-A5.
- The twisted pair cable should be led directly to the Radio Navigation Receiver's NMEA autopilot output. The blue wire should be connected to earth and the red wire connected to the signal line.

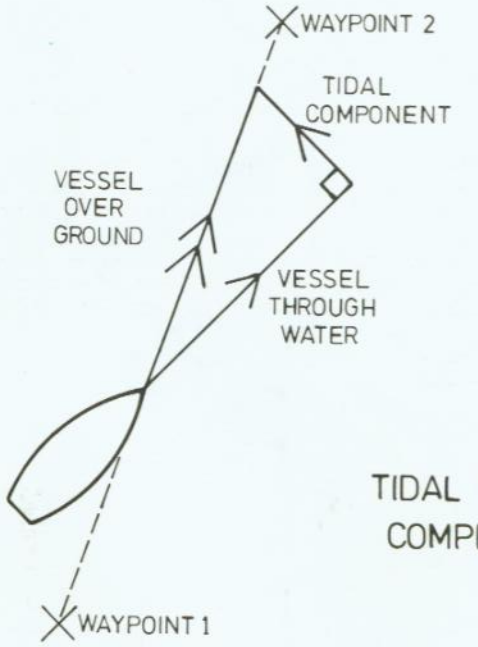
Autohelm 2000/3000

- The 6m cable with a plug on the end should be connected to the **Remote** socket on the control unit. The cable length is sufficient to lead it to the cockpit through the companionway when the Navigation Interface is required.
- The three core cable should be led directly to the Radio Navigation Receiver. The green/yellow wire should be connected to earth and the blue wire connected to the signal line of the Receivers autopilot output. The brown wire should be connected to the + 12V supply of the Navigation Receiver.

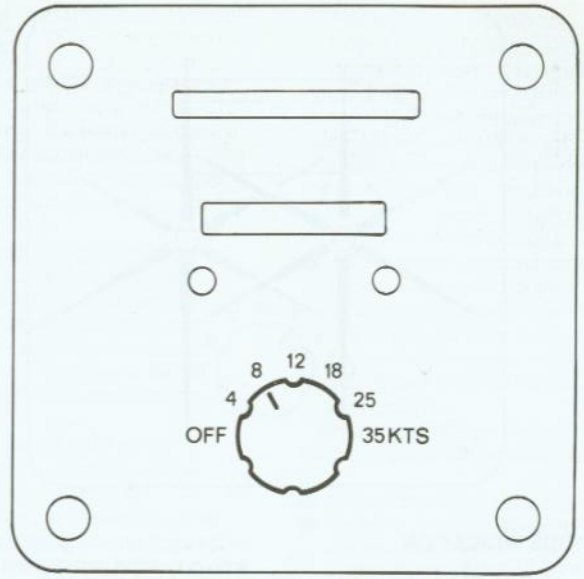
BASIC PRINCIPLES

The Navigation Interface accepts cross track error data from the Radio Navigation Receiver and computes course changes to maintain the desired track. It is primarily designed to keep a boat on track, automatically compensating for tidal streams and leeway. The navigation Interface can also be successfully used to acquire track providing a few simple rules are observed.

To obtain best performance in the track following mode the track should be manually acquired by steering the boat to within 0.05nm of track and then bringing the heading to within 5° of the bearing to the next waypoint **before** the Navigation Interface is engaged. Similarly when advancing onto the next waypoint the same procedure of manually acquiring track should be adopted.



TIDAL STREAM COMPENSATION

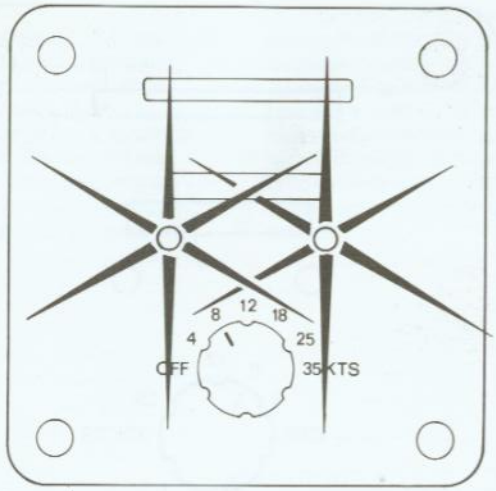


SPEED SELECTION SWITCH

Once the desired track has been set up on the Radio Navigation Receiver, the Navigation Interface is brought into operation by rotating the speed selection switch from **Off** to the speed setting nearest to your present speed. If during operation the vessel's speed is changed significantly and will remain so the speed selection switch should be adjusted to suit the vessels new speed.

The speed selection switch ensures optimum performance from the Navigation Interface over the wide range of vessel speeds.

When your Autohelm is being supervised by the Navigation Interface, full control remains available from all control units.



OPERATING MODE INDICATION
The red and green LEDs are used to perform the folowing functions:-

- Indicating when course changes are transmitted to your Autohelm.
- Indicating when the Navigation Interface is unable to supervise your Autohelm.

Course Change Indication
If required, course changes can be made by the Navigation Interface at a maximum rate of 1° every 5 seconds. When selected, the appropriate LED (red for a course change to port, green for starboard) is illuminated for 1 second. This confirms the frequency and direction of the commands to the drive unit.

Navigation Interface unable to supervise
When the Navigation Interface is unable to supervise your Autohelm, two flashing codes are used to identify the reason.

Code 1 (Error Condition) – This is when no data or invalid data is received from the Radio Navigation Receiver or when the cross track error is greater than 0.30nm (see operating hints). It is identified by both LEDs flashing together once every second.

Code 2 (Standby Condition Autohelm 6000 Only) – This is when the Navigation Interface is unable to tansmit course changes to your Autohelm. The Navigation Interface can only transmit course changes when the autopilot is locked onto a compass course (Auto mode). If the autopilot is in 'windvave' or 'standby' mode and if there is no error condition, the Standby code is displayed and is identified by both LEDs flashing together once every two seconds.

When either of the above conditions are displayed, it must be cleared before any attempt is made to use the Navigation Interface.

NB The Autohelm 2000 and 3000 systems will respond to course changes from the Navigation Interface when they are in either VANE, STANDBY or AUTO mode. **The Navigation Interface must only be used with the Autohelm in AUTO mode and so should be switched off whenever it is not required.**

FUNCTIONAL TEST PROCEDURE

After completing the installation you should carry out the following functional test to familiarise yourself with the Radio Navigation equipment before attempting sea trials. These tests assume that the autopilot functional test procedure has been successfully completed.

Switch on the Radio Navigation Receiver and enter two tracks on the navigation receiver, one to produce a cross track error of approximately 0.1nm to starboard, the second to produce a cross track error of approximately 0.5nm to starboard. Do not switch your receiver to 'Pilot mode' at this point.

Switch on your Autohelm and select **Auto**. (Verify the control unit displays the continuous red LED signal or for an Autohelm 6000 Indicating Control Unit that the LCD shows the prefix **A**).

- Rotate the speed selection switch on the Navigation Interface to 4 knots and observe that the error Code 1 is displayed. This is because no data is being transmitted by your Radio Navigation receiver.
- Switch the Radio Navigation Receiver to **Pilot Mode** and observe that after a few seconds the LEDs stop flashing.

This indicates that the Navigation Interface is now receiving valid cross track error data from the Navigation Receiver. Within a minute the Navigation Interface will acquire its position relative to the selected track and will start selecting course changes to port to turn the vessel towards the track. These course changes will be indicated by the red LED and will cause the rudder to move to produce a turn to port.

- Advance onto the next track which will produce a cross track error of more than 0.30nm and observe that the error Code 1 is displayed within a few seconds.
- Switch the Navigation Interface to **Off** and observe that all the LEDs remain extinguished.

If the autopilot is an Autohelm 6000 the following additional tests should be carried out.

- Repeat the first three stages above.
- Put the autoplot in **Standby** mode and observe that the error Code 2 ('Standby') is displayed on the LEDs within a few seconds.

If an Indicating Control Unit is included in the system, the display will show the locked heading for 20 seconds, followed by the cross track error for 5 seconds. The display also includes a sign to indicate which side of track the error is.

CROSS TRACK ERROR INDICATION
(Indicating Control Units Only)

0.02 n.mile. Error To Starboard.

0.01 n.mile. Error To Port.

Zero Cross Track Error.

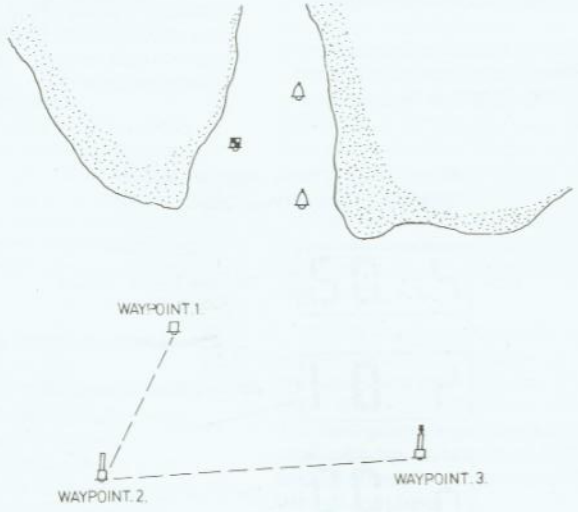
SEA TRIALS

Initial sea trials should be carried out in calm sea conditions with plenty of sea room. Before setting out, a triangular course should be plotted with easily identifiable turning points such as buoys. Each leg should be sufficiently long to provide a minimum duration of 20 minutes at your normal cruising speed, and should be clear of all obstacles for a distance of 0.5nm either side. Each turning point should be entered into your Radio Navigation system as a waypoint, before setting out.

The following initial sea trial procedure is recommended.

- Steer from the first waypoint towards the second and when within 5° of the required heading engage your Autohelm in **Auto** mode and ensure the Radio Navigation Interface is set to **Off.**
- Using the **Pilot Mode** display on your Radio Navigation Receiver check that the vessel is within 0.5nm of track and is heading within 5° of the second waypoint. To engage the Radio Navigation Interface rotate the speed selection switch to the setting nearest to your present speed.
- The Navigation Interface will now guide you onto and maintain track. In most conditions the track will be held to within ±0.02nm (±130ft).
- When the vessel is within 0.1nm of the waypoint, advance the Radio Navigation Receiver onto the third waypoint. Manually steer the vessel onto the new heading to Waypoint 3.
- Use the **Pilot Mode** display on the Radio Navigation Receiver to check the vessel's heading is within 5° of the bearing to the next waypoint.
- Check that the vessel is within 0.05nm of track.

The Navigation Interface may now be left to guide you onto and maintain track.



OPERATING HINTS

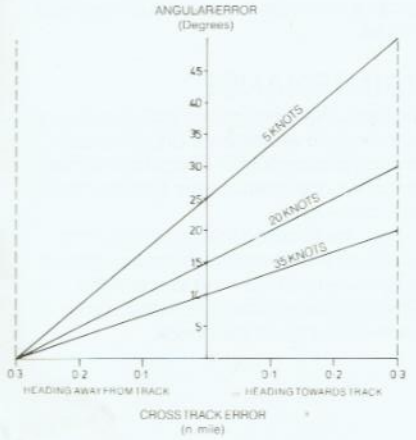
The previous sections have described the operation of the Radio Navigation Interface and will enable it to be used effectively in all conditions.

Limitations

Although there is no need to fully understand the details of the track keeping algorithm, it is very important to understand its limitations to obtain the best performance from the Radio Navigation Interface. The most significant of these limitations is imposed by the cross track error data transmitted by the Radio Navigation Receiver. This data is restricted to ±0.30nm, which means that even if the vessel were 5 miles to starboard of track, the transmitted data would still be 0.30nm. This is a condition of the NMEA 0180 standard and not a limitation of the Radio Navigation Interface.

Attempts to engage the Radio Navigation Interface beyond the 0.30nm limit will lead to excessive overshoots and can result in the vessel circling. For this reason the error code is displayed whenever the cross track error exceeds 0.30nm.

MAXIMUM ANGULAR ERROR vs. DISTANCE OFF TRACK

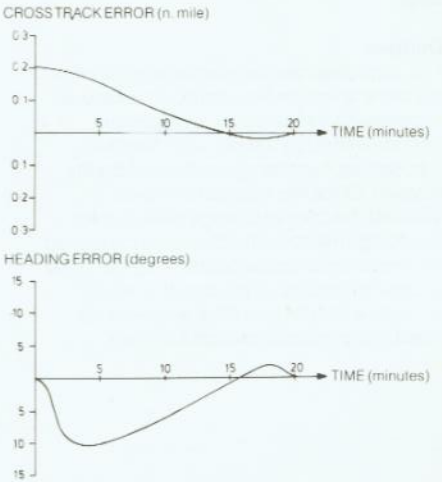


The requirement to remain with 0.30nm of track also limits the maximum allowable angular error between the track course and the vessel's heading. If the angular error is too great, the Navigation Interface will be unable to cancel it within the 0.30nm limit leading to the problems outlined above.

Although it is always advisable to ensure the vessel's heading is within 5° of the bearing to the destination waypoint, and the distance from track is less than 0.05nm, larger errors can be tolerated. The safe operating range is shown in the accompanying diagram. It must be recognised, however, that with larger errors it can take as long as 15 minutes to acquire track.

The correct setting on the speed selection switch is important to ensure correct performance. If the setting is too low, the overall gain of the track keeping algorithm will be too high which will result in the vessel moving slowly from side to side of the track. If the setting is too high, the overall gain will be low which will result in poor track keeping performance, and may result in circling when acquiring track.

TYPICAL TRACK ACQUISITION



Low speed operation
Operating the Navigation Interface at low speeds requires more care as the effect of tidal streams is far more significant than at higher speeds. In general terms, providing the tidal flow is less than 35% of the vessel speed no noticeable difference will occur in the performance of the Navigation Interface. However, extra care should be taken to ensure that the vessel is as close as possible to track, and that the direction made good over the ground is as close as possible to the direction of the next waypoint before engaging the Navigation Interface. Under these circumstances positive positional checks at regular intervals are vital especially if navigational hazards are close.

Initialisation
When the Navigation Interface is first switched on, it takes approximately 30 seconds to establish its distance from track. This prevents the Navigation Interface from accepting a single possibly inaccurate value as its start point, but does mean that the Navigation Interface will not transmit a course change when it is first switched on even if there is a substantial cross track error.

Dodges
Full control remains available from all control units when the Navigation Interface is supervising the autopilot. Dodges are accomplished by simply selecting the desired course change on the Autohelm keypad. Once the hazard has been avoided the course change selected for the dodge manoeuvre should be cancelled by selecting an equal course change in the opposite direction. Provided the vessel remains within 0.1 nm of track there is no need to steer back towards the track.

Safety
Passage making under supervision of the Radio Navigation Interface removes the chores of compensation for wind and tidal drift and will aid precise navigation. It is most important however to maintain an accurate log with regular plots and to verify the computed position read from the Radio Navigation Receiver with a dead reckoned position from recording the average course steered and the distance logged. In open water such plots should be at least hourly and more frequent in confined waters or when potential hazards are near.

Local variations in radio signal quality and changes in the tidal stream will produce deviations from the desired track. When setting up waypoints, remember that deviations will occur, and thoroughly check along each track and to 0.5nm each side to ensure that there are no hazards within the zone. Always confirm the position given by the Radio Navigation Receiver using an easily identifiable fixed object at the start of a passage to check and enable compensation to be made for fixed positional errors.

The use of Radio Navigation control will enable accurate track keeping even in complex navigational situations. It cannot remove the responsibility of the skipper to ensure the safety of his vessel at all times by careful navigation and frequent position checks.

MAINTENANCE

The Radio Navigation Interface requires no maintenance whatsoever. Should a fault develop please double check that all connections to the Interface are tight and free from corrosion.

If you are satisfied that all connections are sound the Navigation Interface should be removed and returned to one of the authorised service centres listed in your Autohelm autopilot handbook.

LIMITED WARRANTY

Nautech or its appointed Distributors or Service Centres will, subject to conditions below, rectify any failures in this product due to faulty manufacture which become apparent within twelve months of the purchase date.

Equipment used in the country of purchase should be sent directly to the authorised Distributor for that country or its appointed Service Centres. The product will then be serviced free of charge and returned promptly direct to the sender.

Equipment used outside the country of purchase can be either:-

a. Returned to the Distributor or Dealer in whose country or from whom the equipment was originally purchased – it will then be serviced free of charge and promptly returned direct to the sender, or

b. The product can be returned freight prepaid to the authorised Distributor or its appointed Service Centres in the country in which the product is being used. It will then be serviced and returned direct to the sender on the basis that the Distributor or Service Centre will supply any parts used free of charge but the sender will be invoiced for the necessary labour and return shipment at the local rate.

CONDITIONS
The warranty is invalid if:-

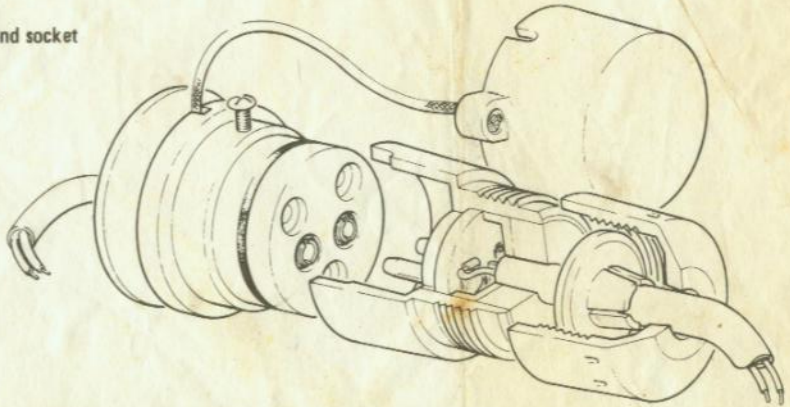
a. The product has been misused, installed or operated not in accordance with the standards defined in this manual.
b. Repairs have been attempted by persons other than Nautech approved Service Personnel.

AFTER SALES SERVICE

If for any reason your Autohelm Radio Navigation Interface requires attention ensure that you return it to one of our Authorised Service Centres. You will find a list enclosed in your autopilot handbook.

Each service centre is trained and equipped to provide expert attention to all Autohelm products.

Dri-plug BD500
Waterproof plug and socket
50V 5amp 2 pin
Patent applied for



DESIGN CENTRE LONDON

FIXING

To fit the socket 3 screws are required. Suitable sizes are – No.6 wood or self-tapping, 4BA or 3.5mm machine screws. Allow 1", 25mm length of screw in socket; csk. head.

Repro. No: BD500/1/83

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RADIO NAVIGATION INTERFACE Z075

This new version of the Radio Navigation Interface may be used with the following Autohelms:-

Product	Catalogue No.
Autohelm 800	Z070
Autohelm 1000	Z071
Autohelm 2000	Z072
Autohelm 3000	Z073

Please ensure that both the product and catalogue number correspond with your Autohelm.

The Z075 Navigation Interface now accepts cross track error data to both the NMEA 0180 and NMEA 0183 formats.

The mounting arrangement has also been improved and is explained in the enclosed sheet.

All other details remain as stated in the Installation and Operating Handbook.