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AUTOPILOT NP2035

Type 102-886 NG002

OPERATOR MANUAL

Nautoguide C - track control (Autopilot with ECDIS) appended

3578E/102-886/885.DOC012 Edition: Apr 15, 2002
Revised: 22. January 2003
Revised: Aug. 8th, 2003
Revised: July 20, 2004
Revised: April 16, 2007
Revised: Oct. 15, 2007
Revised: March 16, 2011

Notes:

1) In the operator manual the term ECDIS is always used for ECDIS or ECS, even if it concerns an ECS.

2) At present a rearrangement of the terms “Course Control” and “Set Course” is taking place internationally.
   - “Course Control” changes to “Heading Control” and
   - “Set Course” changes to “Preset Heading”.

   During the transitional period it can occur that the hardware is delivered with the old labeling. In the operator manual in hand both terms will be used for a time.

Autopilot NP2035
Operator Manual

1. Sensor failures

No.	Action	Effect	Operator Note	Reaction time
1	Failure of the log	A failure of the log is sensed and announced optically and acoustically on the control unit as Spd Ref. Missing. The last valid speed value is frozen and is used from then on as a valid speed for setting the regulator. Valid for speeds > 5 knots.	Switch over the log to manual speed input.	The reaction time – switching over to manual input – is not critical as long as the speed is to be maintained.
2	Error in the heading reference	A heading reference failure is sensed and announced optically and acoustically on the control unit as *Gyro Ref. Missing*. The last valid actual course is frozen and is used from then on as the heading reference. The set course should be the same as the actual course in order to prevent any rudder reaction. It is no longer possible to set a course on the control unit.	a) Reduce the speed to values < 20 knots. Switch over to the magnetic compass or to the second gyrocompass, if one is available. Optimize the control parameters during magnetic compass operation if stable regulation is not available. b) Switch over to manual control and use a second heading reference that is not subject to errors.	If it is necessary to make a maneuver, it is necessary to switch over immediately to manual control.

2. Autopilot errors

No.	Action	Effects	Operator Note	Reaction time
1	System error / Power down	The autopilot can no longer be used in the case of a system error. The effects cannot be described accurately in each case. The aim is to bring the rudder position into the centre position. A system error is announced optically and acoustically on the signal unit.	Switch over to manual control. Reduce the speed so as to be able to better control any possible rudder equalization operations.	The reaction time – switching over to manual control – is critical. It is necessary to switch over at once.
2	Error in the control unit	A control unit error in the form of an electronics failure has no effect on the current controller behavior. The operator notices that the control unit can no longer be used because nothing is shown on the display or else sees the *No Connection* or *No Telegram* message.	Switch over to manual control, since it is not possible to make any more heading settings and there is no further control over the autopilot (warnings, alarms, parameter settings).	The reaction time – switching over to manual control – is not critical

3. Hazard when accelerating or changing course and in heavy seas

No.	Action	Effects	Operator Note	Reaction time
1	Acceleration of the ship	Automatic adaptation of the controller to the speed is especially important during acceleration. A missing log (e.g. errors) can cause controller instability and unpleasantly larger rudder angles.	If it is not possible to ensure a log function, the ship must be accelerated slowly to the desired speed and the speed input made manually. Rudder limiting should be set to the maximum permissible value.	Switch over immediately to manual control in the event of controller instability.

No.	Action	Effect	Operator Note	Reaction time
2	Change of heading	Changes of heading are to be done such that any unacceptably high centrifugal acceleration is avoided (< 0.05g). This reduces the risk of accidents to the passengers and any shifting of loads. Computed relationship: a = d*v a = acceleration (centrifugal acceleration) b = turning speed when changing heading v = travelling speed You can see that the turning speed and the travelling speed have a proportional effect on the acceleration. The turning speed must be selected in relation to a desired maximum speed such that the acceleration rates described above are not exceeded. Turning speed limiting can be set at the autopilot.	Determine the maximum permissible turning speeds for various travelling speeds (depending on the passengers and the load). Determine the maximum amount of rudder limiting.	It is necessary to reduce the travelling speed at once if there is excessive centrifugal acceleration.
3	Sea	a) The speed of the ship must be matched to the current sea conditions. This determination must be made in connection with the ship safety regulations. (Wave height and maximum permissible speed) b) The effects of heavy seas can also cause undesirably high rudder amplitudes with the autopilot.	Increase the yawing setting until a compromise is reached between rudder action and heading accuracy for a travelling speed that is still permissible.	In the case of impermissibly large rudder movements it is necessary to reduce the travelling speed for safety reasons. Then check the yawing setting.

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EG Konformitätserklärung / EC Declaration of Conformity

Directive 96/98/EC, last amended by Directive 2002/75/EC

We hereby declare that the product identified below has been manufactured in accordance with the type approved units and complies with the above mentioned European Directives.

Product Designation:	**Heading Control System**
Type:	**Nautopilot NP 2035** (system components see attached)
Type Examination by:	GL Luxembourg 26, place de la Gare L-1616 Luxembourg Notified Body No. 0801
Type Examination Certificate No.:	42 770 - 02 Lux (Module B)
Assessment of the Production Quality Assurance by:	GL Luxembourg Notified Body No. 0801
EC Certificate of Conformity No.:	44 530 - 07 Lux (Module D)
Applied Standards:	ISO/IEC 11674 (2000) EN 61162-1 (2000), IEC 61162-1 (2000) EN 60945 (2003) / IEC 60945 (2002) IMO Resolutions A.342(IX), A.694 (17), MSC.64(67) Annex 3

This declaration has been made in the name of the manufacturer by:

Kiel, March 14, 2007

Raytheon Anschütz GmbH
Head of Quality Management

Klaus-Peter Schohl

Quality Management

Robert Zissen

EG-BPB/GL-42770-02/Lux KE0027E_070314 Page 1 of 2

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Heading Control System
Type: Nautopilot NP 2035

Listing of the system components:

- Operator Unit NP 2000	102-886 NG003
- Connection Unit NP 2035	102-885 NG002
-	
- Autopilot Remote Control Panel	102-879 NG010 [1]

[1] Optional

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1 General

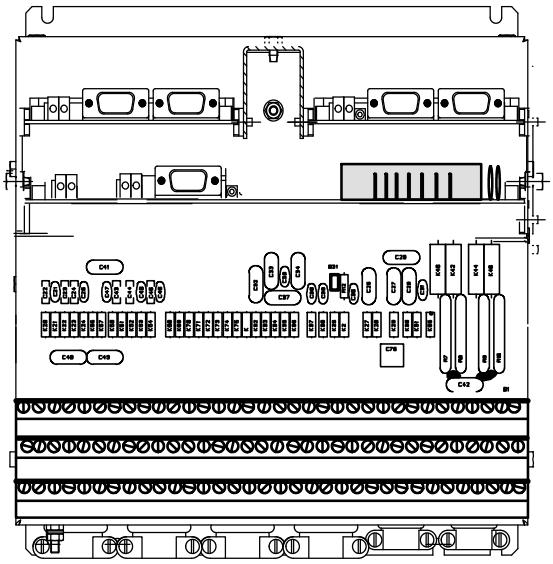
Equipment Overview

The NP2035 is a modern adaptive autopilot system designed for all sizes of sea-going ships.

The autopilot equipment is composed of:

- Operator Unit, Type 102-886
- Control Unit, Type 102-885 NG002
- Connection Cable

Operator Unit



Control Unit
(view from the top, front and top-cover removed)

Operator Manual

This operator manual contains the operating instructions as well as a survey of possible warnings and alarms indicated on the operator unit.

Service Manual

In addition to the operator manual a service manual is available. It contains:

- information about installation and first putting into operation
- information about care, maintenance and repair
- a description of the autopilot equipment

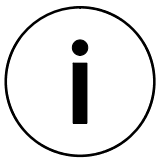
2 Operating Instructions

2.1 General

NOTE

The membrane keyboard must never be operated by a pointed object (ball point pen, pencil etc.)!

For cleaning the membrane keyboard and the display fields, a commercial, acid-free agent is to be used!



In case of lengthy input pauses (approx. 15s), a time-out occurs. The current text indication disappears, the previous indication appears again.

The NP2035 has the following operating modes:

- Heading control in consideration of a radius or R.o.T. limit value adjustment
- Track control in conjunction with an ECDIS system
- Rate-of-turn control via an R.o.T. tiller

The intended operating mode can be called up via command keys.

On selecting an operating mode, all necessary sensor data is checked for plausibility.

Luminous diodes indicate the active operating mode.
In case of disturbance, an error message in plain text appears in the alphanumeric line.
Operator inputs are possible only when the alarm has been acknowledged.

Function keys permit calling up and varying parameters, sensors and permanent information indication within the text line.

Depending on requirements, the operator can adapt the steering quality to the present sailing area by selecting between Economy, Precision and Basic.

Annex provides a short description of the keys and displays on the NP2035 operator unit!

2.1.1 Heading Control Operation

The HEADING CONTROL operating mode is activated by changing the control switch to **AUTO**.

The momentary heading of the ship is displayed in the heading display and in the preset heading display.

The preset heading preadjustment is set via the rotary knob. The heading controller begins with the change of heading within the range of the preset parameter values (such as, e.g. radius- or R.o.T. limit value) and the alarm threshold (heading failure, rudder limitation).

The heading reference - magnet compass or gyro compass - is selected via the operating unit. Compass value deviations are recognized.
An existing preset heading / heading deviation is taken into account when switching over. This results in a preset **heading adaptation**.

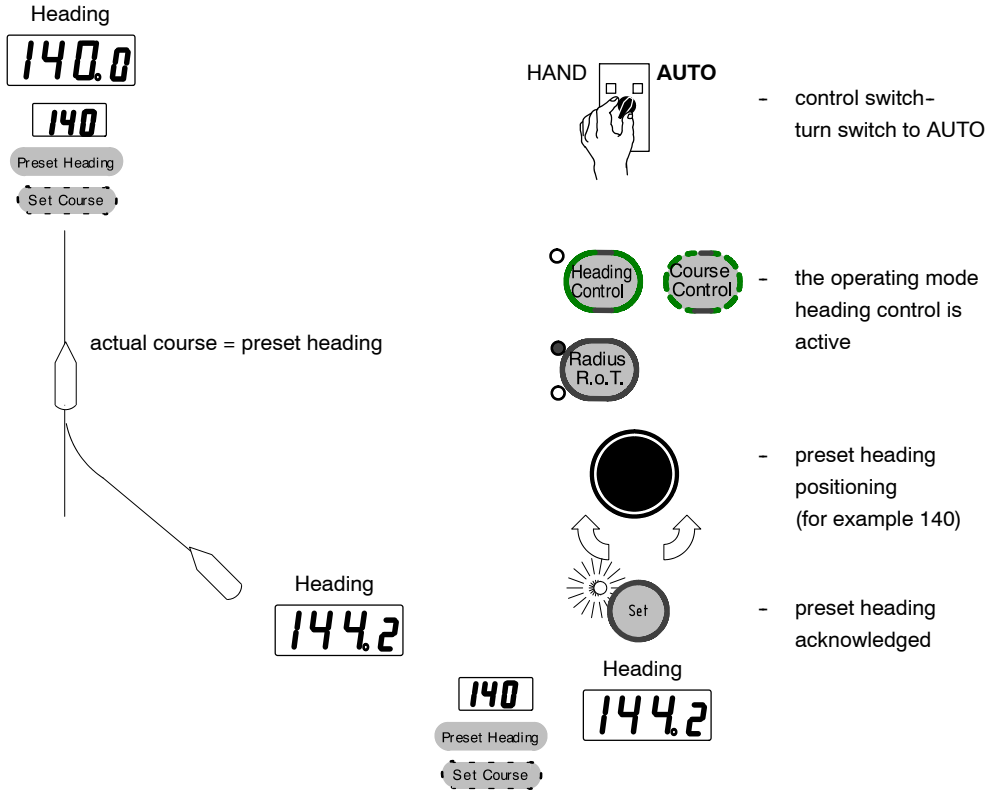


Fig. 1: Heading control after manual heading preadjustment

2.1.2 Parameter Yawing, Rudder and Cnt. Rudder

Parameter Setting in Basic function – Adaptivity is switched off

Yawing

The yawing setting determines rudder activity and course accuracy for the autopilot's control properties.

The optimum setting is obtained by means of observation.

Yawing = 1 signifies control with greatest amount of activity (maximum accuracy level).

Yawing = 6 signifies control with the lowest amount of activity (minimum accuracy level).

If the setting is not optimised the steering gear can become over-stressed. Large rudder angles cause loss of saeway.

Rudder

Each course deviation needs to be corrected by means of a rudder size typical to the ship. The rudder setting determines the ratio of rudder angle to course error.

Rudder too big:

- Unstable behavior => over-reacts to a course correction
  => Overshoots when course is changed

Rudder too small:

- Course control too inaccurate
  => preconfigured rotation speed not reached during course change manoeuvre

Cnt. Rudder

Based on its bulk and load, each ship has a time constant typical to the ship, which needs to be kept in control during course change manoeuvres.

Before the new set course is reached to the turning speed needs to be reduced in good time (e.g. of a counter rudder).

This effect is achieved by the counter rudder setting (Cnt.Rud).

Counter rudder too high:

The ship is stopped before it reaches the new set course.

Counter rudder too small:

The ship does not stop in good time and overshoots the pre-selected set course.

2.1.3 Heading preadjustment more than 180°

There are two different possibilities to adjust the heading preadjustment.

1.Preselected Heading

Heading adjustment und acknowledgement of the adjusted value by the Set-key. In this mode the ship follows the respective heading adjustment within a range of 0 to 359,9°. It means, there will be an all-around circle.

For example: Actual heading is 270°.

New heading will be 280°.

Direction of roation should be Port.

The new heading will be 280° after a around circle of 350° with a direction of rotation to port.

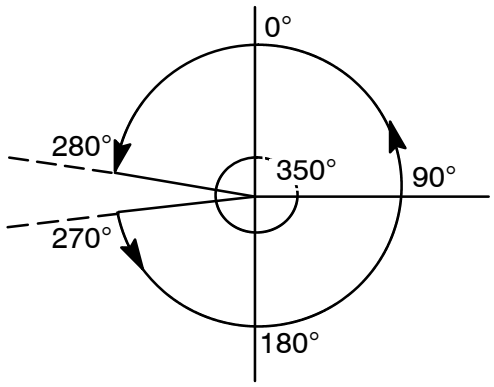


Fig. 2 Direction of rotation of the preselected heading

2. Direct heading

The rotary knob has to be pushed-in while the heading value is adjusted. In this mode the ship follows at once the new value and a change of heading can be more than an all-around circle.

Caution: In case of a malfunction, it means a heading-jump with an adaption to the new heading value, the initialized heading-change-maneuovre will be aborted.

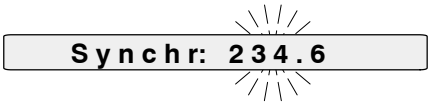
2.2 Explanation of Used Symbols

Key actuation

LED *flashing*

LED *out*

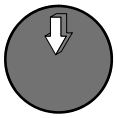
LED *alight*



Parameter indication flashing

Audible signal *on*

Audible signal *off*

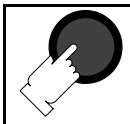


Rotary knob pressed

2.3 NP2035 – PASSIVE – (Steering Mode Selector in Position HAND)

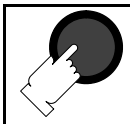
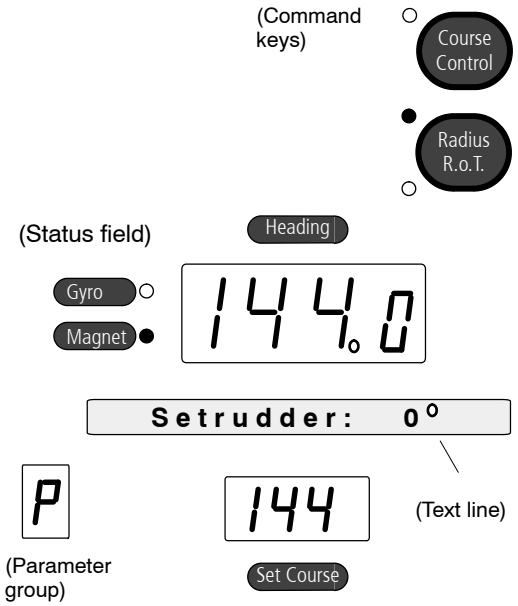
The NP2035 has been separated from the steering control system by means of the steering mode selector.

The operator unit now
- acts as a display unit for the actual heading
- indicates the connected sensors and their status
- permits various configuration adjustments via the function keys.

	Indications	Comment/Notes
1 Setting the steering mode selector to position HAND		
HAND 	(Status field) Heading Gyro ○ Magnet ● 144.0 Manual Steering P 144 (Text line) (Parameter group) Set Course	The current NP2035 operating mode is no longer valid. The functions of the command keys are cancelled. The set course (preset heading) is made to follow up the heading. The status of the heading sensor remains displayed. Within the text line, the status of the NP2035 equipment is permanently displayed. The last parameter group number remains indicated. Settings such as – parameter management – display management, or the – dimmability of the key and display illumination remain possible. Possible sensor failures (compass, log etc.) are signalized by flashing of the symbol key LED. Alarms are not indicated via the text line (no audible signalling).

2.4 NP2035 – ACTIVE – (Steering Mode Selector in Position AUTO)

The Autopilot NP2035 is connected to the steering control system via the steering mode selector switch.

	Indications	Comment/Notes
1 Setting the steering mode selector to position **AUTO**PILOT NP2035		
 AUTO		The NP2035 is automatically switched to operating mode COURSE CONTROL (Heading Control). The LED lights up. The last limit value adjustment for R.o.T. or radius is active. The current heading is adopted as set course presetting (preset heading). The heading sensor status is indicated. The last selected infotext appears in the text line with its current value.

2.5 Secondary Operator Units

Within an NP2035 system, several operator units may be managed. If there is no active disturbance (alarm that is not acknowledged), change-over between the operator units can be performed.

Change-over is made directly via the command keys of the operator unit concerned:

- In case of same operating mode, the set course preselection (preset heading) is maintained
- If the operating mode is changed, the set course (preset heading) is equated with the heading.

Passive operator units are in STANDBY.
STANDBY means;

- Indication of set course (preset heading) and heading
- Status indication of the heading sensor
- Indication of parameter group
- No possibility of adjustment via function keys
- Operator unit can be activated via a command key:

switches the operator unit to the operating mode of course control (heading control).

switches the operator unit to the operating mode of track control

switches the operator unit to the operating mode of R.o.T. control

Any active operator unit permits unrestricted system operation and parameter management.

NOTE

If the autopilot is activated via the steering mode selector switch, the main operator unit is always switched to the operating mode of **Course Control (Heading Control)**.

2.6 Operating Mode of Course Control (Heading Control)

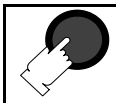
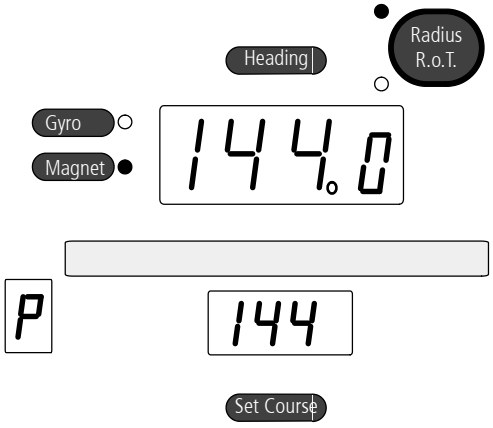
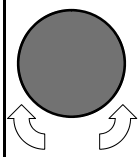
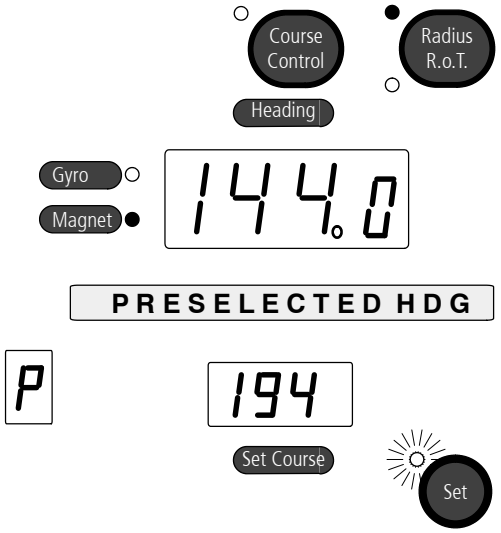
After being activated via the steering mode selector switch the Autopilot NP2035 is automatically switched to the operating mode of course control (heading control).
The set course (preset heading) equals the heading.

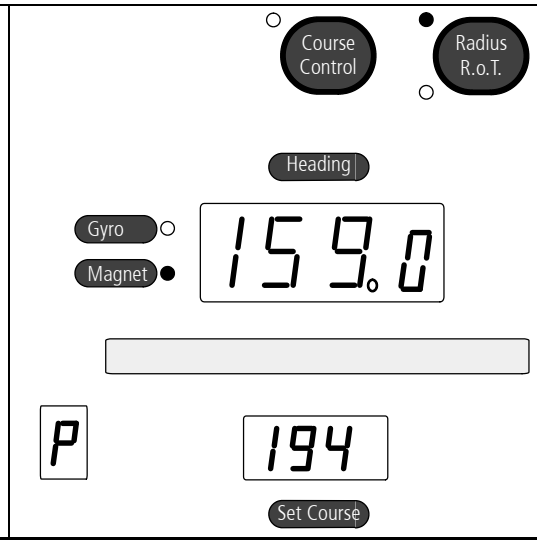
- Prepared set course (preset heading) change

  Pre-condition:

  - Steering mode selector in position **AUTO**

For heading preadjustments more than 180° see section 2.1.3

	Indications	Comment/Notes
1	Switching on the operating mode of course control (heading control)	
		The set course (preset heading) equals the heading. The last limit value adjustment for e.g. R.o.T. remains valid. The parameter adjustments remain valid. The ship is held on the set course (preset heading).
2	Set course (preset heading) preselection	
		Turning the rotary knob results in that the desired set course (preset heading) appears within the **Set Course** display. A comment appears within the text line (for approx. 15s). The previous text is overwritten for this period. The LED of the Set key is flashing. The new set course (preset heading) must be acknowledged within approx.15s. If not acknowledged, the previous set course (preset heading) value, which remains valid, re-appears on the Set Course display after 15 s.

	Indications	Comment/Notes
3 Acknowledging the set course (preset heading) preselection		
Set		The ship starts the heading change maneuver. The heading change maneuver is executed with regard to the limit value adjustment for R.o.T. (see Section 2.9.14). The heading change maneuver is completed as soon as the heading corresponds to the set course (preset heading) preselection.

2.6.1 Parameter Yawing, Rudder and Cnt. Rudder

While adjusting the parameter value a temporary parametergroup is created:
Yawing determines the Yawing variations and so the accuracy of heading control.
Rudder determines the proportionally amplification of the heading controler.
Cnt. Rudder determines the differential part of the heading controller with respective effect of meet of the helm.

2.6.2 Back-up Navigator Alarm

The Back-Up Navigator Alarm is only used for a separate signal unit. The signal unit must be linked with the Autopilot.
The Back-Up Navigator Alarm occurs:

- When a used sensor is off and this alarm is not acknowledged an the bridge units (e.g. Autopilot, Nautoalarm).
- When Track Control is aborted and is not acknowledged.
- When a message, which announces a track change manoeuvre is not acknowledged.
- When a message, which announces a track end is not acknowledged.

2.7 Operating Mode of Track Control

2.7.1 Definitions

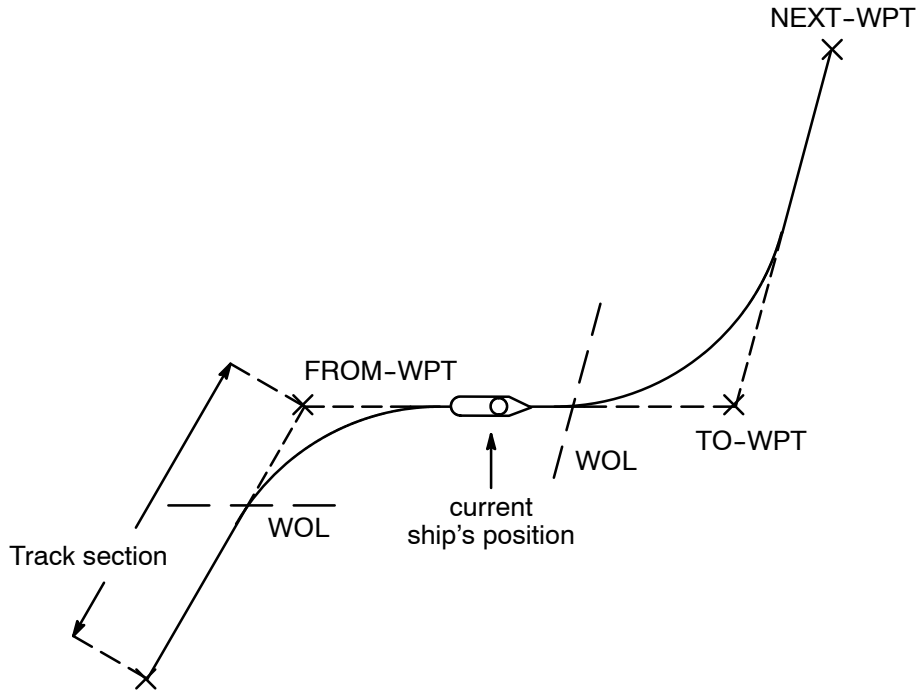


Fig. 3: Definitions

WPT	Waypoint
Track Section	A track section is the route between two WPT.
TO-WPT	Waypoint to be steered for, the WPT being considered as a "TO-WPT" as long as the associated track change maneuver is not terminated and the new track section has not been reached.
FROM-WPT	The "FROM-WPT" is the previous waypoint.
NEXT-WPT	The "NEXT-WPT" is the waypoint following the "TO-WPT".
WOL	Means wheel-over-line and is that line of the track where the planned track change maneuver is intended to start.
Approach-Time	The approach time is that time before the WOL when the approach message is indicated on the operator unit.
ECDIS	**E**lectronic **C**hart **D**isplay and **I**nformation **S**ystem: Track planning system; system where the the planning of the track and the input of the WPTs is performed.
ECS	Electronic Chart System
Control Parameters	Rudder Limit Rate of Turn (R.o.T.) Radius

2.7.2 Principle of Operation

The NP2035 is capable of storing up to 4 WPTs in its WPT memory. Before track control is started, WPTs are transmitted to the NP2035. This process is called initialization. Further WPTs are transmitted during track control from the ECDIS to the NP2035 after request of the NP2035. After initialization, the NP2035 is switched into the operating mode of track control and the ship turns in to the first track section.

Within a time of between 3 to 6 min before a track change maneuver starts, the operator's attention is drawn to the forthcoming track change maneuver by means of a message on the operator unit. The time can be selected on the ECDIS. This message is to be acknowledged by the operator. 30 s before the track change maneuver starts, the operator is requested by the operator unit to acknowledge the forthcoming track change.

At the end of the route, the operator's attention is drawn by an alarm to the track end, and he is requested to change over into the operating mode of course control (heading control).

After each switch-over from track control to course control (heading control) or R.o.T. control the NP2035 waypoint memory is erased. Before switching over to track control again, the NP2035 has to be initialized by the ECDIS again.

2.7.3 Pre-conditions for the Activation of Track Control

The activation of track control is only possible under the following conditions:

1. The NP2035 is in the operating mode of course control (heading control).
2. At least two WPTs are in the memory of the NP2035.
3. A valid position is supplied to the NP2035.
4. The NP2035 receives a valid status from the ECDIS.

Note:
In the normal case (except for defects), automatic read-in from the log is to be switched on for track control because of drift estimation (see Section 2.9.11).

2.7.4 Starting Track Control

Changing over to Track Control - General -

During the operating mode of track control, the adjusted control parameters can be viewed on the operator unit. As a matter of principle, in the operating mode of track control ”Radius” is active. On pressing the key ”Limits Values”, the presently valid radius can be indicated on the display (see Section 2.9.15). For track changes, the NP2035 takes the radius value transmitted from the ECDIS. This radius cannot be varied on the operator unit. This means that the value adjusted during course control (heading control) is overwritten! When changing manually back to course control (heading control), the old value is re-activated.

For the approaching maneuver (the way from the actual ships position to the pre-planned track) a radius can be planned at ECDIS. This radius will be transmitted to the NP2035. If there is no transmission of an approach radius from ECDIS to NP2035 an NP2035 default radius value will be taken. This radius is ships specific and is to be adjusted by the service engineer.

During track control, the rudder limit is automatically set to ”Max.” The value cannot be varied during track control. In case of manual change-over to course control (heading control), the old value is taken again.

Example:
The NP2035 is in the operating mode of course control (heading control), a radius of 0.800 NM is adjusted and ”Radius” is selected. The rudder limit is set to 10°. A route has been planned on the ECDIS, and the radius on the TO-WPT of the route has been planned to be 1.200 NM. The NP2035 has been initialized, the WPTs and the approach radius have been transmitted to the NP2035. The approach radius is set to 0.300NM. After change-over from course control (heading control) to track control and on actuating the key ”Limits Values”, the radius (0.300 NM) can be indicated. On calling-up ”Rudder Limit”, the information ”Max.” appears instead of the value 10°. After reaching the first track (message ”NEW TRACK ...°”), on indicating the radius, the NP2035 displays 1.200NM, i.e. the radius used for the next track change.

If the operating mode is changed back to course control (heading control) by actuation of the key ”Course Control”, the old value of 0.800 NM re-appears on pressing the key ”Limits Values”. On calling up ”Rudder Limit” ”10°” appears again. Now the values can be varied on the operator unit again.

A similar situation occurs, if ”R.o.T.” is selected during course control (heading control). On changing the operating mode from course control (heading control) to track control, change-over from ”R.o.T.” to ”Radius” is performed. The LED for ”R.o.T.” goes out, the LED for ”Radius” is alight. During track control, adjustment of ”R.o.T.” is not possible. ”R.o.T.” cannot be activated.

Example:
The NP2035 is in the operating mode of course control (heading control), a rate of turn of 15°/min. has been adjusted and ”R.o.T.” is active. The rudder limit is set to 10°. A route has been planned on the ECDIS. The NP2035 has been initialized, the WPTs and the approach radius have been transmitted to the NP2035. The approach radius is set to 0.300NM. On changing the operating mode from course control (heading control) to track control, the LED for ”R.o.T.” goes out, and the LED for ”Radius” lights up. On actuating the key ”Limits Values”, the radius (0.300 NM) can be indicated on the display. This value can not be varied, ”R.o.T.” cannot be selected. On calling-up ”Rudder Limit”, the information ”Max.” appears instead of the value 10°.

As soon as the operating mode is manually changed over from track control to course control (heading control) again, the LED for ”Radius” goes out and the LED for ”R.o.T.” lights up again. On calling-up the ”R.o.T.”, 15°/min appear again. The rudder limit is set to 10° again. The values can now be varied again.

The following Sections 2.7.4.1 and 2.7.4.2 describe two types of maneuvers for going to the planned track after starting track control.

The following Section 2.7.4.1 describes the GO-TO-WAYPOINT maneuvers which bring the vessel directly to the TO-WPT, i.e. to the beginning of the track section between TO-WPT and NEXT-WPT. The FROM-WPT is not required for this kind of maneuvers and remains undefined.

The Section 2.7.4.2 describes the GO-TO-TRACK maneuvers which bring the vessel to the track section between FROM-WPT and TO-WPT.

It depends on the ECDIS which of these two types is used.

2.7.4.1 Changing over to Track Control, GO-TO-WAYPOINT Maneuver (with FROM-WPT undefined)

(See Fig. 4 and Fig. 5).

	Indications	Comment/Notes
1 Switch on track control		
Track Control	**Go To Waypoint** three pulses Set	The pulses are repeated every 90s.
2 Acknowledge the track course preselection on the NP2035		
Set	**Chk Track Data** Track Control	Acknowledge track course by pressing the “Set” key, the switching-over procedure to track control is started. The NP2035 track controller will check the geometrical constellation of ships position and the track. If the geometrical constellation of the ship’s position, heading and planned track makes it impossible to reach the track, a warning (see Section 2.10.3, page 64) appears for 15s on the operator unit and the NP2035 doesn’t switch over to track control. If the check is passed and the geometrical constellation admits to switch over to track control, track control is activated.

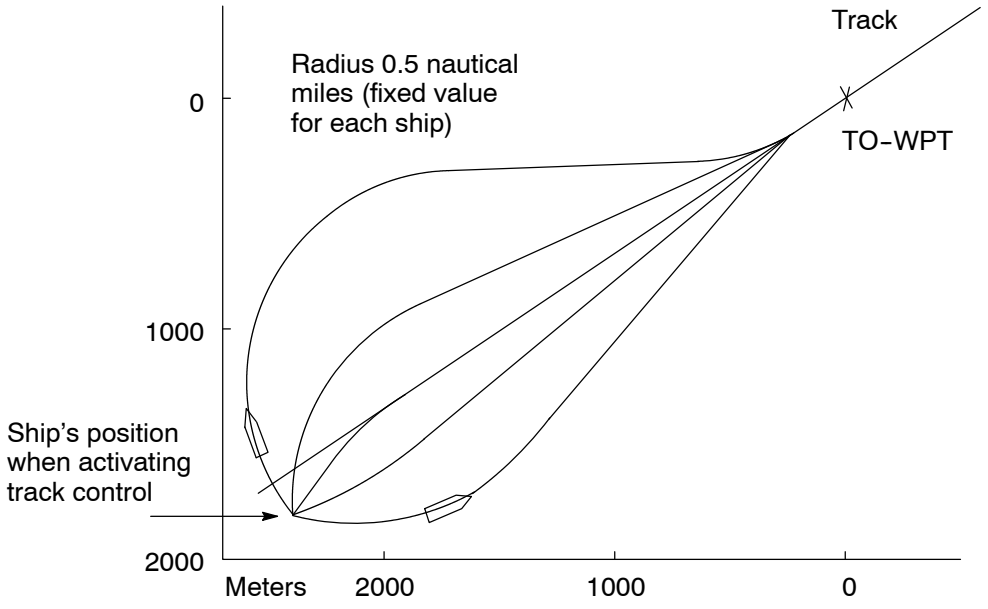
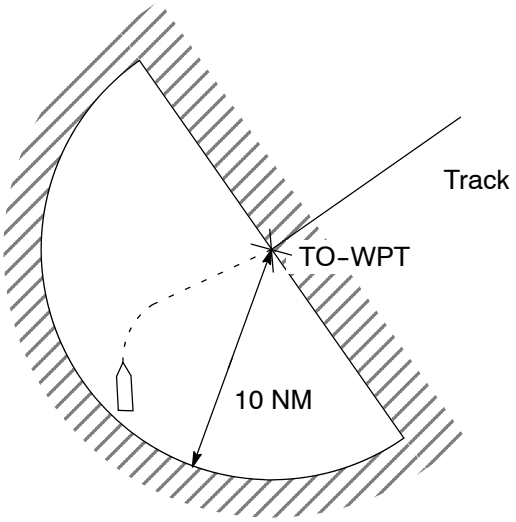


Fig. 4: Example of Five Different GO-TO-WAYPOINT Maneuvers depending on

the Initial Heading

A) The **initial position** must be ”before” the track and less than 10 nautical miles away



B) The **initial heading** must be between track course minus 45° and track course plus 135° if starting from the PORT side of the track and between track course minus 135° and track course plus 45° if starting from the STB side of the track

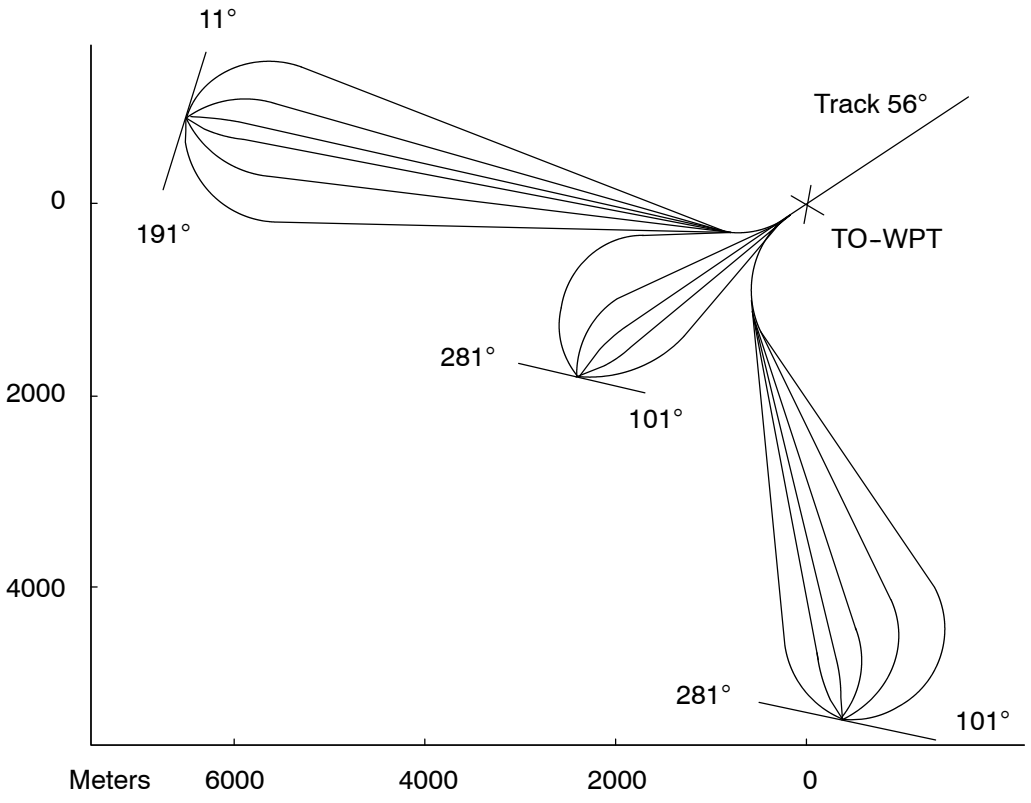
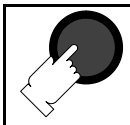
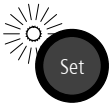


Fig. 5: Geometrical Requirements of GO-TO-WAYPOINT Maneuvers

2.7.4.2 Changing over to Track Control - with FROM-WPT defined by the ECDIS (GO-TO-TRACK Maneuver)

Dependent on the use of the ECDIS, it is also possible to define a FROM-WPT on the ECDIS and to transmit it to the NP2035. Approaching a track is then performed like resuming track control after an interruption.

	Indications	Comment/Notes
1 Switch on track control		
	**New Track 070°**  three pulses 	The pulses are repeated every 90s.
2 Acknowledge the track course preselection on the NP2035		
	**Chk Track Data** 	Acknowledge track course by pressing the “Set” key, the switching-over procedure to track control is started. The NP2035 track controller will check the geometrical constellation of ships position and the track. If the geometrical constellation of the ship’s position, heading and planned track makes it impossible to reach the track, a warning (see Section 2.10.3, page 64) appears for 15s on the operator unit and the NP2035 doesn’t switch over to track control. If the check is passed and the geometrical constellation admits to switch over to track control, track control is activated.

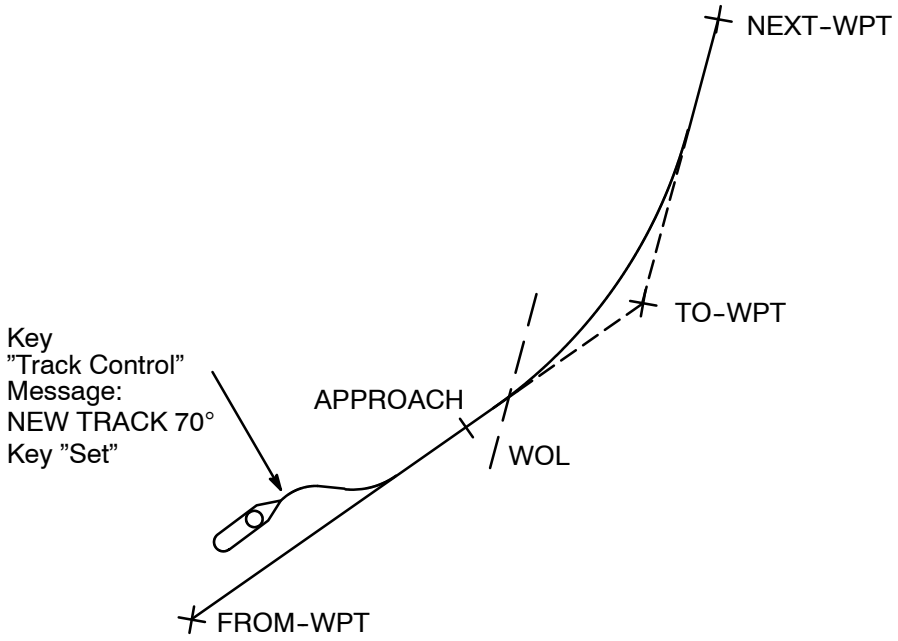


Fig. 6: Changing over to Track Control - on transmitting a FROM-WPT by the ECDIS

NOTE !
In case of failure of the ECDIS during track control, automatic change-over from track control to course control (heading control) takes place. In that situation the response of the NP2035 is different. It is described under "No or Invalid Status from ECDIS" (see Section 2.7.9.3).

2.7.5 Track Change Maneuver

(See Fig. 7).

> **Attention!**
> The track change maneuvers are planned and checked on the ECDIS. No check within the NP2035 takes place. A limitation, however, is incorporated.
> **If a non-realizable small radius is transmitted to the NP2035, this may lead to hard-over rudder positions!**

On planning the routes, attention is to be paid to the fact that from the end of the radius of a track change maneuver to the beginning of the radius of the next track change maneuver at least 350 m are to be planned. This distance is required to bring the ship to the necessary rate of turn. The minimum distance between both radii depends on the vessels maneuverability.

If this is not the case, the result may be that the planned radii cannot be realized. This will be signalized on the operator unit by the error message ”Track CTL Impos.” (track control impossible) and a continuous audible alarm (see Section 2.7.9.4).

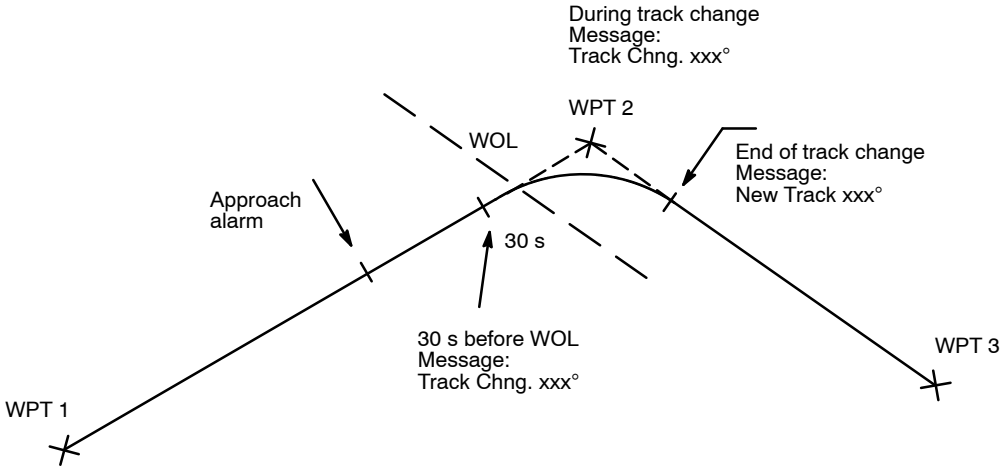
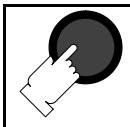
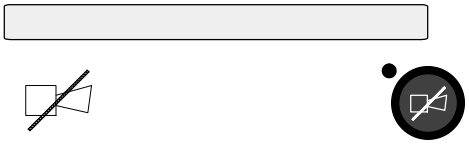
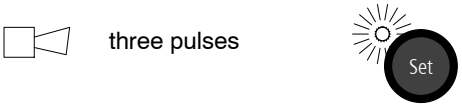
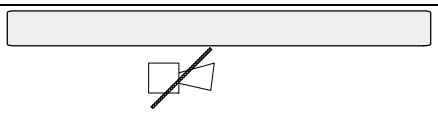


Fig. 7: Procedure of the Track Change Maneuver (Example)

Procedure of the Track Change Maneuver

	Indications	Comment/Notes
1	Alarm	
	App. To-Waypoint 	Between 3 and 6 min. before the WOL. The approach time is transmitted from the ECDIS to the NP2035. The value defined by the NP2035 when the NP2035 is initialized, set to 6 min. and must be varied from the ECDIS, if a variation is wanted by the operator.
2	Acknowledge the alarm	
		
3	Message	
	Track Chng. xxx°  three pulses Set	30s before the track change maneuver is started.
4	Acknowledge the warning	
 Set		
5	Track change maneuver starting	
	Track Chng. xxx° one pulse	Indication when track change maneuver is starting.
6	Approach maneuver to new track ended	
	End of Appr.Man. New Track xxx° one pulse	As soon as the ship has reached the new track section.

Note:
If the WPTs are very close together and if a long APPROACH time has been adjusted, it may happen that the APPROACH alarm of the following WPT appears already during the current track change maneuver:

	Indications	Comment/Notes
1 Alarm		
	App. Next-WPT	
2 Acknowledge the alarm		

Note:
If more than two WPTs are planned close together, it may be that the approach time for the NEXT-WPT remains below the value of the adjusted approach time. ”Close together” means here that the distance of two successive radii is smaller than the adjusted approach time ∗ ship’s speed.

Extreme case:

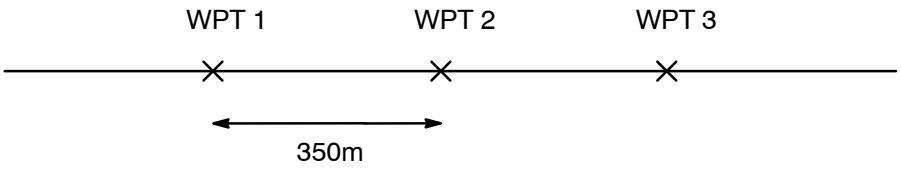


Fig. 8: Extreme Case Example of a Track Change Maneuver

Attention is here to be paid to that the minimum distance of between two successive radii has been defined to be 350 m and that, therefore, with a speed of approx. 20 kn the shortest approach time time that may occur in this most unfavorable case is still approx. 70s.

2.7.6 Interruption of Track Control

Interruption of track control is possible as follows:

- Change-over of the operating mode of track control to course control (heading control) on the operator unit of the NP2035.
- Change-over of the operating mode of track control to manual control by changing over the operating mode on the steering mode selector.
- Activating the override tiller

- If the ECDIS fails, track control is automatically changed to course control (heading control). For more details on this case, refer to ”No or Invalid Status from ECDIS” (see Section 2.7.9.3).

Re-approaching the Track is the same procedure as starting a new track !

2.7.7 Changing TO-WPT and NEXT-WPT without Interrupting Track Control

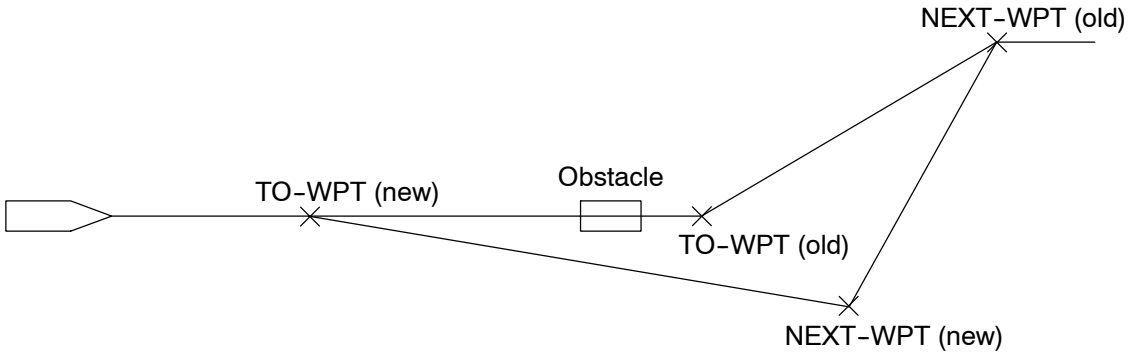


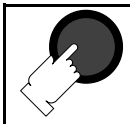
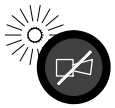
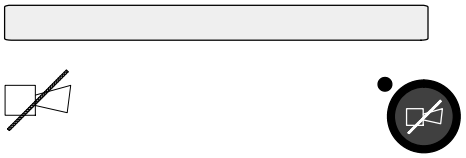
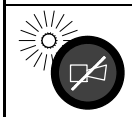
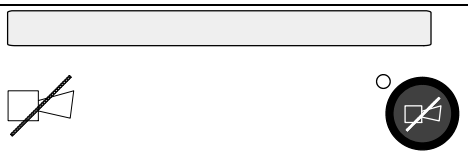
Fig. 9: Changing TO-WPT and NEXT-WPT without Interrupting Track Control

NP2035 permits changing TO-WPT and NEXT-WPT without interrupting track control, if the track planning system (ECDIS) already supports this feature.

Consult your ECDIS manuals for further operating instructions on how to change the waypoints of the active route.

2.7.8 End of Track Control

Via marking the last track point at the ECDIS, the track controller recognizes the end of a track.

	Indications	Comment/Notes
1 Alarm		
	Track End xx Min 	xx minutes left to the last track point.
2 Acknowledge the alarm		
		
3 Alarm		
	Track End Passed **Selec.Headg.Ctrl** 	Last track point reached.
4 Acknowledge the alarm		
		The alarm comes up every 30 s until having changed-over to another operating mode, e.g. heading control or manual control.

Attention:
Before change-over is performed, the ship continues moving along the extended track with the operating mode “Track Control”!

2.7.9 Error Considerations

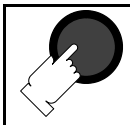
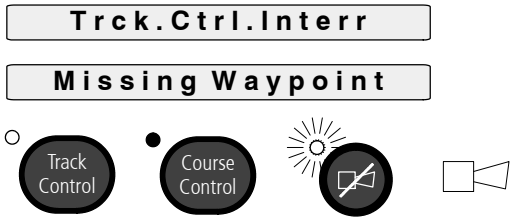
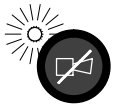
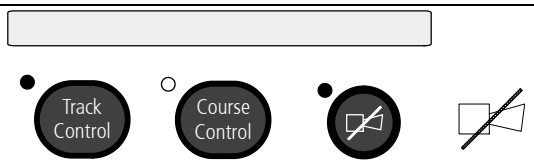
- Missing Waypoint
- No Position
- No or invalid Status
- Track Control Impossible

ATTENTION:
If an error occurs during track control, the operating mode changes from track control to course control (heading control).
As opposed to manual change-over from track control to course control (heading control), the setting of the maneuver parameters is here maintained as under track control. I. e.:

- In any case, the radius setting is maintained. The radius planned for the next track change maneuver is maintained as value.
- **The rudder limit remains at Max.**

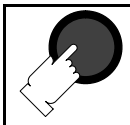
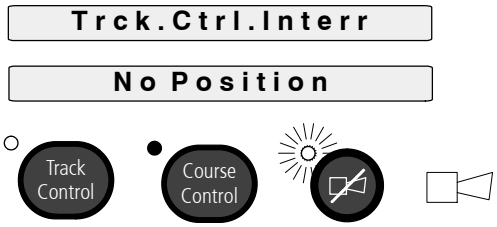
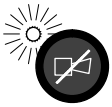
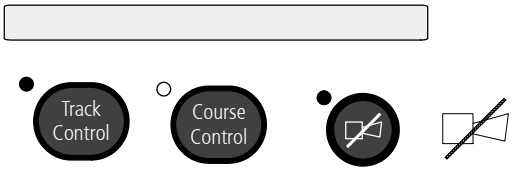
2.7.9.1 Missing Waypoint

Should disturbances occur on the interface between ECDIS and NP2035, and the NP2035 does not receive WPTs, this will be indicated on the operator unit at the end of the track change maneuver. The following alarm appears on the display:

	Indications	Comment/Notes
1 Alarm		
		
2 Acknowledge the alarm		
		The operating mode changes from track control to course control (heading control). The track course of this track section is taken as the new set course (preset heading). As opposed to manual change-over from track control to course control (heading control), the setting of the maneuver parameters is here maintained as under track control. I. e.: - In any case, the radius setting is maintained. The radius planned for the next track change maneuver is maintained as value. - **The rudder limit remains at Max.**

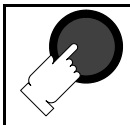
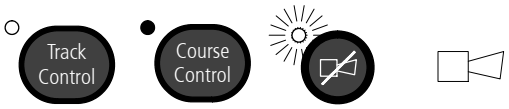
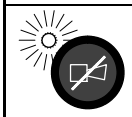
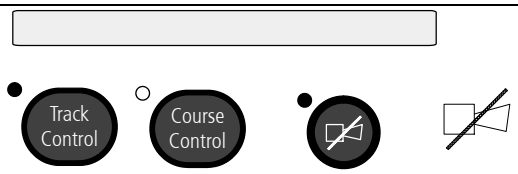
2.7.9.2 No Position

The NP2035 monitors the position interface. In the normal case, the position is transmitted to the NP2035 once per second. Should the position fail to come in for longer than 5s, the following alarm appears on the display:

	Indications	Comment/Notes
1 Alarm		
		
2 Acknowledge the alarm		
		The operating mode changes from track control to course control (heading control). If the ship is at this moment on a track section and not in a track change maneuver, the track course of this track section is taken as the new set course (preset heading). As opposed to manual change-over from track control to course control (heading control), the setting of the maneuver parameters is here maintained as under track control. I. e.: - In any case, the radius setting is maintained. The radius planned for the next track change maneuver is maintained as value. - **The rudder limit remains at Max.** If during automatic change-over from track control to course control (heading control) - the ship is in a track change maneuver, the track course of the next track section is taken as the new set course (preset heading). The radius planned for the current track change maneuver is taken as maneuver parameter.

2.7.9.3 No or Invalid Status from ECDIS

The NP2035 monitors the incoming status of the ECDIS. Should the status fail or be provided with the information that the ECDIS is not ready for operation, one of the following alarms appears on the display:

	Indications	Comment/Notes
1 Alarm		
	Trck.Ctrl.Interr **No ECS Status** or **ECS Not Ready** 	
2 Acknowledge the alarm		
		The operating mode changes from track control to course control (heading control). If the ship is at this moment on a track section and not in a track change maneuver, the track course of this track section is taken as the new set course (preset heading). As opposed to manual change-over from track control to course control (heading control), the setting of the maneuver parameters is here maintained as under track control. I. e.: - In any case, the radius setting is maintained. The radius planned for the next track change maneuver is maintained as value. - **The rudder limit remains at Max.** If during automatic change-over from track control to course control (heading control) - the ship is in a track change maneuver, the track course of the next track section is taken as the new set course (preset heading). The radius planned for the current track change maneuver is taken as maneuver parameter.

2.7.9.4 Track Control Impossible

1. On activating track control (SeeFig. 10 and Fig. 11)

– If the ship – when the track control is activated – is already too close to the TO–WPT and, for geometrical reasons, the intended maneuver can not be realized any more.

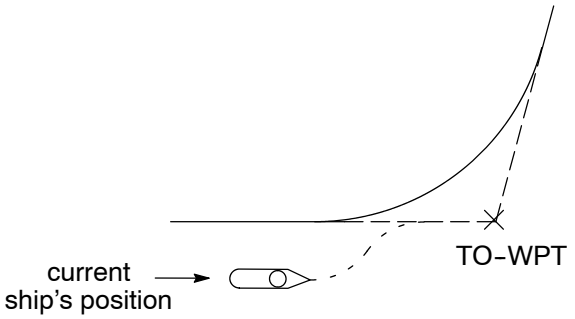


Fig. 10: Intended GO–TO–TRACK Maneuver Impossible with the Ship too Close to the TO–WPT

– If – when the track control is activated – the distance of the current ship's position to the track is greater than the distance between FROM–WPT and TO–WPT or greater than 10 nautical miles.

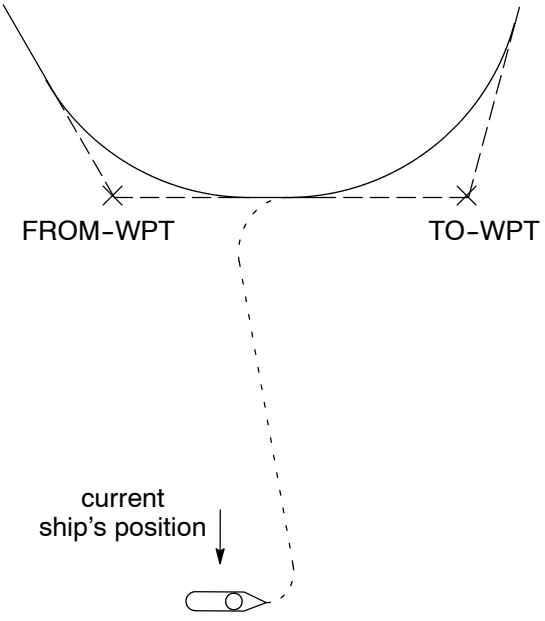
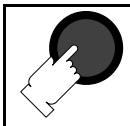
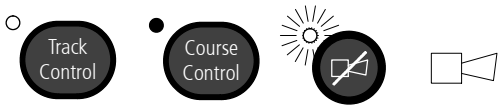
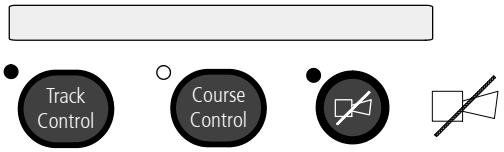


Fig. 11: Track Control Impossible with the Distance to the Track too Large

The following warning appears on the operator unit:

	Indications	Comment/Notes
	Trck.Too Far Awy	

2. During a long active voyage in the operating mode of track control
   The NP2035 received WPTs whose radii are closer together than 350m or the difference of the track courses is >135°.

	Indications	Comment/Notes
1 Alarm		
	Trck.Ctrl. Interr **Dist.TO/NEXT-Wpt** or **Trck.Ctrl. Interr** **Chng.Ang.Too Big** 	
2 Acknowledge the alarm		
		The operating mode changes from track control to course control (heading control). The track course becomes set course (preset heading). As opposed to manual change-over from track control to course control, the setting of the maneuver parameters is here maintained as under track control. I. e.: - In any case, the radius setting is maintained. The radius planned for the next track change maneuver is maintained as value. - **The rudder limit remains at Max.** If during automatic change-over from track control to course control (heading control) - the ship is in a track change maneuver, the track course of the next track section is taken as the new set course (preset heading). The radius planned for the current track change maneuver is taken as maneuver parameter.

2.8 Operating Mode of Rate-of-Turn Control

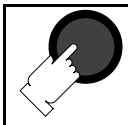
The operating mode requires an external R.o.T. tiller. The desired rate of turn is preset by the tiller, and the ship's rate of turn is controlled via the NP2035.

The desired rate of turn depends

- on the initial turning behaviour of the ship
- and on the adjusted parameters.

When the ship starts turning, the rate of turn may be increased up to approx. 50%!

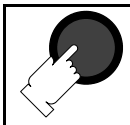
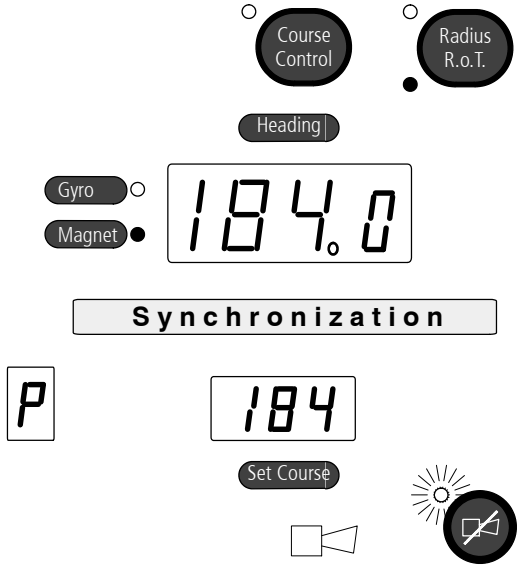
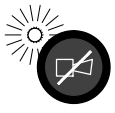
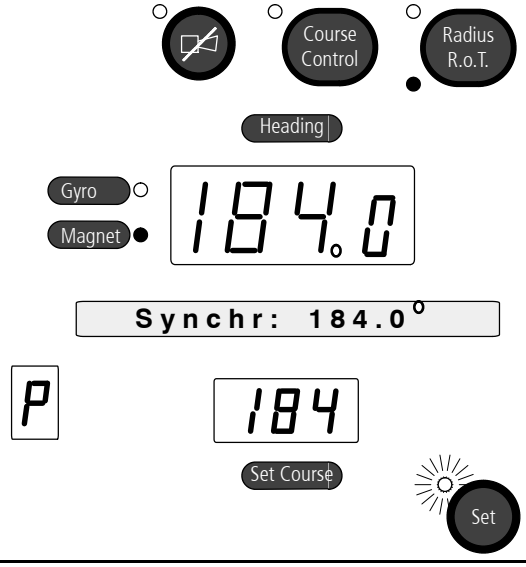
Caution!
Turning behaviour with preset rudder limitation:
If the adjusted rate of turn is not reached due to rudder limitation, the rudder limitation is to be extended only step by step (steps of < 5°). Otherwise, the rate of turn might considerably be exceeded because of the integral component of the controller.

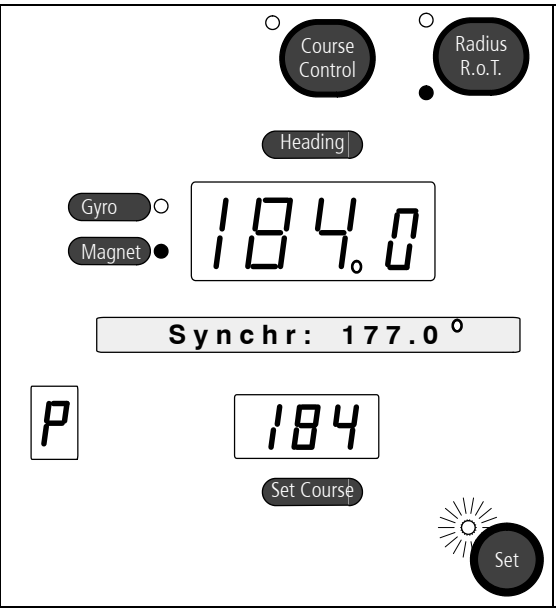
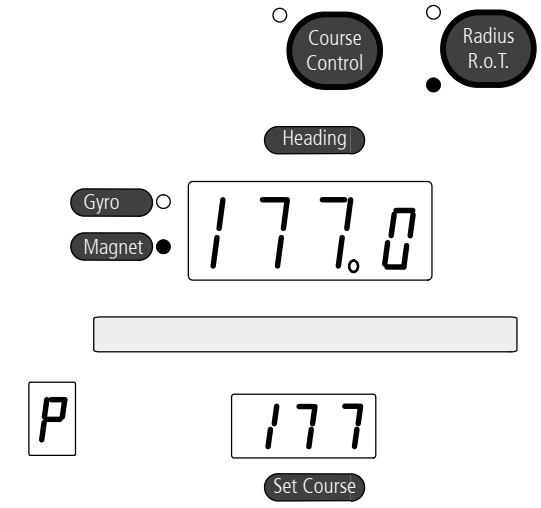
	Indications	Comment/Notes
1 Selecting the R.o.T. tiller		
● R.o.T. Tiller	○ R.o.T. Tiller	The limit-value adjustment (radius or R.o.T.) is now no longer active. The other parameter settings remain valid.
2 Adjusting the R.o.T. tiller		
	○ R.o.T. Tiller	The tiller adjustment (e.g. Port 10°/min) becomes immediately effective. The ship turns with a rate of 10°/min . The operating mode can be varied at any time by actuating a command key.

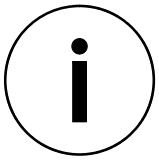
2.9 Operation and Operation Monitoring

2.9.1 Automatic Synchronization of the Gyro Compass Heading

In case of a system start or disturbance (e.g. compass defective or voltage failure), the NP2035 checks the type of compass transmission.
If exclusively fine shaft transmission is recognized (only in conjunction with a heading PCB), the dialogue is as follows.

	Indication	Comment/Notes
1	Automatic request for synchronization (manual request see Section 2.9.2)	
		The last heading is indicated and executed (heading equal to set course (preset heading)). Audible signal is heard continuously. The flashing LED signalizes an alarm message (Synchronization Alarm) and requests acknowledgement.
2	Synchronizing NP2035	
		The last heading is offered as new synchronization value. The flashing LED indicates the data take-over to be acknowledged.

	Indications	Comment/Notes
3 Adjusting a new compass value		
 or 		By actuation of the keys, the current compass heading can be adjusted (e.g. 177°). The set course (preset heading) and heading are adjusted equally to ensure that the heading difference remains constant during the synchronization procedure. The flashing LED indicates the data take-over to be acknowledged.
4 Acknowledging the new compass value		
		

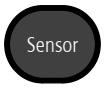
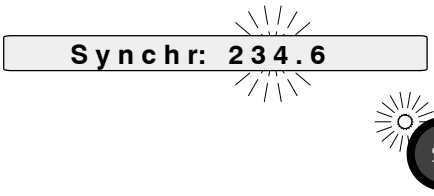
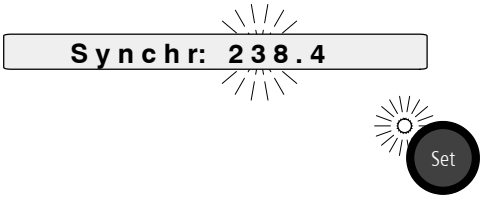
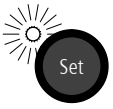
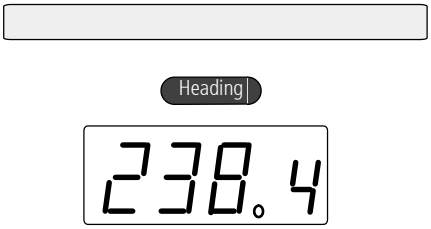


Prior to any departure, check coincidence of heading and compass reading!

2.9.2 Manual Synchronization of Gyro Compass Heading

The synchronization is only required with missing coarse shaft transmission (via the course PCB in systems without STANDARD 20).

Due to, e.g. a power breakdown, synchronization trouble can occur during transmission of the gyro compass heading to the autopilot. The NP2035 senses this condition during a system start (the **Synchronization** alarm is triggered).

	Indications	Comment/Notes
1 Calling up parameter (possible with exclusive fine shaft transmission only)		
		By actuating the key, the current heading value appears. The flashing LED of the key requests acknowledgement.
2 Varying the synchronization value		
		The synchronization value is read off from the gyro compass, e.g. 238.4. By actuating the key, the value has to be adjusted. The flashing LED requests acknowledgement.
3 Acknowledging the synchronization value		
		The text indication disappears. The actual heading corresponds to that of the gyro compass display.

2.9.3 Set Course (Preset Heading) Input

The knob is used exclusively for adjusting the set course (preset heading).

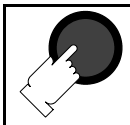
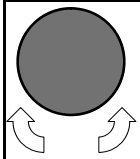
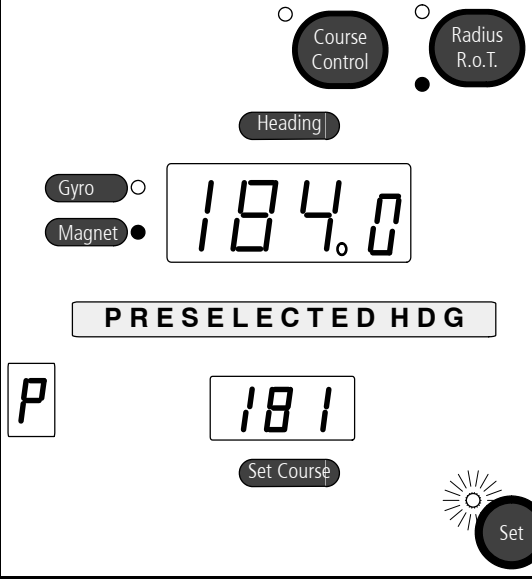
The rotary knob has a loose adjusting range for fine adjustment and a springy stop for port and starboard. If the rotary knob is turned to a springy stop, the result will be a fast change of values of the set course (preset heading) presetting.

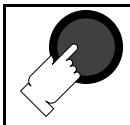
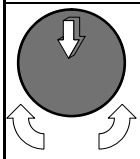
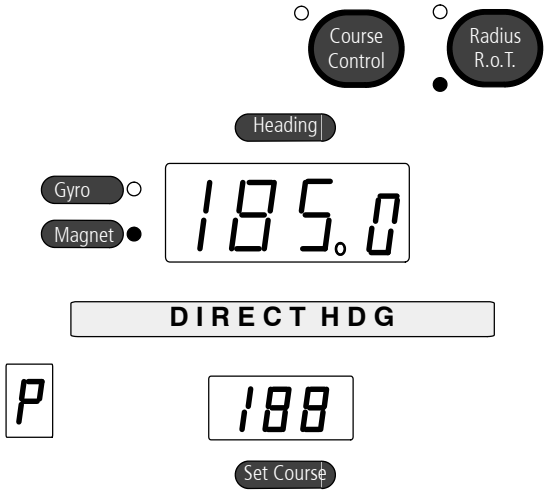
The rotary knob can be used during the operating mode course control (heading control) and track control.
The knob can be used in two different ways:

- turning the knob (set course input) or
- turning the knob and simultaneously pressing the knob (direct set course (preset heading) input).

NOTE

Direct set course (preset heading) input interrupts track control !

	Indications	Comment/Notes
Set course (preset heading) input		
		Enter the new set course (preset heading). The previous preset heading remains valid until the Set key is pressed. If the Set key is not pressed, the new preset heading is deleted after 15 s and the previous preset heading value appears on the display. The new preset heading preselection is only accepted and carried out when the key is pressed.

	Indications	Comment/Notes
Direct set course (preset heading) input		
		Operation mode course control (heading control). Press and turn the knob. The new set course (preset heading) is already accepted while the knob is being turned and the heading change maneuver is initiated. Acknowledgement with the set key is not required. Attention: depending on the configuration of the NP2035, R.o.T or Radius is active: Configuration setting **Maneuver No** has been selected. Selected navigation parameter Radius or R.o.T. is active. Configuration setting **Maneuver Yes** has been selected. The selected navigation parameter is not active, the ships turn with an R.o.T. of up to 120°/min. In case of an preselected R.o.T. value >120°/min, the presetting remains valid (unchanged). Attention: the rudder limitation remains active! The configuration setting can be checked, refer to Service Manual, Section 1.

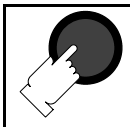
2.9.4 Change-over between the Parameters Radius and R.o.T. for the Heading Change Maneuver

The change-over takes place via a double-function key:

- **R**ate **o**f **T**urn determines the maximum rate of turn (°/min), by which a heading change maneuver is performed. Entry of parameter value see Section 2.9.14.
- **Radius** determines the turning circle radius by which a heading change maneuver is performed. Entry of parameter value see Section 2.9.15.

Note

During a heading change maneuver, do not change the R.o.T/Radius adjustment! Very different R.o.T. and Radius values can result in severe changes in the turning behavior of the ship !

	Indications	Comment/Notes
1 Change-over, e.g. from R.o.T. to Radius		
		The next heading change is executed via a preset turning circle radius.

2.9.5 Selecting the Steering Quality (Economy/Precision or Basic)

Selection between operation mode Economy/Precision and Basic can be made before or during the journey:

Precision

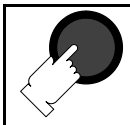
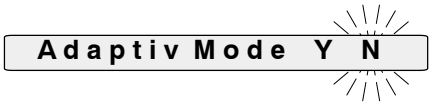
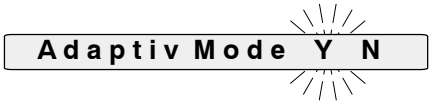
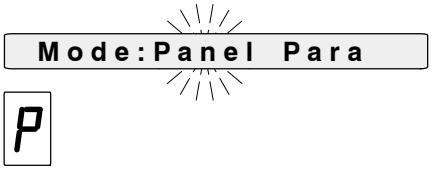
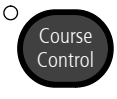
The NP2035 attempts to hold to the preset heading (set course) as exactly as possible.

Economy

The NP2035 adapts automatically to the current weather conditions.

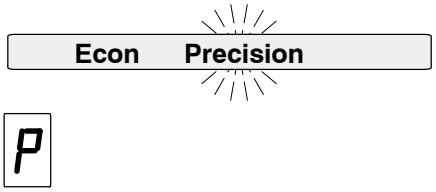
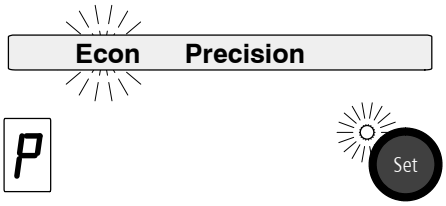
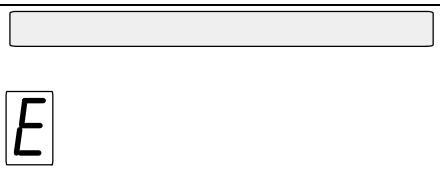
Basic

The adaptivity of the autopilot is switched off.

	Indications	Comment/Notes
1 Calling up the Configuration Selection Menu		
		Press both keys for approx. 4s simultaneously. The following request is displayed on the text line: Y ⇒ ***ECONOMY / PRECISION*** N ⇒ ***BASIC*** Note: The configuration selection menu is immediately quit by pressing a function or command key. Changes in the configuration are not accepted.
2 Selecting the Desired Quality		
		The setting changes from N to Y. The current setting flashes on the cursor.
3 Acknowledging the Desired Quality		
		The display shows the current steering quality after acknowledgment: P ⇒ ***PRECISION*** In the text line the following request appears: Panel ⇒ Change configuration of the operator unit Para ⇒ Change configuration of the system
4 Quit Configuration Selection		
		Quit configuration selection by pressing a function or command key, e.g. COURSE CONTROL (Heading Control). A RESTART of the operator unit is performed automatically.

2.9.6 Change-over between Steering Quality Economy and Precision

Requirement: The Adaptive Mode has been selected as in Section 2.9.5.

	Indications	Comment/Notes
1 Display		
		The display shows the active steering quality.
2 Change-over the Steering Quality		
		You can change-over the steering quality by pressing the key. The flashing LED on the key requests you to acknowledge the setting.
3 Confirming the new steering quality		
		The steering quality Economy is activated.

2.9.7 Entering/Checking the Parameters Yawing, Rudder, Counter Rudder

The parameter management is depending on the steering quality (Economy, Precision or Basic).

Precision

The NP2035 attempts to hold to the preset heading (set course) as exactly as possible.

The key Parameter allows to modify the values of the parameters Yawing, Rudder and Counter Rudder.

The key Control Preset allows to change-over to operation mode Economy.

Economy

The NP2035 adapts automatically to the current weather conditions. This is a gradual process, and not abrupt.

The values of the parameters Yawing, Rudder and Counter Rudder can not be modified.

The key Control Preset allows to change-over to operation mode Precision.

Basic

The adaptivity of the autopilot is switched off.

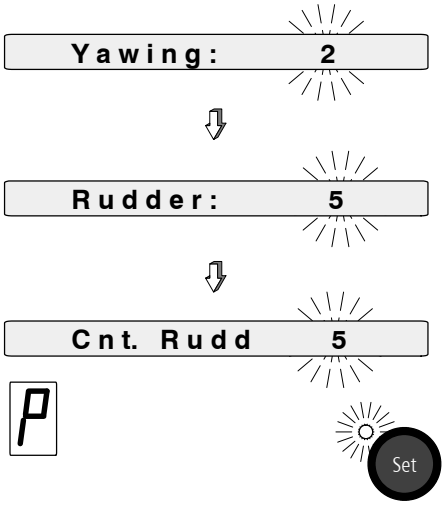
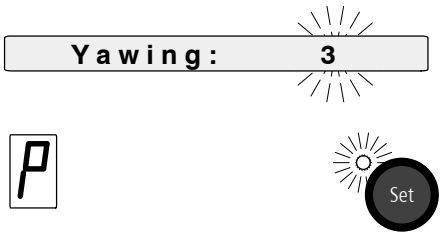
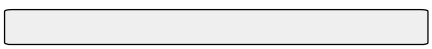
Up to 6 parameter groups can be created and stored. Depending on the present sailing area or the actual weather conditions the corresponding parameter group can be called up and loaded. The parameter values of the loaded group can be individually altered depending on the situation. This altered set of parameters is, however, not permanently loaded into the parameter memory.

The key Parameter is used to open and modify a temporary or a stored parameter group.

The key Control Preset allows selection of a stored parameter group (1 ... 6).

2.9.7.1 Steering Quality Precision - Changing Parameters

Parameter values Yawing, Rudder, Counter Rudder can be pre-set.

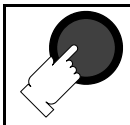
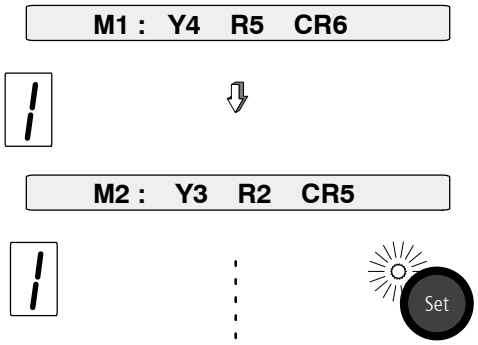
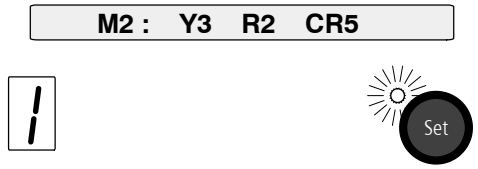
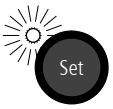
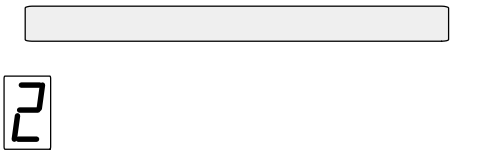
	Indications	Comment/Notes
1 Calling up parameter		
  		The example shows the default values preset at the works.
2 Varying one or more parameter value		
 or 		On actuating one of the keys, a new value appears. The flashing LED of the key requests acknowledgement. If desired, the next parameter, as shown in Point 1, can be called up and varied.
3 Accepting the parameter value		
		The new value is accepted.

2.9.7.2 Steering Quality Basic – Defining and Storing a Parameter Group

Actually not implemented!

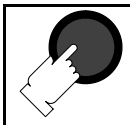
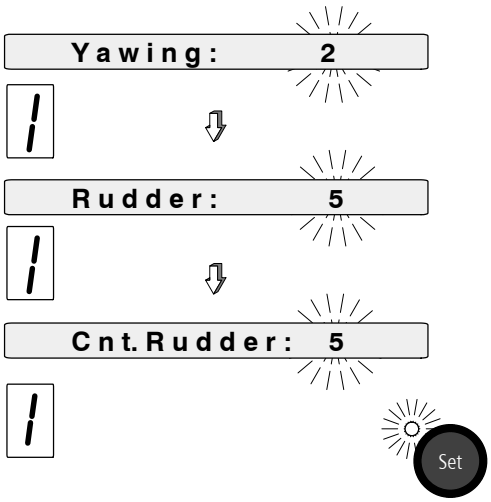
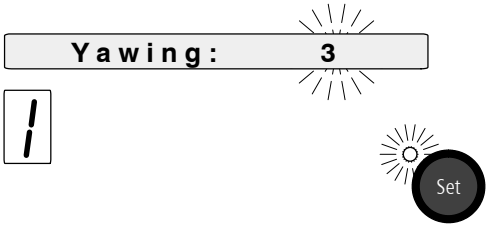
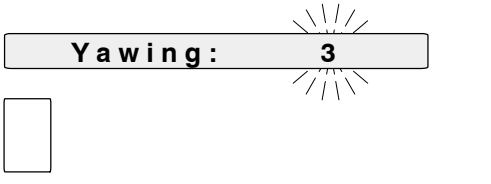
intentionally left blank

2.9.7.3 Steering Quality Basic - Calling-up and Loading Stored Parameter Groups

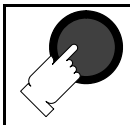
	Indications	Comment/Notes
1 Screening the parameter group		
 		By actuating the key, e.g. this set of parameters is adjusted. The corresponding parameter group number is indicated.
2 Calling up parameter group 2		
		Actuate the key until the group appears in the text line.
3 Loading parameter group 2 for operation		
		NP2035 executes course control (heading control) with parameter group 2.

2.9.7.4 Steering Quality Basic – Temporary Change of Loaded Parameters

Loaded parameter groups can be temporarily changed. Temporary changes are not stored. On calling up another parameter group, the temporary changes are deleted.

	Indications	Comment/Notes
1 Calling up parameter		
 Parameter  Parameter  Parameter		Parameter group 1 is loaded. On actuating the key, the parameters appear (example).
2 Changing one or more parameter values		
 or 		On actuating one of the keys, a new value appears. The flashing LED of the key requests acknowledgement. If desired, the next parameter, as shown in Point 1, can be called up and varied.
3 Taking over parameter value		
 Set		The new value is taken over. The parameter group number is extinguished. NP2035 executes course control (heading control) with the new parameters. On calling up another parameter group, the temporary changes are deleted.

2.9.8 Screening Sensors

	Indications	Comment/Notes
1 Screening sensors		
Sensor	Mag Gyro: 144.2°	By repeated key depression, the next text line appears.
Sensor	Man: 17.2 kts sel	
Sensor	Log: 12.7 kts	This text line is shown only when a log sensor is available.
Sensor	Synchr: 234.6°	This text line will be indicated with fine shaft transmission only (see Section 2.9.1).
Set		The flashing LED requests acknowledgement.

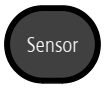
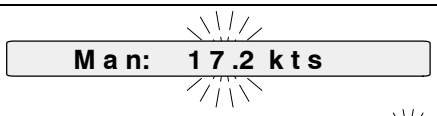
2.9.9 Selecting the Heading Sensor (Magnet/Gyro)

	Indications	Comment/Notes
1 Calling up heading sensor		
Sensor	Gyro ● Magnet ○ Mag Gyro: 144.2° Set	The lettering of the active heading sensor (**Mag**) is flashing. The flashing LED requests acknowledgement.
2 Changing the heading sensor		
	Gyro ● Magnet ○ Mag Gyro: 146.4° Set	The lettering for gyro compass (**Gyro**) is flashing. The flashing LED of the key requests acknowledgement.
3 Selecting the heading sensor		
Set	Gyro ○ Magnet ● (empty)	On actuating the key, the heading sensor is selected. The text indication disappears.

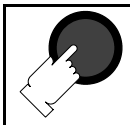
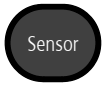
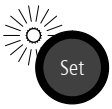
Operating mode of COURSE CONTROL (Heading Control)
If the magnetic compass values and gyro compass values are different, switching-over to the compass difference results in a set course (preset heading) adaptation.
Possible heading differences between set course (preset heading) and heading remain in existence.

2.9.10 Change-over to Manual Speed Input and Manual Entering of Ship's Speed

The manually entered ship's speed must correspond to the current speed, otherwise the control quality can be seriously impaired!

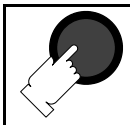
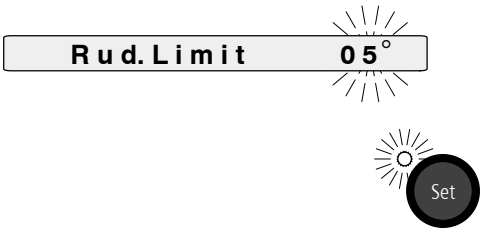
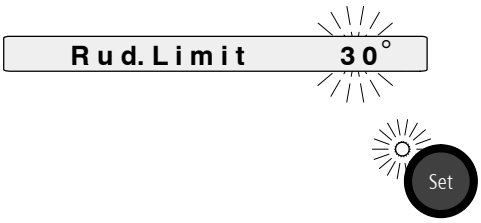
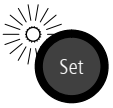
	Indications	Comment/Notes
1 Calling up parameter		
	 	By actuating the key, the last actual value appears. The flashing LED of the key requests acknowledgement.
2 Adjusting or updating the ship's speed		
 or 	 	By actuating the key, the desired value can be adjusted. The flashing LED of the key requests acknowledgement.
3 Acknowledging the value		
		By actuating the key, the value is accepted. The text indication disappears.

2.9.11 Change-over to Speed from Log

	Indications	Comment/Notes
1 Calling up parameter		
	Log: 12.7 kts 	By actuation of the key, the current value appears. The flashing LED of the key requests acknowledgement.
2 Acknowledge log selection		
		The text indication disappears.

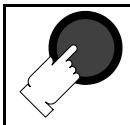
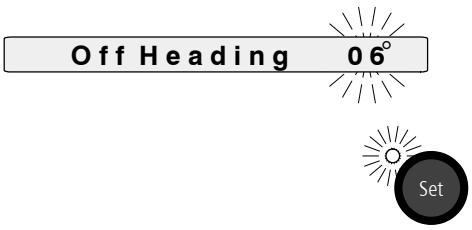
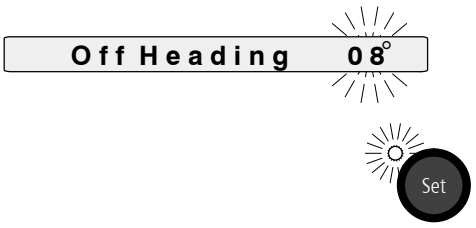
2.9.12 Entering/Checking the Parameter ”Rudder Limit”

Determines the maximum rudder position in ° which the autopilot will not exceed.

	Indications	Comment/Notes
1 Parameter Rud.Limit request		
		
2 Adjusting the new parameter value for example 30°		
		By activating the key, the current value is changed.
3 Acknowledging and saving the new parameter value		
		

2.9.13 Entering/Checking the Parameter ”Off Heading”

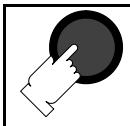
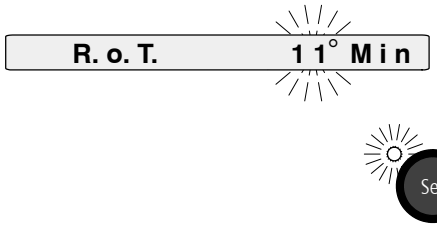
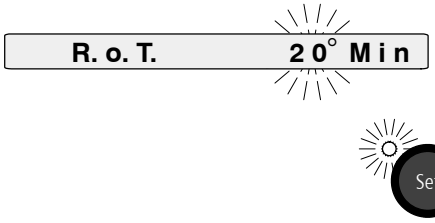
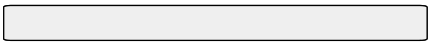
Determines the alarm threshold for heading deviations to port or starboard during course control (heading control).

	Indications	Comment/Notes
		
1 Parameter Off Heading request		
		
2 Adjusting the new parameter value for example 8°		
		By activating the key, the current value is changed.
3 Acknowledging and saving the new parameter value		
		

2.9.14 Entering/Checking the Parameter "Rate of Turn"

Navigation parameter Rate of Turn.

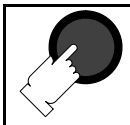
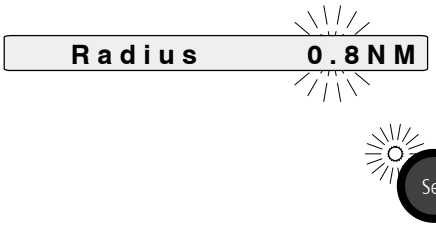
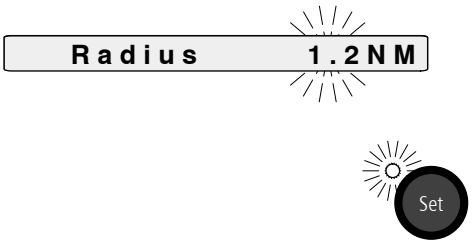
Determines the set rate of turn for the heading change maneuver, see Section 2.9.4.

	Indications	Comment/Note
1 Parameter R.o.T. request		
		
2 Adjusting the new parameter value for example e.g. 20°		
		By activating the key, the current value is changed.
3 Adjusting and saving the new Parameter value		
		

2.9.15 Entering/Checking the Parameter ”Radius”

Navigation parameter Radius.

Determines the set radius for the heading change maneuver, see Section 2.9.4.

	Indications	Comment/Notes
1 Parameter radius request		
		
2 Adjusting the new parameter value for example 1.2NM		
		By activating the key, the current value is changed.
3 Acknowledging and saving the new parameter value		
		

Radius function should used only with a Speed Log sensor to achieve the accuracy of the radius.

2.9.16 Entering/Checking the Parameter "Rudder Trim" (Rudder Bias)

Offset value for the rudder bias has to be achieved in the service menue.

For normal journey/maneuver the value should be set to 0° (automatic rudder bias is active).
For special maneuvers (e.g. towing), manual rudder bias can be set (automatic rudder bias is switched off).

A bias rudder angle is a rudder bias which, via integral parts of the course control (heading control), automatically sets in as a result of disturbances on the ship.

There are 2 different types of rudder bias in the NP2035:
1 automatic rudder bias
2 manually set rudder bias

Automatic Rudder Bias

By constant disturbances as wind, rough sea or asymmetrical pressure, e.g. whilst towing, the autopilot calculates from the integral proportion in the rudder bias to keep the ship on heading. This is automatic and requires no action on the part of the operator.

The bias rudder values are normally only useful for a particular heading range; therefore, in case of a set course (preset heading) change of >20° , the integral proportion of the course controller is reset and the automatically calculated rudder bias is set to 0.

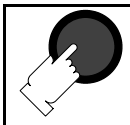
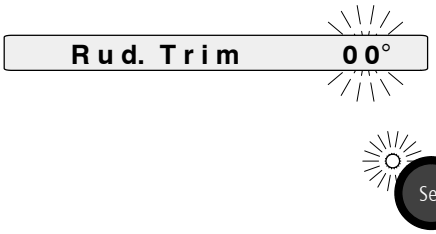
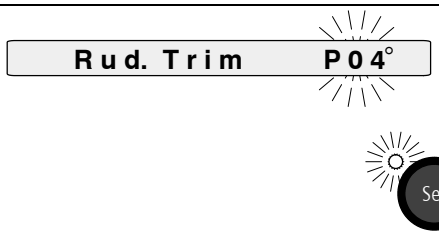
Manually Set Rudder Bias Value

In the event that the operator wishes to directly influence the rudder bias value, he can do this using the Rud. Trim. parameter.

Normally the value is 0° (automatic rudder bias).
The operator can enter a rudder bias angle in ° the port or starboard direction.
The entered value is added to the last valid automatic rudder bias value !

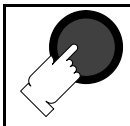
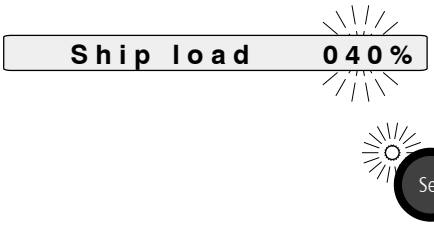
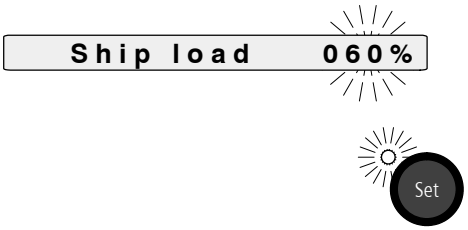
NOTE

Changes in the rudder bias influence the heading stability of the autopilot!
The operator is responsible for any values that he sets!

	Indications	Comment/Notes
		
1 Parameter Rud.Trim. request		
		
2 Adjusting the new parameter value for example 4°		
		By activating the key, the current value is changed.
3 Acknowledging and saving the new parameter value		
		

2.9.17 Entering/Checking the Parameter ”Ship Load”

Determines the load condition for the optimization of the heading regulation in dependence on the load of the ship. The load condition is entered in % .

	Indications	Comment/Note
1 Parameter Ship load request		
		
2 Adjusting a new ships loading e.g. 60%		
		By activating the key, the current value is changed.
3 Acknowledging and saving the new Parameter value		
		

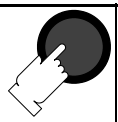
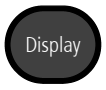
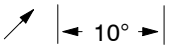
2.9.18 Display

Additional information can be displayed in the text line using the DISPLAY key.

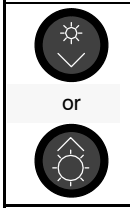
The displayed information is overwritten when:

- an alarm or warning occurs
- values are entered

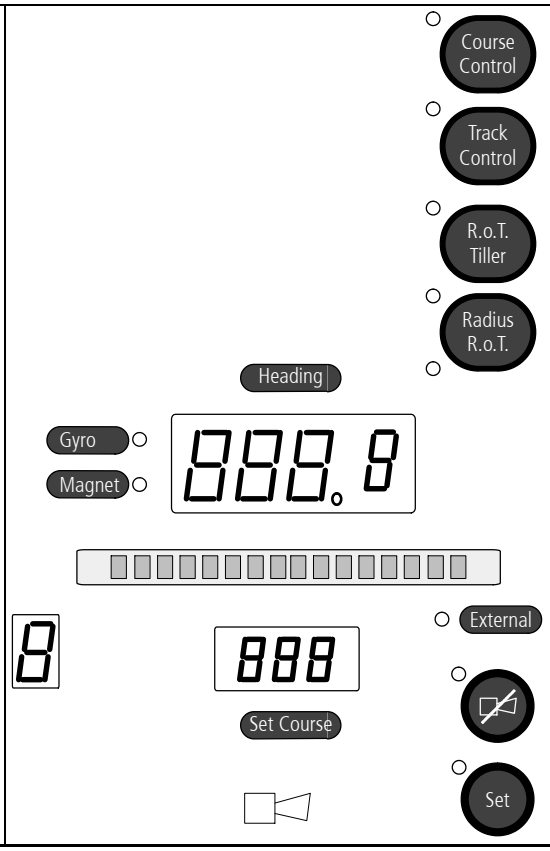
After acknowledgement of the alarm or completion of the entry, the additional information selected re-appears in the display.

	Indications	Comment/Notes
Possible information display		
	 ⇩ (Bar-Limit 10°)   (Pointer for limit exceeding) ⇩ **Man: + 17.2kts** or **Log: 12.7kts** ⇩ **Set Course: 98.4 °** ⇩ **Set rudder: P 10 °**	No indication. Shows the heading deviation (only with the operating mode of COURSE CONTROL (Heading Control)) as a tendency indication. The tendency indication can be adjusted via the configuration of **Bar-Limit** (see Service Manual). Indicates the current speed, manual or transmitted via log sensor. Indicates the current set course (preset heading) with a 1/10 degree of resolution. Indicates the current set rudder position, **P** for Port, **S** for Starboard.

2.9.19 Dimming

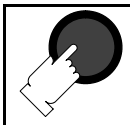
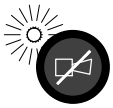
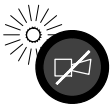
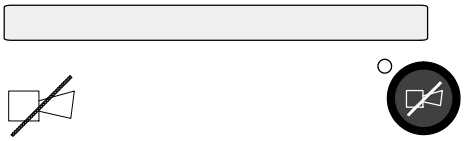
	Indications	Comment/Notes
Dimming the indications or key illumination		
		Actuating a key results in that the luminosity is varied.

2.9.20 Lamp Test

	Indications	Comment/Notes
Starting the lamp test– only possible in the operating mode NP2035 PASSIVE		
		By actuating the keys simultaneously, the lamp test adjusts itself. Subject to test: – All displays (7–segment display) – Status indications – Status indications of keys – All indicating elements of the text line (16 pcs) – Audible signalling The test lasts for approx. 10s, subsequently, the last valid indicator surface appears. ⚠ In case a visual error is recognized, the Raytheon Marine Service **must** be informed for REASONS OF SAFETY!

2.10 System Messages

2.10.1 Alarms

	Indications	Comment/Notes
1 Alarm		
	Alarm message continuous sound 	On the operator unit, no inputs can be made.
2 Acknowledge the alarm		
		The audible alarm ceases. The error message is written into a memory until elimination of the disturbance. The LED remains alight until elimination of the disturbance. The operator unit can now be used again.
3 Calling-up alarm messages		
	**Alarm message**	By actuating the key, all error messages stored in the memory can be indicated one after another.

No.	Indication	Signification	Possible Cause	Effects on Operation	Measures
1	CHECK VALUES	Initial start	During the system's starting phase, a memory test is executed. If an implausibility is recognized, all parameter values are automatically replaced by default values	All individually adjusted values get lost	With the system start completed, the individual parameter profile can now be adjusted (see Section 2.9.7 and 2.9.12 to 2.9.17)
2	Off heading	Heading error. Adjustable threshold for the difference between heading and preset heading is exceeded	Compass disturbance. Sudden drift effects	Inaccurate heading keeping	Eliminate compass disturbance. Check course error alarm threshold, adapt, if required (see Section 2.9.13). Check rudder controls

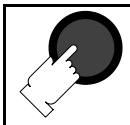
No.	Indication	Signification	Possible Cause	Effects on Operation	Measures
3	Gyro-Ref:Failure*	Gyro compass failure	External disturbance	No course control (heading control) or track control with gyro compass possible	Change over to MAG compass (see Section 2.9.9)
4	TMC-Ref:Failure	Magnetic compass failure	External disturbance	No course control (heading control) or track control with magnetic compass possible	Change over to GYRO compass (see Section 2.9.9)
5	Speed Alarm	Data from speed sensor is not plausible	External disturbance	The autopilot may show a different control behavior	Change over to manual speed adjustment (see Section 2.9.10)
6	Spd Ref missing	Speed sensor failure	External disturbance	The autopilot may show a different control behavior	Change over to manual speed adjustment (see Section 2.9.10)
7	Synchronization	Synchronization alarm	Coarse shaft of gyro compass failed or not existing	No course control (heading control) or track control is possible.	Perform synchronization (see Section 2.9.1 or 2.9.2)
8	Course-Bus Error	Course bus faulty	External disturbance	Course control (heading control) or track control not possible. No heading reading	Change over to HAND control (see Section 2.3). Repairs see Service Manual, Section 2
9	I/O-PCB	I/O PCB operating faultily	I/O PCB is defective	Autopilot NP2035 not ready for operation	Change over to HAND control (see Section 2.3). Repairs see Service Manual, Section 2
10	No Telegrams	Telegram transmission between operator unit and electronic connection box disturbed	Internal disturbance. Computer disturbance		
11	No Connection	Telegram transmission between operator unit and electronic connection box disturbed	Internal disturbance. Computer disturbance		

* Attention: This error Alarm is actuated.
Signal Unit indicates SYS alarm

No.	Indication	Signification	Possible Cause	Effects on Operation	Measures
12	Trck. Ctrl. Interr Missing Waypoint	During track control a disturbance between ECDIS and NP2035 occurs	ECDIS does not transmit requested waypoint to autopilot	Automatic change-over from track control to course control (heading control)	Check ECDIS. Start track control again
13	Trck. Ctrl. Interr No Position	During track control a position transmission failure occurs	ECDIS gets no position information		Check position information at ECDIS
14	Trck. Ctrl. Interr No ECS Status	During track control an ECDIS status failure occurs	ECDIS breakdown. Disconnection of ECDIS and autopilot		Perform restart of ECDIS
15	Trck. Ctrl. Interr ECS not ready	During track control ECDIS not ready for operation	Restart of ECDIS		None
16	Trck. Ctrl. Interr Chng.Ang.Too Big	During track control the next track change angle is too big	–		Check route. For explanation of the error, see Section 2.7.9.4
17	Trck. Ctrl. Interr Dist.TO-Wpt Shrt	During track control the distance to the TO-WPT is too short	–		Check route
18	Trck. Ctrl. Interr Dist.TO/NEXT-Wpt	During track control the distance between the TO-WPT and the NEXT-WPT is too short	–		Check route. For explanation of the error, see Section 2.7.9.4
19	Trck. Ctrl. Interr WOLine-Overrun	During track control the wheel-over-line has been reached before the geometrical check has been performed	–		Check route
20	Trck. Ctrl. Interr Too Close To Wpt	During track control the ship is too close to the waypoint. The approach would end after track end or after start of next track change	–		Check route
21	Trck. Ctrl. Interr Wpt Not Ahead	During track control the bearing to the new waypoint (after having finished track change maneuver) does not fit with the heading of the ship after the turn	Modification of route during track control		Restart track control
22	Track End Passed Selec.Headg.Ctrl	During track control the track end passed	–	The alarm comes up every 30s until having changed over to course control (heading control) or HAND control	Change over to course control (heading control) or HAND control

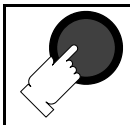
No.	Indication	Signification	Possible Cause	Effects on Operation	Measures
23	Override defect.	Override tiller defective during override mode	Connection between ARCP override tiller and autopilot control unit interrupted	Override mode not possible	Change over to HAND control (see Section 2.3)
24	App. To-Waypoint	3 to 6 minutes left to turning maneuver	-	-	-
25	App. Next-Wpt	3 to 6 minutes left to the next turning maneuver when still being in a turning maneuver	-	-	-
26	Track End x Min	x minutes left to track end	-	-	-

2.10.2 Acknowledgeable Warnings

	Indications	Comment/Notes
1 Warning		
	Warning message  three pulses 	On the operator unit, no inputs can be made. The pulses are repeated every 90 s.
2 Acknowledge the warning		
		The audible signal ceases. The warning message disappears

No.	Indication	Signification	Possible Cause	Effects on Operation	Measures
1	Track Chng xxx°	30 seconds left to turning maneuver. Next track will be xxx°	-	-	-
2	New Track xxx°	Track control is started with "Return To Track" maneuver. New track xxx°	-	-	-
3	Go To Waypoint	Track control is started with "Go To Waypoint" maneuver	-	-	-
4	Man. Speed Selec	Manual speed input selected	When switching the steering mode selector switch from HAND to AUTO manual speed input is selected although the autopilot gets valid speed information from the log	-	Change-over to speed from log. See Section 2.9.11

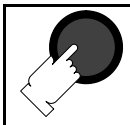
2.10.3 Warnings

	Indications	Comment/Notes
1 Warning		
	W a r n i n g m e s s a g e  two pulses	The text appears for approx. 15 s

No.	Indication	Signification	Possible Cause	Effects on Operation	Measures
1	Rudder Limited	Rudder limit reached. **Exception:** **<u>three</u> pulses**	R.o.T. limit value selection too high, or rudder limitation too low	The required R.o.T. will not be reached	Adapt R.o.T., acc. to Section 2.9.14 or adapt rudder limit acc. to Section 2.9.12
2	Low-Speed	Ship's speed too low	-	Autopilot NP2035 shows instable behavior.	Change over to manual speed adjustment (see Section 2.9.10)
3	No Waypoints	When selecting track control no waypoints transmitted to the NP2035	ECDIS does not transmit requested waypoint to autopilot	Track control not possible	Check ECDIS. Initialize the NP2035 on the ECDIS
4	No Position	When selecting track control no valid position transmitted to the NP2035	ECDIS gets no position information	Track control not possible	Check position information at ECDIS
5	No ECS Status	When selecting track control no status transmitted from the ECDIS to the NP2035	ECDIS breakdown. Disconnection of ECDIS and autopilot	Track control not possible	Perform restart of ECDIS
6	ECS not ready	When selecting track control ECDIS not ready	Restart of ECDIS	Track control not possible	None
7	Changed Wpts	The stored waypoints in the autopilot are overwritten by the ECDIS because of route modifications	Modification of route during track control	New calculation of Approach and WOL warnings	-
8	Chng.Ang.Too Big	When selecting track control the next track change angle is too big	-	Track control not possible	Check route
9	Dist.TO-Wpt Shrt	When selecting track control the distance to the TO-WPT is too short	-	Track control not possible	Check route. For explanation of the error, see Section 2.7.9.4

No.	Indication	Signification	Possible Cause	Effects on Operation	Measures
10	Dist.TO/NEXT-Wpt	When selecting track control the distance between the TO-WPT and the NEXT-WPT is too short	-	Track control not possible	Check route
11	WOLine-Overrun	When selecting track control the wheel-over-line has been reached before the geometrical check has been performed	-	Track control not possible	Change start situation. E.g. select other start waypoint (TO-WPT)
12	Trck.Too Far Awy	When selecting track control with "Return To Track" maneuver the ship is too far away from the planned track	-	Track control not possible	For explanation of the error, see Section 2.7.9.4. Approach the track by manual control or course control (heading control) and then select track control again
13	Too Close To Wpt	When selecting track control the ship is too close to the waypoint. The approach would end after track end or after start of next track change	-	Track control not possible	Change start situation. E.g. select other start waypoint (TO-WPT)
14	Wpt Too Far Away	When selecting track control with "Go To Waypoint" maneuver the ship is too far away from the first waypoint	-	Track control not possible	For explanation of the error, see Section 2.7.4.1. Approach the waypoint by manual control or course control (heading control) and then select track control again
15	Go To Wpt Imp.PS	When selecting track control with "Go To Waypoint" maneuver the ship is in a sector where the maneuver is impossible	-	Track control not possible	For explanation of the error, see Section 2.7.4.1. Approach the waypoint by manual control or course control (heading control) and then select track control again
16	Go To Wpt Imp.HD	When selecting track control with "Go To Waypoint" maneuver the heading of the ship deviates too much for approaching the waypoint	-	Track control not possible	For explanation of the error, see Section 2.7.4.1. Approach the waypoint by manual control or course control (heading control) and then select track control again
17	Chk track data	Geographical check of the track is performed when track control is selected	-	The autopilot remains in course control (heading control) until the check is finished	-

2.10.4 Notes

	Indications	Comment/Notes
1 Note		
	N o t e m e s s a g e one pulse	The text appears for approx. 15 s

No.	Indication	Signification	Possible Cause	Effects on Operation	Measures
1	Override	OVERRIDE tiller is active	–	Tiller control	–
2	STANDBY	Steering mode selector in position HAND. Change–over to a secondary operator unit has been made	–	–	Set steering mode selector to HAND control. Activate secondary operator unit (see Section 2.5)
3	Track Chng. xxx°	Track change manoeuvre starting	–	–	–
4	End of Appr.Man. New Track xxx°	Approach maneuver to the new track ended. New track xxx°	–	–	–
5	Track Chng. xxx° (no audible signal) (Text appears during whole turning maneuver)	Track change manoeuvre in progress	–	–	–

E/P
- **Modification** of the parameter
  Yawing
  Rudder
  Cnt. Rudder

BASIC
- **Opens** a temporary parameter group
- **Modification** of the temporary parameter group
- **Preadjustment** for preparing or varying a parameter group (M1..M6)

E/P
- **Display** indicates the current operating mode
  E for Economy
  P for Precision

BASIC
- **Display** for the numerical assignment of the parameter groups

E/P
- **Change over** to the operating mode **Economy** or **Precision**.

BASIC
- **Calling up** a parameter group (M1 ..M6)
  Quick-Tune

- **Indication** of the current heading sensor
- **Indication** of log sensor
- **Indication** of the manual speed adjustment
- **Presetting** for
  - Heading sensor selection
  - Manual speed adjustment
- **Synchronization** between heading sensor and NP2035 (only with fine shaft transmission)

- **Indication** or **presetting** for
  - Rudder Lim ...°
  - Off Heading ...°
  - Rot ...°/min
  - Radius ...NM
  - Rud. Trim ...°
  - Ship Load ...%

- **Fading out** the text line (except for not acknowledged alarm messages)
- **Fading in** a continuous text or bar graph representation;
  - Heading difference indication as bar graph representation in the operating mode of *Course Control (Heading Control)*
  - Track error (XTE) in the operating mode of *Track Control*
  - Manually adjusted speed
  - Set course (preset heading) with 1/10° indication
  - Set rudder position in °

- **Status indication**, indicates the adjusted heading sensor

- **Alphanumeric line**, as text line or bar graph representation for the heading difference indication (heading/set course (preset heading)

- **Display** for heading indication

- **Display** for heading indication. Shows:
  - in the operating mode *Course Control* (Heading Control)
    - the set course (preset heading)
  - in the operating mode *Track Control*
    - the track course
  - in conjunction with an R.o.T. tiller
    - the heading
  - in the passive state of device (OFF)
    - the heading

- **Set course (preset heading) presetting in conjunction with the SET key**
  (only possible in the operating mode Course Control (Heading Control))
- **Direct set course (preset heading) presetting**
  For this method, the rotary knob is first to be pressed and then readjusted. The set course (preset heading) alteration is effective immediately!
  Direct set course (preset heading) presetting interrupts track control

- Command key.
  Switches to operating mode *Course Control* (Heading Control) (LED lights up).

- Command key.
  Switches to operating mode *Track Control* (LED lights up).
  Only possible in conjunction with an external track planning system or navigation receiver.

- Command key.
  Switches to operating mode *R.o.T. Control*
  "Rate-of-Turn" (LED lights up).
  Only possible in conjunction with an external R.o.T. tiller

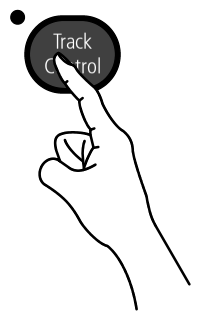
- **Determines** the type of heading change manoeuvre.
  - Heading change via a determined radius value (LED lights up), or
  - Heading change via a determined R.o.T. limit value (LED lights up)

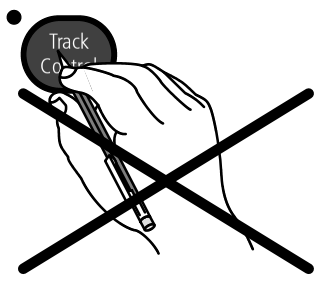
- **Status indication**, indicates REMOTE operation.

- The flashing LED signalizes an action which will be stored or effective only when **acknowledged**.

- **Acknowledges** the audible alarm. LED shows red.
  The alarm message is stored.
- **Screening** the stored alarm messages. All alarm message are cyclically indicated via the text line.

- **Dimmer** for key and display illumination.
- **Modification** of parameter values.
- **Selection** of heading sensor
- **Lamp test** (both keys to be actuated simultaneously)





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ANSCHÜTZ

NAUTOGUIDE C - track control

For full control on straight legs and turns
with ECDIS and Autopilot
NP2035 (NP2030)
- according IEC 62065, Category C

OPERATOR MANUAL

3680.DOC012 Edition: Feb. 05, 2004

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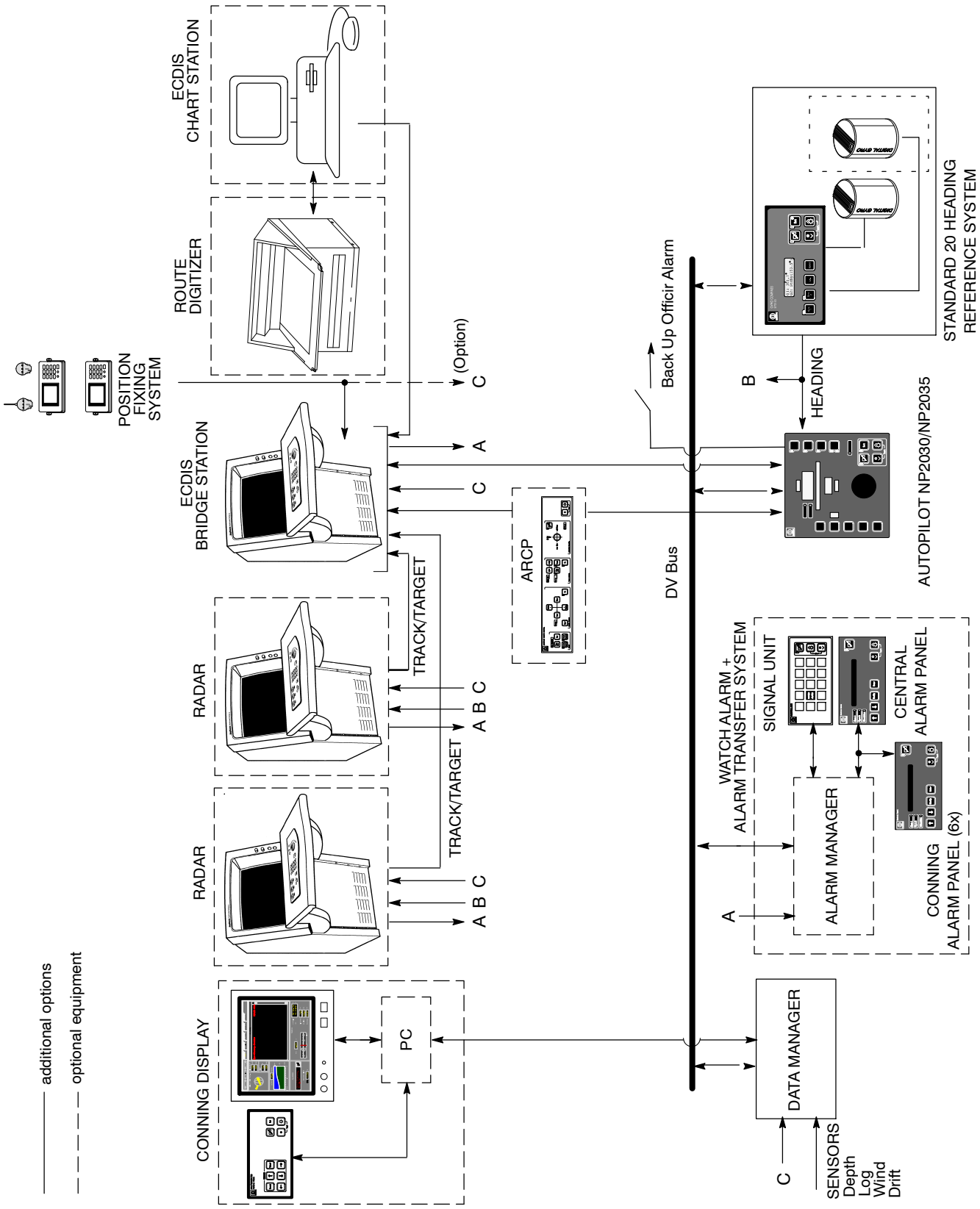
1 General


ECDIS CHART STATION
ROUTE DIGITIZER
POSITION FIXING SYSTEM
ECDIS BRIDGE STATION
RADAR
RADAR
CONNING DISPLAY
PC
(Option)
C
A
C
TRACK/TARGET
A B C
TRACK/TARGET
A B C
ARCP
Back Up Officir Alarm
DV Bus
B
HEADING
STANDARD 20 HEADING REFERENCE SYSTEM
AUTOPILOT NP2030/NP2035
WATCH ALARM + ALARM TRANSFER SYSTEM
SIGNAL UNIT
CENTRAL ALARM PANEL
ALARM MANAGER
CONNING ALARM PANEL (6x)
A
DATA MANAGER
C
SENSORS
Depth
Log
Wind
Drift
additional options
optional equipment

1.1 Main Components of the Track Control System

The Track Control System Nautoguide is a Track Control System according IEC 62065 Category C.

The main components of the Track Control System are:
- ECDIS BRIDGE STATION
- DATA MANAGER or direct sensor input to ECDIS/Autopilot
- AUTOPILOT NP2030 or NP2035
- STANDARD 20/22 Heading Reference System
- POSITION FIXING SYSTEM
- LOG

Optional equipment:
- ECDIS CHART STATION
- ROUTE DIGITIZER
- NAUTOCONNING DISPLAY
- ALARM MANAGER
- AUTOPILOT REMOTE CONTROL PANEL, ARCP
- ADDITIONAL SENSORS

1.1.1 Short Description of Main Components

ECDIS BRIDGE STATION

Pathfinder/ST ECDIS is an integrated navigation system with advanced electronic chart capabilities including: route planning, route monitoring, look ahead and other navigational tasks. It enables a navigator to conveniently do all navigational routines which are currently done on paper charts.

Pathfinder/ST ECDIS ’s advanced route planning capabilities make it easier for the navigator to set waypoints and create routes, name and save your routes so you can use them again, or navigate to a waypoint that you’ve stored in your navigation device. Pathfinder/ST ECDIS features waypoint and cross–track error alarms to assist you while navigating.

AUTOPILOT NP2030 or NP2035

The NP2030 or NP2035 is a modern adaptive autopilot system designed for all sizes of sea-going ships.

The NP2030 or NP2035 has the following operating modes:

- Heading control in consideration of a radius or R.o.T limit value adjustment
- Track control in conjunction with an ECDIS system
- Rate-of-turn control via an R.o.T. tiller

Depending on requirements, the operator can adapt the steering quality to present sailing area by selecting between Economy, Precision and Basic.
Track change will be done by heading control with preset Radius/R.o.T.

1.1.2 Short Description of Optional Components

ARCP

The ARCP is an additional control panel for the autopilot NP2030 or NP2035 family in combination with an ECDIS.
It has the following functions:

- Change-over between heading control and track control
- Changing the preset heading (set course) during heading control
- Changing the turn radius during heading control
- Autopilot override by means of an override tiller

NAUTOCONNING

NAUTOCONNING is the central display and data and alarm management system for the ship's command.
A NAUTOCONNING system consists of:

- Data manager
- Conning display
- Alarm manager with alarm panels

Tasks and performance features:

Data Manager:

- Registration and adaptation of sensor data (Compass, Autopilot, ECDIS, etc.)
- Registration and preparation of navigational data (Log, NavRec, Wind, Depth, etc.)
- Selection from between redundant sensors (GPS receivers)

Conning Display:

- Display of the registered data, alarms and procedure sequences (tracking) in corresponding monitor screens
  (NAVIGATION, DOCKING, SENSORS, RECORD, ALARM)

Alarm Manager:

- Registration and management of alarms and system conditions
- Distribution of the data and alarms to connected elements

ECDIS CHART STATION and ROUTE DIGITIZER

The ECDIS CHART STATION intended primarily for route planning and monitoring has a high resolution colour display. It could be combined with a digital chart table (large format digitizing table).

By placing a sea chart on the tablet‘s surface and digitizing a planned route on the chart the coordinates of the waypoints are converted into digital format and saved in the ECDIS System. On the ECDIS BRIDGE STATION the stored route can be displayed and used for track control.

1.2 Function

Heading Control

The adaptive heading controller can be operated from autopilot operator unit as well as from ECDIS console integrated Autopilot Remote Control Panel (ARCP). A take-over system between ARCP and autopilot makes it possible to change during heading control the preset heading and radius settings via the ARCP. The preset heading and the radius are displayed at the ECDIS.

An override of heading control can be carried out by a NFU tiller on the active ARCP.

Track Control

ECDIS BRIDGE or CHART STATION with or without DIGITIZER generated routes can be used for automatic track keeping. The track control function can be activated at the ARCP.

An override of track control can be carried out by a NFU tiller on the active ARCP.

Data Management

All navigation information (heading speed, position, depth, wind, drift) is managed by NAUTOCONNING. In case of several sources of the same type of data (e.g. position), the data is selected and distributed throughout the system. Thus all information for the track control system is provided centrally by NAUTOCONNING. In case of data failure an alarm is generated.

Heading Distribution

The heading information is distributed by the gyro compass STANDARD 20/22 system. Systems which require a high update rate (autopilot, RADAR) receive the heading information via the course bus. Indication and monitoring devices (NAUTOCONNING) receive the heading information via the Data Distribution bus.

The heading reference (Gyro 1/Gyro 2/Magnetic compass) is selected at the NAUTOCONNING or at the operator unit(s) STANDARD 20/22.

Position Distribution

The position information is read in at the ECDIS and transmitted to the Data Distribution bus (Option). NAUTOCONNING or ECDIS takes over the selection of the system master position. NAUTOCONNING and RADAR receive the position via the data manager. STANDARD 20/22 receives the position via the Data Distribution bus. The autopilot gets it directly from the ECDIS.

Speed Distribution

The speed information is read in and managed centrally at the NAUTOCONNING. NAUTOCONNING also takes over the selection of the speed sensor. The speed information is distributed via the Data Distribution bus and via the data manager.

Sensor Data Distribution (Wind, Depth, Drift, etc.)

These data are read in and managed centrally at the NAUTOCONNING. A selection between different sensors is not possible. The sensor data are distributed via the Data Distribution bus and via the data manager.

Alarm Management

The alarm manager as an independent unit in the NAUTOCONNING permits – besides the input and display of external alarms (binary contacts) – protocolling on the NAUTOCONNING and distribution and signaling on its own signal units via serial data bus. Subsidiary to it is a watch alarm system which monitors the connected navigation equipment (RADAR, ECDIS, autopilot etc.) for proper operation and, in addition to the reset buttons, resets the watch alarm. When the prescribed period of time has elapsed, alarms are given according to the rules of the IEC 62065 on up to the general alarm (normally–closed contacts).

Conning Display

The conning display is part of the NAUTOCONNING SYSTEM. It receives the data and alarms of all devices and sensors connected to the system and displays them on a monitor.

2 Operation

2.1 Safety Notes

The safety notes given in the descriptions of ECDIS and autopilot NP2030 / NP2035 series are to be observed in every detail.

Warning!
Automatic steering modes (course control, track control) may only be used, when the expectable steering accuracy complies with the traffic and navigational situation.
Special care must be taken in confined and congested waters.

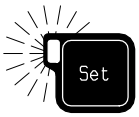
Notes on the use of the membrane keyboard:

The operator unit NP2030 or NP2035
series is equipped with a membrane keyboard. In order to protect the membrane from mechanical damage, it should never be operated with sharp implements such as screwdrivers, pencils, etc.

2.2 Explanation of Used Symbols

Note:
Selected functions are written in bold, buttons to be operated are written in italic and messages (display) are set into quotation marks.

Key actuation



LED *flashing*

LED *out*

LED *alight*

Audible signal *on*

Audible signal *off*

ECDIS display alarm messages in the alarm area

Fig. 1-1 Message Display Area

2.3 Route Planning

There are 3 different possibilities to generate a route on ECDIS.

- *Using official chart data:* Route planning direct on ECDIS (Bridge or Chart station)
- *Manual input:* Using official paper charts taking waypoint coordinates out of the paper chart and enter coordinates manually via keyboard in ECDIS (Bridge or Chart station)
- *Digitizer input:* Using official paper charts together with the digitizer to enter waypoint coordinates into ECDIS.

This section (2.3) contains:
- Route Planning Digital Chart Data (see section 2.3.1).
- Route description (see section 2.4).
- Edit Route Command (see section 2.5).
- Creating a new Route (see section 2.5.1).
- Planning a Route using the ECDIS with Digital Chart Data (see section 2.5.2).
- Planning a Route using the ECDIS with manual coordinate input (see section 2.5.3).
- Route Planning with ECDIS and Digitizing table (see section 2.5.4).
- Track Control (see section 2.6).
- Loading Route (see section 2.7).
- Checks to be made before switching ON the Track Control (see section 2.8).
- Displaying the GO-TO-Waypoint of a Route (see section 2.9).
- Activating Track Control at ECDIS (see section 2.10).
- Activating Track Control at ARCP (Option) (see section 2.11).
- Track Change Manoeuvre (see section 2.12).
- Track End (see section 2.13).
- Interruption of Track Control by the User (see section 2.14).
- Reactivating Track Control after user interruption (see section 2.15)
- Interruption of Track Control in Case of a Defect (see section 2.16).

2.3.1 Route Planning Digital Chart Data

ECDIS has sophisticated route planning capabilities.

During route planning, each route section is automatically checked for free and safe passage of the ship. The automatically check-up comprises Prohibited Areas, Own Ship's Contours, Buoys and Beacons known from and indicated in the sea charts (93/3 and S57).
In case a dangerous situation is realized during route planning, a corresponding alarm is displayed in the Alarm Window (see Fig. 1-1).

ECDIS displays waypoints as circles. The active waypoint is marked with an additional circle around it. If you label your waypoints, the labels appear below the marker. When a route is established, the following information is automatically displayed:

1. A planned track (course line) between the waypoints (is red in colour and appears as a thick dashed line between waypoints and a dashed line between the ship and the active waypoint).
   Using the route planning feature, a primary as well as a secondary route can be created (see section 2.5). The route priority can be selected via menu function as needed.

   The primary route is displayed in thick, red, dashed lines.
   The secondary route is displayed in thin, red, dashed lines.

2. The planned turning arc/radius (red in colour); the turning arc which was established when you entered the waypoint.
   The turning arc/radius is limited to maximum 135°.
   This limit value is checked during route planning and if this limit is exceeded an error message is released.

3. Crosstrack limit boundaries: width defined by the current cross-track error alarm setting.

4. The wheelover point, or the point at which own ship must start turning to follow the predicted turning arc.
   The wheelover point position is controlled by the “Turning Response” box in the Autopilot dialogue box. Please see ”Driving an Autopilot” in the ECDIS operation manual section 12.1.10.

2.4 Route Description

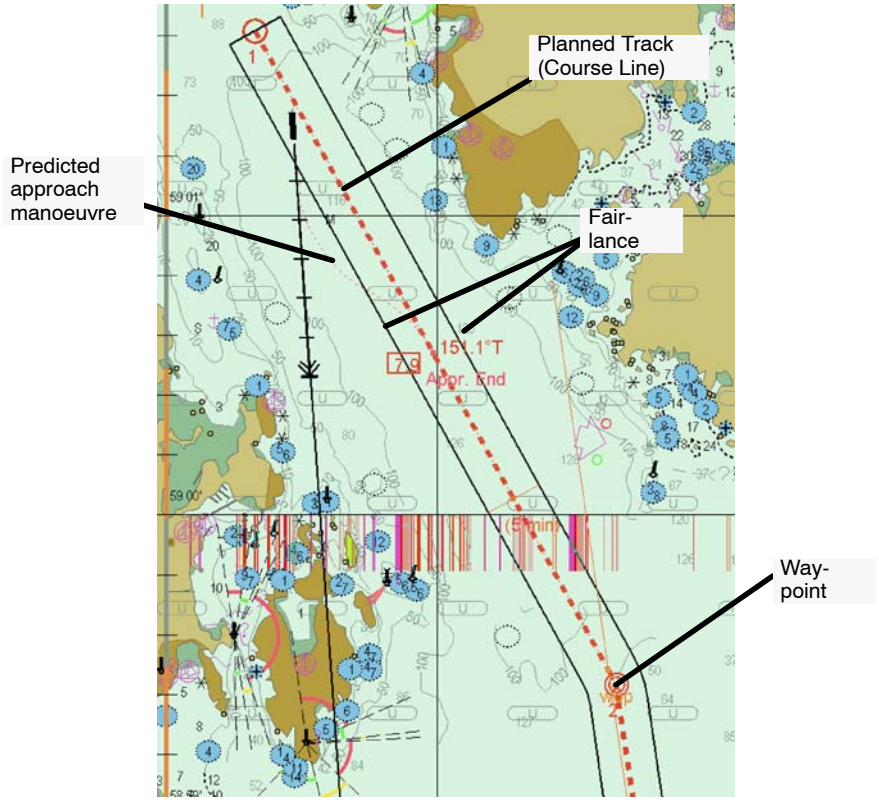


Fig. 1-2 Route Description

ECDIS does not select an active waypoint until the Steer to Track dialogue box has been opened and the active waypoint has been selected.

2.5 Edit Route Command

The Edit Route Command enables the operator to create or modify routes by:

Enter and label waypoints
Move waypoints or change their labels
Delete waypoints from a route
Enter and change the planned turn radius/arc
Insert new waypoints in a route
Reverse the order of waypoints in a route
Name and save a route

When you choose the **Edit Route** command, ECDIS displays the Edit Route dialogue box with the name of the open route in the title bar. If you are creating a new route, the title bar reads “untitled”.

Planning a route is simply entering waypoints. You can use the **Edit Route** command to enter a waypoint in two ways:

1. Positioning the cursor in the display.

2. Using the Latitude and Longitude boxes to enter specific coordinates.

While you are entering waypoints, Pathfinder/ST ECDIS automatically checks the route and fairlane (cross track limits) for unsafe and restricted areas as well as to check if they are reasonable (relative to their geometrical coordinates). If the fairlane or route is not reasonable, and cannot be created, one of the two following message boxes will appear, Fig. 1-3.

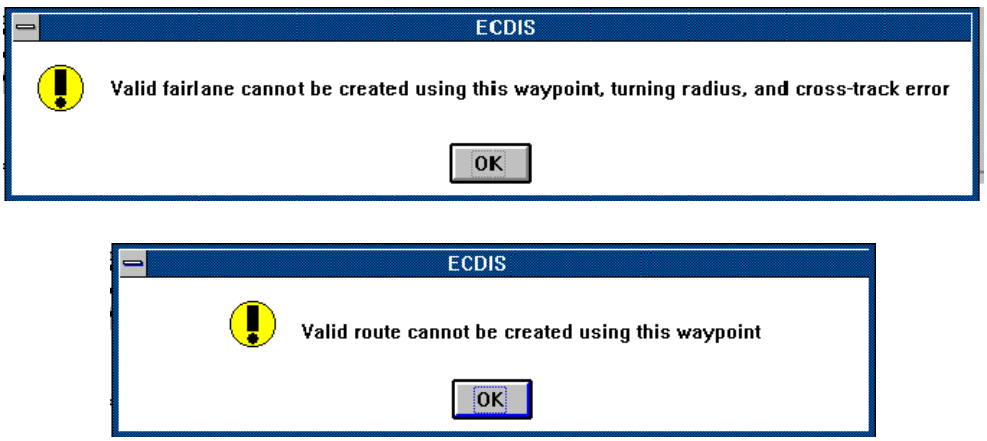


Fig. 1-3 Route Warning Messages

When these message boxes appear, you will not be allowed to enter this part of the route. Acknowledge the message box by clicking on *OK*. If the route action is not accepted, you must change the location of the waypoint. If the geometrical limits are not accepted, you may either change the waypoint, waypoint radius, or the Cross–track Error Alarm (you may leave the Edit Route dialogue box open while you do this).

If you enter a waypoint in a restricted area, ECDIS will display a warning “Route Intersects Restricted Area”. ECDIS allows you to save routes containing a waypoint in a restricted area.

Handling Primary Route and Secondary Route

The ECDIS is able to display two routes at the same time:

- the first route which has been created or loaded is defined as “Primary Route”
- the second route which has been created or loaded is defined as “Secondary Route”.

Route priorities are indicated by the entry “Primary” and “Secondary” in the menu guide (see ECDIS operator manual section 8.1.13).

When starting the Edit Route mode the operator is asked to select the Primary or Secondary route, if more than one route has been loaded.

If Track Control is active a modification of the active (Primary) Route is possible. During this time the Secondary Route is faded out.

If the Primary Route is deleted by means of the function **Clear Route**, the Secondary Route becomes the Primary Route

2.5.1 Creating a new Route

NOTE

In general it could be said: The larger the chosen scale of the displayed chart, the more accurately you can locate specific coordinates. If you want to place a waypoint at a location that is not in view, you can move the display using the Zoom feature, the Scale and Center command, the View Area command or the arrow keys while the Edit Route dialogue box is open. For further details see ECDIS operator manual.
Observe the Alarm Window (Information Panel), consider the messages about: Prohibited Areas, Own Ships Contours, Buys and Beacons.

Select the desired chart area for the route planning.

1. Select **Edit Route** from the Routes menu or use Keystrokes *<Alt+R+E>.*

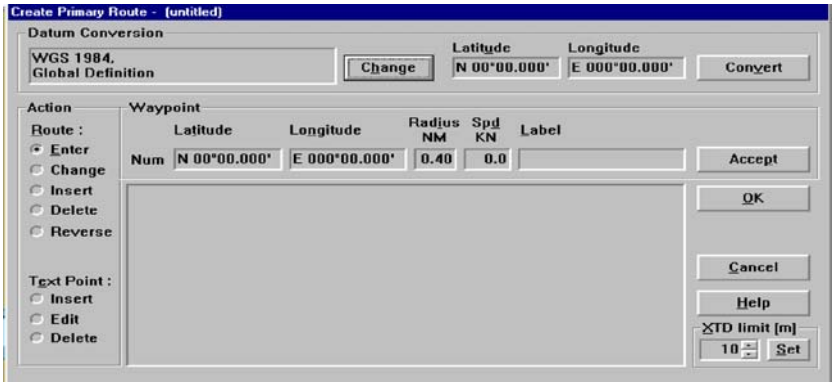


Fig. 1-4 Creating a new Route

2. Select either by cursor or by numerical input of *Lat/Long* the first waypoint position, press the *Enter* key or click on the *Accept* button.
   The waypoint number and the waypoint coordinates are shown in the dialogue window.
3. Select either by cursor or by numerical input of *Lat/Long* the next waypoint as described under item 1.If the waypoints are more than 200NM away from each other, Great Circle Navigation will be considered (see ECDIS operator manual section 8.1.4).

4. By clicking the *OK* button, route planning is finished. The route can now be saved under any name.

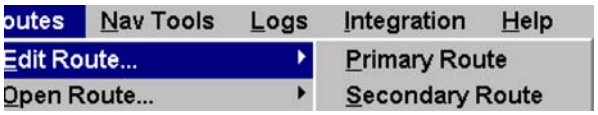
Alarm overview for areas which the ECDIS detects and indicates in the Alarm Window:

Traffic separation zone
Traffic routing scheme crossing or roundabout
Traffic routing schema precautionary area
Two way traffic route
Deep-water route
Recommend traffic lane
Inshore traffic zone
Fairway
Restricted area
Caution area
Offshore production area
Areas to avoided
Military practice area
Seaplane landing area
Submarine transit lane
Ice area
Channel
Fishing ground
Fishing prohibited
Pipeline area
Cable area
Anchor prohibited
Dumping ground
Spoil ground
Dredged area
Cargo transshipment
Incineration area
Special protected areas

2.5.2 Planning a Route using ECDIS with Digital Chart Data

NOTE

1. Select **Edit Route** from the Routes menu or use Keystrokes <*Alt*+*R*+*E*>.



Select **Primary Route** or **Secondary Route** to open the Route dialogue box.

If Track Control is active the following dialogue box appears:

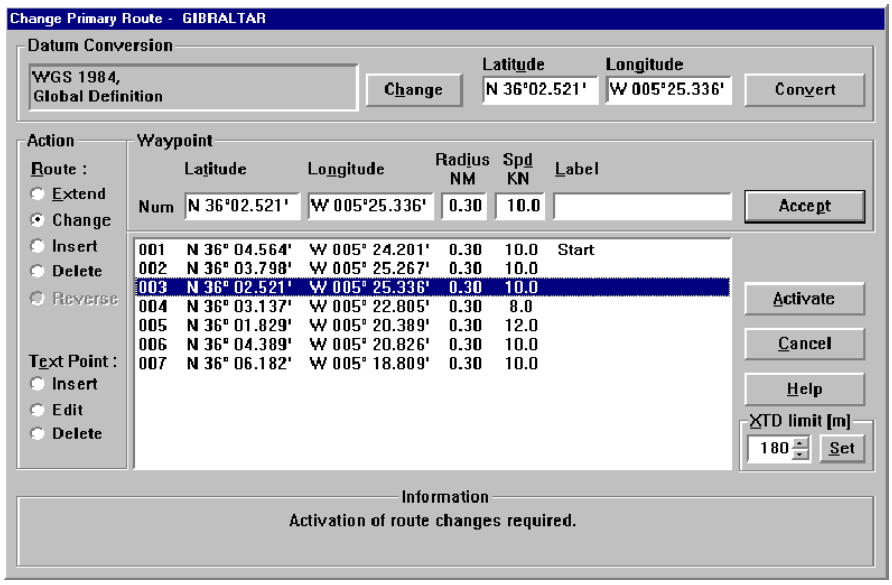


Fig. 1-5 Edit Route / Active Route Dialogue (Track Control active)

When having the route modifications finished, the modified route has to be activated by the *Activate* button. The text field at the bottom of the dialogue box (Information) displays corresponding messages.

If Track Control is not active the following dialogue box appears:

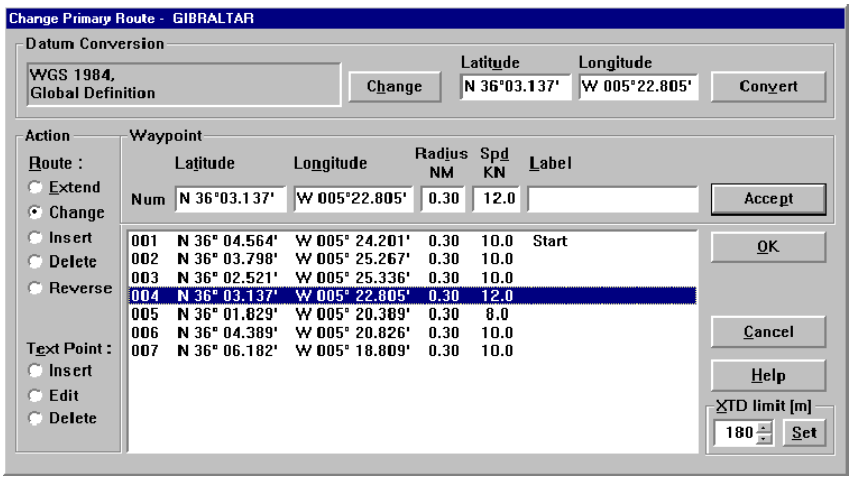


Fig. 1-6 Edit Route / Active Route Dialogue (Track Control not active)

Current changes are confirmed by the *OK* button. Differing from the above mentioned dialogue box there is no Information text field and no *Activate* button.
The dialogue box is closed using the *OK* button.

NOTE

You can either enter a label and a turn radius before you place the waypoint, or you can go through the Change Waypoint process to add one later.

1. Label the waypoint by typing a label of up to 10 characters in the Label text box.

2. Enter a turn radius for the waypoint by clicking in the Radius text box and entering the desired value.

3. Position the target cursor at the desired location for the waypoint and click. A way point symbol appears in the display.

NOTE

Datum is always WGS 1984.

4. To enter additional waypoints, repeat steps 2 – 4.

On the ECDIS a waypoint symbol appears at each location you click on and the route is completed with fairlanes and the planned track leg. (solid line).

5. To enter a cross-track error, click in the XTD text box and enter the cross-track limit in m. Click on *Set* to make the change. The fairlanes on the display will be adjusted according to the cross-track limit settings.

6. Click on *OK*. The Save Route dialogue box appears, Fig. 1-7.

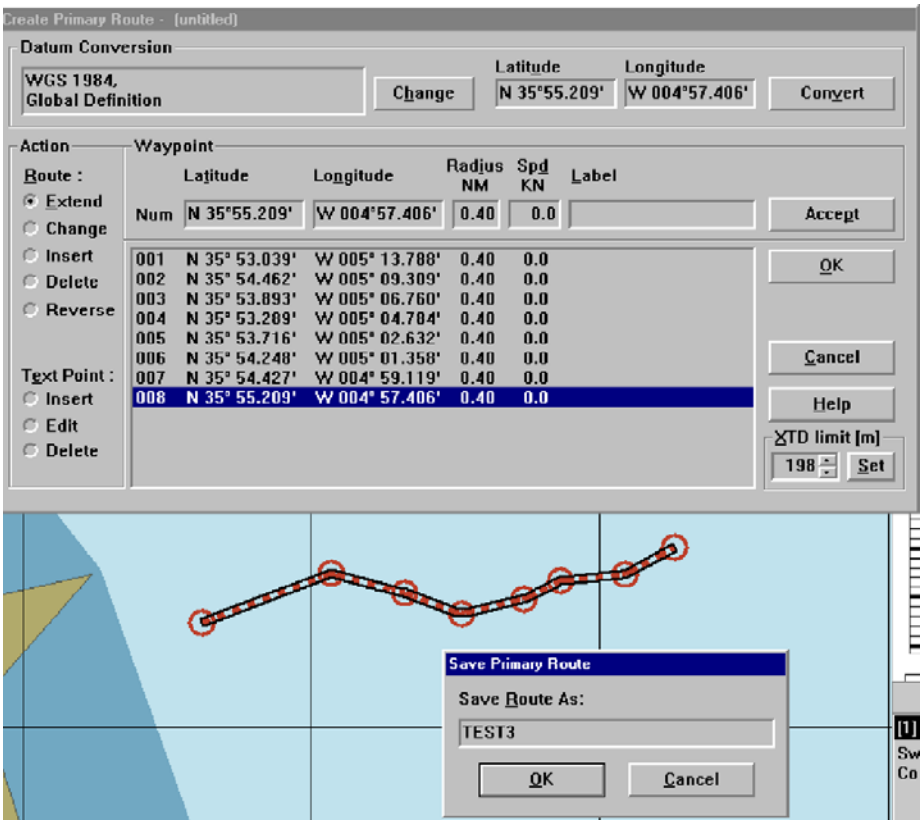


Fig. 1-7 Save Route Dialogue Box

NOTE

If you are entering a route which intersects a restricted area, Pathfinder®/ST ECDIS will not prompt you to save it. You may save the route by selecting **Save Route** from the Routes menu.

7. To save the route, type a name of up to 25 characters in the text box, then click on *OK*. If you do not want to save the route, click on *Cancel*.

NOTE

The value for the turning arc/radius is limited to 135°. If this limit is exceeded while planning a route a message window pop-up giving respective information.

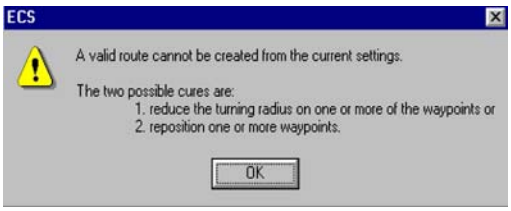


Fig. 1-8 Pop-up when turn arc/radius greater than 135°

2.5.3 Planning a Route using the ECDIS with manual coordinate input

1. Select **Edit Route** (primary or secondary) from the Routes menu or use Keystrokes <*Alt*+*R*+*E*>.
   The Edit Route dialogue box appears with the action “Enter” selected, Fig. 1-9.

> **NOTE**
> You must either enter a label and turn radius before you place the waypoint, or you can go through the Change Waypoint process to add it later.

2. Select *change* button next to the datum list box and scroll through the pull-down to select the datum of the chart from which you read off the waypoint (latitude/longitude).
3. To enter the latitude and longitude of a waypoint, type in the coordinates (hemisphere, degrees and minutes). If you express minutes to a tenth hundredth or thousandth of a minute, be sure to include a decimal point (.).
4. Label the waypoint by typing a label of up to 10 characters in the label text box.
5. Enter a turn radius for the waypoint by clicking in the Radius text box and entering the desired value.
6. Click on *Convert* to convert the waypoint‘s datum into WGS1984 datum.
   The converted coordinates appear in The Edit Route dialogue box, Fig. 1-9.

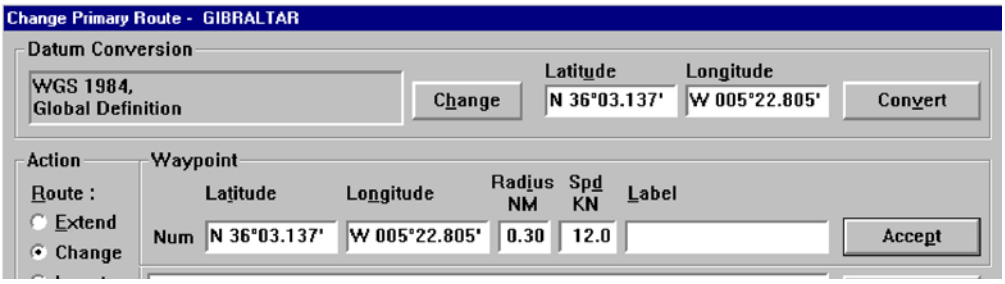


Fig. 1-9 Edit Route Dialogue Box

7. Click on *Accept*. The waypoint appears in the waypoint list, and a waypoint symbol appears in the display.

8. To enter additional waypoints, repeat steps 2 – 7. A waypoint symbol appears at each location you specify and the route is extended with fairlanes and a planned track (dashed).

9. To enter a cross-track error, click in the XTD text box and enter the cross-track limit in m. Click on *set* to make the change. The fairlanes on the display will be adjusted according to the cross-track limit settings.

10. Click on *Quit*. The Save Route dialogue box appears, Fig. 1-7.

NOTE

If you are entering a route which intersects a restricted area, ECDIS will not prompt you to save it. You may save the route by selecting **Save Route** from the Routes menu.

11. To save the route, type a name of up to 25 characters in the text box, then click on *OK*. If you do not want to save the route, click on *Cancel*.

2.5.4 Route Planning with ECDIS and Digitizing table

If your system is equipped with a digitizing table waypoint coordinates could be read in from paper chart into the ECDIS system for further use.

For that procedure the it is necessary to

- enter paper chart details (name, scale, datum, offset, type of projection etc.)
- align the paper chart on the digitizing table
- enter waypoints with puck of the digitizing table
- enter route name while saving route process.

(Further information is given in ECDIS operator manual, section 4).

2.6 Track Control

There are several conditions to be met for activating track control:

- a route is to be created with official chart data
- the route has to be loaded
- the ship is to be brought into an area close enough to pre-planned track
- the automatic steering mode is required
- the Start Waypoint of the route has to be selected
- the type of track approaching manoeuvre has to be chosen:
  GO-TO-Waypoint or GO-TO-Track)
- the approach radius is to be selected and
- track control has to be activated

In section 2.7 and following, the above mentioned steps are described precisely.

Approach manoeuvre types

The system offers two different types of approach manoeuvres

- the GO-TO-Waypoint manoeuvre
- the GO-TO-Track manoeuvre.

For a better understanding the difference between the two types of track approach manoeuvres are described in the following.

GO-TO-Waypoint manoeuvre (see Fig. 1-10 and Fig. 1-11)	**GO-TO-Track manoeuvre** (see Fig. 1-12)
The main idea behind the GO-TO-Waypoint manoeuvre is, that the selected GO-TO-Waypoint is crossed. The start point is thought to be laid in free water to enter narrow water without any risk. The geometrical restrictions to be followed are shown in the a.m. figures.	The GO-TO-Track manoeuvre is the standard approaching manoeuvre. It is used when a route should be entered not at the beginning or entering a route after a track control interruption carried out by the operator. The following geometrical restrictions are to be met.

GO-TO-Waypoint manoeuvre

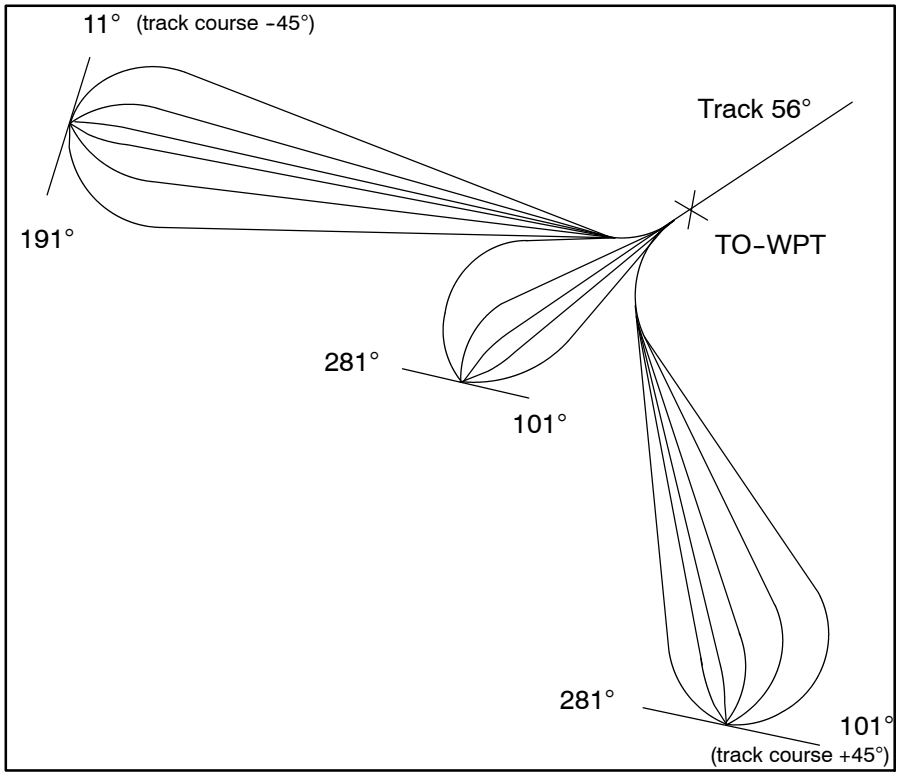


Fig. 1-10 Preset heading in relation to track course of preplanned track

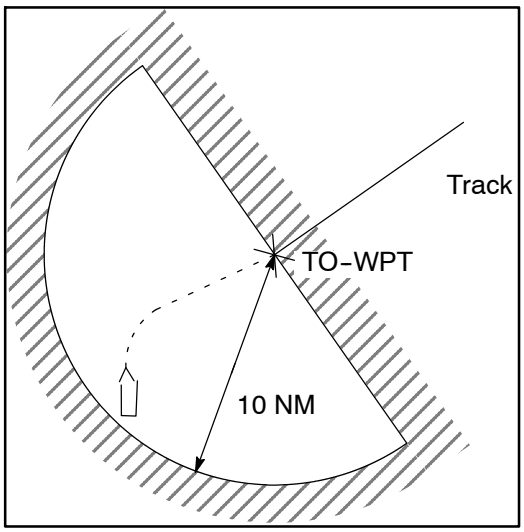


Fig. 1-11 Initial position

GO-TO-Track manoeuvre

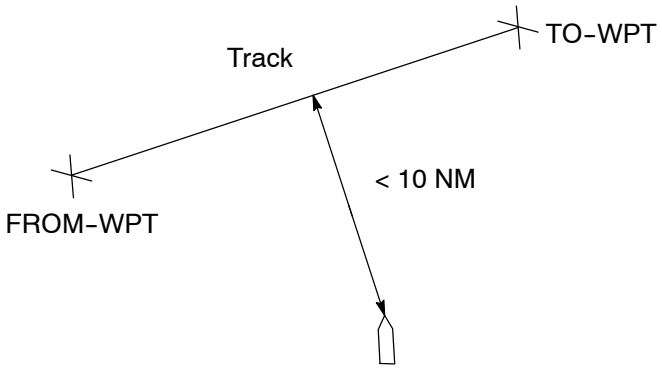


Fig. 1-12 GO-TO-Track

Approach radius

(see Fig. 1-13)

The radius for the approaching manoeuvre is user selectable at the “Track Control Activating Procedure”. The radius influences the shape of the approach manoeuvre from the position where the Track Control Process is started to the preplanned track. The following sketches show the reaction of the system using a small or large approach radius. This could be helpful to sail around obstacles when entering a preplanned track.
The radius could be decreased down to a ships specific minimum. The minimum value as well as the default value is set by a service engineer.

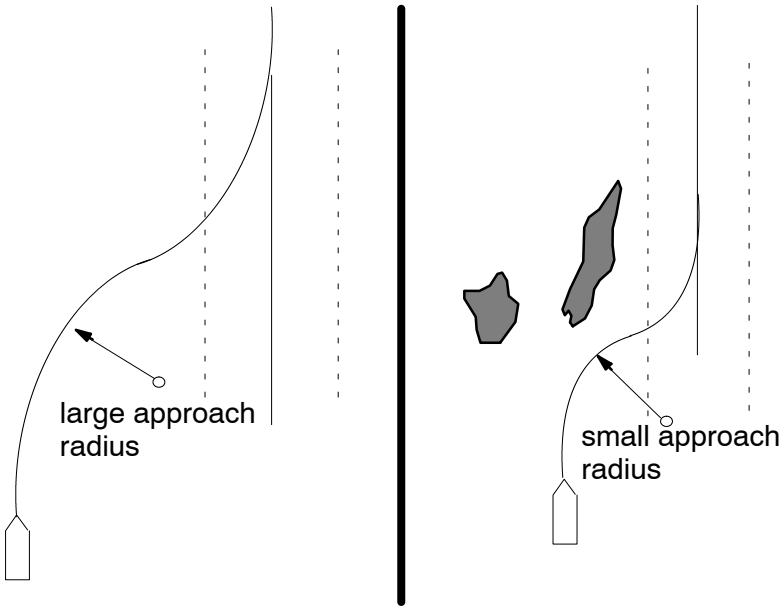


Fig. 1-13 GO-TO-Track (approach radius)

Displaying the approach track manoeuvre

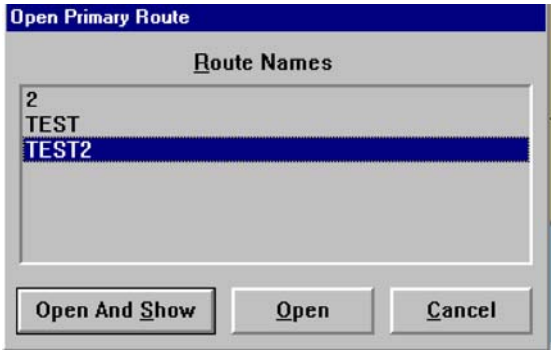
A short time after the system switched over to **Track Control** it displays the approach manoeuvre to the preplanned track on ECDIS screen.

2.7 Loading a Route

Note:

If another Route is active you have to clear it.

Select menu “ROUTES→ CLEAR ROUTE” (see ECDIS Manual chapter 8.1.18).

	Indications	Remarks/Notes
On the ECDIS select menu “ROUTES → OPEN ROUTE”		
Select the route you want to open		
Select *Open* or *Open And Show*. Open And Show will center the display on an appropriate chart and the route centered on first waypoint.		

The following track parameters are defined:

- WOP circle
- Approach circle
- Maximum track deviation

2.8 Checks to be made before switching ON the Track Control

For correct functioning of the trackkeeping, faultless operation of the following systems and devices is required:

- Steering gear and steering control system
- Sensors and corresponding transmission from
  - gyro compass
  - magnetic compass
  - log
  - position sensor

2.9 Displaying the GO-TO-Waypoint of a Route

When you open the Steer to Track dialog box after creating or opening a route, ECDIS automatically selects the first valid waypoint in the route as the active waypoint. If you want to navigate to a different waypoint, you can do so by using the arrow keys. When you select the new waypoint, ECDIS checks to make sure it is a valid course line, then it circles the waypoint, redraws the course line, and updates the Information Panel. If it is not a valid course line, then ECDIS grays the dialog box, except the *Select Active Waypoint arrow* buttons, until a valid waypoint is selected. Selecting an active waypoint is very useful when you are navigating a long route. For example, suppose you are navigating a route from Seattle to Pusan and decide to stop in Prince Rupert. When you are ready to continue on to Pusan, open your route again, and then using the **Track Control** command, you can reassign the active waypoint and continue on the route.

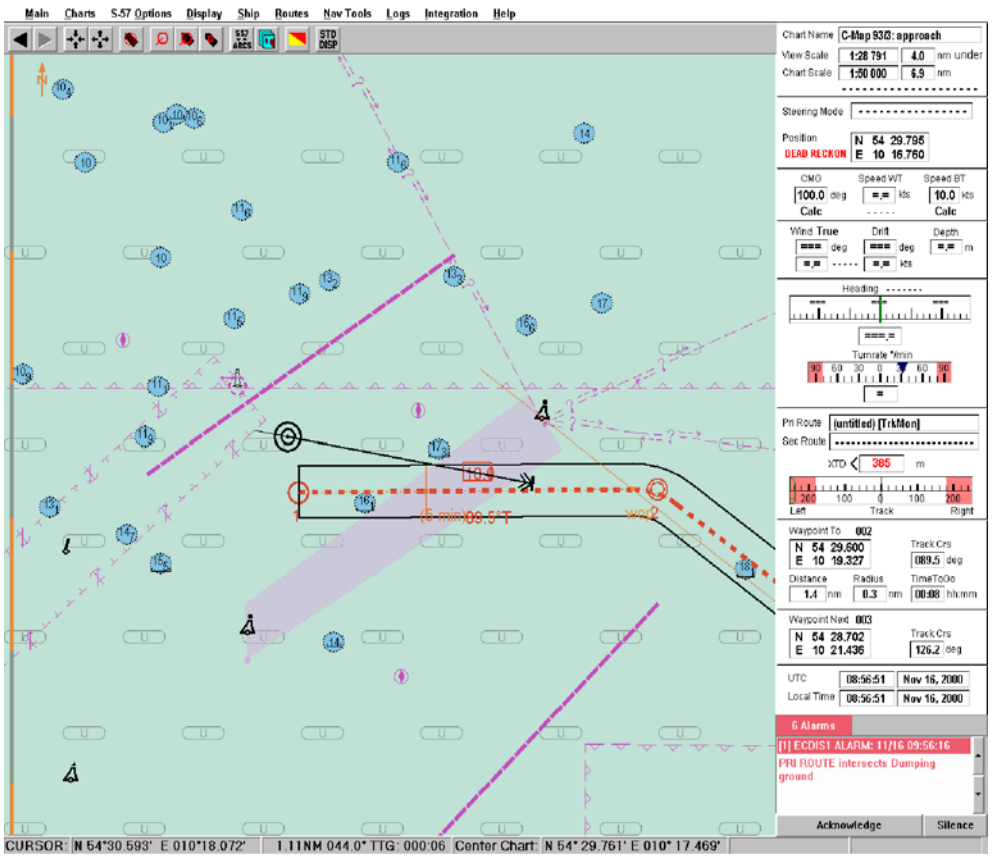


Fig. 1-14 Approaching the Track

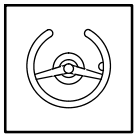
2.10 Activating Track Control at ECDIS

2.10.1 Approaching the Track

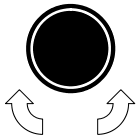
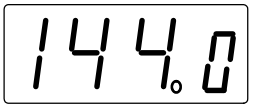
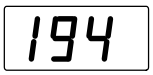
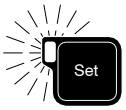
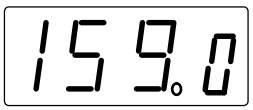
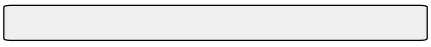
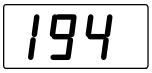
The track approaching manoeuvre needs some requirements to be kept:
GO-TO-Waypoint manoeuvre
1) The TO-WPT has to be located in free water (see Fig. 1-10 and Fig. 1-11).
2) The **initial position** must be before the track and less than 10 nautical miles away.

GO-TO-Track manoeuvre (see Fig. 1-12)

Make sure, that these requirements are fulfilled when starting track control.

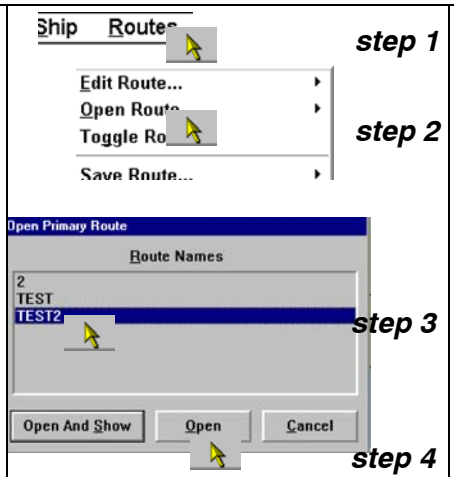
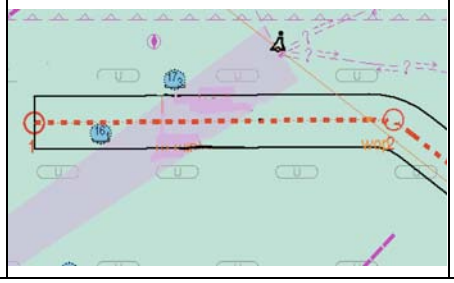
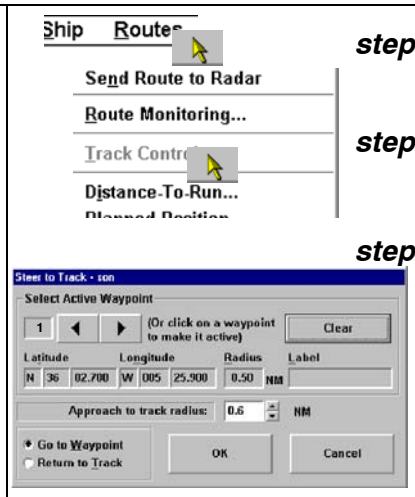
	Indications	Remarks/Notes
1 Approach by manual control		
		Approach the track until initial position and initial heading are reached.

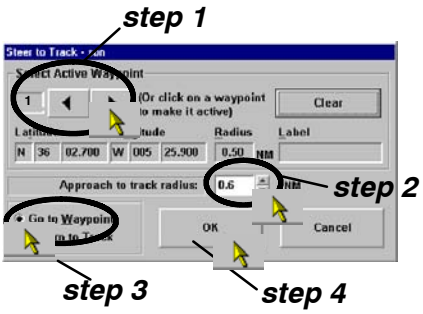
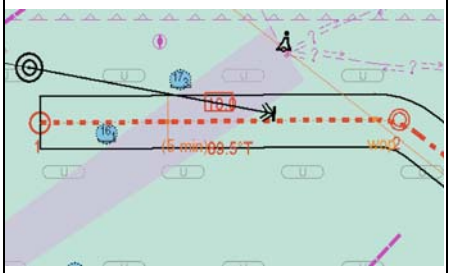
	Indications	Remarks/Notes
1 Approach by autopilot NP2030 or NP2035 heading control		
		Select **Autopilot** Approach the track until initial position and initial heading are reached.

	Indications	Remarks/Notes
2 Preselect preset heading		
	Heading  **PRESELECTED HDG**  Preset Heading 	Turning the rotary knob results in that the desired preset heading appears within the **Preset Heading** display. A comment appears within the text line (for approx. 15s). The previous text is overwritten for this period. The LED of the Set key is flashing. The new preset heading must be acknowledged within approx.15s. If not acknowledged, the previous preset heading value, which remains valid, re-appears on the Preset Heading display after 15 s.
3 Acknowledge the preset heading preselection		
	Heading    Preset Heading	The ship starts the heading change maneuver. The heading change maneuver is completed as soon as the heading corresponds to the preset heading preselection.

The system is now ready for further start Track Control procedure.
This can be done at ECDIS or in combination ECDIS and ARCP (see sections 2.10.2 and 2.11.2)

2.10.2 Activating Track Control, GO-TO-Waypoint Manoeuvre

	Indications	Remarks/Notes
1 Select the **Open Route** command from the menu bar **Routes**		
		***step 1*** select the Menu command **Routes**. ***step 2*** select the command **Open Route**. A dialog box appears with already created routes (primary or secondary). Take your choice. ***step 3*** select a route and click on *Open* (***step 4***).
		the route takes place in the chart display.
2 Select the **Track Control** command from the menu bar Routes		
		***step 1*** select the Menu commands **Routes** again. ***step 2*** select the command **Track Control**. A dialog box **Steer to Track** appears (***step 3***).

	Indications	Remarks/Notes
3 Select the **TO-WPT** (active waypoint)		
	 **Track Control** is activated 	Waypoint selecting per cursor. Move the cursor over the waypoint (**TO-WPT**) to which you want to navigate and press *left mouse* button. *Or* **step 1** Use the left or right arrow key for selecting the waypoint (**TO-WPT**). **step 2** Select a convenient approach radius. **step 3** Select **Go to Waypoint**. **step 4** Click on *OK*. **Track Control** is activated.

Notes:

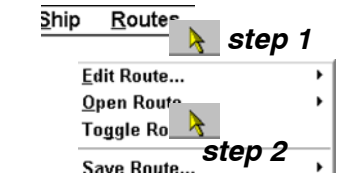
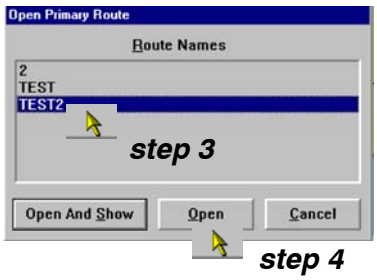
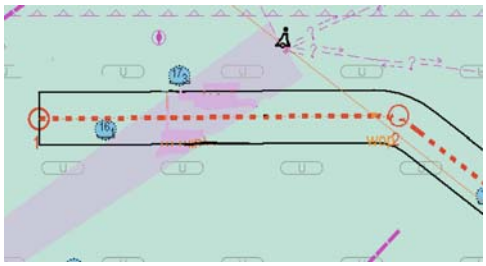
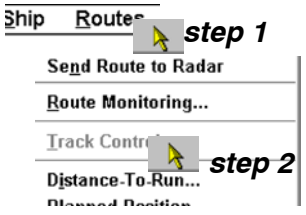
During the operating mode of track control

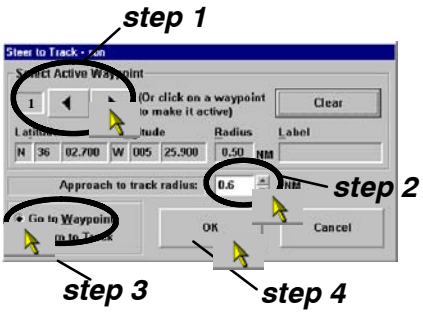
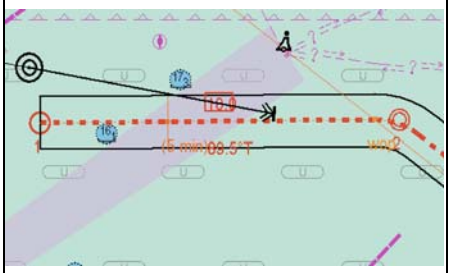
- The navigation parameter is set to “Radius” if “R.o.T. “ has been activated. For track change manoeuvres, the NP2030/NP2035 takes the radius value planned at the ECDIS. This radius cannot be varied on the operator unit of the autopilot.

  For the approaching manoeuvre (the way from the actual ships position to the preplanned track) a radius can be planned at ECDIS. If the approach radius is not modified at ECDIS, the last used radius will be taken. The selectable minimum radius is ships specific and is to be adjusted by the service engineer.

  When changing back to heading control, the navigation parameters change back to the parameters (and values) which were active before track control has been started.
- The rudder limit setting is automatically set to “Max”. The value cannot be varied during track control. In case of manual change-over to heading control, the old value is taken again.
- The adjusted control parameters can be viewed on the operator unit of the autopilot.

2.10.3 Activating Track Control, GO-TO-Track Manoeuvre

	Indications	Remarks/Notes
1	Select the **Open Route** command from the menu bar **Routes**	
	  	***step 1*** select the Menu command **Routes**. ***step 2*** select the command **Open Route**. A dialog box appears with already created routes (primary or secondary). Take your choice. ***step 3*** select a route and click on *Open* (***step 4***). the route takes place in the chart display.
2	Select the **Track Control** command from the menu bar Routes	
	 	***step 1*** select the Menu commands **Routes** again. ***step 2*** select the command **Track Control**. A dialog box **Steer to Track** appears (***step 3***).

	Indications	Remarks/Notes
3 Select the **TO-WPT** (active waypoint)		
	 **Track Control** is activated 	Waypoint selecting per cursor. Move the cursor over the waypoint (**TO-WPT**) to which you want to navigate and press *left mouse* button. Or **step 1** Use the left or right arrow key for selecting the waypoint (**TO-WPT**). **step 2** Select a convenient approach radius. **step 3** Select **Go TO Track**. **step 4** Click on *OK*. **Track Control** is activated.

Notes:

During the operating mode of track control

- The navigation parameter is set to “Radius” if “R.o.T. “ has been activated. For track change manoeuvres, the NP2030/NP2035 takes the radius value planned at the ECDIS. This radius cannot be varied on the operator unit of the autopilot.

  For the approaching manoeuvre (the way from the actual ships position to the preplanned track) a radius can be planned at ECDIS. If the approach radius is not modified at ECDIS, the last used radius will be taken. The selectable minimum radius is ships specific and is to be adjusted by the service engineer.

  When changing back to heading control, the navigation parameters change back to the parameters (and values) which were active before track control has been started.
- The rudder limit setting is automatically set to “Max”. The value cannot be varied during track control. In case of manual change-over to heading control, the old value is taken again.
- The adjusted control parameters can be viewed on the operator unit of the autopilot.

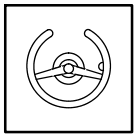
2.11 Activating Track Control at ARCP (Option)

2.11.1 Approaching the Track

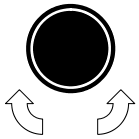
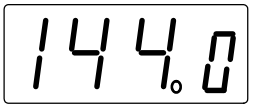
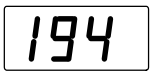
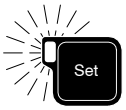
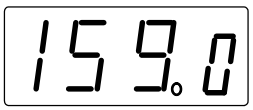
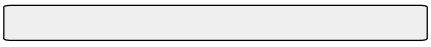
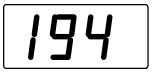
The track approaching manoeuvre needs some requirements to be kept:
GO-TO-Waypoint manoeuvre
1) The TO-WPT has to be located in free water (see Fig. 1-10 and Fig. 1-11).
2) The **initial position** must be before the track and less than 10 nautical miles away.

GO-TO-Track manoeuvre (see Fig. 1-12)

Make sure, that these requirements are fulfilled when starting track control.

	Indications	Remarks/Notes
1 Approach by manual control		
		Approach the track until initial position and initial heading are reached.

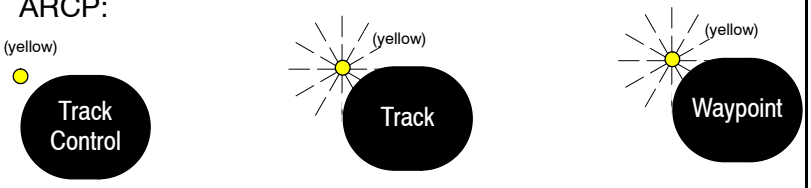
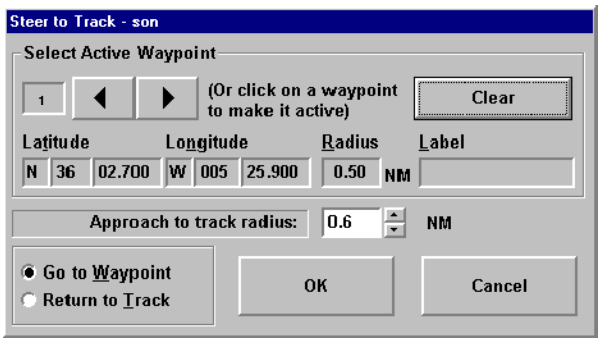
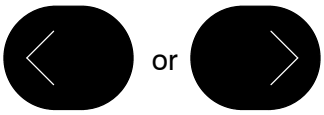
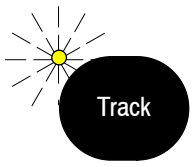
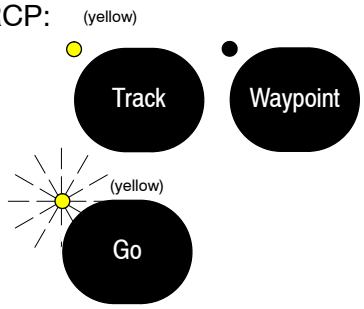
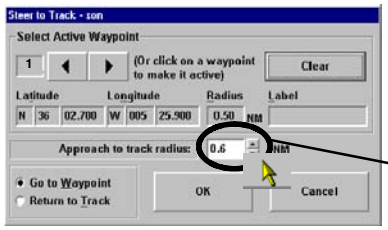
	Indications	Remarks/Notes
1 Approach by autopilot NP2030 or NP2035 heading control		
		Select **Autopilot** Approach the track until initial position and initial heading are reached.

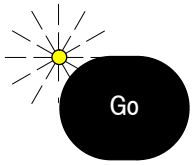
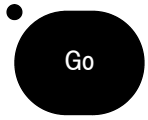
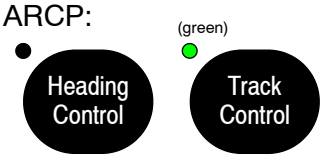
	Indications	Remarks/Notes
2 Preselect preset heading		
	Heading  **PRESELECTED HDG**  Preset Heading 	Turning the rotary knob results in that the desired preset heading appears within the **Preset Heading** display. A comment appears within the text line (for approx. 15s). The previous text is overwritten for this period. The LED of the Set key is flashing. The new preset heading must be acknowledged within approx.15s. If not acknowledged, the previous preset heading value, which remains valid, re-appears on the Preset Heading display after 15 s.
3 Acknowledge the preset heading preselection		
	Heading    Preset Heading	The ship starts the heading change maneuver. The heading change maneuver is completed as soon as the heading corresponds to the preset heading preselection.

The system is now ready for further start Track Control procedure.
This can be done at ECDIS or in combination ECDIS and ARCP (see sections 2.10.2 and 2.11.2)

2.11.2 Activating Track Control, GO-TO-Waypoint Manoeuvre at ARCP (Option)

	Indications	Remarks/Notes
1 Activate Heading Control		
AUTO-PILOT	Autopilot: Heading Control ARCP: (green) Heading Control, In Command	If the track is approached via manual steering, set steering mode selector switch to **AUTO.** Heading control is thus selected. ARCP passive. Operating mode of autopilot is indicated.
2 Activate the ARCP in front of ECDIS		
ARCP: Take Over	ARCP: (yellow) Set, (yellow) In Command	
ARCP: Set	ARCP: Set, (green) In Command, (green) Ready, (green) Heading Control	Acknowledge take-over. Operating mode of autopilot remains.

	Indications	Remarks/Notes
3 Select Track Control		
ARCP: 	ARCP:  ECDIS Dialog Box: 	
4 Select TO-WPT (active waypoint)		
ARCP: 		Coordinates of selected waypoint are indicated in the Steer to Track dialog box at the ECDIS
5 Select Type of Approach Maneuver here: ”Go to Track”		
ARCP: 	ARCP: 	Indication in the Steer to Track dialog box at the ECDIS changes from “Go To Waypoint” to “Return to Track”.
Select approach radius size		Select convenient approach radius

	Indications	Remarks/Notes
6 Acknowledge		
ARCP: 	ARCP: 	Check of the geometrical constellation of ship's position and requested track.
	ARCP:  Autopilot: 	Track control is started when the check of the geometrical constellation of ship's position and track is passed. The new calculated preset heading appears within the "Preset Heading" display of the autopilot. The ship starts turning.

Notes:

During the operating mode of track control

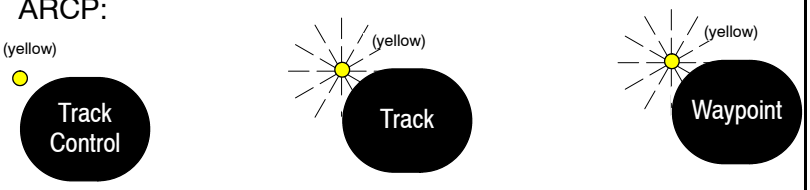
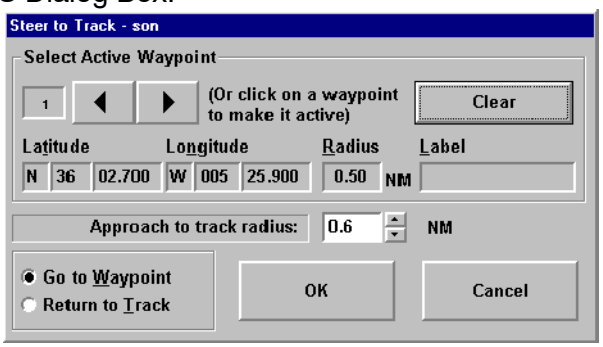
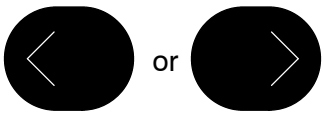
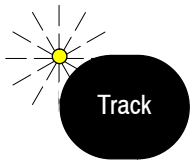
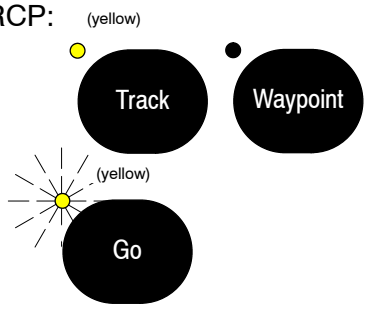
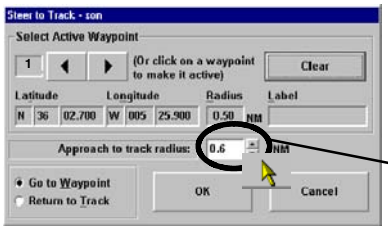
- The navigation parameter is set to "Radius" if "R.o.T. " has been activated. For track change manoeuvres, the NP2030/NP2035 takes the radius value planned at the ECDIS. This radius cannot be varied on the operator unit of the autopilot.

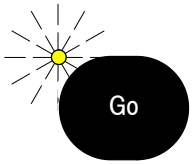
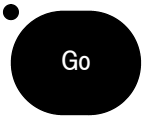
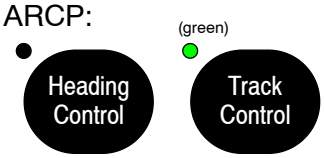
  For the approaching manoeuvre (the way from the actual ships position to the preplanned track) a radius can be planned at ECDIS. If the approach radius is not modified at ECDIS, the last used radius will be taken. The selectable minimum radius is ships specific and is to be adjusted by the service engineer.

  When changing back to heading control, the navigation parameters change back to the parameters (and values) which were active before track control has been started.
- The rudder limit setting is automatically set to "Max". The value cannot be varied during track control. In case of manual change-over to heading control, the old value is taken again.
- The adjusted control parameters can be viewed on the operator unit of the autopilot.

2.11.3 Activating Track Control GO-TO Track Manoeuvre at ARCP (Option)

	Indications	Remarks/Notes
1 Activate Heading Control		
AUTO-PILOT	Autopilot: Heading Control ARCP: (green) Heading Control, In Command	If the track is approached via manual steering, set steering mode selector switch to **AUTO.** Heading control is thus selected. ARCP passive. Operating mode of autopilot is indicated.
2 Activate the ARCP in front of ECDIS		
ARCP: Take Over	ARCP: (yellow) Set, (yellow) In Command	
ARCP: Set	ARCP: Set, (green) In Command, (green) Ready, (green) Heading Control	Acknowledge take-over. Operating mode of autopilot remains.

	Indications	Remarks/Notes
3 Select Track Control		
ARCP: 	ARCP:  ECDIS Dialog Box: 	
4 Select TO-WPT (active waypoint)		
ARCP: 		Coordinates of selected waypoint are indicated in the Steer to Track dialog box at the ECDIS
5 Select Type of Approach Maneuver here: ”Go to Track”		
ARCP: 	ARCP: 	Indication in the Steer to Track dialog box at the ECDIS changes from “Go To Waypoint” to “Return to Track”.
Select approach radius size 		Select convenient approach radius

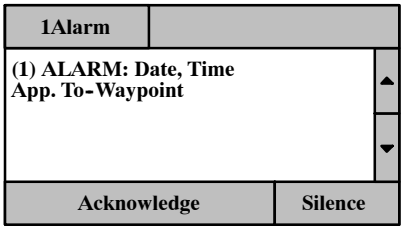
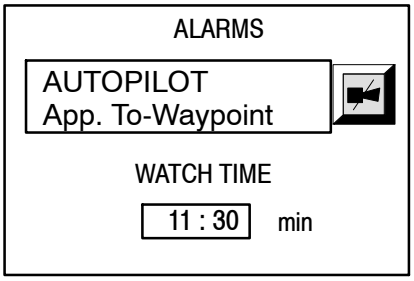
	Indications	Remarks/Notes
6 Acknowledge		
ARCP: 	ARCP: 	Check of the geometrical constellation of ship‘s position and requested track.
	ARCP: (green)  Autopilot: 	Track control is started when the check of the geometrical constellation of ship‘s position and track is passed. The new calculated preset heading appears within the “Preset Heading” display of the autopilot. The ship starts turning.

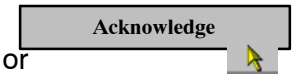
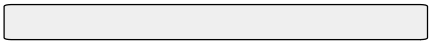
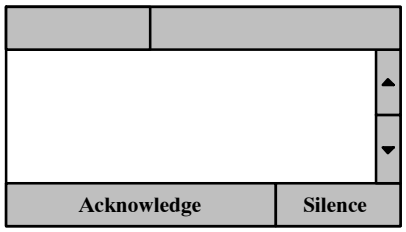
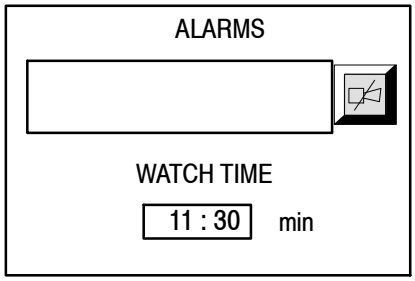
Notes:

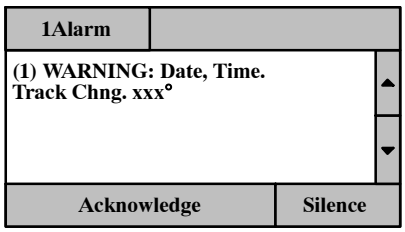
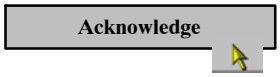
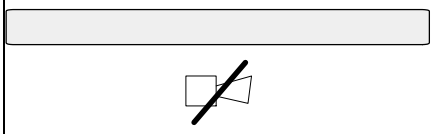
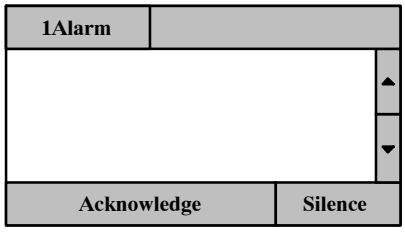
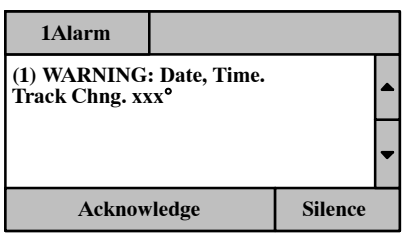
During the operating mode of track control

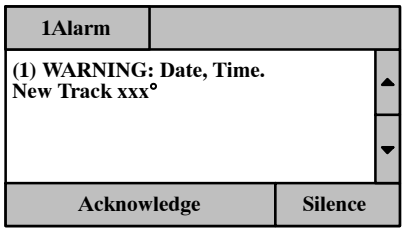
- The navigation parameter is set to “Radius” if “R.o.T. “ has been activated. For track change manoeuvres, the NP2030/NP2035 takes the radius value planned at the ECDIS. This radius cannot be varied on the operator unit of the autopilot.
  For the approaching manoeuvre (the way from the actual ships position to the preplanned track) a radius can be planned at ECDIS. If the approach radius is not modified at ECDIS, the last used radius will be taken.
  The selectable minimum radius is ships specific and is to be adjusted by the service engineer.
  When changing back to heading control, the navigation parameters change back to the parameters (and values) which were active before track control has been started.
- The rudder limit setting is automatically set to “Max”. The value cannot be varied during track control. In case of manual change-over to heading control, the old value is taken again.
- The adjusted control parameters can be viewed on the operator unit of the autopilot.

2.12 Track Change Manoeuvre

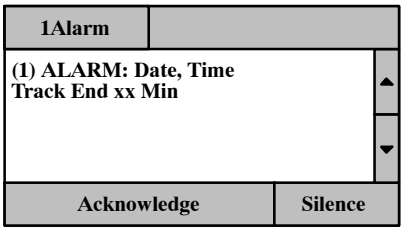
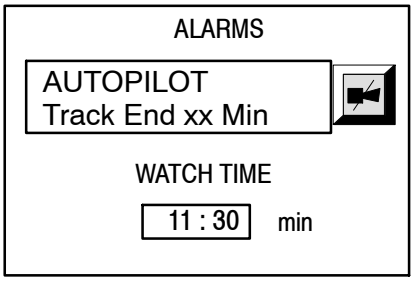
	Indications	Remarks/Notes
1 Alarm		
	Autopilot: **App. To-Waypoint**  ECDIS:  1Alarm (1) ALARM: Date, Time App. To-Waypoint Acknowledge Silence NAUTOCONNING (Option):  ALARMS AUTOPILOT App. To-Waypoint WATCH TIME 11 : 30 min Conning alarm panel (Option): **AUTOPILOT** **App. To-Waypoint** 	Between 3 and 6 min. before the WOP. (Adaptable at ECDIS default is 6 min.)

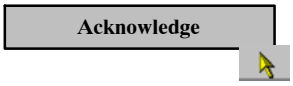
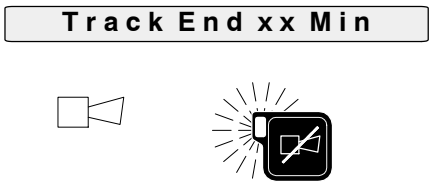
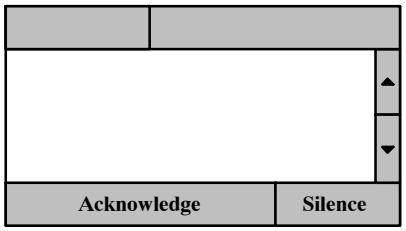
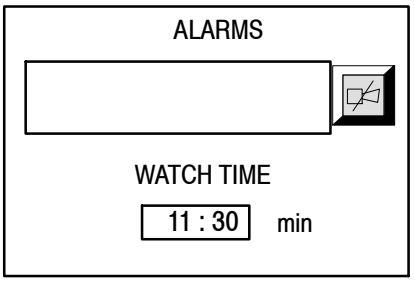
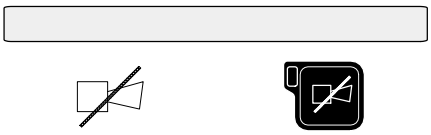
	Indications	Remarks/Notes
2 Acknowledge alarm		
Autopilot:  ECDIS:  or  NAUTOCONNING: or  Operator unit NAUTOCONNING: or  Conning alarm panel:	Autopilot:    ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option):   	

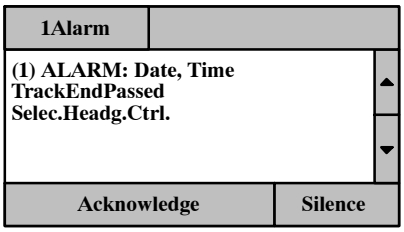
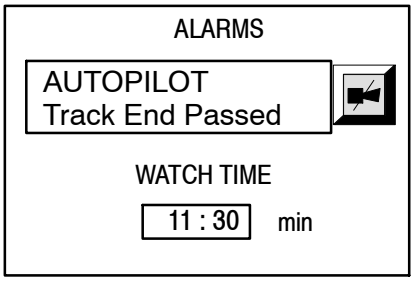
	Indications	Remarks/Notes
3 Warning		
	Autopilot: **Track Chng. xxx°** three pulses  ECDIS: 	30s before the track change maneuver is started.
4 Acknowledge warning		
Autopilot: or ECDIS  	Autopilot:  ECDIS: 	
5 Track change maneuver starting		
	Autopilot: **Track Chng. xxx°** one pulse ECDIS: 	Indication when track change maneuver is starting. The track change maneuver is starting even if the operator did not acknowledge the previous alarms and warnings!

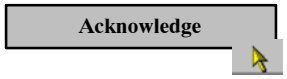
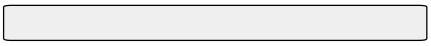
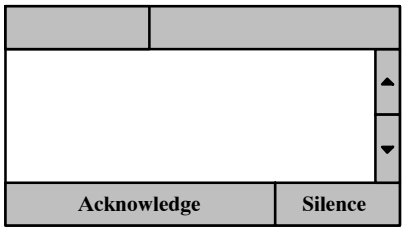
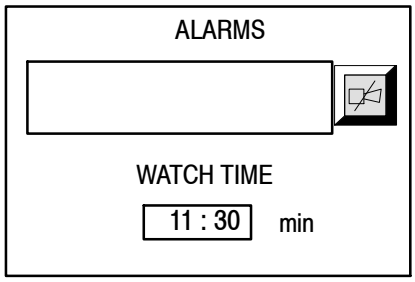
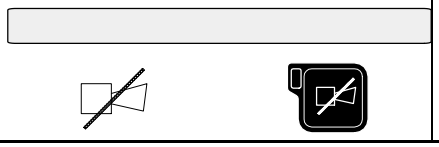
	Indications	Remarks/Notes
6 Track change manoeuvre ended		
	Autopilot: **New track x x x °**  one pulse ECDIS: 	As soon as the ship has reached the new track section.

2.13 Track End

	Indications	Remarks/Notes
1 Alarm		
	Autopilot: **Track End xx Min**   ECDIS:  **1Alarm** **(1) ALARM: Date, Time** **Track End xx Min** **Acknowledge** **Silence** NAUTOCONNING (Option):  ALARMS AUTOPILOT Track End xx Min WATCH TIME 11 : 30 min Conning alarm panel (Option): **AUTOPILOT** **Track End xx Min**  	xx minutes left to last waypoint.

	Indications	Remarks/Notes
2 Acknowledge the alarm		
Autopilot:  ECDIS:  or: NAUTOCONNING: or  Operator unit NAUTOCONNING:  or Conning alarm panel: 	Autopilot:  ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option): 	

	Indications	Remarks/Notes
3 Alarm		
	Autopilot: **Track End Passed** **Selec. Headg. Ctrl.**  ECDIS:  **1Alarm** **(1) ALARM: Date, Time** **TrackEndPassed** **Selec.Headg.Ctrl.** **Acknowledge** **Silence** NAUTOCONNING (Option):  ALARMS AUTOPILOT Track End Passed WATCH TIME 11 : 30 min Conning alarm panel (Option): **AUTOPILOT** **Track End Passed** 	Last waypoint passed

	Indications	Remarks/Notes
4 Acknowledge the alarm		
Autopilot:  ECDIS:  or: NAUTOCONNING: or  Operator unit NAUTOCONNING:  or Conning alarm panel: 	Autopilot:   ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option): 	The alarm comes up every 30 s until having changed-over to another operating mode, e.g. heading control or manual control.

Attention:
The system remains in “Track Control” on the last track course-line until a user changes-over to another steering mode.

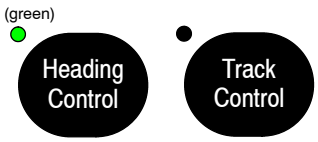
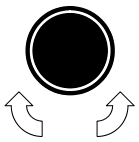
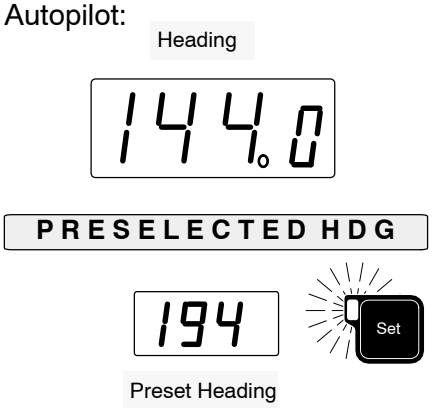
2.14 Interruption of Track Control by the User

In case of emergency (e.g. collision avoidance) interruption of track control is possible in several ways. The possibilities are listed from low to high level in the steering control hierarchy.

Overview:

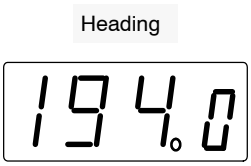
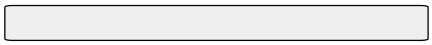
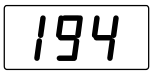
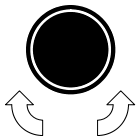
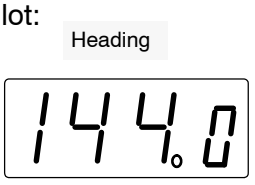
- Select **Heading Control** on the ARCP which is in command
- Select **Heading Control** on the Operator Unit Autopilot
- Actuate Override Tiller on the ARCP which is in command
- Change-over to Manual Control (FU Handwheel)
- Actuate Main Override Tiller (NFU)

2.14.1 Switch-over from Track Control to Heading Control at ARCP (Option)

	Indications	Remarks/Notes
1 Change-over to **heading control** on the ARCP		
ARCP: 	ARCP:  Autopilot: 	The actual heading is taken as new preset heading.
2 Preselect new preset heading		
Autopilot: 	Autopilot: 	Turning the rotary knob results in that the desired preset heading appears within the “Preset Heading” display. The new preset heading must be acknowledged within approx.15s.
3 Acknowledge the preset heading preselection		
Autopilot: 		The ship starts the heading change maneuver. The heading change maneuver is completed as soon as the heading corresponds to the preset heading preselection.

Reactivating track control is the same procedure as starting track control !
See Section 2.10.2 or 2.11.2 !

2.14.2 Switch-over from Track Control to Heading Control at Autopilot Operator Unit

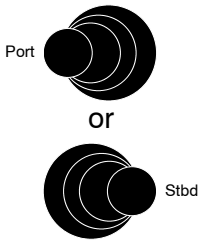
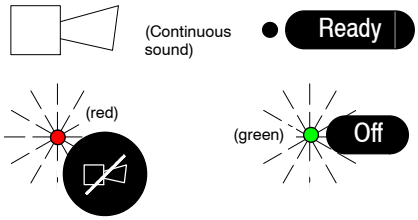
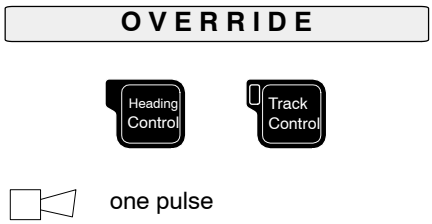
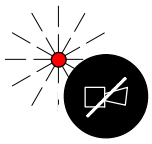
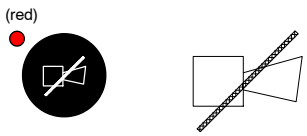
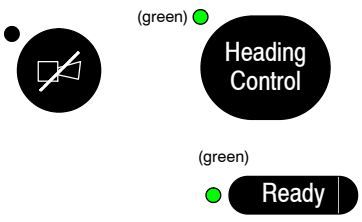
	Indications	Remarks/Notes
1 Change-over to heading control on the autopilot		
Autopilot: 	Autopilot:     ARCP: 	The actual heading is taken as new preset heading.
2 Preselect new preset heading		
Autopilot: 	Autopilot:   	Turning the rotary knob results in that the desired preset heading appears within the “Preset Heading” display. The new preset heading must be acknowledged within approx.15s.

	Indications	Remarks/Notes
3 Acknowledge the preset heading preselection		
Autopilot: 		The ship starts the heading change maneuver. The heading change maneuver is completed as soon as the heading corresponds to the preset heading preselection.

Reactivating track control is the same procedure as starting track control !
See Section 2.10.2 or 2.11.2 !

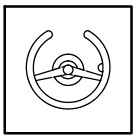
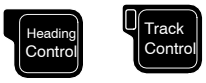
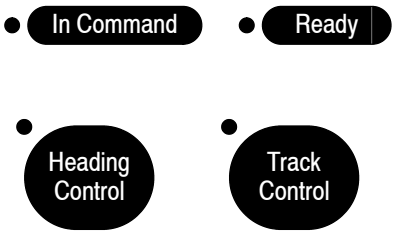
2.14.3 Switch-over from Track Control or Heading Control to Autopilot Override Mode at Autopilot Override Tiller at the ARCP (Option)

NOTE
ARCP Override Tiller is only ready for use if the ARCP is “in command”

	Indications	Remarks/Notes
1 Start override		
ARCP: 	ARCP:  Autopilot: 	The rudder moves in the pre-selected direction as long as the contact is made. The actual rudder angle is to be observed on a rudder angle indicator.
ARCP: 	ARCP: 	
2 End override		
ARCP: 	ARCP: 	Heading control is active, independent of the operating mode before.

Reactivating track control is the same procedure as starting track control !
See Section 2.10.2 or 2.11.2 !

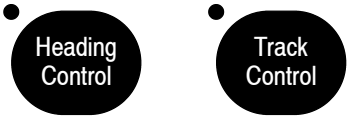
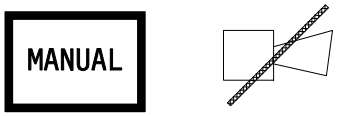
2.14.4 Change-over to Manual Control (FU Handwheel)

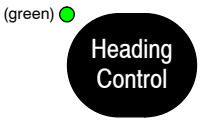
	Indications	Remarks/Notes
1	Change-over to manual control by changing over the operating mode on the steering mode selector switch.	
	Autopilot:  ARCP: 	Adjust rudder angle by means of the handwheel. The rudder is moved until it reaches the required angle set by the hand-wheel.

Reactivating track control is the same procedure as starting track control !
See Section 2.10.2 or 2.11.2 !

2.14.5 Actuate Main Override Tiller (NFU)

(Option, not available in all system configurations)

	Indications	Remarks/Notes
1 Start override		
Actuate main override tiller	Autopilot: **OVERRIDE**  Override Indicator:  ARCP (Option):  	Adjust rudder angle by means of the tiller. The rudder position is changed as long as the contact is made. The actual rudder angle is to be observed on the rudder angle indicators.
Override indicator:  	Override indicator:  	

	Indications	Remarks/Notes
2 End override		
Override Indicator: 	Autopilot:  Override indicator:  ARCP: 	Heading control is active, independent of the operating mode before.

Reactivating track control is the same procedure as starting track control !
See Section 2.10.2 or 2.11.2 !

2.15 Reactivating Track Control after user interruption

The reactivation of Track Control is the same procedure as performing a GO-TO-Track manoeuvre see section 2.10 or 2.11 in case of using ARCP (Option)

2.16 Interruption of Track Control in case of a Defect

In case of any failure of the system it is not necessary for the officer of the watch to react immediately. The system becomes degraded to the next lower steering control mode level and continues started manoeuvres as far as possible.

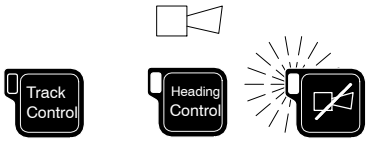
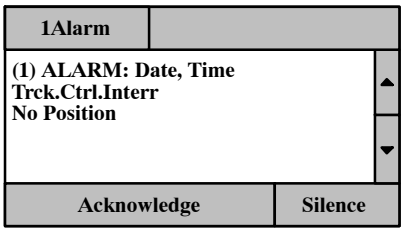
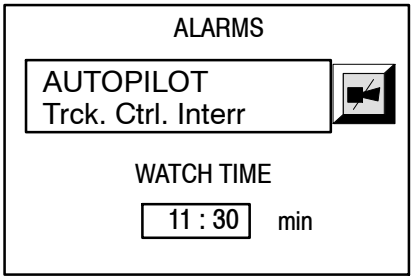
Note!
There is one exception from that.
In case of loosing the heading reference it is not possible for the system to continue the course of the preplanned track in a fall back mode.
In that case the present rudder angle is frozen, the rudder motion will be stopped (IMO requirement).
The operator has immediately to take over via Override Tiller or select Hand Steering Mode via Steering selector Switch.

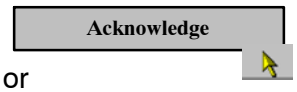
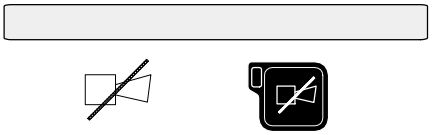
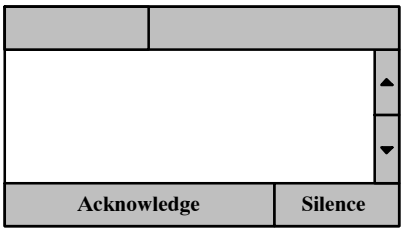
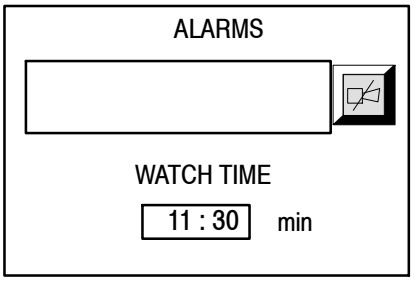
During **track control** mode two different phases are distinguished:
1) the ship is sailing on a straight track leg
2) the ship is in a track change manoeuvre

Interruption of track control leads to two different reactions depending on the phase the vessel is in, see the following Sections.
A summary is given section 2.17.

2.16.1 Interruption of Track Control During Sailing a Straight Track Leg

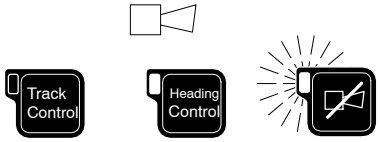
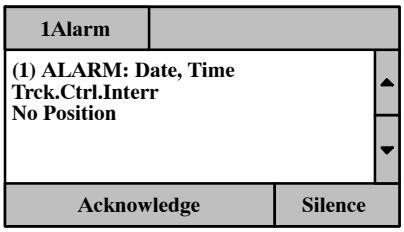
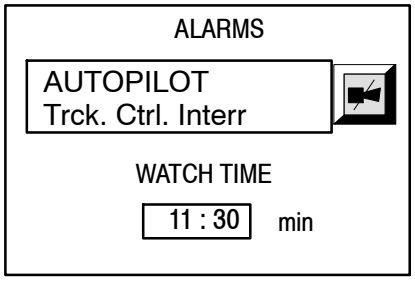
The track approach is finished. The vessel is on a straight track leg.

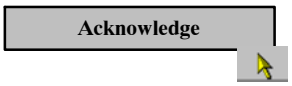
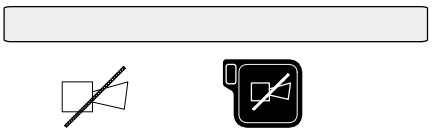
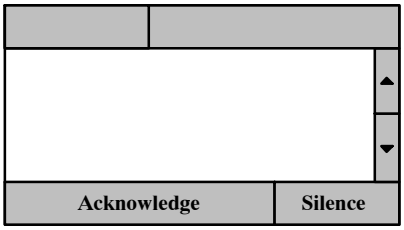
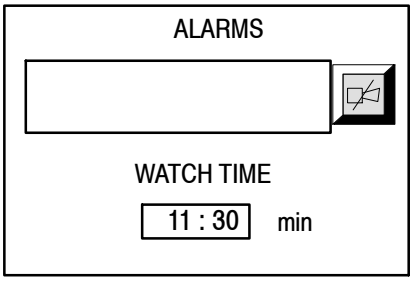
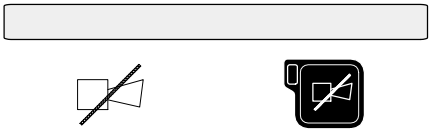
	Indications	Remarks/Notes
1 Alarm (e.g. No Position)		
	Autopilot: **Trck.Ctrl.Interr** **No Position**  ARCP (Option):  ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option): **A U T O P I L O T** **Trck.Ctrl.Interr** 	1. The operating mode changes from track control to heading control. 2. The actual heading is taken as the new preset heading. 3. The rudder limit remains at max.

	Indications	Remarks/Notes
2 Acknowledge alarm		
Autopilot:  or ECDIS:  or NAUTOCONNING:  or Operator unit NAUTOCONNING:  or Conning alarm panel: 	Autopilot:  ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option): 	

2.16.2 Interruption of Track Control in a Track Change Manoeuvre

A track change manoeuvre is running.

	Indications	Remarks/Notes
1 Alarm (e.g. No Position)		
	Autopilot: **Trck.Ctrl.Interr** **No Position**  ARCP:  ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option): **A U T O P I L O T** **Trck.Ctrl.Interr** 	1. The operating mode changes from track control to heading control. Preset heading is the track–course of the new track. 2. The radius planned for the current track change maneuver is taken as maneuver parameter. 3. The rudder limit remains at max. 4. The track change maneuver has tried to be finished in **heading control** mode.

	Indications	Remarks/Notes
2 Acknowledge alarm		
Autopilot:  or ECDIS:  or NAUTOCONNING:  or Operator unit NAUTOCONNING:  or Conning alarm panel: 	Autopilot:  ECDIS:  NAUTOCONNING (Option):  Conning alarm panel (Option): 	

2.17 Summary failure situation

Interruption of track control	Steering mode	New preset heading	Navigation parameters
during track approach maneuver	Automatic change over to heading control	actual heading	parameters (and values) which were active before **track control** has been started
during sailing a straight track leg		actual track course	radius with the value of the preplanned TO–WPT radius
during track change maneuver		new track course	radius with the value of the actual maneuver

Attention:
If the current alarm is not acknowledged within 30s the “Back Up Officer Alarm” will be generated. The system activates a relay.

Note:
There is one exception from that.
In case of loosing the heading reference it is not possible for the system to continue the course of the preplanned track in a fall back mode.
In that case the complaint with international regulations the rudder angle is frozen, the rudder motion will be stopped.
The operator has to take over via Override Tiller or select Hand Steering Mode via Steering selector Switch.

DEVICE	MESSAGES	SIGNIFICATION	PROBABLE CAUSE	EFFECTS on OPERATION	MEASURES
ECDIS	XTD GREATER THAN xxx M	During track control or track monitoring the current position is too far away from planned route	- XTE monitoring limit is too small. - Performance of the Track Control System not sufficient - Autopilot parameters not adapted - Problems with the steering gear or the steering control system	The preplanned cross track limit cannot be kept.	Increase XTE limit. XTE limit is user defined. Value can be adjusted in menu “Route” entry “Edit Route”. Check autopilot parameters. Check steering gear or steering control system.
ECDIS	GYRO ERROR	Timeout on interface lost HDG	Too much time has passed since last HDG telegram from GYRO	No Track Control possible	Check GYRO and/or HDG telegram
ECDIS	POSITION ERROR	NO position available	No data of position fixing system. Interface configuration	No Track Control possible	Check Nav interface, position input

ECDIS	GROUND SPEED ERROR	Timeout on interface, lost SOG data	No data of Speed Log. Interface Configuration	No Track Control possible	Check NMEA telegram VBW in interface Monitor. Check Sensor and communication cable to ECDIS
ECDIS	SPEED LOG ERROR	Timeout on interface, lost LOG data	Too much time has passed since last VBW (containing Longitudinal ground speed LOG). No data of Speed Log. Interface configuration	No Track Control possible	Check VBW telegram
ECDIS	WATER SPEED ERROR	Timeout, lost STW telegram	Too much time has passed since last good STW telegram	No Track Control possible	Check telegram and communication cable
ECDIS	WAYPOINT MISMATCH	Autopilot – ECDIS during track control a discrepancy between ECDIS and Autopilot data occurs	Interface problems	No Track Control possible	Stop Track Control. Check autopilot connection, if necessary restart ECDIS and Autopilot.

ECDIS	AUTOPILOT ERROR	Timeout, stop track control, in case of missing status from Autopilot	Used Autopilot: Check Status from Autopilot; if too much time has passed since last status ,message from the Autopilot then the ECDIS stops track control.	No Track Control possible	Check Autopilot, connection between Autopilot and ECDIS. PANZSTA telegram
NP2030/35	App. To-Waypoint	3 to 6 minutes left to turning manoeuvre	Approaching TO-Waypoint	----------	Acknowledge alarm
NP2030/35	App. Next-Wpt	3 to 6 minutes left to next turning manoeuvre when still being in a turning manoeuvre	Approach NEXT-Waypoint	----------	Acknowledge alarm
NP2030/35	Track End x Min	x minutes left to track end	Approaching Track End	----------	Acknowledge alarm
NP2030/35	Track End Passed Selec. Headg. Ctrl.	During track control the track end passed	----------	----------	The alarm comes up every 30s until having changed over to heading control or HAND control. Change over to heading control or HAND control

NP2030/35	Trck. Ctrl. Interr. Missing Waypoint	During track control a disturbance between ECDIS and NP2030/2035 occurs	No waypoint data on ECDIS interface	Automatic change over from track control to heading control. No Track Control possible	Check ECDIS. Start track control again.
NP2030/35	Trck. Ctrl. Interr. No Position	During track control a position transmission failure occurs	ECDIS gets no position information	Automatic change-over from track control to heading control. No Track Control possible	Check position information at ECDIS
NP2030/35	Trck. Ctrl. Interr. No ECS Status	During track control an ECDIS status failure occurs	ECDIS breakdown. Disconnection of ECDIS and autopilot	Automatic change-over from track control to heading control. No Track Control possible	Perform restart of ECDIS
NP2030/35	Trck. Ctrl. Interr. ECS not ready	During track control ECDIS not ready for operation	Restart of ECDIS		
NP2030/35	Trck. Ctrl. Interr. Chng.Ang. Too Big	During track control the next track change angle is too big.	Modification of active route. Transmission of wrong waypoint data	Automatic change-over from track control to heading control. No Track Control possible	Check route. For explanation of the error, see section NO TAG

NP2030/35	Trck. Ctrl. Interr. Dist. TO-Wpt Shrt	During track control the distance to the TO-WPT is too short	Modification of active route. Transmission of wrong waypoint data	Automatic change-over from track control to heading control. No Track Control possible	Check route
NP2030/35	Trck. Ctrl. Interr. Dist.TO/NEXT-Wpt	During track control the distance to the TO-WPT and the NEXT-WPT is too short	Modification of active route. Transmission of wrong waypoint data	Automatic change-over from track control to heading control. No Track Control possible	Check route. For explanation of the error see section NO TAG.
NP2030/35	Trck. Ctrl. Interr. Too close to Wpt	During track control the ship is too close to the way-point. he approach would end after track end or after start of next track change.	Modification of active route. Transmission of wrong waypoint data	Automatic change-over from track control to heading control. No Track Control possible	Check route
NP2030/35	Trck. Ctrl. Interr. Wpt Not Ahead	During track control the new way point (after having finished track change manoeuvre) does not fit with the heading of the ship after the turn.	Modification of active route during track control	Automatic change-over from track control to heading control. No Track Control possible	Restart track control

> Warning!
> Automatic steering modes (course control, track control) may be used only, when the expectable steering accuracy complies with the traffic and navigational situation.
> Special care must be taken in confined and congested waters.

Starting Track Control

1) Checks to be made before starting track control

For correct functioning of the trackkeeping, faultless operation of the following systems and devices is required: Steering gear and steering control system, Sensors and corresponding transmission from gyro compass, magnetic compass, log, position sensor.

2) Load a route

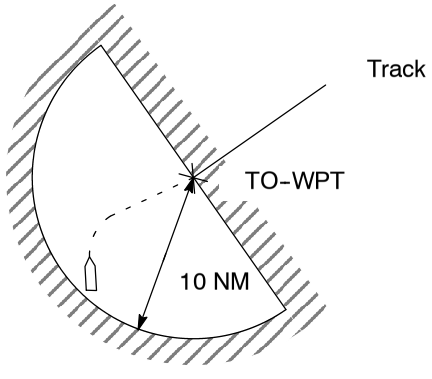
- On the ECDIS select menu WAYPOINTS → OPEN ROUTE. The Open Route dialog box appears.
- Select the route you want to open.
- Select ”Open” or “Open And Show”. “Open And Show“ will center the display on an appropriate chart and the route.

3) Approach the track

3a) Approach the track (GO-TO-WAYPOINT Maneuver, FROM-WPT undefined)

Approach the track by manual control (Handwheel) or by NP2030/NP2035 heading control (course control) until initial position and initial heading are reached:

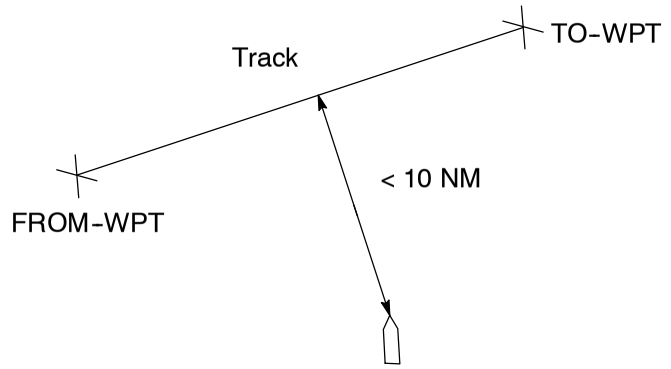
- The TO-WPT has to be located in free water
- The **initial position** should be ”before” the track and less than 10 nautical miles away



3b) Approach the track (GO-TO-TRACK Maneuver, FROM-WPT defined)

Approach the track by manual control (Handwheel) or by NP2030/NP2035 heading control (course control) until initial position is reached.

The instal position must be within the predefined track limits.



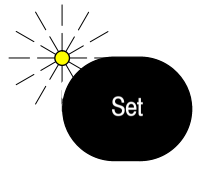
4) Activate Heading Control (if not in heading control)

If the track is approached via manual steering, set steering mode selector switch to **AUTO.** Course control (heading control) is thus selected.

5) Activate the ARCP

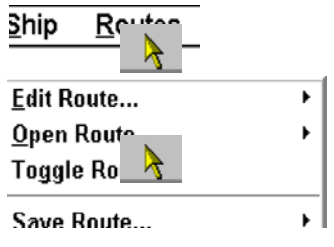
- 

On the ARCP press the **Take over** key.

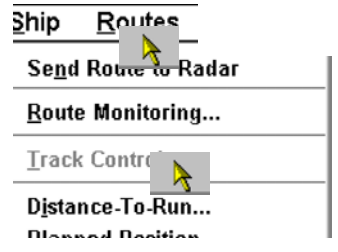
- 

On the ARCP acknowledge the take-over by pressing the **Set** key.

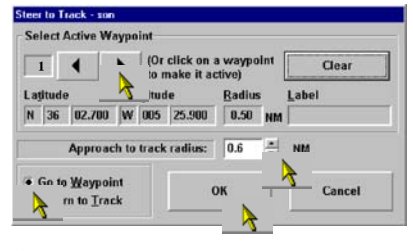
6) Activate at the ECDIS



Select the **Open Route** command from the menu bar **Routes**.
Click on *Open*



Select **Track Control** command from the menu bar **Routes**



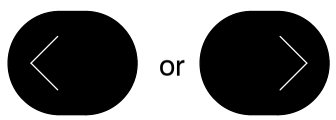
Select Waypoint
Select type of approach manoeuvre
Adjust approach radius
Activate **Track Control**

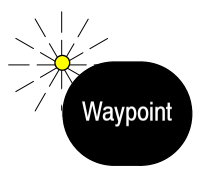
7) Start track control

7a) Start track control (GO-TO-WAYPOINT Maneuver, FROM-WPT undefined)

- 

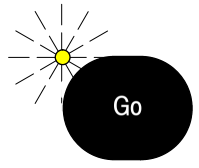
On the ARCP press the **Track control** key. On the ECDIS the Steer to Track dialog box appears.

-  or
On the ARCP select first TO-WPT (active waypoint) by pressing the **<** or **>** key. Coordinates of selected waypoint are indicated in the Steer to Track dialog box at the ECDIS.

- 

On the ARCP select "Go to Waypoint" by pressing the **Waypoint** key.

- Check approach radius at ECDIS dialog box.

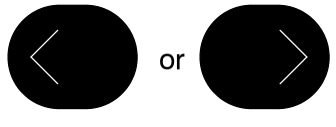
- 

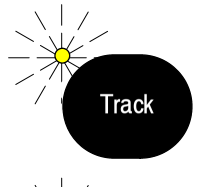
Acknowledge stat of Track Control by pressing **Go** key at ARCP. Track control is started when the check of the geometrical constellation of ship's position and track is passed. The new preset heading, which is needed to approach the track is calculated and displayed in the Set Course display of the NP2030/NP2035.

7b) Start track control (GO-TO-TRACK Maneuver, FROM-WPT defined)

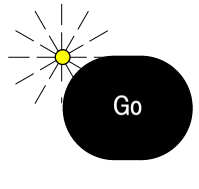
- 

On the ARCP press the **Track control** key. On the ECDIS the Steer to Track dialog box appears.

-  or
On the ARCP select first TO-WPT (active waypoint) by pressing the **<** or **>** key. Coordinates of selected waypoint are indicated in the Steer to Track dialog box at the ECDIS.

- 

On the ARCP select "Go to Track" by pressing the **Track** key.

- 

Acknowledge stat of Track Control by pressing **Go** key at ARCP. Track control is started when the check of the geometrical constellation of ship's position and track is passed. The new preset heading, which is needed to approach the track is calculated and displayed in the Set Course display of the NP2030/NP2035.

Normal Track Change Maneuver

During track change manoeuvre the preset heading for the turn is changing. It is updated cyclically in the Set Course display of NP2030/NP2035.

Interruption of Track Control by the User and Reactivating Track Control

In case of emergency (e.g. collision avoidance) interruption of track control is possible in several ways. The possibilities are listed from low to high level in the steering control hierarchy.

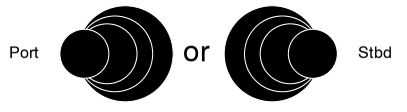
A) Select Heading Control on the ARCP

Change-over to heading control by pressing the **Heading Control** key at the ARCP.
The actual heading is taken as new set course (preset heading).
Reactivating track control is the same procedure as starting track control !

B) Select Heading Control on the Operator Unit Autopilot

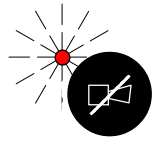
Change-over to heading control by pressing the **Course Control** key at NP2030/NP2035 operator unit.
The actual heading is taken as new set course (preset heading).
Reactivating track control is the same procedure as starting track control !

C) Actuate Override Tiller on the ARCP

- 

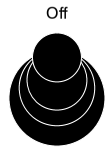
Move the lever of the override tiller to port or starboard at the ARCP. The rudder moves in the preselected direction as long as the contact is made. The actual rudder angle is to be observed on a rudder angle indicator.

-  The ARCP buzzer sounds continuously.

- 
Acknowledge the alarm by pressing the **Acknowledge** key at the ARCP.

- The warning **OVERRIDE** appears in the autopilot display.

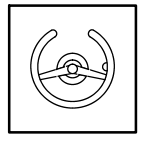
 1x The buzzer sounds once.

- 

To end override move the lever of the override tiller at the ARCP to Off. Heading control is active, independent of the operating mode before.

Reactivating track control is the same procedure as starting track control !

D) Change-over to Manual Control (FU Handwheel)


Change-over to manual control by changing over the operating mode on the steering mode selector switch. Adjust rudder angle by means of the handwheel. The rudder is moved until it reaches the required angle set by the handwheel.
Reactivating track control is the same procedure as starting track control !

E) Actuate Main Override Tiller (NFU) (Option)

- Actuate main override tiller. Adjust rudder angle by means of the tiller. The rudder position is changed as long as the contact is made. The actual rudder angle is to be observed on the rudder angle indicators.
- The warning **OVERRIDE** appears in the autopilot display.

  1x The buzzer sounds once.
- On the override indicator the MANUAL key lights up and the buzzer sounds continuously.
- On the override indicator acknowledge the alarm by pressing the **MANUAL** key.
- To end override on the override indicator press the **AUTO** key.

Heading control is active, independent of the operating mode before.
Reactivating track control is the same procedure as starting track control !

Interruption of Track Control in Case of a Defect

In case of any failure of the system it is not necessary for the officer of the watch to react immediately. The system becomes degraded to the next lower steering control mode level and continues started maneuvers as far as possible. **Exception: Loss of heading sensors.**

During track control mode two different phases are distinguished:
A) sailing a straight track leg
B) track change maneuver

The interruption of track control leads into two different reactions depending on the phase the vessel is in, see the following Sections.

A) Interruption of Track Control During Sailing a Straight Track Leg

The track approach is finished. The vessel is on a straight track leg.
In the autopilot display, e.g. **Trck.Ctrl.Interr.** **No Position**
appears.
The buzzer sounds continuously.

Acknowledge the alarm by pressing the **Acknowledge** key at autopilot operator unit..

The operating mode changes automatically from track control to heading control (course control).
The actual heading is taken as the new set course (preset heading).

B) Interruption of Track Control During Track Change Maneuver

A track change maneuver is running.
In the autopilot display, e.g. **Tck.Ctrl.Interr.** **No Position**
appears.
The buzzer sounds continuously.

Acknowledge the alarm by pressing the **Acknowledge** key at autopilot operator unit.

The operating mode changes automatically from track control to heading control (course control).
The track course of the next track section is taken as the new set course (preset heading).
The radius planned for the current track change maneuver is taken as maneuver parameter.
The track change maneuver is tried to be finished in heading control mode.

Attention:
If the alarm will not be acknowledge within 30s the “Back Up Officer Alarm” will be activated.

Track End

In general all alarms are indicated on ECDIS,. It is also displayed at NAUTOCONNING and Conning alarm panel if that option is available.
Alarms can be acknowledged on ECDIS. It can also be acknowledged at NAUTOCONNING and Conning alarm panel, if that option is available.

Attention:
The system remains in “Track Control” on the last track course-line until a user changes-over to another steering mode.