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NautoPilot® NP 60

Operator Manual

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SAFETY INFORMATION

The Autopilot NP 60 relieves the helmsman of his duty to steer the vessel, however, it does not relieve him of his duty to continuously keep watch of the traffic situation and implement measures to ensure his and other vessels are not endangered or come to harm.

The following rules should be observed:

- Observe the international regulations for safety at sea
- Maintain a permanent watch and regularly check all around for other vessels and obstacles to navigation.
- Correct performance after alterations of heading shall be monitored.
- All control and monitor functions/modes shall be checked on a regular basis.
- NautoPilot 60 allows to define a rate of turn value for heading alterations. Make sure that these values are appropriate to the vessel's manoeuvring characteristics or present operating conditions.
- NautoPilot 60 allows to define a rudder limit value for heading alterations. Make sure that these values are appropriate to the vessel's manoeuvring characteristics or present operating conditions.
- Wrong settings for radius, rate of turn, rudder and counter rudder could cause high heeling angles.
- Maintain an accurate record of the vessel's position on a current chart using GPS-data or by means of visual bearings.
- It is also important to pay attention to draught and the impact of the tides.
- Even when the Autopilot is locked onto the desired track, erroneous GPS-data can lead to dangerous situations. A regular check of the position data and the route is mandatory.

- Ensure all crew members are able to instantly disengage the Autopilot and take manual control of the vessel.
- Make sure that in the event of an emergency, an immediate manual heading correction can be carried out.
- When using a magnetic compass or fluxgate compass as a heading sensor, keep in mind the effect of magneting variation on the accuracy of the compass heading.
- Before setting the NP60 into operation, read this manual carefully.

SAFETY INFORMATION

▶ **Note**

The desired rate of turn depends

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

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

▶ **Caution**

Set headings differing by more than ± 180 ° from the ship's current actual heading are not executed over the shorter heading by the **NP60**.
The set heading change is carried out to correspond with the default set heading > 180° .

▶ **Note**

HEADING CONTROL operating mode

If the values on the magnet compass differ from the values on the gyro compass, switching-over to the compass reference results in a set heading adaptions.
So any differences between the set heading and the actual heading are retained.

WAYPOINT operating mode

In this operating mode the actual heading can, depending on the track error, deviate from the track course.
Important: Please refer to chapter 2.7.4 before using this mode.

SAFETY INFORMATION

▶ **Note**
Autopilot operation at high speeds
(HSC High Speed Craft, as per IMO guidelines from
30 Kn to 70Kn)
Behaviour rules for the following situations are set out on pages HSC-1, HSC-2 and HSC-3

1. **Sensor failures**
2. **Autopilot errors**
3. **Hazards caused by acceleration, heading change and seaway**

Operator Manual
Autopilot operation at high speed

1. Sensor failures

No.	Event	Effect	Operator guidance	Response time
1	The log fails	At a speed of below 3 kn the *low speed* alarm is output both visually and audibly on the operator unit.	Change over to manual operation. Set Autopilot to manual speed input.	The response time for changing to manual input is critical because control can become unstable.
2	Heading reference error	A heading reference failure is detected and a visual/audible *Gyro Fail* alarm is output on the operator unit. The most recent valid actual heading is frozen and is maintained in use as heading reference. So that there is no reaction from the rudder, the set heading is equalised to the actual heading. It is no longer possible to alter the set heading on the operator unit.	a) Reduce speed to values of < 20 kn. Change over to magnetic compass or second gyro-compass reference if available. Optimise the control parameters in magnetic compass operation, if no stable control is present. b) Switch to manual control and use a correct second heading reference.	If a manoeuvre is under way, it is essential to switch to manual control immediately.

2. Autopilot error

No.	Event	Effect	Operator guidance	Response time
1	System error / Power down	When there is a system error the Autopilot is not operational. It is not possible to describe the effects for every case. The aim when dealing with the fault is to maintain the current rudder position. An audible/visual system error alarm is output on a warning device.	Change over to manual operation. Reduce speed in order to be able to better handle any rudder adjustment procedures.	The response time – i.e. change over to manual operation – is critical. It is essential that the change over is made immediately.
2	Operating unit error	An operating unit error in the form of defective electronics has no effect on current steering behaviour. The operator is made aware that the operator unit is inoperable, because there is no indication on the display or a *No Connection* message appears on the display unit.	Switch to manual control, because it is no longer possible to adjust the set heading, and Autopilot controls (warnings, alarms, parameter configuration) no longer exist.	The response time – i.e. change over to manual operation – is not critical.

3. Hazards caused by acceleration, heading change. and seaway

No.	Event	Effect	Operator guidance	Response time
1	Ship acceleration	Automatic adjustment by the controller to the speed is particularly important when accelerating. A missing log (e.g. error) can result in controller instability and to inappropriately large rudder angles.	If the log function cannot be assured, the ship should be accelerated slowly to the desired speed, while at the same time making manual speed entries. Rudder limitation should be set to the maximum permissible value.	Change over immediately to manual steering if the controller becomes unstable.

No.	Event	Effect	Operator guidance	Response time
2	Heading change	Changes in heading should be carried out in such a way as to avoid impermissibly high centrifugal acceleration (< 0.05g). This reduces danger of personal injury and from cargo slippage. Mathematical context: a = d * v a = Acceleration (centrifugal acceleration) b = Rotation speed at heading change v = Travelling speed It is recognized that the rotation speed and travelling speed have a proportional effect on acceleration. The rotation speed should be selected in connection with a required maximum speed, so that the above-stated acceleration is not exceeded. The rotation speed limitation can be configured on the Autopilot.	Set the maximum permissible rotation speed for various travelling speeds. (this depends on passengers, cargo). Define the maximum rudder limitation.	If the centrifugal acceleration is found to be too high, the travel speed must be reduced immediately.
3	Seaway	a) The ship's speed must be adapted to the current seaway conditions. This is specified within the context of ship safety-regulations. (wave height and permitted maximum speed). b) Seaway effects can cause undesirably high rudder amplitudes on the Autopilot.	Increase the Yawing setting until a compromise between rudder activity and heading accuracy at the travel speed that is still permitted has been found.	If the rudder amplitude is higher than permitted the travel speed must be reduced for safety reasons. Then check the Yawing setting.

1 General

The NP60 Autopilot forms an efficient component within a navigation and steering control system.

It is for use in vessels up to 60 m in length, in particular fishing trawlers, tugs and other working vessels, as well as in motor yachts.

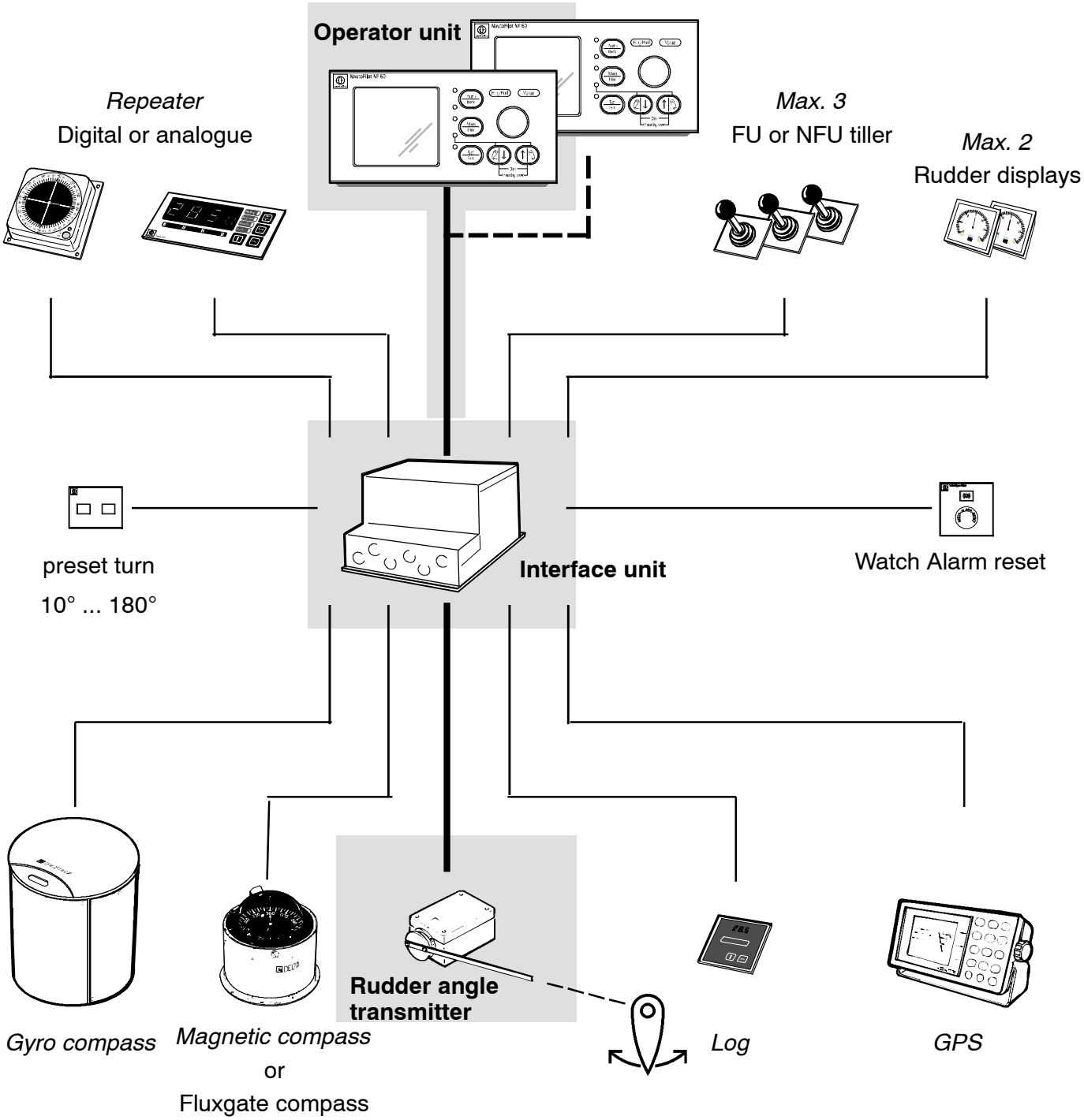
Traditional heading steering and waypoint steering are both adjustable.

An LCD display unit provides indications of all the essential information, such as

- gyro compass heading (magnet compass heading)
- the steered heading
- yawing, rudder and counter rudder
- rudder position

The basic version of the Autopilot consists of the following elements:

- Operating unit, type 102-881
- Interface unit, type 102-880
- Rudder angle transmitter unit 101-529
- Connecting cable (operator unit – interface unit)
- Accessories (spare parts)
- 2 manuals
  Operating manual 3464/100-037.DOC011
  Service manual 3464/100-037.DOC031



Basic system

Picture 1: Nautopilot NP 60, basic system with options

Operating instructions

These operating instructions contain every operational procedure as well as information about behaviour when alarms occur on the LCD display unit.

Service manual

In addition to the operating manual, there is also a service manual. It contains the following:

- Information relating to installation and initial start-up
- Information relating to maintenance and repairs

1.1 Technical data

1.1.1 Electrical data / Environmental conditions

- Operator unit
  - Power consumption: 4W
  - Supply through interface unit: 24V d.c.
  - Type of protection: IP 44 or IP 56
  - Ambient temperature: – 15° .. + 70°

- Interface unit
  - Power consumption when operator unit is used: 10 W
  - Supply with polarity inversion protection: 10 .. 36V d.c.
  - Type of protection: IP 21
  - Ambient temperature: –15° .. + 55°
  - Relative humidity following IEC 945: 93% at 40 °C
  - EMC: as per EN 60945

  - Steering gear output:
    - Switch output (2x): 24Vd.c. max. 48W
    - Analogue output, floating (2x) max. set rudder value: variable voltage value for max. set rudder value: +/– 10V d.c. / 5mA

  - Interface ports for optional sensors:
    - Gyro compass with transmission system: ANSCHÜTZ course bus system
    - External compass: 1/6° Step system
    - Magnetic compass with transmission system: ANSCHÜTZ scanning sonde
      or
      Electronic Fluxgate compass with NMEA 0183 Interface
    - Ship's log: 200 pulses or with NMEA 0183 interface port
    - Position receiver: (APA-, APB-, NMEA 0183, RS232 / RS422)

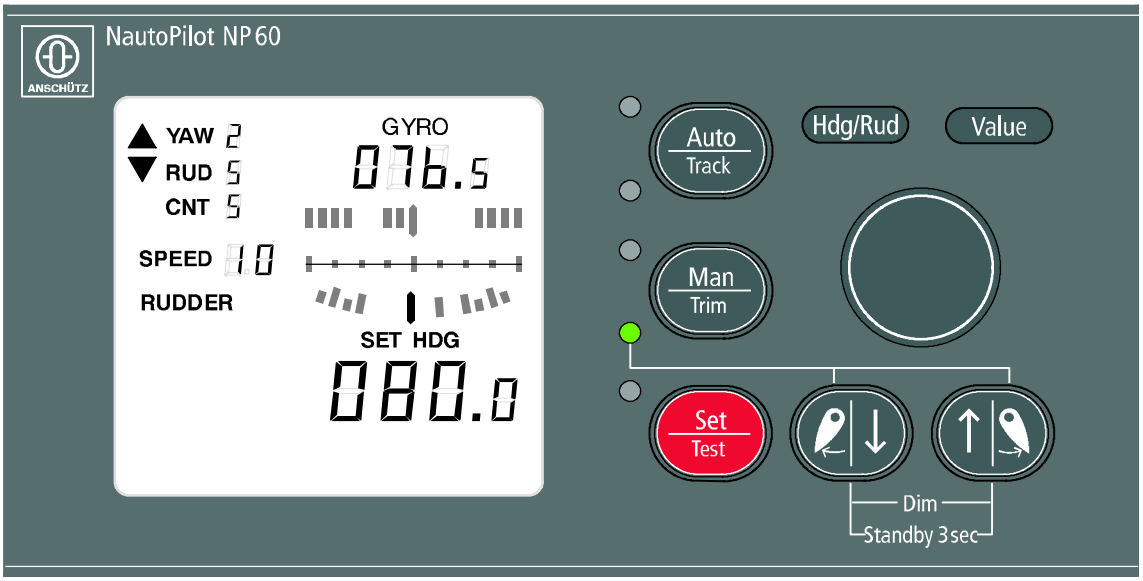
- Interface ports for optional components:
  - maximum 3 tillers possible: FU Tiller, NFU Tiller
  - max. 2 rudder position display units: ± 10 V d.c each at 2.5mA
  - max 4 operator units: 1 main unit, 3 auxiliary steering units

- Preset Turn operator unit: 10° ... 180°

- No-voltage alarms and signal outputs to supply an external signal transmitter:
  - Alarm outputs (relay outputs): AUTO FAILure (Automatic unit defective), POWER FAILure (voltage supply defective), STEERING FAILure, OFF HEADING (heading error against gyro compass), HEADING MONITOR (heading error against magnetic compass)
  - Status (Relay output): for TILLER ON status
  - Status (Relay output): for Auto ON status
  - Signal output (heading): serial output RS422 for ANSCHÜTZ Digital repeater indicator (actual heading)
    or serial output RS422 for ANSCHÜTZ steering repeater for GYROSTAR II
  - Watch Alarm reset: reset key
  - General Watch Alarm output: relay contact

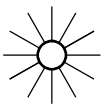
- Rudder position transmitter
  - Supply through NP 60: ± 15V d.c.
  - Type of protection: IP 56
  - Ambient temperature: -25° .. + 55°

2 Operation

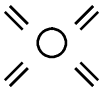


Picture 2: Operator Unit for NP 60 Nautopilot

2.1 Symbols used

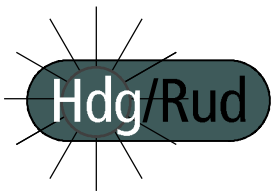


LED *on*



LED *flashing*

LED *off*



Display unit*on*

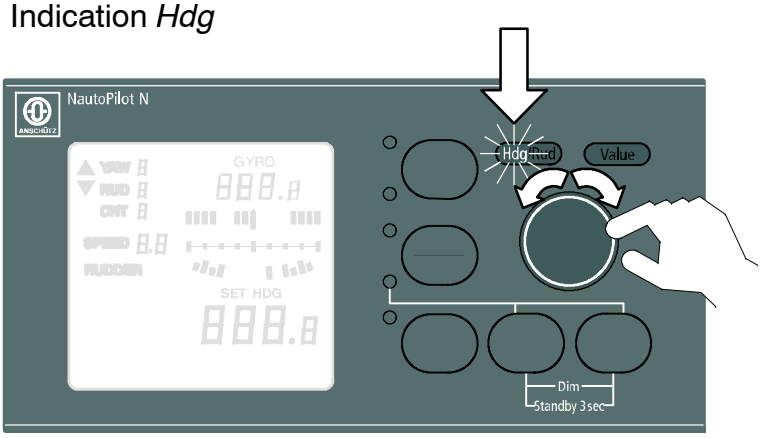
Display unit*off*

audible signal *on*

audible signal off

2.2 Status indications

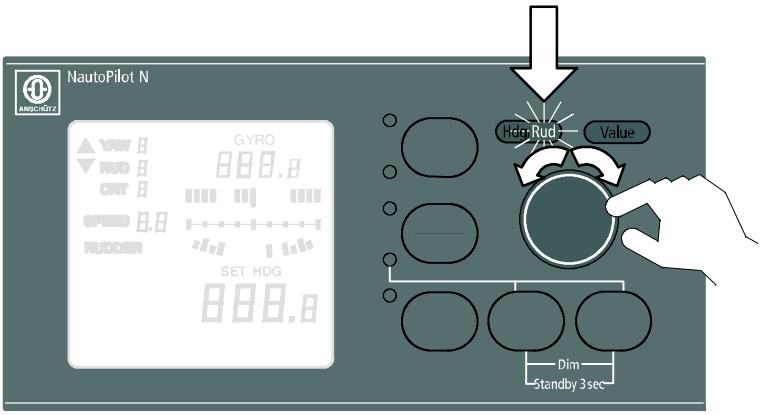
A Indication *Hdg*



- The Autopilot is in **Heading Control (Auto)** or **Trim** operating mode.

  The control knob can be used for *set heading adjustments*.

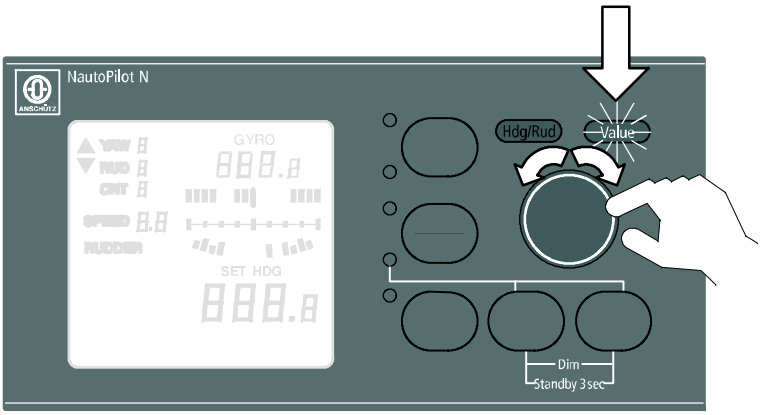
B Indication *Rud*



- The Autopilot is in **Manual Rudder Movement (Man)** operating mode.

  The control knob can be used to move the rudder in 1° steps

C Indication *Values*

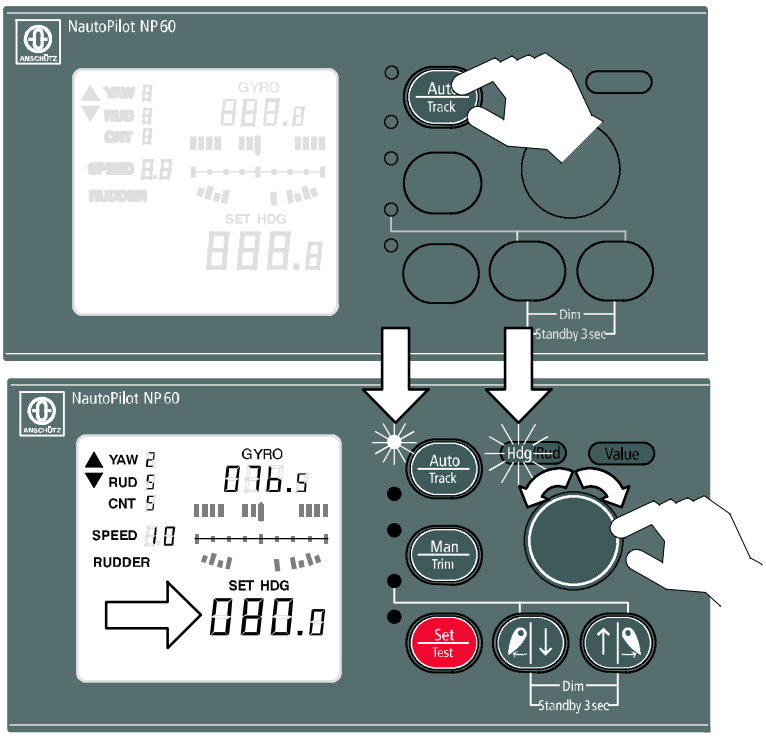


- The Autopilot is in **Heading Control (Auto), Manual Rudder Movement (Man)** or **Waypoint (Track)** operating mode, and the parameter list has been selected.

  The control knob can be used to *change* values.

2.3 Switching on at operator unit

A

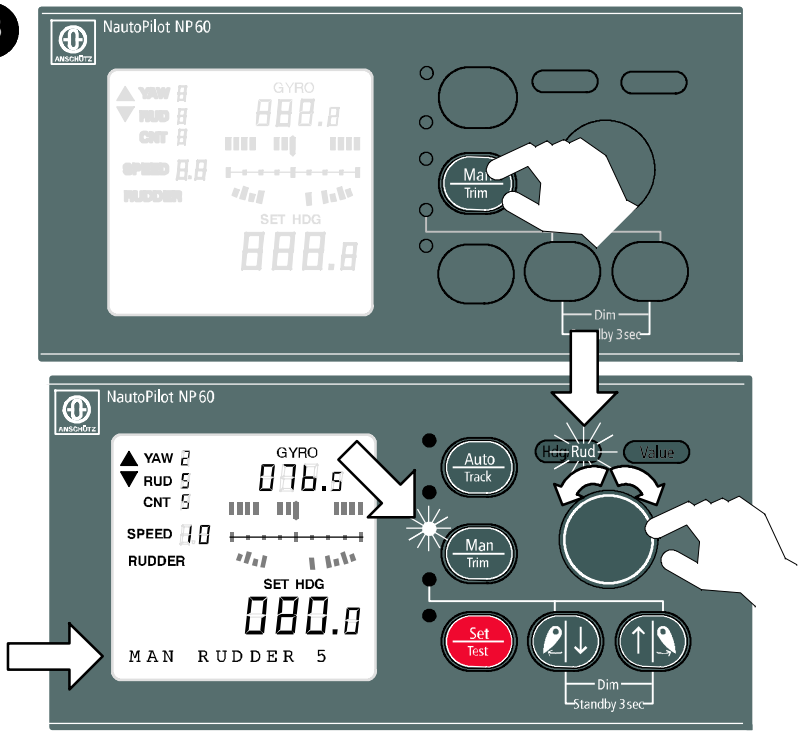


- Press the Auto Track key

- The Autopilot changes to **Heading Control** operation mode.

  The control knob can be used to make set heading adjustments.

B



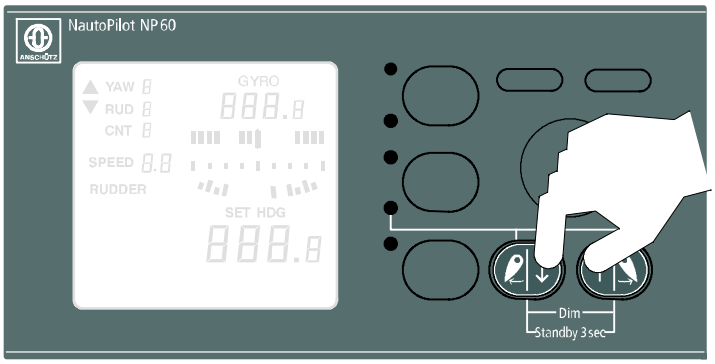
- Press the Man Trim key

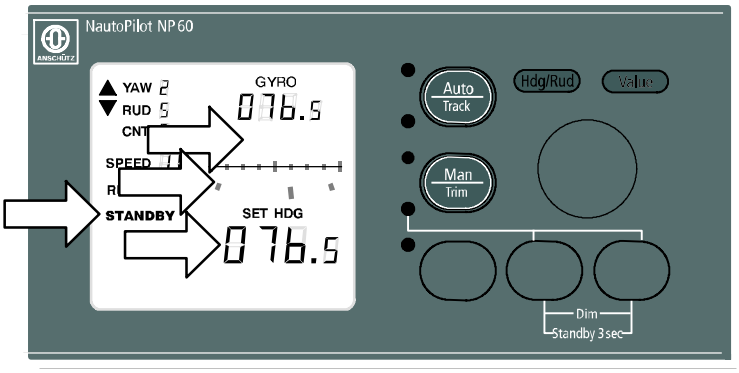
- The Autopilot changes to **manual control** operating mode.

  The control knob is now activated for manual control of the ship (rudder movement). The display indicates **Rud**.

  The set rudder values are indicated on the LCD display unit (**MAN RUDDER 5** as an example for 5°).

2.4 Switching off at operator unit – standby operation





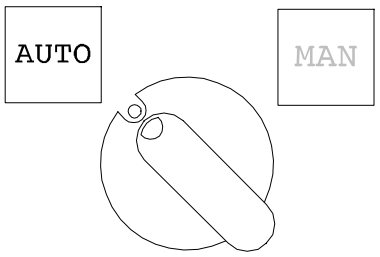
- Hold both keys down simultaneously for approximately 3 seconds.
- The Autopilot goes into **STANDBY** MODE.
- All operating and status indications are extinguished (Hdg/Rud, value).
- The set heading is locked into the actual heading.
- The heading/track error scale is suppressed.
- The actual rudder position is displayed, there is no rudder limitation.

Switch Autopilot back on confirm with the Auto Track or the Man Trim key.

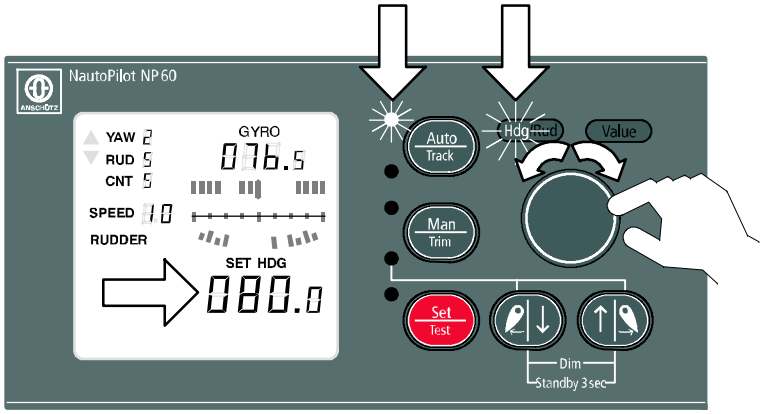
Note:

If no steering mode selector is available the Autopilot can be switched on and off at the operator unit.

2.5 Using the steering mode selector to switch on



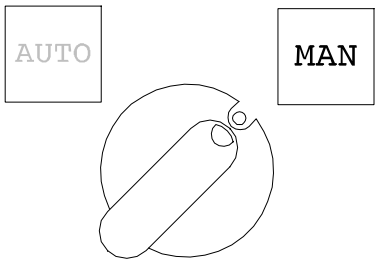
- Steering mode selector to **AUTO** setting.



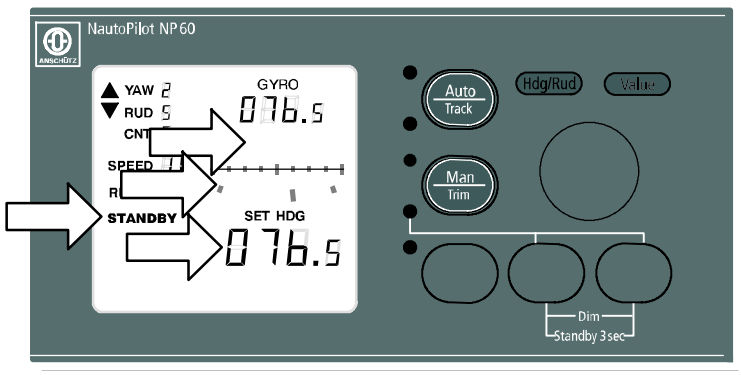
- The Autopilot returns the **heading control** operating mode

  The control knob can be used for set heading adjustments.

2.6 Using the steering mode selector to switch off – standby operation



- Steering mode selector to **MAN** setting.

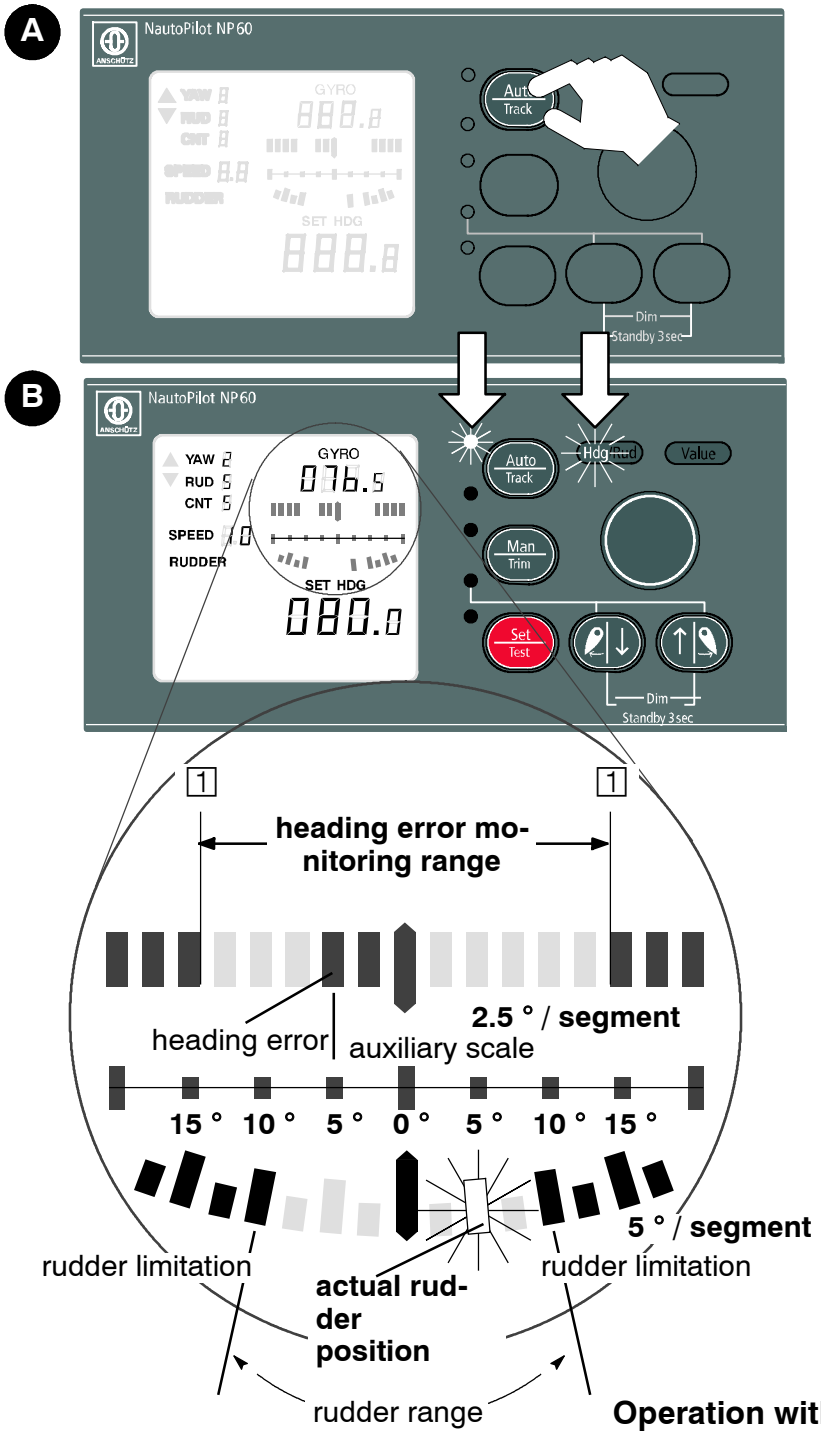


- The Autopilot goes into **STANDBY** mode.
  (see section 2.4)

2.7 Operating modes

2.7.1 Heading control (AUTO)

2.7.1.1 Activation and Indications

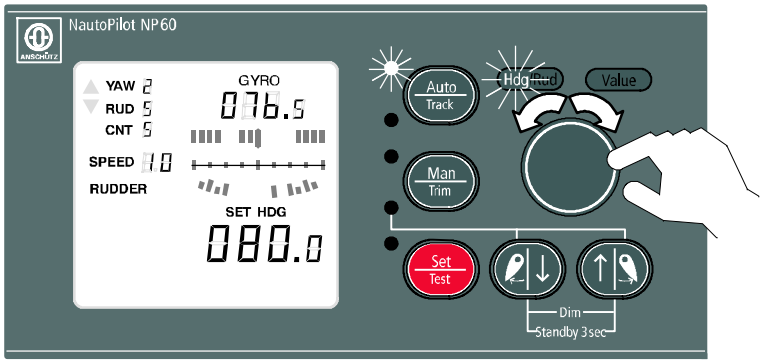


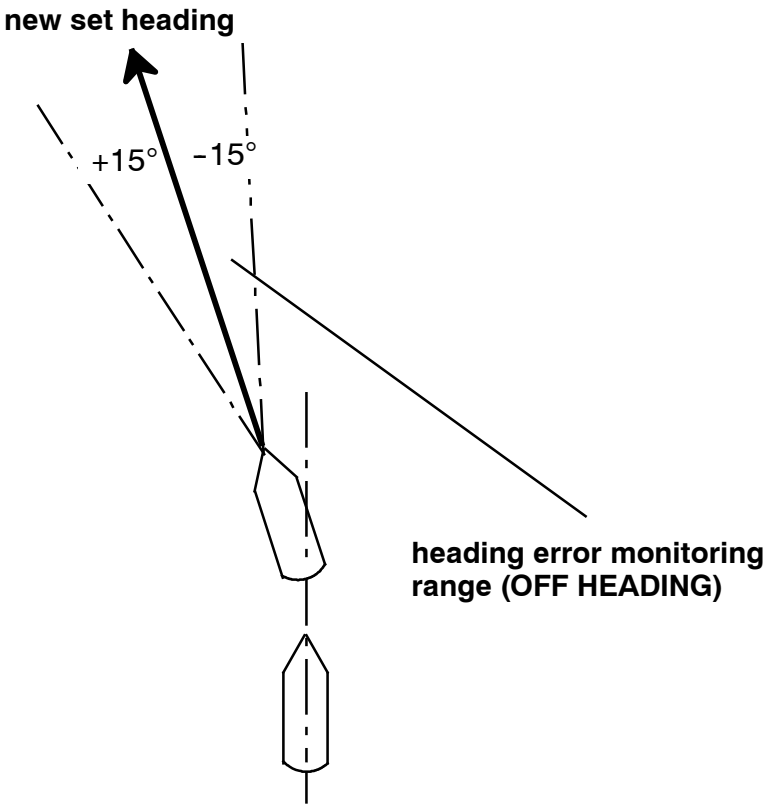
- Press the Auto Track key until the **AUTO** LED is illuminated.
- The Autopilot goes into **Heading Control (AUTO)** operating mode.
- The current actual heading is adopted as set heading.
- The display indicates the heading error monitoring range on a scale, and also the monitoring limits [1].
  This range is configurable on the (OFF HEADING) parameter.
  Display resolution is in 2.5° / segments.
  There is an auxiliary scale in the relevant amount to assist the reading procedure.

  The current heading error (port or starboard) is displayed by means of the relevant number of segments (e.g. 2 segments for a 5° o deviation). If the heading error is greater than the heading error monitoring range, the segments concerned *flash*
- In the bottom part of the display a scale indicates the rudder range together with the set limits
  (Resolution 5° / segment).
  The actual rudder position is shown as a blinking segment.

Operation with Voith Schneider Propellers (VSPs):
Please make sure that the vessel has speed ahead (with no changes in heading nor transversal speed) when activating the autopilot.

2.7.1.2 Manual set heading setting





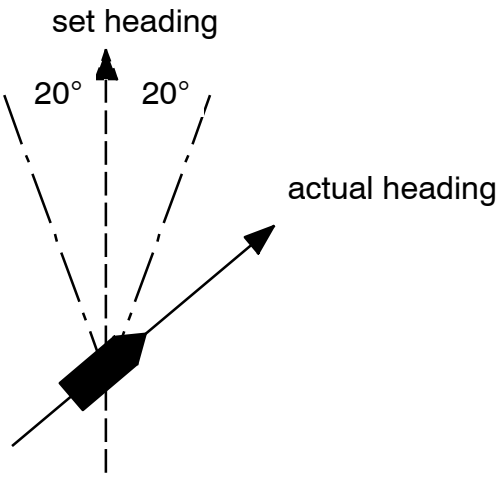
- Set heading changes are made from the **control knob** (in 0.5° steps).

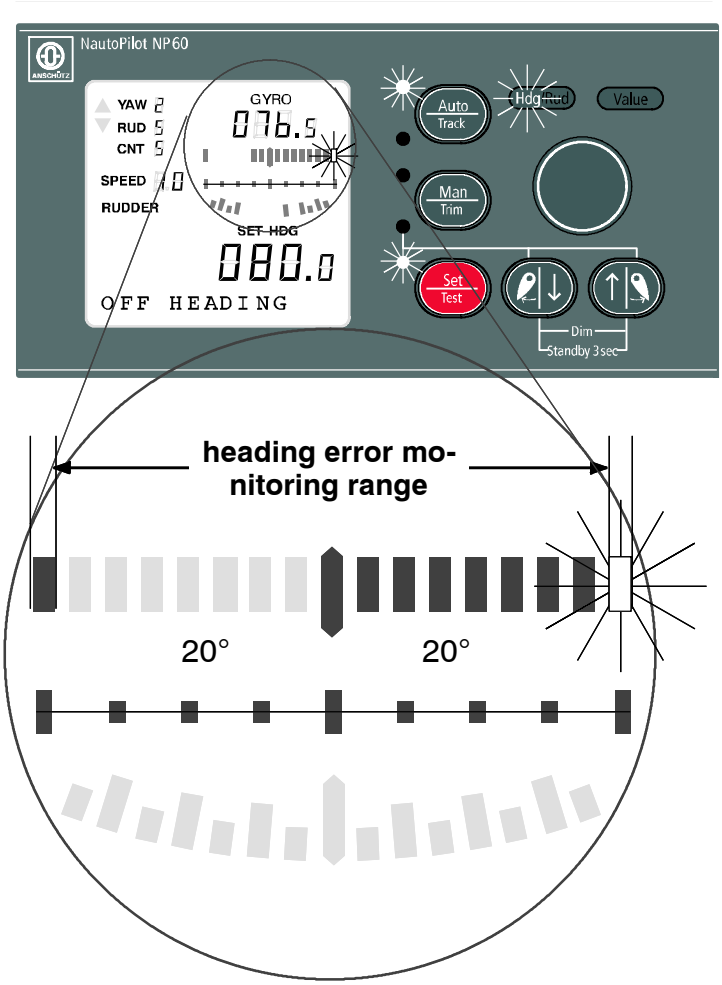
  If the set heading is changed by more than the set heading error monitor limit (OFF HEADING) the relevant number of segments from the heading error monitoring limit will flash.

  The OFF HEADING alarm is suppressed while the heading is being changed.

  Note:
  If set heading data is above 180 ° the ship will follow the direction entered.
  The heading will NOT change over the shorter route.

2.7.1.3 OFF HEADING alarm





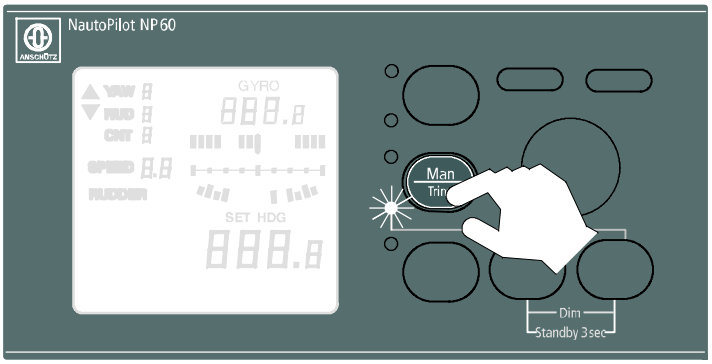
- Set heading deviations that exceed the adjusted off heading limit (20° in the example) trigger an OFF HEADING alarm.
- An audible alarm is also output.

- The relevant relay output is activated.

2.7.2 Trim Mode

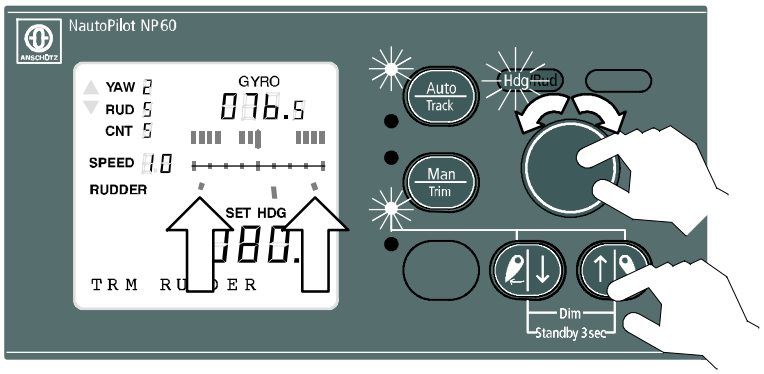
The Trim Mode can be used for a number of different manoeuvring situations, for example in an emergency turn or if an uneven load requires compensation.

A



- Press the Man Trim key

B



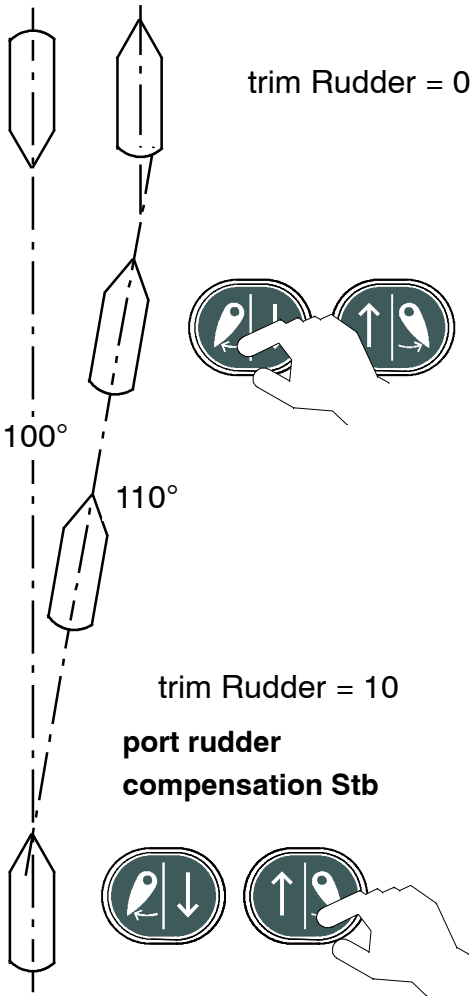
- In Trim mode Heading Control is activated.

  As long as the keys are not used (TRM RUDDER = 0) the heading controller is operational with its Autotrim function; if one of the keys is pressed, the Autotrim function is switched off.
  The Trim rudder is moved by 1° each time the key is pressed, and the text line of the display unit contains an indication.

Rudder limitation is automatically switched off so that the full rudder angle can be used for manoeuvring.

2.7.2.1 **Emergency turn manoeuvre (dodge function)**

This function can be used where it is intended to make small emergency turns (< 10°), without changing the set heading.



- If a turn needs to be executed to dodge an oncoming vessel – without changing the set heading – depending on the direction either the Port or Stb key can be used.
  At a certain Trim Rudder setting, the heading controller is not able to maintain the set heading and a heading difference arises, which results in the desired dodge manoeuvre.

  If, at the end of the manoeuvre, you wish to return to the original set heading, the trim rudder angle needs to be reset in stages to TRM RUDDER 0, using the other key.

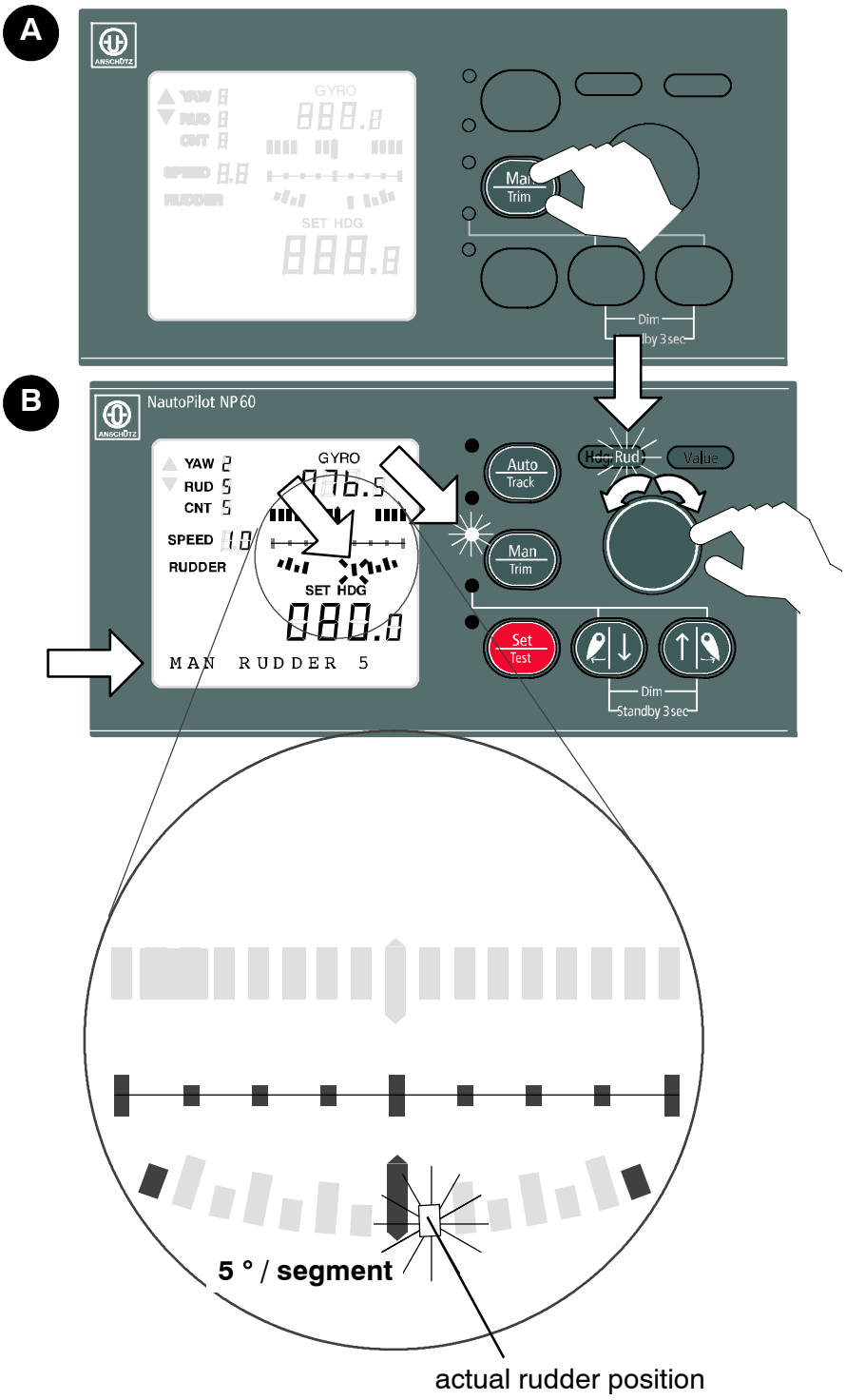
  Note:
  The Autotrim function is effective only at a Trim Rudder setting of 0 (TRM RUDDER 0).

2.7.2.2 **Unsymmetrical load, low speed**

With the aid of manual rudder movement Trim Mode provides support for heading control, so that if the load is unsymmetrical, the required heading angle is reached more quickly.

It is sensible to use the rudder trim setting at **low speeds** because the effect on the rudder is too little due to lack of flow against the rudder.
The TRIM rudder keys allow you to compensate for this disadvantage.
Note:
The Autotrim function is switched off in this operating mode.

2.7.3 Manual (MAN) rudder movement



- Press the Man Trim key

- The Autopilot goes into manual rudder movement mode.

  The control knob is now activated for manual control of the ship (rudder movement).
  The display indicates **Rud**.
- The rudder can be moved in steps of 1°.

  The set rudder values are indicated in the LCD display (MAN RUDDER 5 for 5° for example).

  The segment corresponding to the actual rudder position in the actual rudder graphic indicator is flashing.

Note:
*in the **MAN** operating mode there is no rudder limitation.*

2.7.4 Waypoint operating mode

Important note:

Please note that the Waypoint operating mode may only be used on non-SOLAS vessels. It must not be used on vessels falling under the SOLAS convention.

IMO has defined 2 different operating modes / systems for automatic steering. These are

- Heading Control and
- Track Control

For both of these systems performance and test standards have been defined. Authorities / classification societies test against these standards and issue a corresponding certificate if the products are compliant to these standards.

For Waypoint operating mode no performance and test standards have been defined and thus these systems are not tested by authorities / classification societies.

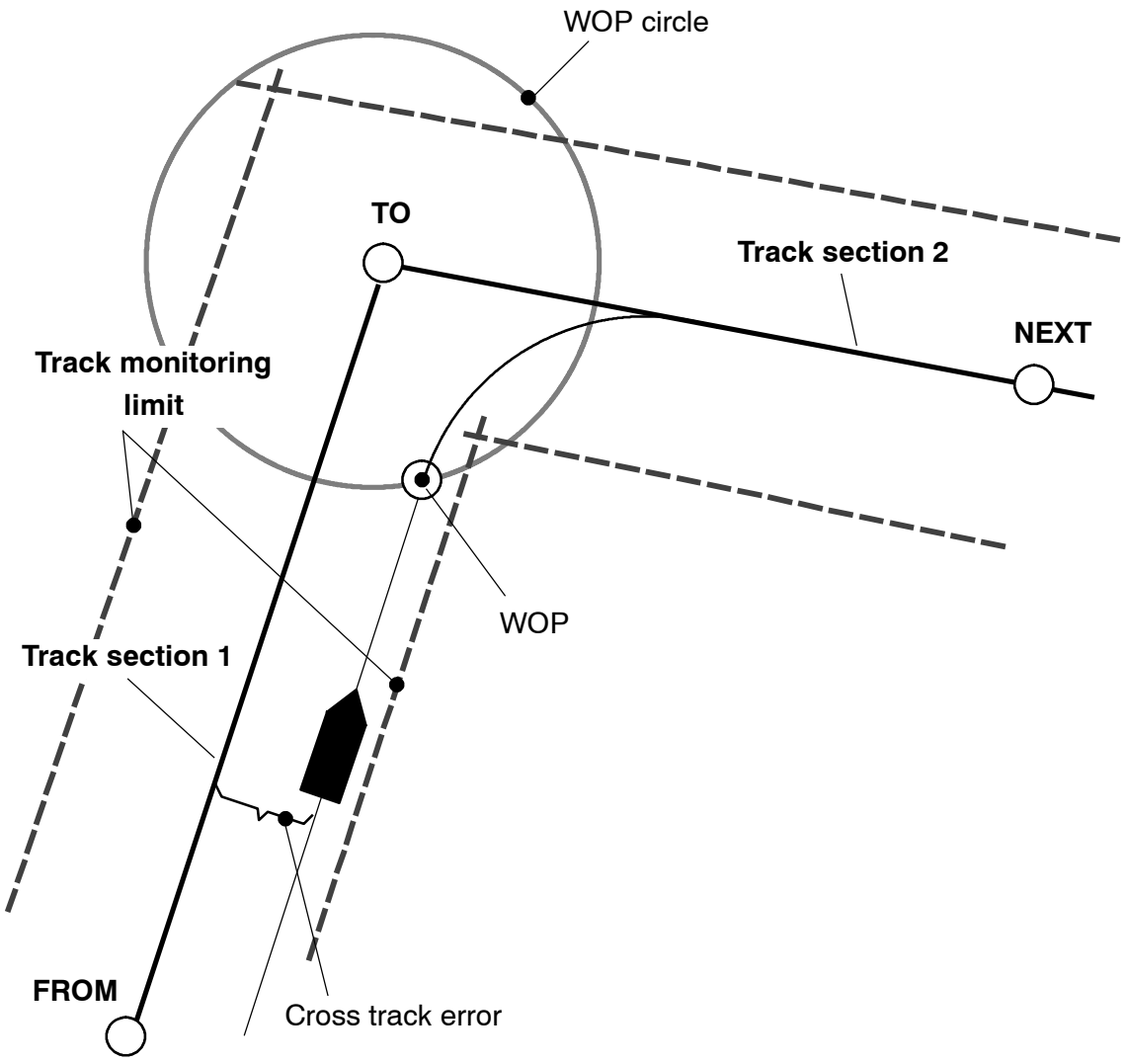
Regulation 3 of SOLAS Chapter I, Part A regulations describes the following exceptions for non-SOLAS vessels:

(a) The present regulations, unless expressly provided otherwise, do not apply to:
  (i) Ships of war and troopships.
  (ii) Cargo ships of less than 500 gross tonnage.
  (iii) Ships not propelled by mechanical means.
  (iv) Wooden ships of primitive build.
  (v) Pleasure yachts not engaged in trade.
  (vi) Fishing vessels.

(b) Except as expressly provided in chapter V, nothing herein shall apply to ships solely navigating the Great Lakes of North America and the River St Lawrence as far east as a straight line drawn from Cap des Rosiers to West Point, Anticosti Island and, on the north side of Anticosti Island, the 63rd meridian.
(Source: SOLAS CONSOLIDATED EDITION 2009, Chapter 1, Regulation 3)

In case of uncertainness please check with your Flag State Authority.

2.7.4.1 Terms used



Picture 3: Terms used

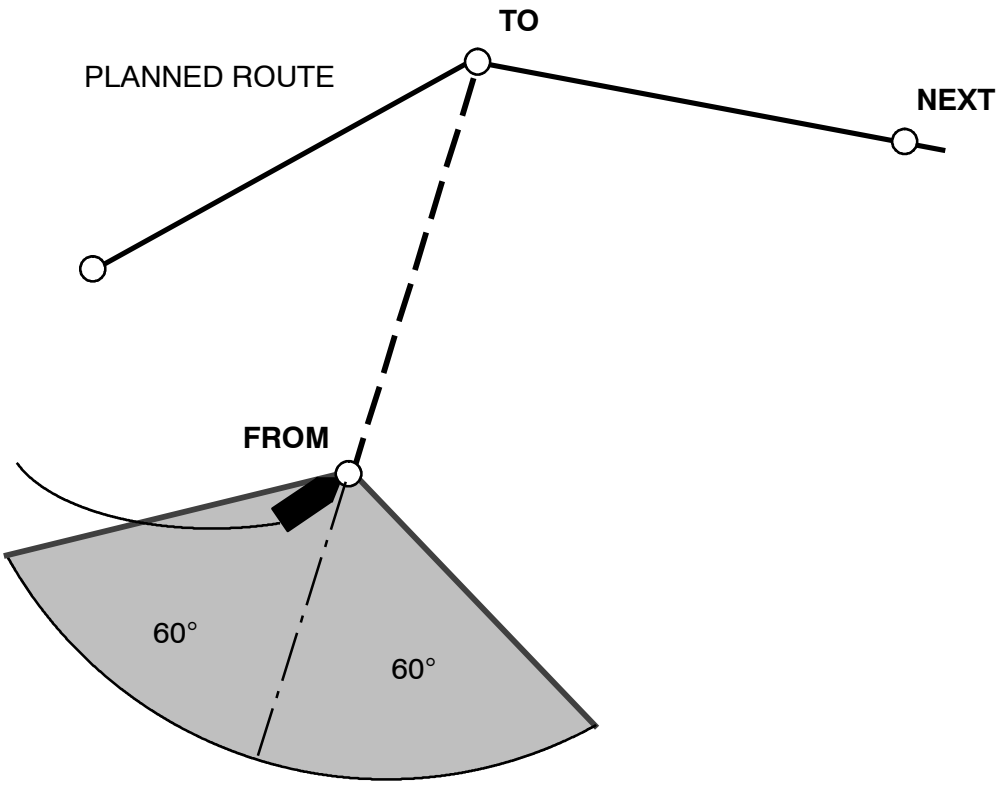
2.7.4.2 Travelling along planned route

Travel the route using **manual steering** or **heading control** as far as the "FROM" starting position.

At this position start **waypoint operating mode**.

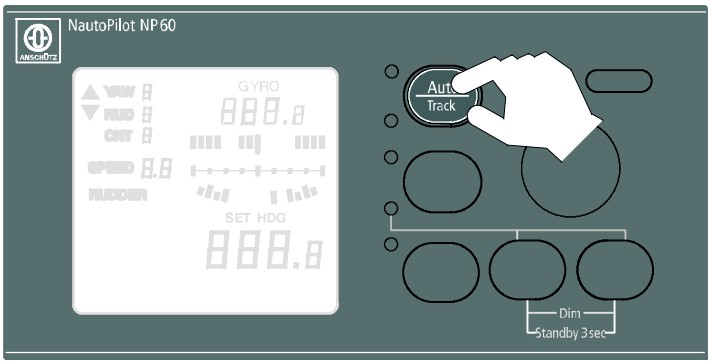
Note:

To achieve optimum bracketing into the first track section, we recommend that the (FROM) start position is starting within a 60 ° sector.



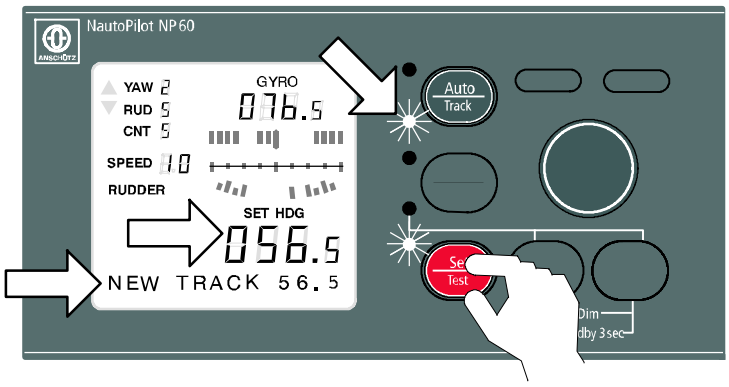
2.7.4.3 Waypoint operating mode

A



- Press the Auto Track key

B

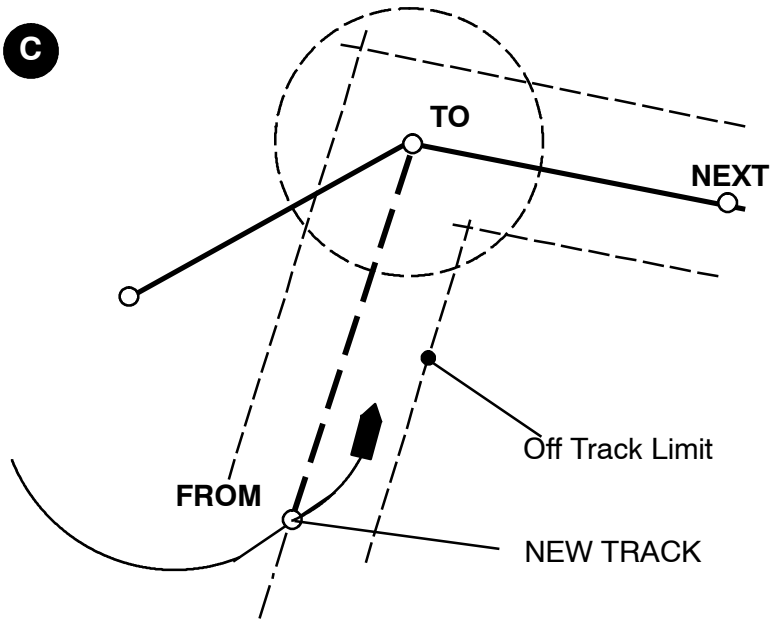


- The autopilot goes into **Waypoint operating mode**.
- The next track section FROM – TO is displayed in the text field of the indicator unit (e.g. **NEW TRACK 56.6**)
- The Set Test key is pressed to confirm the track section shown.
- Once confirmed the heading to the next track section is indicated as the **set heading** in the display.
  The current ship's position is integrated into the route as a new start point (FROM).

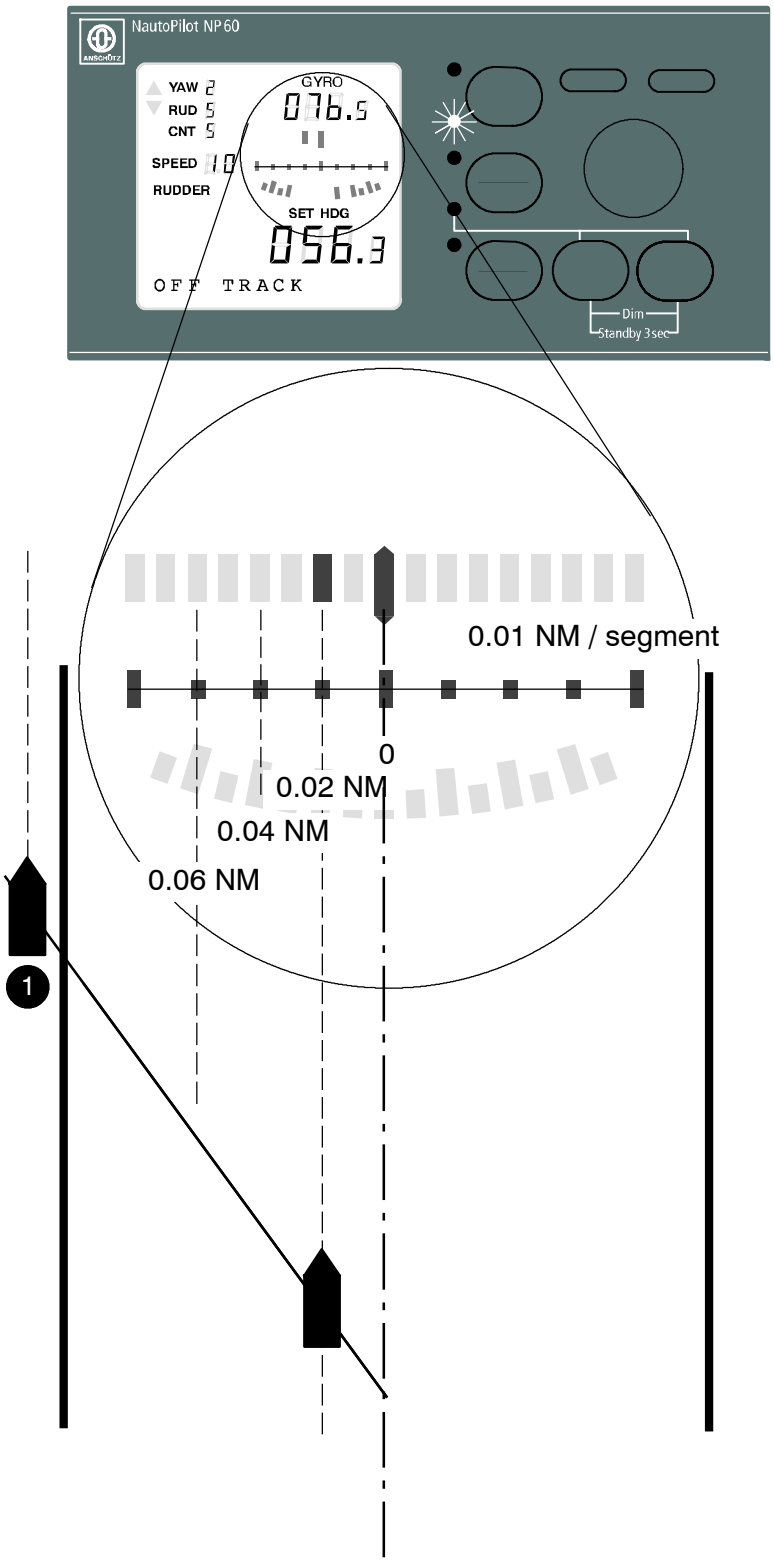
  The first track section therefore becomes the current ship's position (FROM) and the next route point taken from the waypoint planning system, such as GPS, becomes the next point on the route (TO).

  The ship is now sailing in waypoint operating mode. **Off Track Limit** is the track monitoring limit. The Off Track Limit parameter is configured in parameter mode.

C



2.7.4.4 Travelling in waypoint operating mode

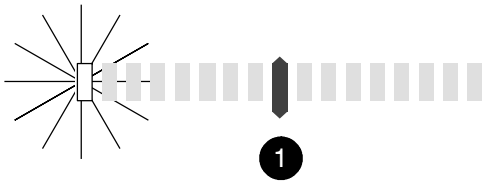


- Once waypoint operating mode has been activated, the upper bar in the display unit indicates the current ship's position left or right of the track centre.

- If the ship's position falls outside the range that can be displayed on the display unit bar, the last segment flashes.

- If the ship moves outside the monitored track range, the **Off Track alarm** is triggered.

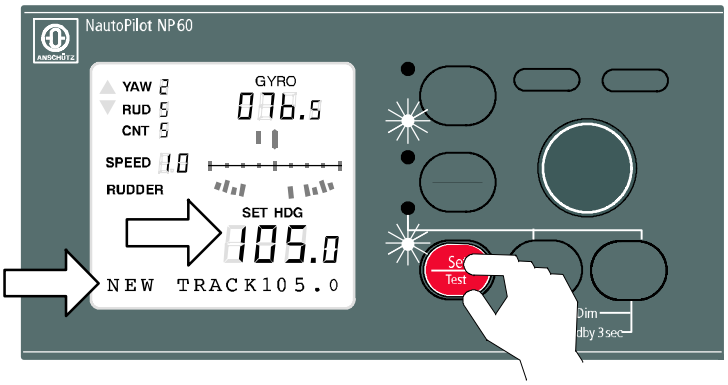
  The Off Track alarm is audible and visual.



Note:
The track monitor limits start at 0.1 NM.

2.7.4.5 Changing the track section

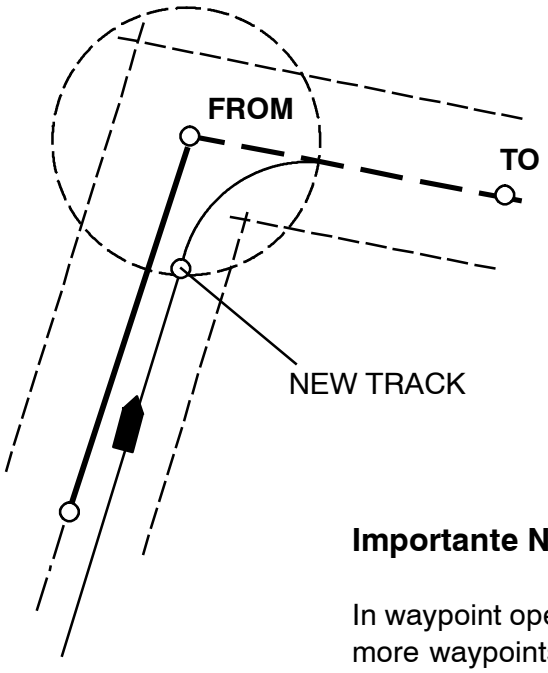
A



- Track section changes are derived from the track planner (e.g. GPS).
- The next track is displayed in the text line of the display unit. (e.g. **NEW TRACK 105.0**). An audible alarm also sounds.
- Press the 

to confirm the track section shown.
- Once confirmed the heading to the next track section appears in the display unit as the set heading.

B



- The TRACK parameter <> can be used to influence waypoint operating mode (e.g. increasing values if drift is too high).

Caution:
Control can become unstable if values are very high.

To ensure optimum track heading changing, the Autopilot rotation speed must be adjusted to the planned radius (R.O.T.)

The moment of track change can be configured on the navigation system.

Importante Note:

In waypoint operation mode the route - consisting of 2 or more waypoints - is planned on a GPS, chart plotter or equivalent navigation system. NP 60 receives only the data from the navigation system in order to steer the vessel on a certain track. The operator must have good knowledge of the navigation system in use as this system controls the autopilot with regards to heading alterations, track changes and the corresponding alert philosophy. The operator should closely monitor the progress when sailing on a route. In case of deviations from the route or any uncertainty the operator should switch to Auto and use the heading control function.

2.8 Watch Alarm

2.8.1 Function

The Watch Alarm automatically triggers a visual/audible alarm if the watch officer on the bridge has left his post and therefore does not acknowledge the watch alarm within the defined time.

The alarm is triggered locally on the Autopilot operator unit and can be transmitted to another point by means of a relay contact.

There are 3 levels of alarm:

(1) After the set time has elapsed a pre-alarm occurs consisting of a **Watch Alarm** message (flashing) on the text line of the LCD display unit.

(2) If the alarm is not acknowledged, after 15 seconds the internal alarm in the operator unit becomes a visual and audible alarm.

(3) If this alarm is not acknowledged within a further 15 seconds, the external alarm contact is triggered.

2.8.2 Time setting

Use the configuration parameters (see service manual) to make settings for the Watch Alarm function and the preset time period.

Watch Alarm 0 no Watchalarm

Watch Alarm 1.5 min, 3min, 12 min (before pre-alarm is triggered)

2.8.3 Acknowledgement

There are two ways of acknowledging alarms:

(1) Timeout control can be reset by hitting the reset key.

(2) Timeout control can be reset by an external Watch Alarm Reset Unit.

2.8.4 Active/passive operator unit - tiller

The Watch alarm can be reset only on the active operator unit.

Standby operator units are for indication purposes only. If a tiller belonging to the Autopilot system has been activated, the Watch Alarm function is not operational. The function is reactivated once the switch has been made back to Autopilot operation.

2.9 Adjusting the operating parameters

After initial start-up the individual standard operating values are fixed as shown in the table on the next page(Table1) in the “Standard” column.
These standard values are maintained even if the ship’s mains fails or the ship’s power is switched off.

Parameters that depend on operating conditions (e.g. the weather) can be changed in any operating mode except for **TRIM** since the parameter selection keys are reserved for TRIM mode (see section 2.12 When do parameter values need to be configured).

Note:
Where operating parameter values (see table) are changed during operation and need to be kept as the standard values, you need to save them as shown in section 2.9.3.

The parameter list is selected either by using the  key or the 

key (as described in the next two sections).

Depending on the key you press, either **YAWING** or **RUDDER** (“Start” column) appears as the start parameter.
You can use these two keys to browse through the complete list.

The status indication is displaying **Value** while a parameter setting is being made (see section 2.2).

Key	Start	Parameter	Min	Max	Standard	Step	Indication
		Compass switch from Gyro to Magnetic	mag	gyro	gyro	1	COMPASS gyro/mag
		Variation [°]	-35	35	0.0	0.5	VARIATION XXX
		Off Track Limit [0.1 NM]	0.1	1.2	0.4	0.1	TRACK LIM X.X
		Off Heading [°]	5	30	10	5	OFF HEAD. XX
		RoT ° /MIN[° /Min ...full]	10	300, full	30	10	ROT °/MIN XXX
		RUD Limit [°]	5	90 *	20	5	RUD. LIMIT XX
		Yawing	1	6	2	1	YAWING X
		RUDDER	1	9	5	1	RUDDER X
		CNT RUD	1	9	5	1	CNT. RUD X
		SPEED [KN]	log/5	70	(man.) 20	5	SPEED XX
		TRIM YAW	1	6	2	1	TRIM YAW X
		TRIM RUD	1	9	4	1	TRIM RUD X
		TRIM CNT	1	9	6	1	TRIM CNT X
		TRACK < >	-280	280	0	20	TRACK <> XXXX
		SYNCHRON [1/10°] **	0	360	0.0	0.1	SYNCHRON. XXXX
		CONFIG	OFF	ON	OFF		CONFIG OFF/ON

Table1 Parameters dependent on operating conditions

* Max. value according to max. rudder scale

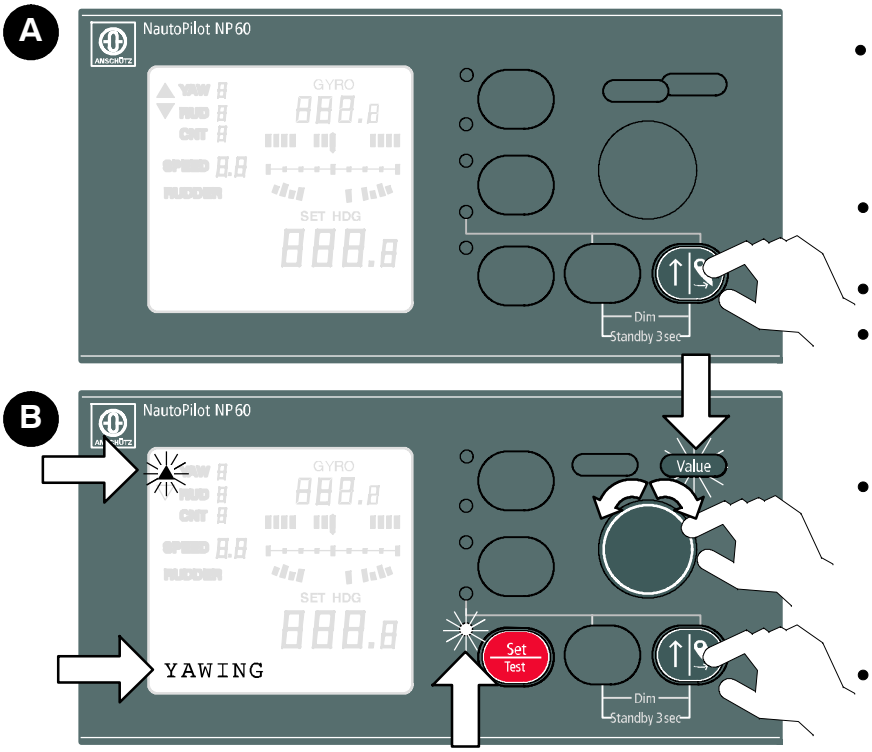
** Possible only with analog input from gyro compas (step)

Note:

To store operating parameters see 2.9.3.

2.9.1 "Upward arrow" key

(see alsoTable1)



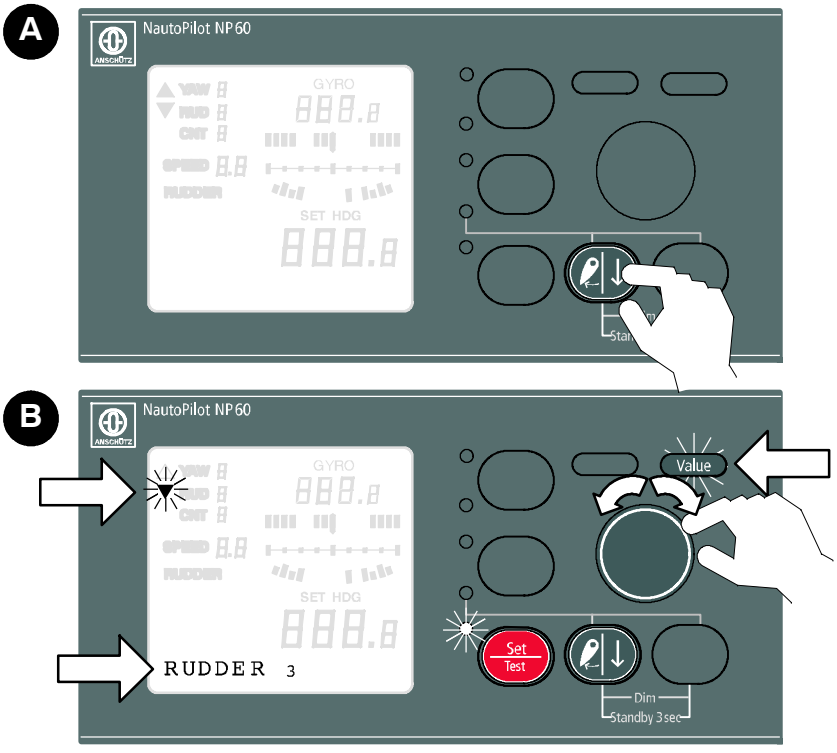
- Press the  key

  (keep pressed down for at least 1 second until the tone sounds).
- **Values** is illuminated in the indicator
- The **Set** LED is illuminated.
- **YAWING** appears as the first entry in the parameter list in the bottom line of text.
- Use the  keys

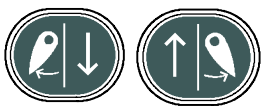
  to select the parameter you require.
- Changes to the values are made using the control knob and are active immediately.

2.9.2 "Downward arrow " key

(see alsoTable1)



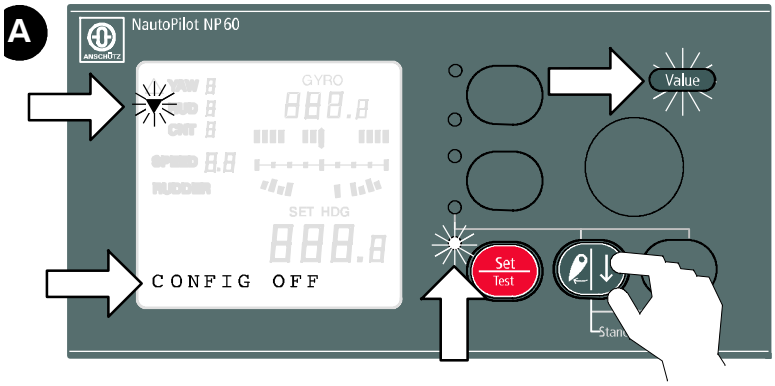
- Press the  key

  (keep depressed for at least 1 second – until you hear an audible tone).
- **Values** is illuminated in the indicator.
- The **Set** LED illuminates.
- **RUDDER** appears as the first entry on the parameter list in the bottom line of text.
- Use the  keys

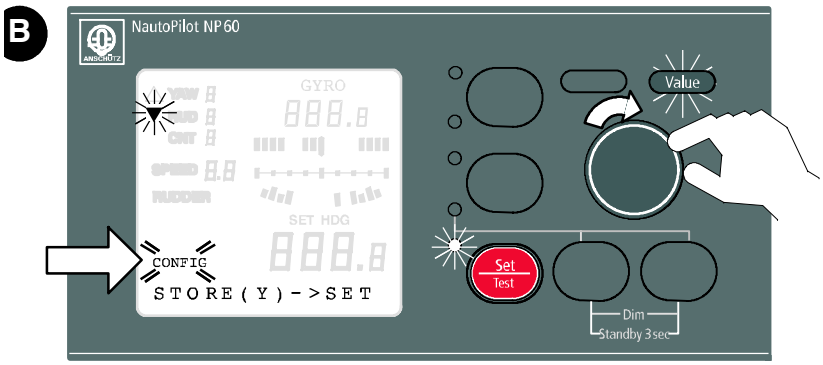
  to select the parameter you require.
- Changes to values are made using the control knob and are effective immediately.

2.9.3 Saving parameter values

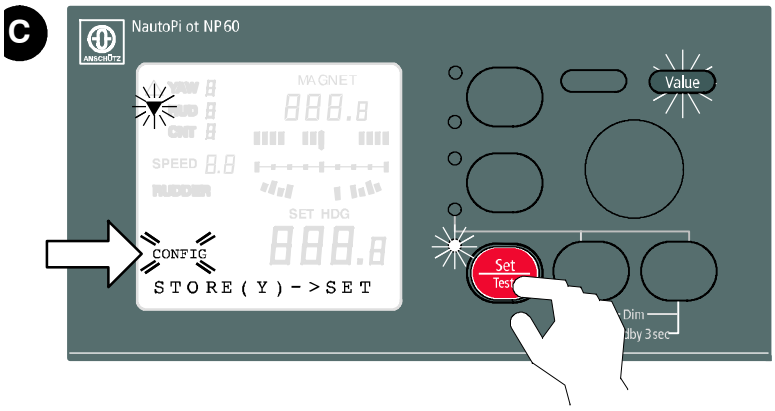
To permanently save parameter changes the following procedure needs to be carried out:



- Press the  key until **CONFIG OFF** appears on the display unit.



- Turn the control knob to the right.
- **CONFIG ON** is displayed in the text line.
- Continue turning until **STORE (Y) -> SET** appears



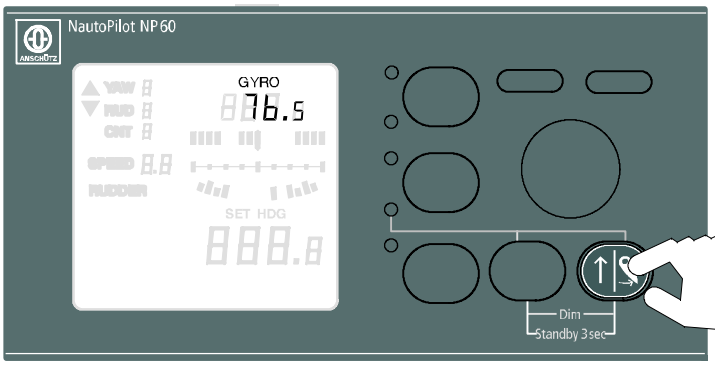
- Press the  key

The parameter values are permanently saved.
The system immediately switches to set heading mode (**Value** display disappears). The control knob is now ready to make a change to the set heading.

2.9.3.1 Compass switch

Example: From Gyro to Magnetic compass

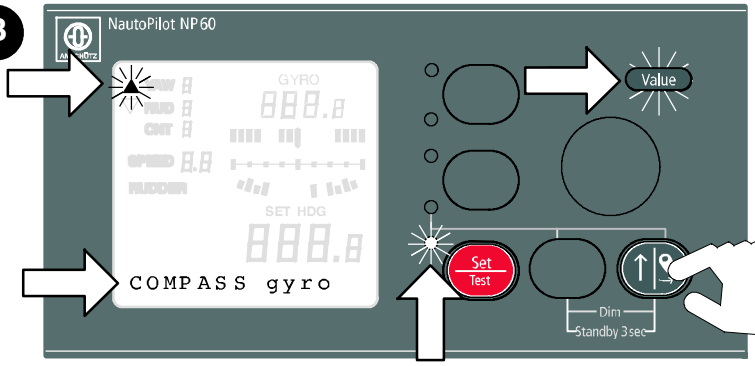
A



- Press the key down (hold it down for at least 1 second until the tone sounds).

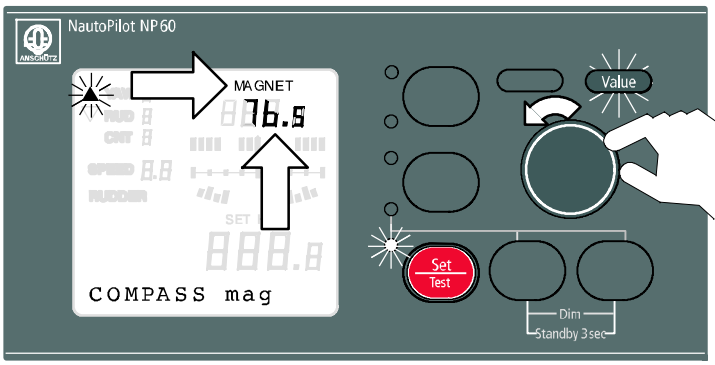
  Note
  ***TRIM** mode should not be active!*

B



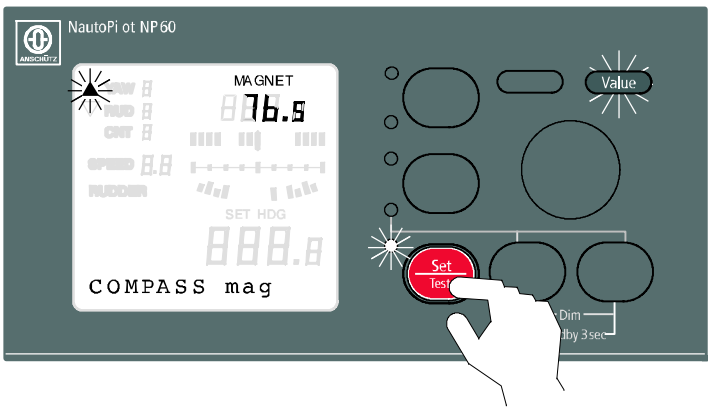
- **Values** is illuminated in the display.
- The **Set** LED is illuminated.
- **Yawing** appears in the bottom line of text, as the first value in the list of parameters.
- Press the  key until **COMPASS gyro** appears in the display unit.

C



- Turn the control knob to the left until the indication in the display changes from COMPASS gyro to **COMPASS mag**.
- The actual heading derived from the magnetic compass is immediately displayed.

D

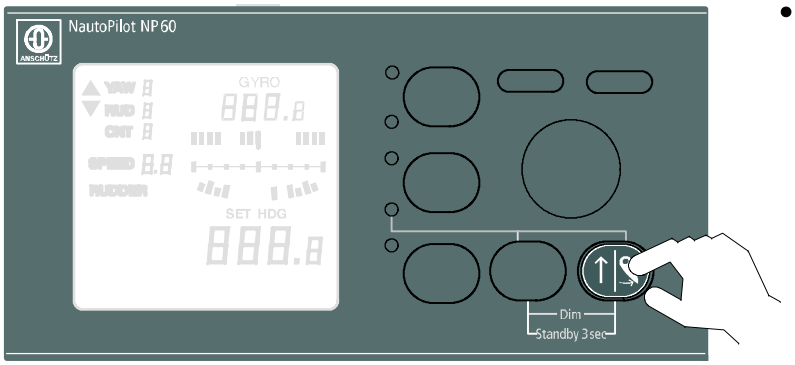


- Press the  key to change the system now to set heading mode (**Value** display disappears). The control knob is now ready to make a change to the set heading.

2.9.3.2 Entering magnetic compass error (variation)

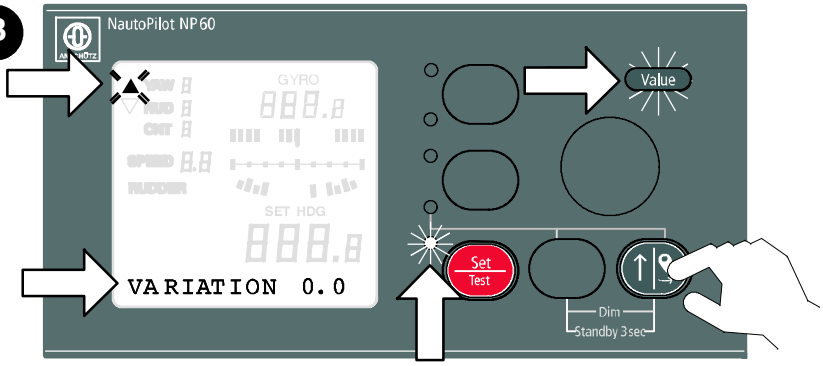
Example: Changing from 0.0 to 10.5

A



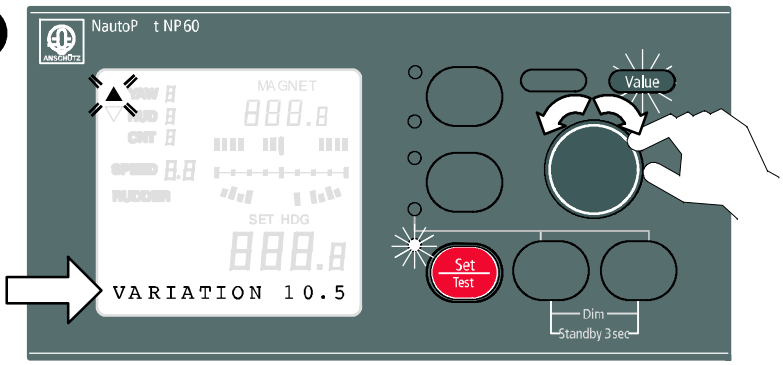
- Press the key down (hold it down for at least 1 second until the tone sounds).

B



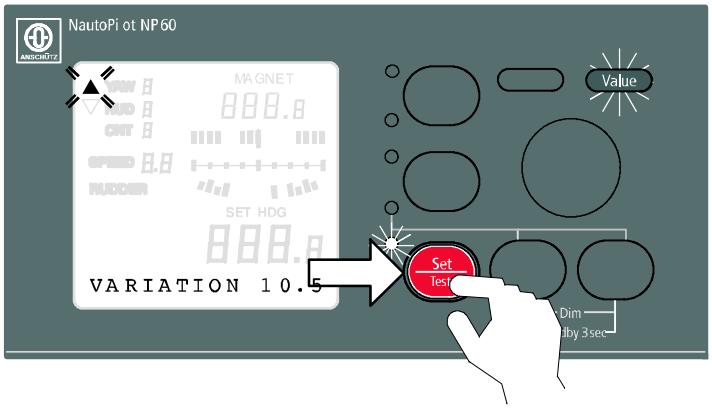
- **Values** is illuminated in the display.
- The **Set** LED is illuminated.
- **Yawing** appears in the bottom line of text, as the first value in the list of parameters.
- Press the  key until **VARIATION 0.0** appears in the display unit.

C



- Turn the control knob to the left (values decrease) or to the right (values increase) until the indication in the display shows the value you require (VARIATION 10.5).
  On a travelling ship variation values should be entered slowly and in stages, in order to keep undesirable heading reactions to a minimum.

D

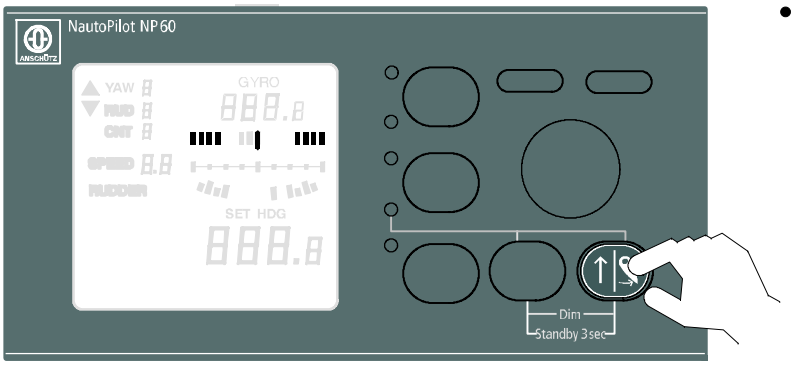


- Press the  key to change the system immediately to set heading mode (**Value** display disappears). The control knob is now ready to make a change to the set heading.

2.9.3.3 Changing the off heading monitoring limits (OFF HEAD.)

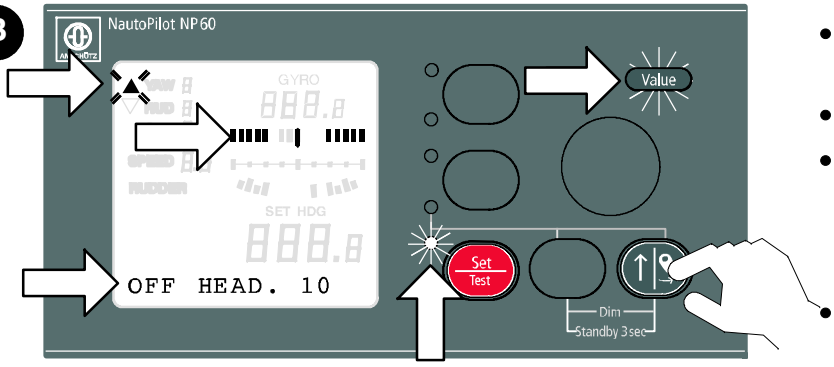
Example: Changing from 10 to 20

A



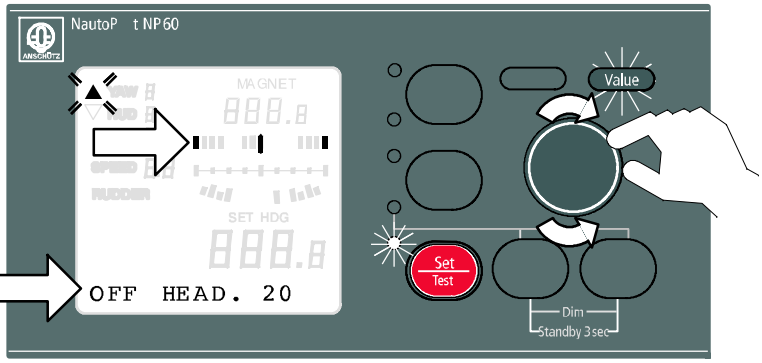
- Press the key down (hold it down for at least 1 second until the tone sounds).

B



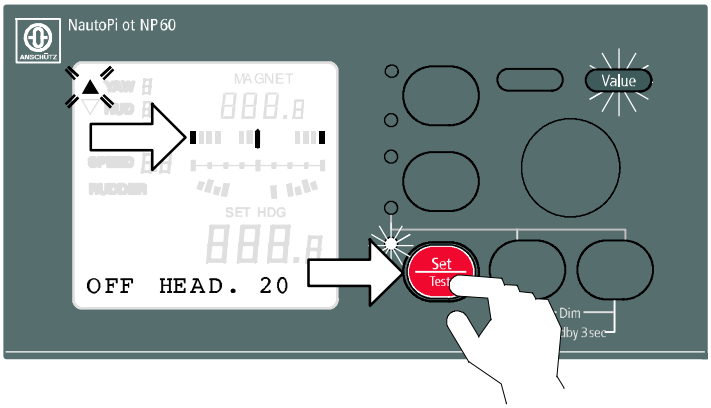
- **Values** is illuminated in the display.
- The **Set** LED is illuminated.
- **Yawing** appears in the bottom line of text, as the first value in the list of parameters.
- Press the  key until **OFF HEAD. 10** appears in the display unit.

C



- Turn the control knob to the left (values decrease) or to the right (values increase) until the indication in the display shows the value you require (**OFF HEAD. 20**).
  The corresponding bar indicator adjusts immediately to the new value
  (1 segment corresponds to 2.5°).

D

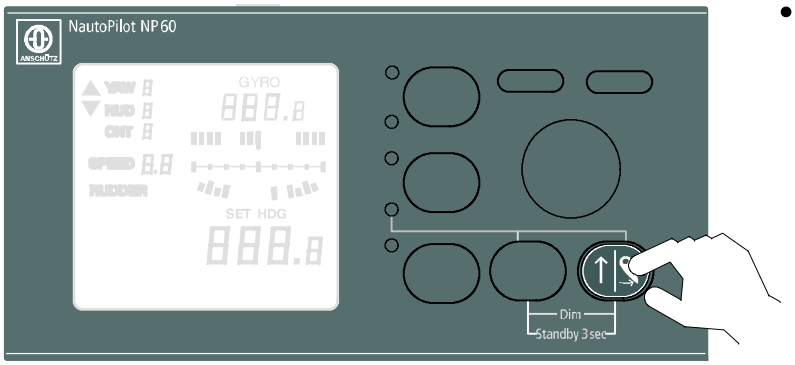


- Press the  key to change the system immediately to set heading mode (**Value** display disappears). The control knob is now ready to make a change to the set heading.

2.9.3.4 Entering rotation speed (RoT ° , MIN)

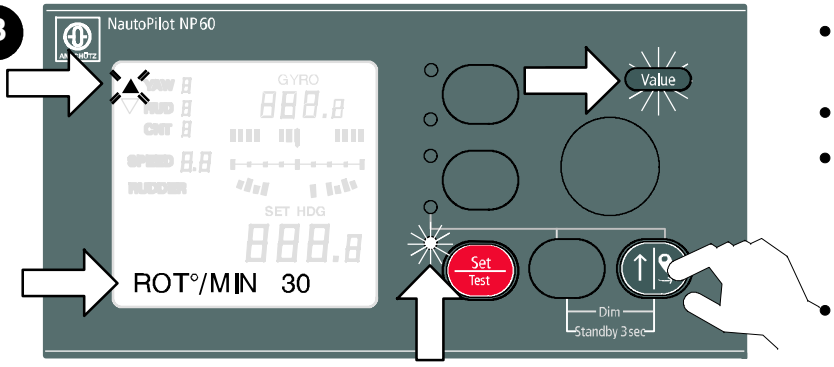
Example: Changing from 30 to 60

A



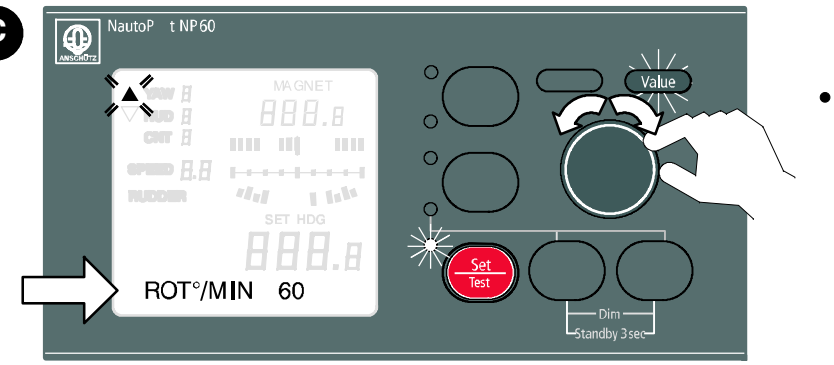
- Press the key down (hold it down for at least 1 second until the tone sounds).

B



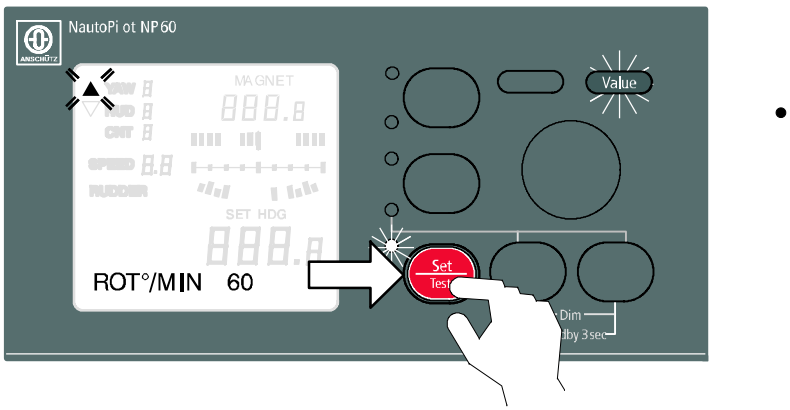
- **Values** is illuminated in the display.
- The **Set** LED is illuminated.
- **Yawing** appears in the bottom line of text, as the first value in the list of parameters.
- Press the  key until **ROT°/ MIN 30** appears in the display unit.

C



- Turn the control knob to the left (values decrease) or to the right (values increase) until the indication in the display shows the value you required (ROT° /MIN 60).

D

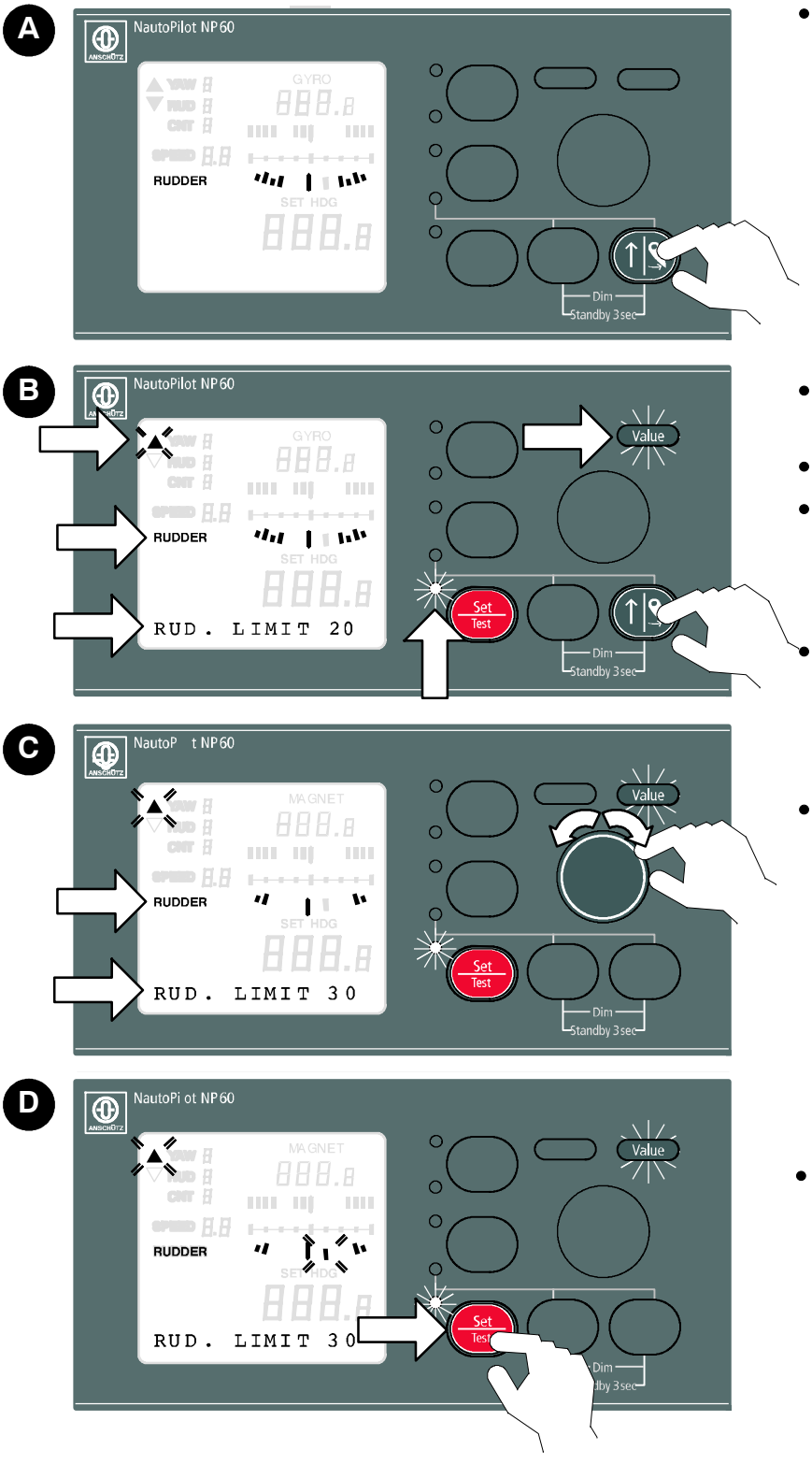


- Press the  key

  to change the system immediately to set heading mode (**Value** display disappears). The control knob is now ready to make a change to the set heading.

2.9.3.5 Entering Rudder Limitation (RUD. LIMIT)

Example: Changing from 20 ° to 30 °



- Press the key down (hold it down for at least 1 second until the tone sounds).

- **Values** is illuminated in the display.
- The **Set** LED is illuminated.
- **Yawing** appears in the bottom line of text, as the first value in the list of parameters.
- Press the  key until **RUD. LIMIT 20** appears in the display unit.

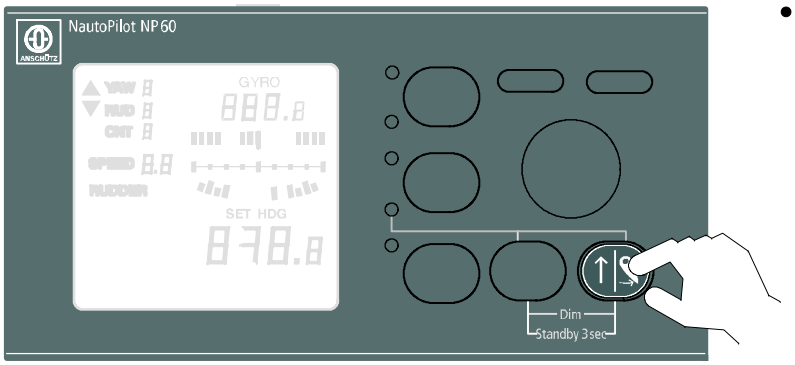
- Turn the control knob to the left (values decrease) or to the right (values increase) until the indication in the display shows the value you required (**RUD. LIMIT 30**).
  The corresponding bar indicator (Rudder) immediately adjusts to the new value (1 segment corresponds to 5°).

- Press the  key to change the system immediately to set heading mode (**Value** display disappears). The control knob is now ready to make a change to the set heading.

2.9.3.6 Setting the track monitoring limits (Off Track Limit)

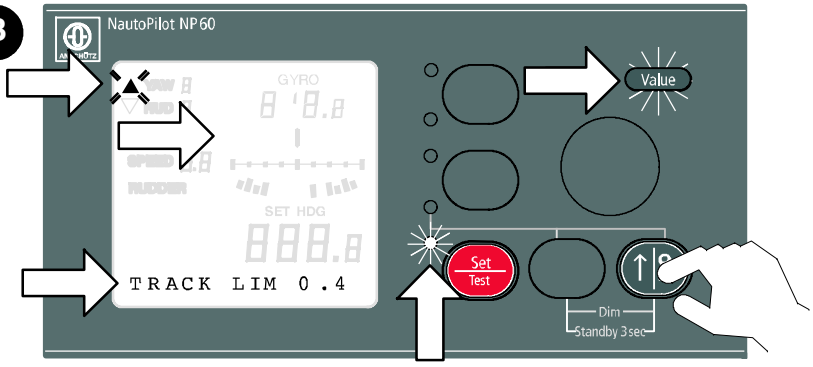
Example: Change track limit form 0.4NM to 1.2NM

A



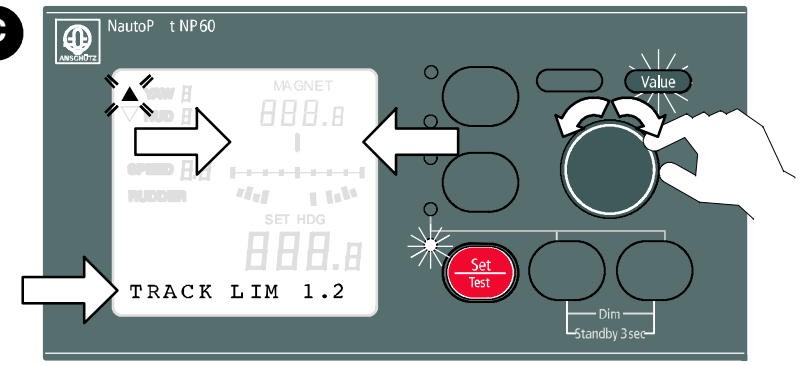
- Press the key down (hold it down for at least 1 second until the tone sounds).

B



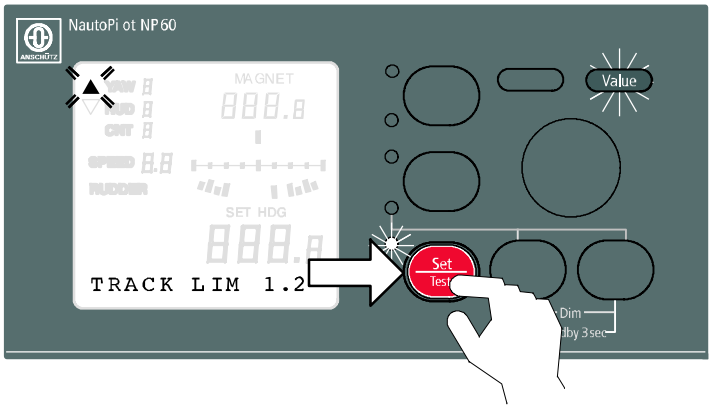
- **Values** is illuminated in the display.
- The **Set** LED is illuminated.
- **Yawing** appears in the bottom line of text, as the first value in the list of parameters.
- Press the  key until **TRACK LIMIT 1.2** appears in the display unit.

C



- Turn the control knob to the left (values decrease) or to the right (values increase) until the indication in the display shows the value you require (**TRACK LIM 1.2**).
- If the value just set is within the resolution of the bar display it is immediately updated.

D

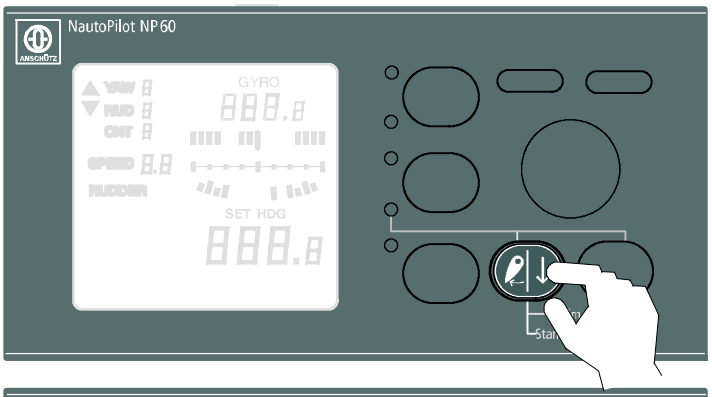


- Press the  key to change the system immediately to set heading mode (**Value** display disappears). The control knob is now ready to make a change to the set heading.

2.9.3.7 Entering speed manually (operation without LOG)

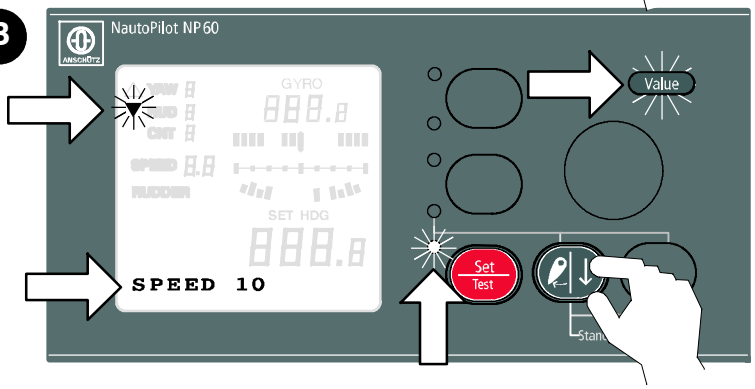
Example: Changing from 10 to 20 kn

A



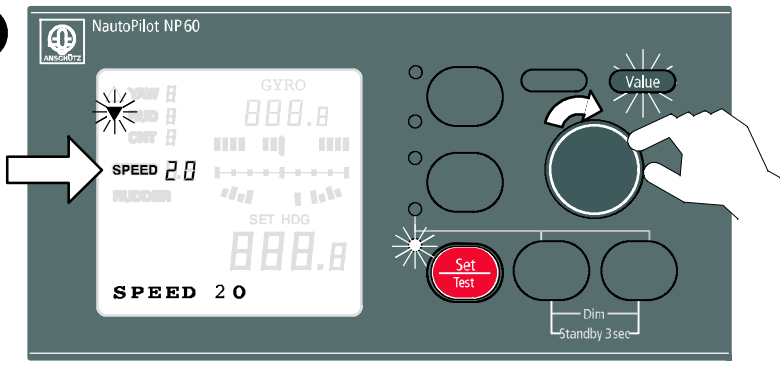
- Press the key down (hold it down for at least 1 second until the tone sounds).

B

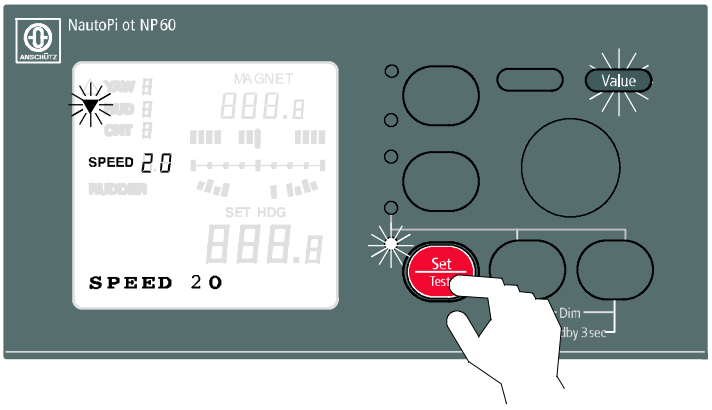


- **Values** is illuminated in the display.
- The **Set** LED is illuminated.
- **Rudder X** appears in the bottom line of text, as the first value in the list of parameters.
- Press the  key until **SPEED 10** appears in the display unit.
- Turn the control knob to the right until the indication in the display shows **SPEED 20**.

C



D

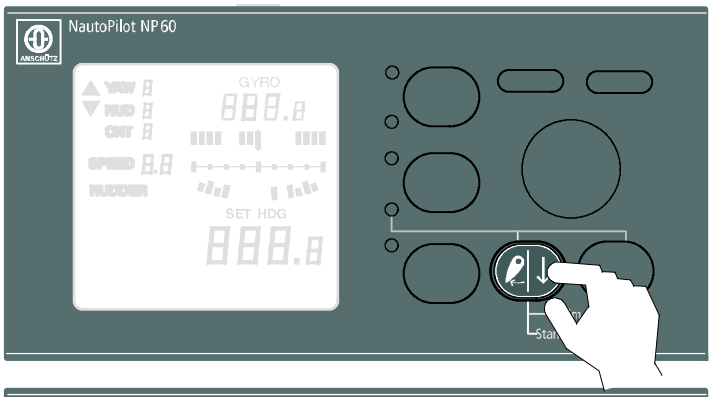


- Press the  key

  The system immediately switches to set heading mode (**Value** display disappears). The control knob is now ready to make a change to the set heading.

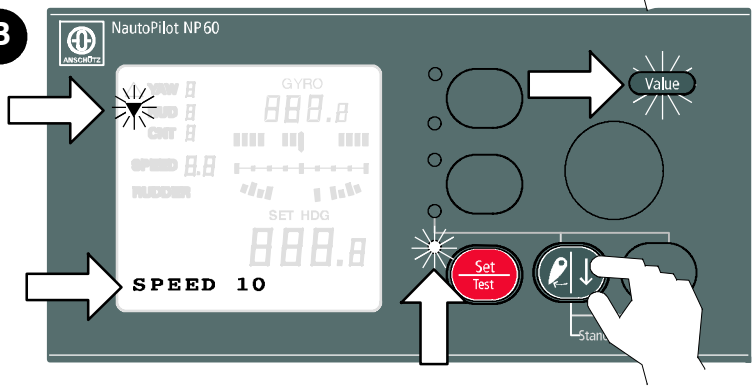
2.9.3.8 Switching from manual SPEED input to LOG

A



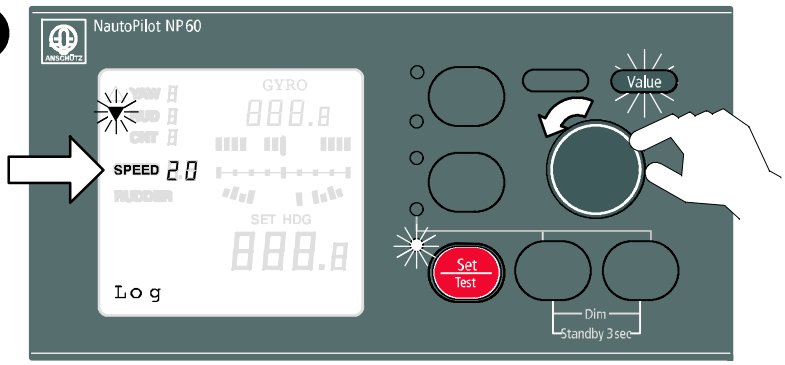
- Press the key down (hold it down for at least 1 second until the tone sounds).

B



- **Values** is illuminated in the display.
- The **Set** LED is illuminated.
- **Rudder X** appears in the bottom line of text, as the first value in the list of parameters.
- Press the  key until **SPEED XX** appears in the display unit.

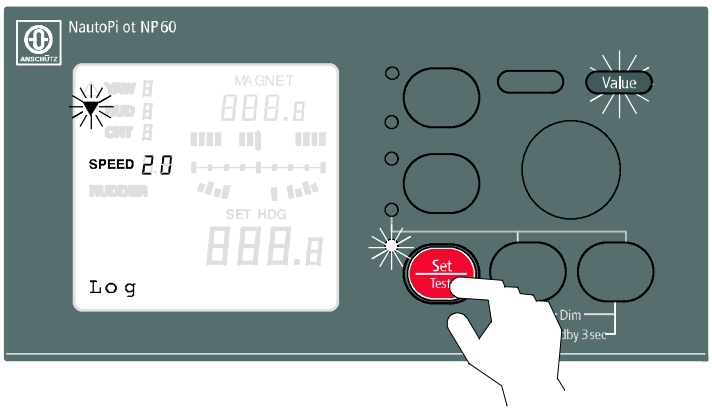
C



- Turn the control knob to the left until **Log** appears.

  From now on the *Speed* parameter is automatically read and displayed from the installed log (see service manual – Setting the LOG type parameter).

D

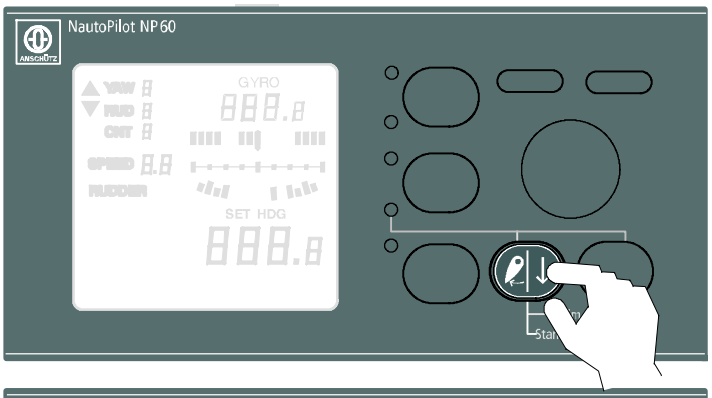


- Press the  key.

  The system immediately switches to set heading mode (**Value** display disappears). The control knob is now ready to make a change to the set heading.

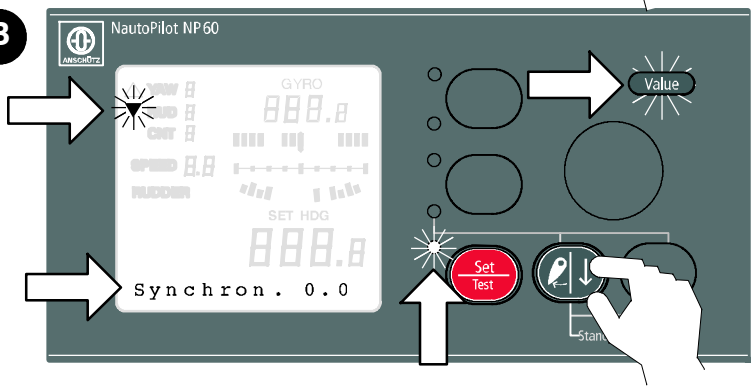
2.9.3.9 Actual heading synchronisation for compasses with 1/6 ° Step (Sperry) output

A



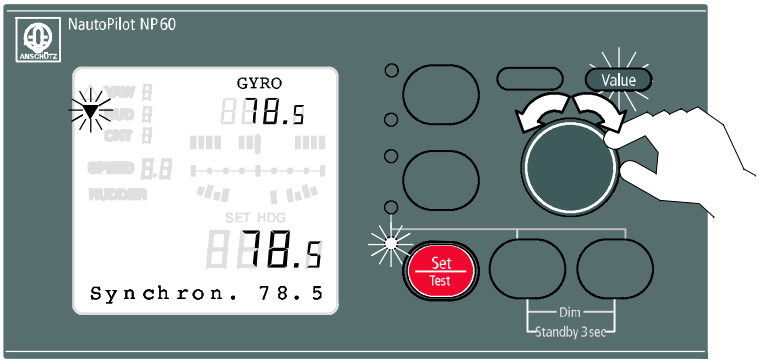
- Press the key down (hold it down for at least 1 second until the tone sounds).

B

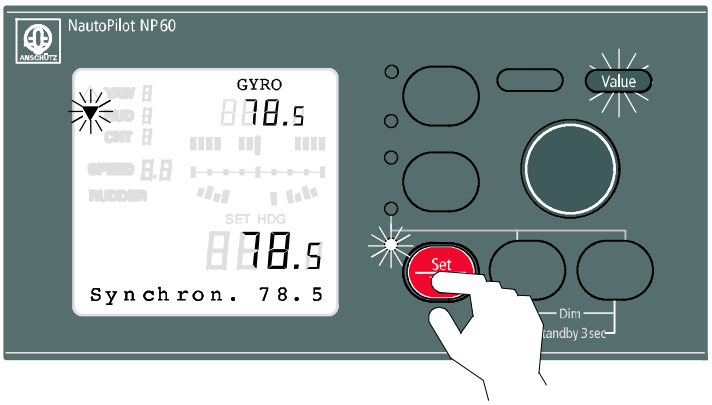


- **Values** is illuminated in the display.
- The **Set** LED is illuminated.
- **Rudder X** appears in the bottom line of text, as the first value in the list of parameters.
- Press the  key until **SYNCHRON XX** appears in the display unit (X.X is the current value on the step compass)
- Read off the value from the step compass and enter (e.g. 78.5°)
- The set gyro actual heading is immediately adopted as the new set heading.

C



D



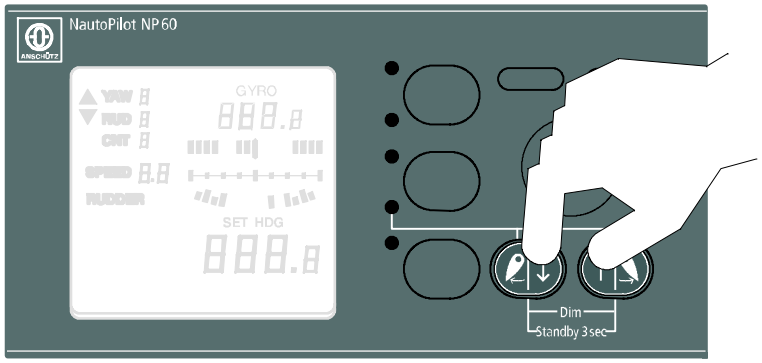
- Press the  key.

The system immediately switches to set heading mode (**Value** display disappears). The control knob is now ready to make a change to the set heading.

Note:
After a voltage failure the display indicates that you should **Synchronize!**

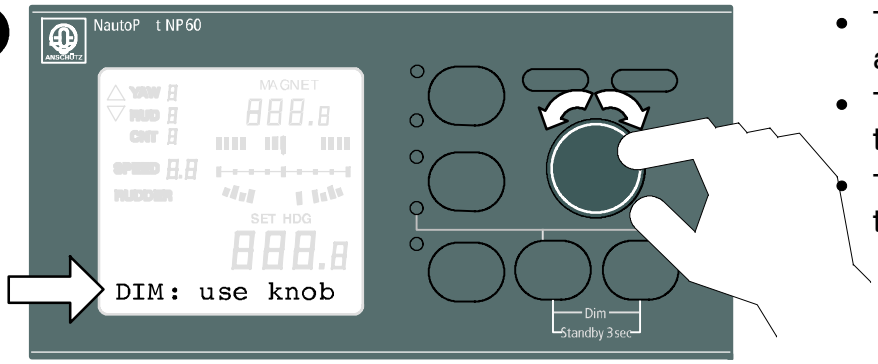
2.9.3.10 Changing the brilliance of key illumination and display background.

A



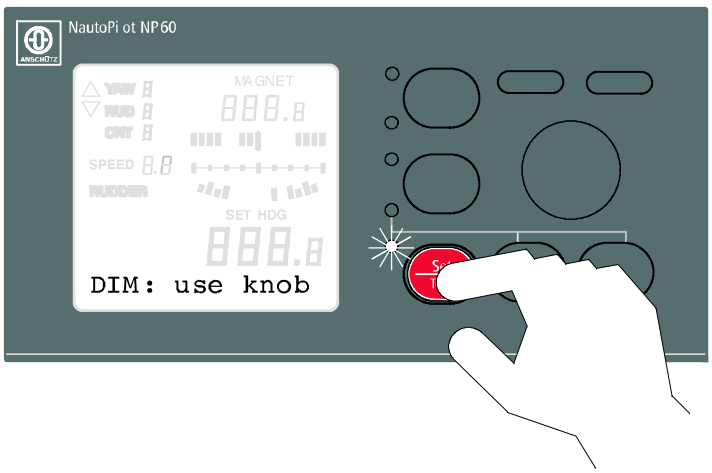
- Press both arrow keys down at the same time (for approx. 2 seconds).

B



- The words ”DIM: use knob” appear in the line of text.
- Turn the control knob to the right to increase intensity
- Turn the control knob to the left to decrease intensity

C



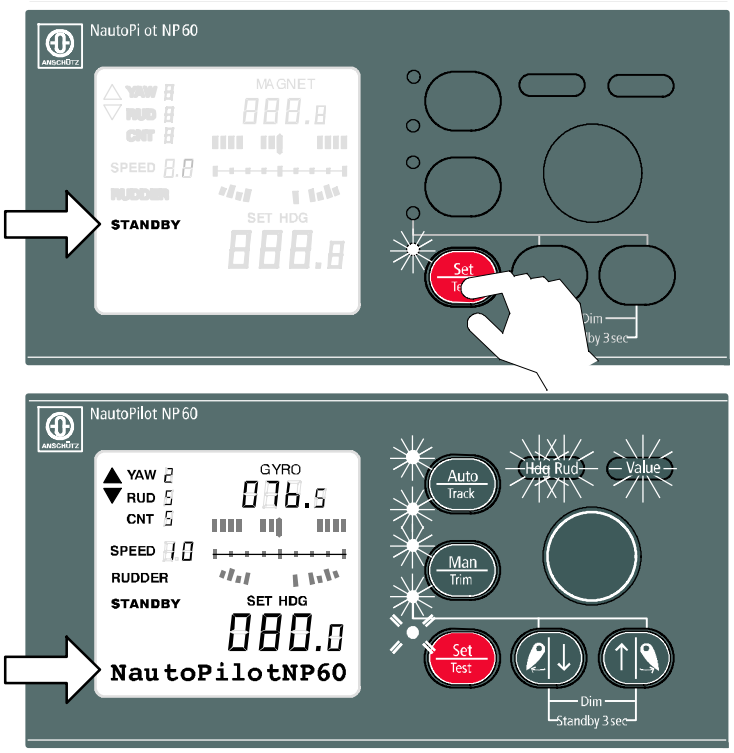
- Press the 

key

The control knob is ready once again for entering the set heading.
The system automatically exits from DIM mode after a timeout period of 15 seconds.

2.9.3.11 Self-test + Lamp test + operator unit settings

A Self-test and lamp test

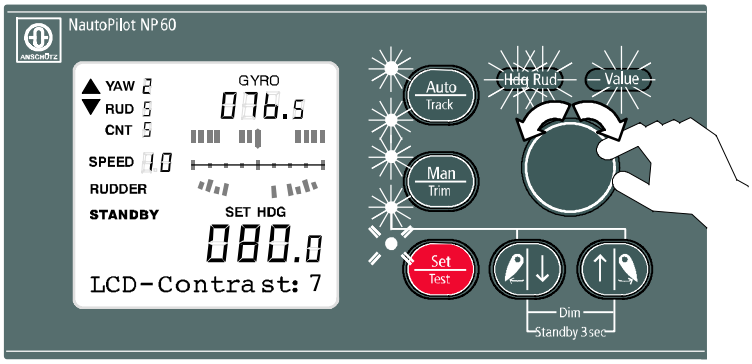


- Switch the Autopilot into **STANDBY** mode (see section 2.4).
- Press the Set Test
- All segments on the LCD display unit are displayed.
- The LED for the Set Test key is flashing.

  All other LEDs, keys and indicators are illuminated.
- The (audible alarm) sounds.
- The internal diagnostics test runs and
  - **NautoPilotNP60**
  - **Version VXX.XX** (Softwareversion)

  are displayed in sequence on the text line.
- Continue with item **B**

B Setting the LCD contrast (Depends on Display Version)

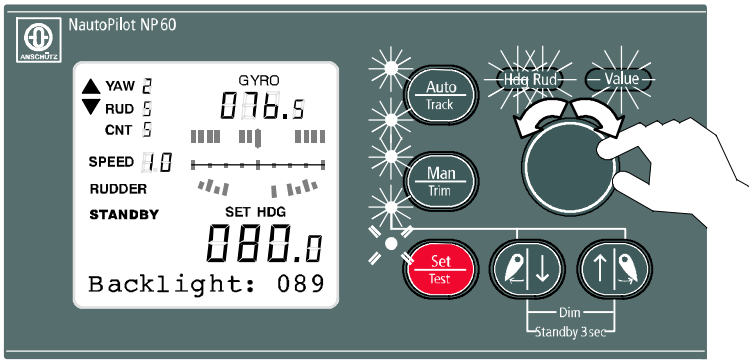


- Once the self-test and lamp test routines have finished **LCD Contrast X** is displayed in the bottom line of text.
- The contrast on the display can now be changed in the range of **5 - 9** using the control knob.

  Note:
  If no values are changed within approx. 3 seconds, the system exits from test mode
- Press the Set Test key

  The contrast value just set is now saved.
- Continue with item **C**

C Changing the backlighting intensity on the display

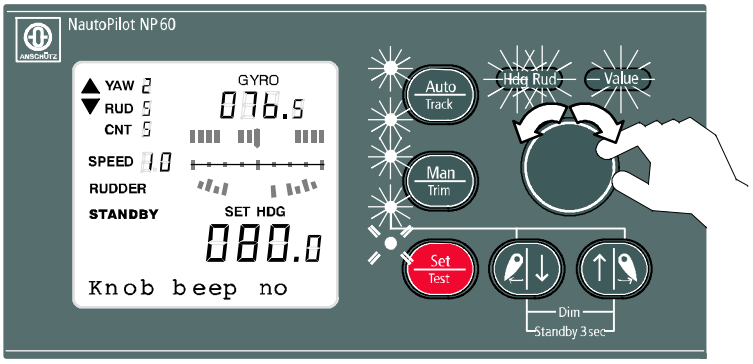


- Once the contrast has been set **Backlight XXX** appears in the bottom line of text.
- The backlighting intensity on the display can now be changed in the range of **000 - 197** using the control knob.

  Note:
  If no values are changed within approx. 3 seconds, the system exits from test mode
- Press the Set Test

  The backlight value just set is now saved.
- Continue with item **D**

D Switching control knob click tone on/off



- Once the backlight intensity has been set the prompt **Knob beep yes/no** appears in the bottom line of text.

  Yes means that there will be a clicking noise when the control knob is turned.
  No means that there is no clicking noise.

  Note:
  If the value is not altered within 3 seconds, test mode ends.

- Press the 

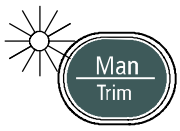
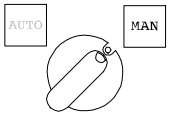
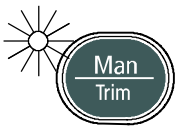
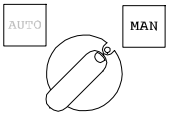
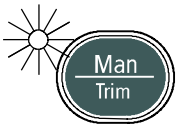
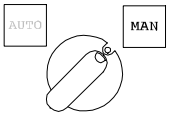
  The value just set is adopted.
- Continue with item **E**

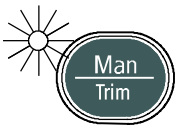
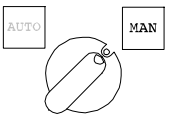
2.10 Warnings and Comments

All relevant Autopilot functions are continually displayed and monitored during any mode of operation.
If the monitoring limits are exceeded a warning message appears on the text line, and an audible signal is output.

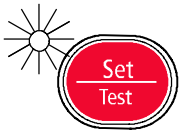
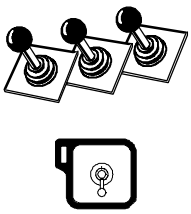
In combination with a connected and active tiller, the relevant control location is displayed in the text line.

2.10.1 Significance of the various alarms in the text line.

Alarms	Meaning	Possible measures to put in hand	Measures to put in hand on Operator unit/ peripherals
OFF HEADING	The actual heading is outside the monitoring limits. Heading deviation is increasing. Autopilot NP60 is faulty. Rudder position transmitter faulty. Steering gear system faulty.	Check parameters contingent upon operating conditions and adjust if necessary. The selected monitoring limits are too narrow, if necessary widen the limits. Switch to *"Manual Steering"* operating mode. Steering mode selector to **MAN** setting.	  
OFF TRACK	The actual position is outside the track monitoring limits. Drift is too great – planned radius and Autopilot rotation rate are not identical. NP60 is faulty. Steering Control faulty.	Check parameters contingent upon operating conditions and adjust if necessary. Increase <> Track Adjust rotation speed. Switch to Manual Steering operating mode. Switch steering mode selector to *MAN* setting.	   
LOW SPEED (if LOG sensor present)	Ship's speed is less than 2 Kn. The Autopilot steering properties are poor.	Switch to Manual Steering. Steering mode selector to *MAN* setting.	 

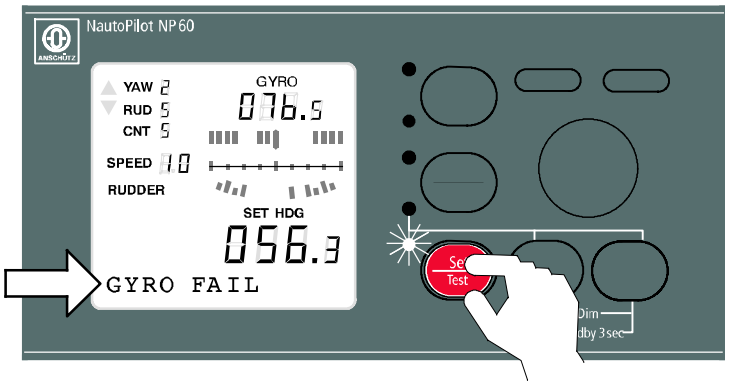
Alarms	Meaning	Possible measures to put in hand	Measures to put in hand on Operator unit/ peripherals
HEADING MON	The magnetic compass actual heading is outside the monitoring limits. Defective Gyro The magnetic compass is being affected so that it is unreliable. Autopilot system and Steering Control faulty.	Check magnetic heading correction / VARIATION. Check gyro heading. Change heading sensor (magnetic or flux gate compass). The selected monitoring limits are too narrow, if necessary widen the limits. Switch to *Manual Steering* ” operating mode. Steering mode selector to MAN setting.	  

2.10.2 Significance of the various comments in the text line.

Note:	Meaning	Measures to take	Measures to put in hand on Operator unit/peripherals
NEW TRACK ...	The Navigation Receiver is transferring the next track section data to the Autopilot.	Acknowledge plain text message.	
TILLER ... TILLER X active	The symbol key on the tiller has been activated. The Autopilot operator unit is automatically switched to STANDBY operation.		

2.11 Faulty operation

Every fault triggers an audible alarm. A corresponding message appears on the text line in the display unit.



The audible alarm can be acknowledged, the fault message remains.
The LED on the symbol key is illuminated for the duration of the recognized fault.

2.11.1 Possible fault messages and measures to take

The table below shows all the possible fault messages, the causes with which they are connected, and the measures to take to correct the fault.

No.	Indication	Meaning	Likely cause	Effect on operation	Measures to take
1	AUTO FAIL	Internal fault on NP60	• Program fault • CPU card faulty or defective.	System is no longer operational	• Switch steering mode selector to MAN setting • Check LED indication on CPU card • Replace CPU card
2	PANEL FAIL	Operator unit no longer operating without error	• Connection cable broken • Supply voltage Operator unit failure • Operator unit faulty	System is no longer operational	• Switch steering mode selector to MAN setting • Check LED indication on CPU card • Check connection cable • Check supply voltage • Replace operator unit
3	GYRO FAIL	Gyro data transmission failure.	• Connection cable broken, defective Gyro • (if step system present) If there is a short-term on-board power failure the configured synchronization value is lost.	The system is operational under certain conditions. The latest actual heading is automatically saved, the set heading is locked in.	• Select the magnet or flux gate compass from the operator unit • Check connection cable • Check GYRO • Check synchronization, configure if necessary.
4	MAGNET FAIL	The magnetic/flux gate data transmission is not plausible.	• Connection cable broken, magnetic/flux gate compass faulty	The system is operational under certain conditions. The latest actual heading is automatically saved, the set heading is locked in.	• Switch steering mode selector to MANual setting • Select gyro compass from the operator unit • Check connection cable • Check the magnet / flux gate compass
5	STEERING FAIL	Fault in steering gear circuit	• Steering gear faulty or defective. • Rudder position transmitter faulty or defective • Pre-configured rudder positioning speed not set correctly • FU control faulty or Rud Fail range is set too narrow	System is no longer operational	• Switch steering mode selector to MANual setting • Check parameter value for RUD.SPEED and configure if necessary. • Check parameter value for RUD LIMIT and configure if necessary. • Extend Rud Fail
6	NAVDATA FAIL	Track course data transmission malfunction	• Connection cable faulty • Navigation receiver or Set course transmission system faulty	WAYPOINT operating mode no longer possible	• Set heading control (AUTO) or MAN operating mode

No.	Indication	Meaning	Likely cause	Effect on operation	Measures to take
7	Nav Data invalid	Data transmission from position receiver	• Poor reception	TRACK (waypoint operating mode) is operational under certain conditions.	• Set AUTO or MAN operating mode
8	No Connection	Internal fault in NP60 system Operator unit receiving no data.	• Program fault • CPU card faulty or defective. • Connection cable to oper rator unit broken	System is no longer operational	• Reinitialise device using the Hardware RESET switch on the CPU card • Replace CPU card • Check connection cable
9	Log Fail	Data transmission to Log Source is interrupted	• Connection cable faulty • Log source faulty	Controller is unstable	• Switch from LOG to Man Speed entry • Check connection
10	Low speed	• Pulse log failure • Ship's speed too low	• Pulse log interrupted	• Controller is unstable • Control is inaccurate	• Switch to manual control. • Check connection

2.12 When do parameter values need to be configured

⁎ Parameters flagged with an asterisk must be configured each time they are started up in the harbour or in test trips.

No.	Parameter	when	why	how
1	COMPASS	To switch between gyro and magnet compasses. Only if 2 heading sensors are present.	Heading sensor as heading reference for the NP60. Redundancy if sensor fails.	
2	VARIATON	Correction of magnet heading information.	The faulty indication on the magnetic compass can be compensated. It is derived from the local magnetic heading. **MAGNETIC VARIATION** (see sea chart) and the **DEVIATION.** Error typical to ship.	
3	TRACK LIM	WAYPOINT operating mode Setting Track monitor limit	Assists with secure tracking. Determines the monitoring limits left and right of track. If the limit is exceeded the OFF TRACK alarm is triggered.	
4	OFF HEADING	HEADING CONTROL operating mode Setting for the heading monitoring limit	Supports secure HEADING CONTROL. Determines the surveillance limit for the set/actual heading deviation. If the limit setting is exceeded the OFF HEADING alarm is triggered.	
5	RoT° /MIN	HEADING CONTROL and WAYPOINT operating mode Speeds pre-selection	This value determines the speed at which the ship executes a change of heading or of track.	
6	RUD.LIM	HEADING CONTROL or WAYPOINT operating mode Except for TRIM rudder limit setting	This value is used to set the maximum permissible rudder position that, for safety reasons, the rudder may not exceed when travelling under autopilot.	
7	YAWING TRIM YAW	HEADING CONTROL or WAYPOINT/TRIM operating mode. Setting The setting depends on the seaway	The YAWING setting determines rudder activity and heading accuracy for the NP60's control properties. The optimum setting is obtained by means of observation. ^ YAWING = 1 signifies control with the 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 seaway.	
8	RUDDER TRIM RUD	HEADING CONTROL or WAYPOINT operating mode Setting Start-up, test voyage	Each heading 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 heading error. RUDDER too big: - Unstable behaviour => over-reacts to a heading correction => Overshoots when heading is changed RUDDER too small: - Heading control too inaccurate => pre-configured rotation speed not reached during heading change manoeuvre.	

No.	Parameter	when	why	how
9	CNT.RUD TRIM CNT	HEADING CONTROL / WAYPOINT operating mode Setting Start-up, test voyage	Based on its bulk and load, each ship has a time constant typical to the ship, which needs to be kept in control during heading change manoeuvres. Before the new set heading is reached the rotation speed needs to be reduced in good time (e.g. by means 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 heading. Counter rudder too small: The ship does not stop in good time and overshoots the pre-selected set heading.	
10	SPEED	Switch from manual speed entry and from a speed sensor. Input manual speed values.	The ship's properties alter with the speed. For this reason it is necessary to adapt the controller to optimum control.	
11	TRACK< >	WAYPOINT operating mode Setting Depending on requirements	Track controller too passive: The drift effects are too strong and result in greater cross-track error. The accuracy can be increased by means of the TRACK > amplification setting (greater). Track controller too active: Gradually reduce the amplification setting using < TRACK. until the required setting is reached. Optimum between accuracy and controller activity (course trim).	
12 ✳	SYCHRON.	There is no transmission of the absolute heading from the heading sensor (gyro compass) to the NP60. Setting only for step systems - at start-up - desynchronisation after voltage failure	The heading between the compass and the NP60 is desynchronised and needs to be synchronised manually.	

- Manual rudder movement + LED (Man)
- Trim function + LED (Trim)

- Switching on
- Heading control + LED (Auto)
- Track + LED (Track)

Manual rudder movement active (control knob)

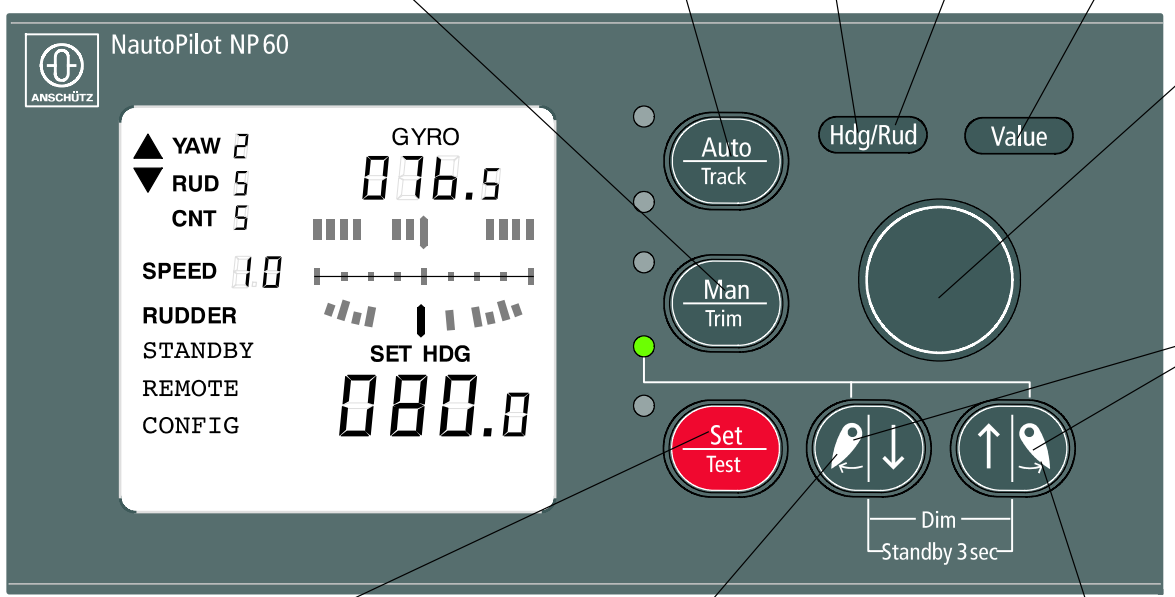
Manual set course setting active (control knob)

Changing parameters and altering values possible (control knob)

- Set heading setting (Auto/Trim)
- Rudder movement in 1° steps (Man)
- Changing parameters and altering values (Auto/Man/Track)

Activate DIM Mode or set to Standby mode

Press both keys at the same time!



- Acknowledging of alarms
- Adopting parameter values
- Self test + Lamp test + operator unit settings (Only in standby mode)

- Trim-rudder movements in 1° steps (Trim)
- Parameter list 1. entry **RUDDER**
- Browse through parameter list in direction of arrow

- Trim rudder movements in 1° steps (Trim)
- Parameter list 1. entry **YAWING**
- Browse through parameter list in direction of arrow

Active heading sensor GYRO or MAGNET

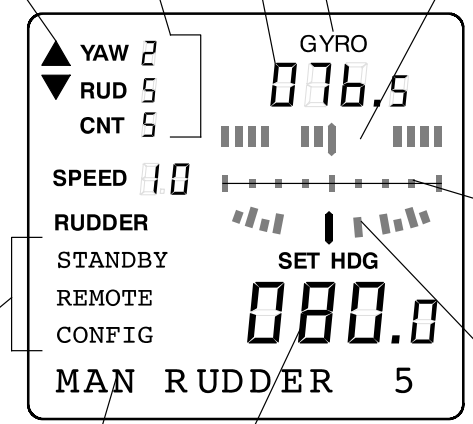
Actual course

Controller parameters

Parameter list
Direction

Waypoint operating mode
- Cross track error

Heading control
- Display heading error
- Display heading error monitoring range



Auxiliary scale

- Display rudder range
- Display actual/set rudder position
- Display rudder limitation

Status displays
(in standard mode off)

Set Heading

- Display parameters
- Display of Set Rudder Value
- Alarm messages
- Fault messages