ALPHASEAPILOT MFC Autopilot

Operating manual

Document : Manual ALPHASEAPILOT MFC
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IMPORTANT APPLICATION & OPERATING NOTE:-
The ALPHASEAPILOT Autopilot System is Type Approved and Wheelmarked compliant with IMO A342 (ix) as amended by MSC 64/67 Annexe 3 which is applicable to vessels up to 30 knots (non High Speed Craft). **It is also Type Approved for high Speed Craft (HSC) compliant with ISO 16329 to provide an overall speed application to 70 knots.** **Since the Control parameters – conventional displacement vessels versus High Speed Craft – are very different, it is essential that the correct vessel type (DISP or HSC) is correctly entered in the Autopilot SET UP Menu during installation and calibration (see Section 2.16)**

NB: Whilst all efforts have been made to ensure the safety and reliability of the ALPHASEAPILOT Autopilot system, it should be noted that the installation of any such system, should never be permitted to detract from the adequate provision of sound and continuous watch keeping duties.

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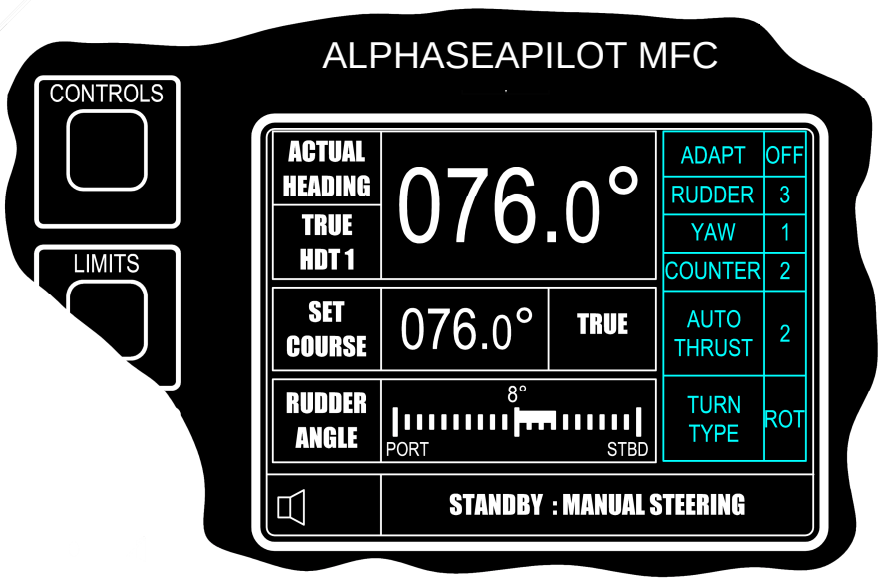
Section 1: Short Operating Instructions

These Short Operating Instructions provide a quick reference guide to setting up and operating the ALPHASEAPILOT MFC Autopilot. The locations in the manual where more detailed descriptions can be found are shown against each heading in brackets, e.g. (Section X.XX).

1.1 Control Unit Display Data & Initial Control Settings - (Section 2.4)

The ALPHASEAPILOT MFC Autopilot is Speed Adaptive and – provided it is used in adaptive mode and calibrated for the correct vessel type (DISP or HSC per 2.16) – will automatically set its own control parameters for optimum steering performance.

Adaptive/non adaptive operation is selectable via **CONTROLS** key operation and entry to the **Controls Menu** which is shown on the right of the main display.



Unless alternative settings have been established from experience during sea passages with the Autopilot in operation, selection of the non adaptive mode will be necessary to enable primary control settings (YAW, RUDDER, COUNTER RUDDER) to be manually adjusted.

If conducting first time sea trials or - if unfamiliar with ALPHASEAPILOT MFC Autopilot operation – see section 2.4.

1.2 Switching to STANDBY (or OFF) – (Section 2.1)

(i) Use the **STANDBY key** to enter the **STANDBY Mode**.

(ii) Wait for self test to complete which will be followed by the operational Control Unit display screen.

In this mode, the Control Unit tracks and displays "Actual Heading", Rate of Turn ("ROT") and "Rudder Angle" etc. and will continue in a tracking mode until the Autopilot is engaged ("ON" key operation).

NB. The Autopilot can be switched OFF at any time by "**OFF**" key operation.

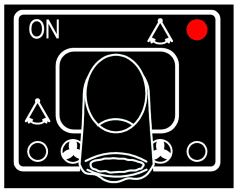
1.3 Engaging Autopilot (ON) – (Section 2.2 & 2.18)

The ALPHASEAPILOT MFC Autopilot can only be switched via the Standby condition thus switching directly from OFF to ON is not possible.

To engage the Autopilot:-

(i) Steady the vessel on the required heading.

(ii) Use the **"ON"** key to engage the Autopilot.



NB. Single press of the "ON" key engages the Autopilot in Rudder control mode only, a continuous 2 second press is Thruster mode only and a further 2 second continuous press is Rudder AND Thruster mode.

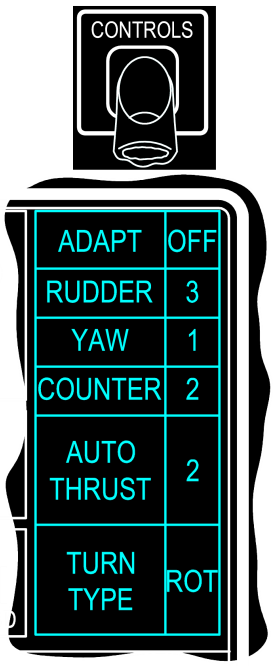
1.4 Adjusting Steering Performance – (Section 2.19 – 2.22)

(Manual Adjustment of Controls)

If the Autopilot has been programmed with Speed Adaptive values based on earlier sea trials or prior seagoing operational performance – no initial adjustment will be required.

If no predetermined values have been stored, it will not be possible to enter - or operate – in the Adaptive Mode (until calibrated per Section 2.29) and manually entered operational control settings will be required via access to the Controls Menu as follows:-

(i) With the Autopilot in the "**STANDBY**" mode (access also available from "ON" or "Track" modes), use the "**CONTROLS**" key to display the Controls Menu.



(ii) Note the position of the flashing cursor over the Controls Menu item "ADAPT ON/OFF" which should be "**OFF**" in the absence of Adaptive Data. Also, when no Speed Data is available, non Adaptive (OFF) Autopilot operation is necessary and PID Control is required involving manual RUDDER, YAW & COUNTER Control adjustment.

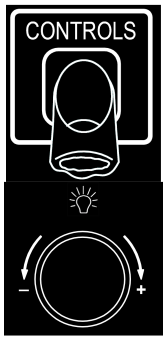
(iii) Select ADAPT "**OFF**" via the rotary (+/-) illum. control then note that the "CONTROLS" key is again used to select RUDDER, YAW or COUNTER (as required) so that adjustment can be made to the value (1 to 9) of the selected control via the rotary (+/-) illum. control.

NB. The Controls Menu display will timeout and revert to the normal operational display if no adjustments are made for a period of 30 seconds. Re-entry to the Controls Menu is by "**CONTROLS**" key operation.

Manual Adjustment of Controls:

(iv) Use the "**CONTROLS**" key to select "YAW" and set a value of "1" using the rotary (+/-) illum. key.

(v) Use the "**CONTROLS**" key to select "**COUNTER**" and set a value of "1" using the rotary (+/-) illum. key.

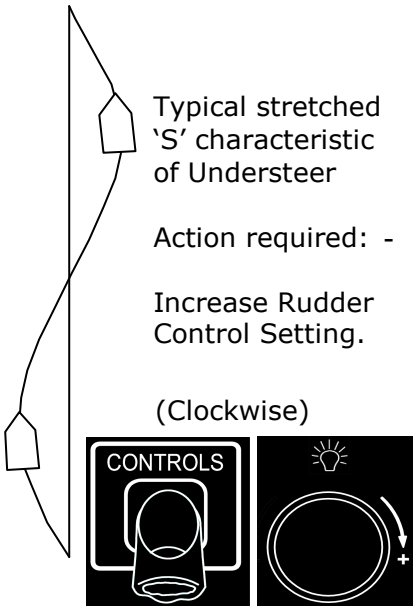


The vessel should now be steady on the required heading under manual steering (Autopilot STANDBY Mode) or engaged (Autopilot ON).

(vi) Check that the Autopilot is ON (engaged) and note the steering performance in terms of Understeer or Oversteer as follows:-

Understeer Characteristics

Large deviations or protracted periods off the Heading Set due to insufficient rudder application in response to Yaw: -



Typical stretched 'S' characteristic of Understeer

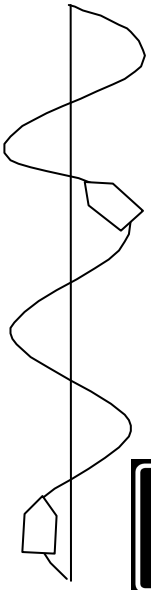
Action required: -

Increase Rudder Control Setting.

(Clockwise)

Oversteer Characteristics

Autopilot applying too much rudder causing vessel 'weave' which may increase to a tight 'S' pattern: -

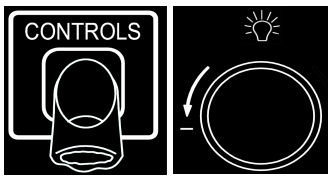


Typical tight 'S' characteristic of Oversteer

Action required: -

Reduce Rudder Control Setting.

(Anticlockwise)



(vii) Use the "**CONTROLS**" key to select "**RUDDER**" and increase or decrease the Rudder Control value (1 to 9) using the rotary (+/-) illum. key to optimise the straight line steering performance in terms of Understeer/Oversteer.

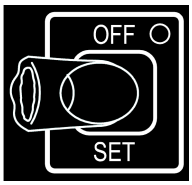
1.5 Matching Heading Steered with Heading Set (Section 2.23)

When the Autopilot is engaged the **AUTOTRIM** (Automatic Permanent Helm – APH) function continuously monitors any long-term differences between the heading set and the mean course actually steered. Any long-term difference is automatically adjusted by the Autotrim (APH) function applying the appropriate amount of permanent helm.

To speed up this automatic (APH) process: -

(i) Wait for vessel to settle on steady heading.

(ii) Press the **AUTOTRIM SET** key.



Pressing and holding down the AUTOTRIM key for 5 seconds will switch the AUTOTRIM function OFF as confirmed by the red corner keypad LED.

1.6 Avoiding Unnecessary Rudder Correction (Section 2.25)

Frequent rudder movements when the vessel is yawing either side of the set heading in a seaway indicates that the autopilot sensitivity is set too high for the sea conditions being experienced. This can cause premature wear of the steering gear and, whilst an automatically adjusted feature of the full Adaptive operating mode, will require manual adjustment in the non Adaptive (PID) mode.

To manually decrease the frequency of rudder movement due to yawing: -

(i) Use the "**CONTROLS**" key to display the controls menu.

(ii) Use the "**CONTROLS**" key again to select "YAW" and increase the Yaw value (1 to 9) using the rotary (+/-) illum. key.
(The normal operational display will resume automatically after a timeout period of 30 secs.).

NB. Don't forget to reduce the YAW setting when yawing decreases as the vessel moves from rougher to calmer sea conditions.

1.7 Altering to a New Heading (Section 2.36)

In full Adaptive operational mode, a course change executed by the Autopilot system may be controlled by pre-programmed Rate or Radius of Turn data.

These limiting factors can also apply in the non Adaptive (PID) operating mode provided the Autopilot CONTROLS and LIMITS menus have been programmed and - for Radius controlled turns - that Speed (SOG) input data is available.

If the existence of safe limiting factors is uncertain, the RUDDER LIMIT function – which otherwise limits the maximum permissible angle of rudder applied by the Autopilot – can be employed to produce small rudder angles/slow turns.

To alter course to a new heading using the Autopilot: -

(i) Use the "**LIMITS**" to enter the Limits Menu where the Rudder Limit value is the first item shown and should now be flashing.

NB. Each parameter in the Limits Menu is selectable via step by step use of the LIMITS keypad and is confirmed by flashing of the appropriate box.

(ii) Set the Rudder Limit value (**RUD LT**) to a safe value (range 5° to 50°) via the rotary (+/-) illumination control.

(iii) Turn the Course Selector ("**Set Course**" Control) clockwise to alter course to Starboard or anticlockwise to alter course to Port. The Port & Starboard demand chevrons will flash & an audible bleep will be heard.

(iv) Press the "**CONFIRM**" key to execute the turn. As a safety precaution to prevent accidental course selector operation the course change will be cancelled if the confirm key is not pressed within the timeout period (nominally 30 sec). Without confirmation within 30 seconds the new course demand will automatically cancel and the original set course will be maintained. Pressing the "**CANCEL**" key will also cancel the course change.

NB. The Autopilot will order the vessel to turn in the same direction as the Course Selector knob is turned for any amount of Course change up to 359°. The result is that if the course change is more than 180° the vessel will continue to take the "long way" round to the new course.

1.8 Adjusting Rate of Turn using the Rudder Limit Control (Section 2.31)

To adjust (simple) Rate of Turn when altering course using the Autopilot: -

If vessel turns too quickly - reduce Rudd Limit (**RUD LT**) value 1 - 9 per 1.7 (ii).

If vessel turns too slowly - increase Rudd Limit (**RUT LT**) value 1 - 9 per 1.7 (ii).

1.9 Programmable Automatic Rate of Turn Control (Section 2.6, 2.32 & 2.33)

The Autopilot Rate of Turn (ROT) control function can operate – as programmed via the CONTROLS and LIMITS Menus – in both the Adaptive and non Adaptive (PID) modes:-

To select Rate of Turn control vs Radius of Turn:-

(i) Use the "**CONTROLS**" key to select the Controls Menu.

(ii) Use the "**CONTROLS**" key again to step through the Menu listing until the "**TURN TYPE**" box is flashing.

(iii) Use the rotary (+/-) illumination control to select "**ROT**".

To select required Rate of Turn (6 – 300 deg/min or 0.1 – 5 deg/sec):-

NB. ROT can be expressed (and displayed) in °/min or °/sec as preferred and can be selected accordingly via the Set Up Menu. (Section 2.6(v) refers).

(iv) Use the "**LIMITS**" key to display the Limits Menu.

(v) Use the "**LIMITS**" key again to step through the Menu listing until the "**ROT°/S**" box is flashing.

(vi) Use the rotary (+/-) illumination control to select the required ROT in °/min or °/sec (noting that 6–300°/min = 0.1-5°/sec).

Using the Turn Rate control.

Provided the Rate of Turn function is enabled and specified with a value in °/min or °/sec, it will automatically control the vessel's rate of turn during course changes. When the vessels Rate of Turn is being limited by this function the SET ROT display box will flash alternating between the value set (i.e. **1°/SEC**) and "**MAX**". As the vessel approaches the new set heading and the Rate of Turn decreases, the MAX display indication will automatically extinguish.

NB. During Track Steering Mode using the HTC sentence (Section 2.9 & 2.38) it is possible for the Track Controller to override the Autopilot programmed (internal) value. However, this is only possible up to any maximum permissible ROT value set within the Autopilot. In this (HTC sentence) Track Steering Mode, it is not possible to manually Adjust ROT.

1.10 Programmable Automatic Radius of Turn (Section 2.6 & 2.34)

The Autopilot Turn Radius Control function can operate in both the Adaptive and non Adaptive Modes but it is essential to note that Speed over the Ground (SOG) input data must be present – without which Radius control will not exist.

To select Radius of Turn Control vs Rate of Turn:-

(i) Use the "**CONTROLS**" key to select the Controls Menu.

(ii) Use the "**CONTROLS**" key again to step through the Menu listing until the "**TURN TYPE**" box is flashing.

(iii) Use the rotary (+/-) illumination control to select **"RAD".**

To select required Radius of Turn (0.1 - 9.9Nm):-

(iv) Use the "**LIMITS**" key to display the Limits Menu.

(v) Use the "**LIMITS**" key again to step through the Menu listing until the "**RAD:nm**" box is flashing.

(vi) Use the rotary (+/-) illumination control to select the required Radius of Turn between the limits 0.1–9.9Nm.

1.11 Adjusting Overshoot and Undershoot (Section 2.4 & 2.24)

This performance aspect is based on Counter Rudder Control settings and, if operating in the full Adaptive mode, is unlikely to require manual adjustment.

If manual adjustment is required (more likely in the non Adaptive PID mode) the **"COUNTER"** Rudder value is changed as follows:-

(i) Use the "**CONTROLS**" key to display the controls menu.

(ii) Use the "**CONTROLS**" key again to select "**COUNTR**" and increase or decrease the value (1-9) using the rotary (+/-) illum. key based on the following:-

To adjust overshoot (vessel goes past new heading) or undershoot (vessel stops short of new heading) when altering course using the Autopilot: -

If vessel overshoots - increase COUNTER RUDDER value

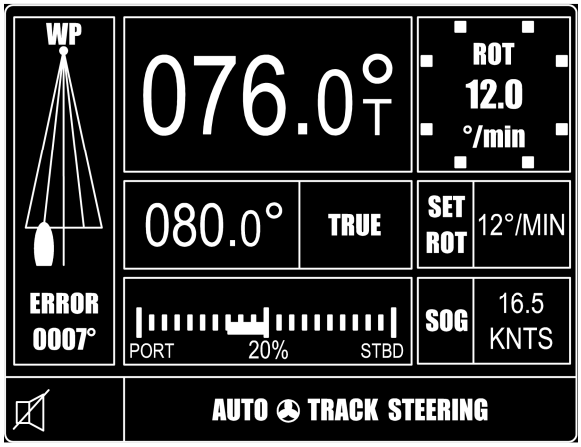
If vessel undershoots - reduce COUNTER RUDDER value

1.12 Using the Track Function (Section 2.9 & 2.38)

The Autopilot is equipped with a comprehensive Track Steering facility which is activated by operation of the "**TRACK**" key provided the Autopilot System is engaged **(ON)** and suitable Track data is available from a proprietary approved GPS/Track Control system/ECDIS etc.

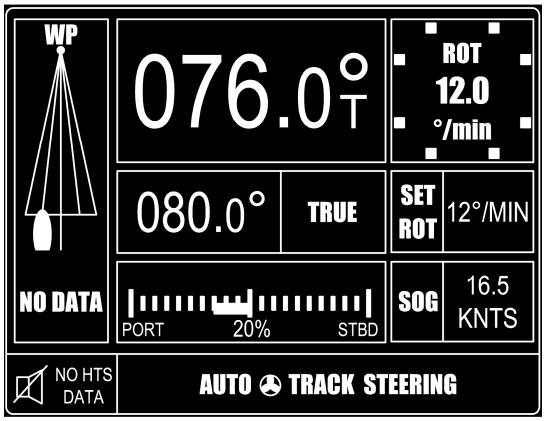
Track Operation is confirmed by red corner LED illumination of the Track key and additional display information for AUTO TRACK STEERING Mode.

Three Track sentence types are accepted ($XXHTC, $XXHSC, $XXAPB) all three of which provide the "Heading to Steer" data required for single or multi waypoint route steering by the Autopilot system.



When operating in conjunction with an approved Track Control system sending the comprehensive "HTC" sentence, complex manoeuvres based on externally ordered ROT & Radius controlled turns to new headings can be acknowledged and executed by the Autopilot.

To engage the Track function:-
(It is assumed that valid track data is available to the Autopilot system).



(i) With the Autopilot engaged (**ON**) use the "**TRACK**" key to accept data.

NB. In the event that no data is available, the "**NO HTS DATA**" alarm will be generated (visual and audible).

(ii) Valid Track data acceptance will be confirmed below the Track graphic as "**HTC DATA**",

"**HSC DATA**" or "**APB DATA**" as appropriate and the New Heading to Waypoint (**NEW HDG TO WP**) display area flashing accompanied by the red and green control panel chevrons requesting Confirm or Cancel action.

(iii) If the Track Mode Heading to Waypoint is to be accepted – use the "**CONFIRM**" key.

(If the "**Confirm**" key is used, the vessel will immediately turn to take up the ordered new Heading to Waypoint and the Track graphic will show vessel icon left or right of heading with the error angle below).

If the Track Mode Heading to Waypoint is to be rejected – use the "**CANCEL**" key.

(If the "**Cancel**" key is used, a silent period will follow beyond which the Cancel/Confirm request will be repeated and this sequence will continue until the Track Heading is accepted or Track Mode is set to "**OFF**").

(iv) To disengage the Track Mode at any time, use the "TRACK" key when it will be noted that the Track graphic will automatically be removed from the Control Unit display and the red corner LED in the "TRACK" key will turn off.

NB. Track data failure during Track Mode operation is signalled by a Control Unit generated alarm and alarms requesting Operator action (CONFIRM/CANCEL) will also be generated as follows:-

$XXHSC & $XXAPB Operation – Confirm/Cancel action required for any New Heading to Waypoint change in excess of 10°.

$XXHTC Operation – No Cancel/Confirm action required – New Heading change to next waypoint will be executed automatically.

1.13 Cancelling an Audible Alarm (Section 2.8)

All audible alarms can be silenced by the "TEST" key temporarily or permanently (Alarms Muted). When an operational alarm is cancelled by normal use of the Test keypad, the audible alarm will stop but will restart automatically after a timeout period of 60 seconds if the alarm condition persists. During the timeout period, a visual warning will be displayed to advise of such an existing condition.

Audible alarms may be permanently muted by 5 second continuous operation of the "TEST" key confirmed by the alarm off icon in the bottom left display corner. Audible alarms are re-enabled by further 5 second continuous operation of the "TEST" key.

NB. Audible alarms may be permanently muted but this function should be used with extreme caution since a permanently muted alarm may result in a missed alarm condition with dire consequences.

To cancel an audible alarm:-

(i) Use the "**TEST**" key 1x

1.14 Testing Alarms (Section 2.8)

The alarms may be tested by double press of the "**TEST/OFF**" keypad provided the alarm function is not muted. (In the muted condition, a second double press is required).

To test Alarms:-

(i) Double press the "**TEST/OFF**" key.

(Each Control Unit keypad corner LED will now be illuminated in turn accompanied at each step by audible alarm bleep).

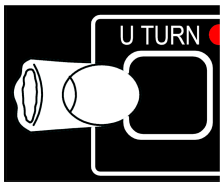
1.15 Keypad Turns (Sections 2.11 & 2.36)

Two types of turn can be selected using the "U TURN" or "NEXT COURSE" keys as required confirmed in either case by illumination of the red corner LED as appropriate.

The "U TURN" function (Section 2.11 & 2.36):-

Operation of this keypad makes the Autopilot ready to produce a 180° turn from current heading (to reciprocal heading) which is executed when turn direction is first specified by "**CANCEL**" (PORT) or "**CONFIRM**" (STBD) key operation followed by second "**CANCEL**" (abort) or "**CONFIRM**" (execute **U TURN**) key use.

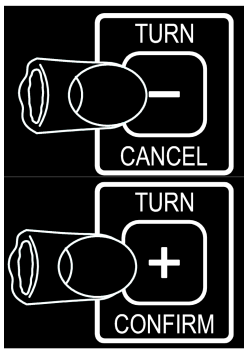
(i) To use the "U TURN" function:-



Press the "U TURN" key confirmed by flashing red corner LED illumination.

NB: "U TURN" request cancelled - if required - by second press of "U TURN" key.

A) Use the "+" (STBD) or "-" (PORT) "TURN" key to specify the direction of "U TURN" required.



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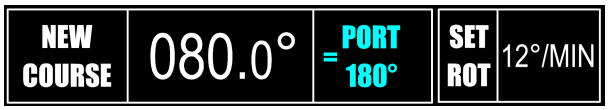

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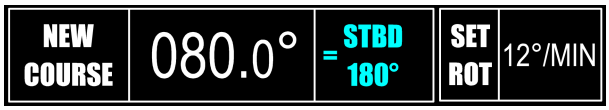


NB: Unless U Turn follow up action is taken within 30 seconds, U Turn selection will be cancelled.

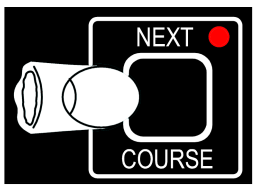
B) Use the "+" (CONFIRM) or "-" (CANCEL) "TURN" key to execute or cancel the "U TURN" order.

(ii) "NEXT COURSE" (Section 2.11(ii))

Operation of this keypad allows a new (NEXT) course to be stored and shown on the display in advance of actual turn to the next course. Once ready (Next Course stored) CANCEL/CONFIRM key operation actions the turn to Next Course.

To use the "NEXT COURSE" function:-

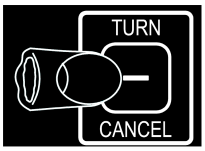
A) Press the "NEXT COURSE" key confirmed by flashing red corner LED illumination.



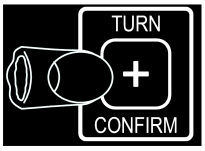
NB. "NEXT COURSE" request cancelled - if required - by 2nd press of "NEXT COURSE" key.

B) Note the "NEXT COURSE" area of the Control unit display and turn the SET COURSE knob until the display shows required "NEXT COURSE".

C) Use the "+" (STBD) or "-" (PORT) "TURN" key to specify the direction of turn required to the "NEXT COURSE" heading displayed.



D) Use the "+" (CONFIRM) or "-" (CANCEL) "TURN" key to execute or cancel the "NEXT COURSE" order.

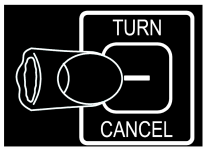


(iii) "±1°/ ±5°" Step Turns (Section 2.13 & 2.36): -

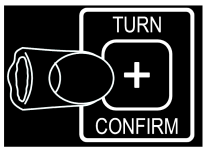
Under normal operating conditions (no U TURN, NEXT COURSE or NEW COURSE sequences in process) the "TURN" + (Stbd) or "TURN" – (Port) keys can be used to order small permanent course changes in 1°/5° steps etc.

To use the "±1°/±5°" function:-

A) Use the "+" (STBD) or "-" (PORT) "TURN" key to specify the direction of turn required in single presses (for 1° course change steps) or hold the key down to produce an increase in the new heading step values automatically from 1° to 5° to 10° etc.



B) Note that the actual amount of course change ordered using the "TURN" keys is always confirmed by the new permanent heading shown in the "SET COURSE" area of the display.

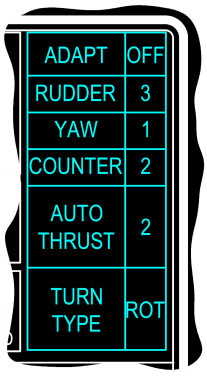


1.16 The Controls Menu (Section 2.4)

This Menu can be conveniently displayed during normal "STANDBY" or "ON" operating modes by use of the "**CONTROLS**" key:-

Entry to the CONTROLS Menu is confirmed by a listing from "ADAPT" to "TURN TYPE" (as shown) and selection of the parameter required is via further **CONTROL** key operation.

When the required item is highlighted by a "flashing" display, the value – or state – of that item is set by movement (+/-) of the rotary illumination control.



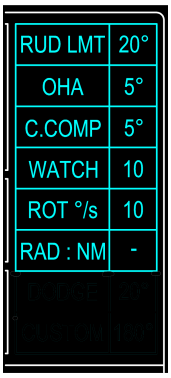
NB. In the event that the **CONTROLS** Menu has been entered but no change has been made for timeout period of 30 seconds, the display will revert automatically to its normal operating mode.

1.17 The Limits Menu (Section 2.6)

This Menu can be conveniently displayed during normal "STANDBY" or "ON" operating modes by use of the "**LIMITS**" key:-

Entry to the LIMITS Menu is confirmed by a listing from "RUD LT" to "CUSTOM" (as shown) and selection of the parameter required is via further **LIMIT** key operation

When the required item is highlighted by a "flashing" display, the value – or state – of that item is set by movement (+/-) of the rotary illumination control.



NB. In the event that the **LIMITS** Menu has been entered but no change has been made for timeout period of 30 seconds, the display will revert automatically to its normal operating mode.

1.18 The Remote Key (Section 2.10 & 2.40)

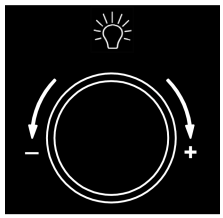
Where more than one Control Unit is installed in the Autopilot system, or, where Remote Power Steer Controls are involved, the "**REMOTE**" key provides unconditional Enable (Remote ON) or Disable (Remote OFF) legislation.

REMOTE On (red corner LED on) – Remote Stations permitted to work.
REMOTE Off (red corner LED off) – Remote Stations not permitted to work.

1.19 The Illumination Control (Section 2.5)

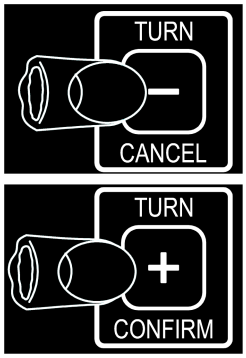
In the normal Autopilot Operating Mode, the rotary (+/-) illumination control is adjusted clockwise (+) or anticlockwise (-) for brighter or dimmer control panel and display illumination respectively.

When either the LIMITS Menu or CONTROLS Menu is entered and displayed, the illumination control is used to change the state of – or adjust the value of – the Menu item selected.

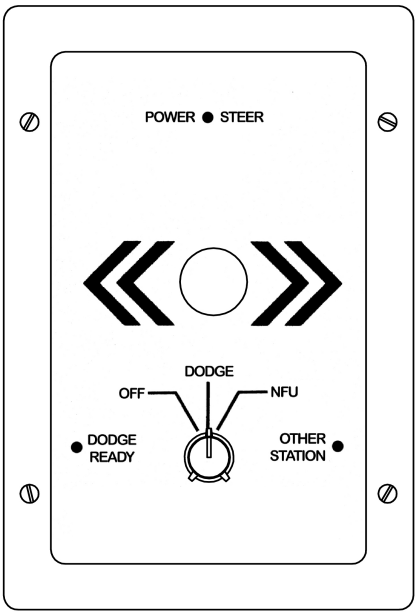


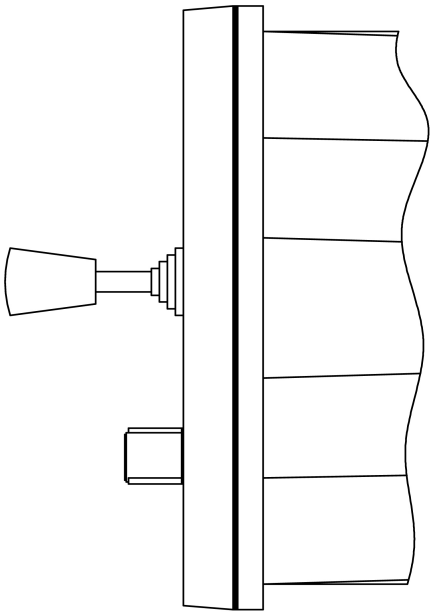
1.20 The Cancel and Confirm Keys (Section 2.13)

The CANCEL (TURN/-) and CONFIRM (TURN/+) keys are mainly concerned with new Autopilot headings which may be automatically (Track Mode Waypoint Steering etc.) or manually (Dodge/Custom Turns etc.) entered.



1.21 Using NT920NFU Dodge and Power Steer (if fitted)





NT920NFU

Operating Instructions: -

NB. The NT920NFU(s) will only function when the Autopilot "**REMOTE**" key is set to enable Remote inputs (REMOTE key red corner LED on). If the "**REMOTE**" key is off (no red corner LED) the NFU(s) will be disabled.

DODGE MODE: -

(i) Check that the Autopilot "**REMOTE**" key is activated.

(ii) Select **DODGE** on the **NT920NFU** selector switch.
(Confirmed by illumination of DODGE READY LED).

(iii) Move and hold the NT920NFU Jog Lever right (STBD) or Left (PORT) to apply corresponding rudder and override the Autopilot.

(iv) Release the Jog Lever to centre when ready for the Autopilot to return the vessel to the original Autopilot heading.

NFU MODE: -

(i) Check that the Autopilot "**REMOTE**" key is activated.

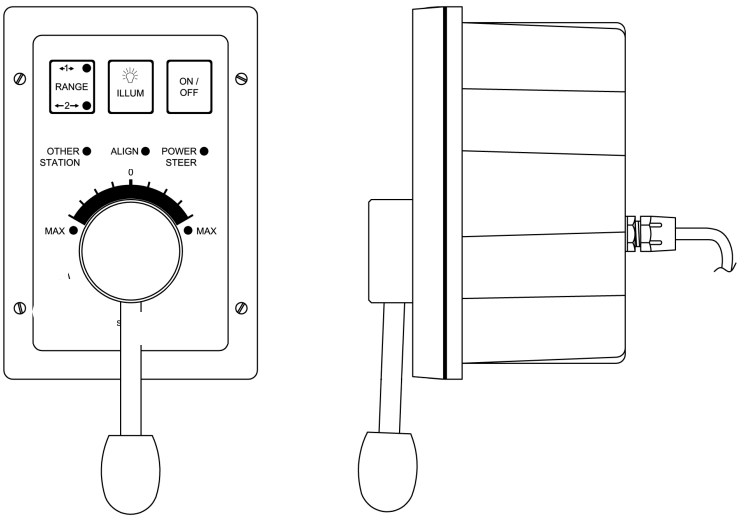
(ii) Select **NFU** on the **NT920NFU** selector switch.
(Confirmed by illumination of the POWER STEER LED).

(iii) Move the NT920NFU Jog Lever Right (STBD) or Left (PORT) and release the Jog lever to centre when the required angle of applied rudder is attained.

(iv) Repeat Jog Lever operation as necessary to align the vessel on the new heading required.

(v) Select **DODGE** or **OFF** on the **NT920 NFU** selector switch to return heading control to the Autopilot which will maintain the vessel on the new (current) heading.

1.22 Using the NT990FU Power Steer (if fitted)



Engaging Follow Up Power Steer:-

NB. The NT990FU will only function when the Autopilot "**REMOTE**" key is set to enable Remote inputs (REMOTE key red corner LED on). If the "**REMOTE**" key is off (no red corner LED) the NT990 FU(s) will be disabled.

(i) Check that the Autopilot "**REMOTE**" key is activated.

(ii) Press the **ON/OFF** key on the **NT990 FU**.

(iii) If the **ALIGN LED** flashes, move the lever in the direction towards the flashing **MAX LED** to pick up the current rudder position.

(iv) When power steer mode is engaged the **POWER STEER LED** will illuminate.

(v) Move the lever Port or Stbd to achieve the desired angle of Port or Stbd rudder.

Disengaging Follow Up Power Steer:-

(vi) Press the **ON/OFF** key on the **NT990FU** or use the "**REMOTE**" key on the Autopilot Control Unit to disable Remote Station operation.

(The **NT990 FU POWER STEER LED** will extinguish, the **OTHER STATION LED** will illuminate and the Autopilot will maintain the vessel on the current heading).

1.23 Using Proprietary Power Steer and Override functions

(i) Standard Dodge, Non Follow Up & Follow Up Functions:-

Non Navitron (proprietary) Power steer Controls may be connected to the Autopilot System and are discussed and detailed in Section TM3.4.1 – 4 of the Installation & Technical manual

(ii)Override Power Steer Functions:-

Latched and Non Latched Override Power Steer controls allow the immediate Override of the Autopilot System and are discussed and detailed in Section 2.43.

Section 2: Operator Controls and Sea Trials

Operator Controls and Displays Defined: -

2.1 The Autopilot STANDBY / OFF Key & Modes

2.2 The Autopilot ON Key Modes (Rudder / Thruster)

2.3 The Adaptive & Non Adaptive (PID) Autopilot Modes

2.4 The CONTROLS Menu

- **(i) Adaptive / Non Adaptive Selection**
- **(ii) Rudder Control**
- **(iii) Yaw Control**
- **(iv) Counter Control**
- **(v) Autothrust**
- **(vi) Turn Type (ROT or RAD)**

2.5 The Rotary (+/-) Illumination Control

2.6 The LIMITS Menu

- **(i) Rudder Limit**
- **(ii) Off Heading Alarm**
- **(iii) Course Comparator Alarm**
- **(iv) Watch Alarm**
- **(v) Rate of Turn (ROT) Calibration & Display (°/sec or °/min)**
- **(vi) Radius of Turn (RAD) Calibration**
- **(vii) Dodge Angle Calibration**
- **(viii) Custom Turn Calibration**

2.7 The AUTOTRIM Key (Automatic Permanent Helm)

2.8 The Alarm TEST / OFF Key

2.9 The TRACK Key

2.10 The REMOTE Key

2.11 The TURN MODE Keys

- **(i) Dodge**
- **(ii) Custom**
- **(iii) +/-1 / +/-5**

2.12 The Rotary SET COURSE Control

2.13 The CANCEL & CONFIRM Keys

2.14 The Control Unit Start Up Display (Splash Screen)

2.15 The Control Unit Operational Display

Sea Trials:-

2.16 Sea Trials and Autopilot Type Selection

2.17 Mag/True Heading Assessment

2.18 Autopilot Engagement (ON)

PID Adjustments for Adaptive Mode Calibration:-

2.19 Initial Course Keeping Performance

2.20 Optimising the Rudder Control Setting

2.21 Optimising the Rudder Control Band

2.22 Loop Gain Calibration

2.23 Autotrim (Automatic Permanent Helm) Assessment

2.24 The Counter Rudder Control Setting

2.25 Optimising the Yaw Control Setting

Adaptive Mode Calibration:-

2.26 STW Speed Data Input (Speed through the Water)

2.27 SOG Speed Data Input (Speed over the Ground)

2.28 Draft Input (Laden State)

2.29 Calibration of Steering Performance & Override Controls vs Speed

2.30 Calibration of Steering Performance vs Draft.

Adaptive & Non Adaptive (PID) Adjustments:-

2.31 Setting the Rudder Limit Control
2.32 Setting Rate of Turn Control
2.33 Setting Maximum Safe Rate of Turn
2.34 Setting Radius of Turn Control
2.35 Optimising the Off Heading Alarm
2.36 Setting and Confirming New Autopilot Courses
2.37 Setting the Watch Alarm Period
2.38 The Track Function
2.39 Manual & Auto Deviation Correction

Optional Units:-

2.40 ALPHASEAPILOT MFC Second Station Control Units
2.41 NT920 NFU Power Steering
2.42 NT990 FU Power Steering
2.43 Special Latched & Non Latched Power Steer Controls

2.1 The Autopilot Standby / OFF Key & Modes (See Vessel Type p.s. 2.16)

(i) OFF — All Autopilot functions are inoperative
(No display data or keypad LEDs activated)

(ii) STANDBY — Control Unit Display operational.
Standby keypad red LED activated
Manual steering required

A Red LED in the Autopilot Mode **STANDBY** keypads confirms the operational status of the steering mode which is also "written" at the bottom of the Control Unit Display as "**STANDBY: MANUAL STEERING**".

All display aspects are drawn – and shown where data is available - and Heading plus Rudder Angle data outputs are available for use by proprietary VDR, Radars etc.

Press the **OFF/STANDBY** key to switch off or the **ON** key to engage the Autopilot System.

2.2 The Autopilot ON Key Modes (Rudder/Thruster)

The Autopilot can only be switched on via the Standby condition thus switching directly from Off to On is not possible.

The Autopilot "ON" keypad is equipped with 3 corner LEDs which illuminate (as appropriate) to confirm the selected working mode as follows:-

(i) First press – Autopilot engaged in **RUDDER** only mode.
(Display indication **AUTO △ STEERING**)

NB. After initial first press to engage the Autopilot subsequent Mode changes require a 2 second continuous press of the key.

(ii) Second press – Autopilot engaged in **THRUSTER** only mode.
(Display indication **AUTO ✇ STEERING**)

(iii) Third press – Autopilot engaged in combined **RUDDER and THRUSTER** mode.
(Display indication **AUTO △+✇ STEERING**)

The Autopilot system controls the steering gear and the steering performance of the vessel in the ON mode but can be disengaged at any time by operation of the **STANDBY / OFF** key.

2.3 The Adaptive & Non Adaptive (PID) Autopilot Modes

The Autopilot system may be operated as a conventional PID (Non Adaptive) system, which typically involves manual adjustment of the Autopilot controls (Rudder, Yaw, Counter Rudder etc.) to achieve optimum steering performance.

Alternatively, the ALPHASEAPILOT MFC can function as an Adaptive Autopilot where the control parameters are automatically adjusted as a function of Speed and Draft input data which, typically, requires little or no manual adjustment beyond initial installation and Sea Trials.

Whilst PID operation is not dependent on Speed input data, it should be noted that certain information such as Speed through the Water (STW) is an essential requirement for the Speed Adaptive operating mode.

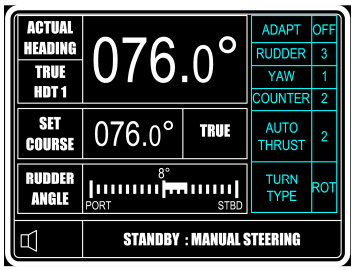
Similarly, Draft input data enables the Autopilot system to automatically set its operational control parameters for changes in steering characteristics geared to ballast/laden conditions.

In most displacement vessel applications – and always in High Speed Craft (HSC) cases - the Adaptive Autopilot mode will be preferred and selected via reference to the CONTROLS Menu where it will be seen that facilities also exist for manual control adjustments – even when the Adaptive mode is selected – to permit immediate "fine tuning" of the automatic parameters if required.

2.4 The CONTROLS Menu

The Controls Menu is rapidly and conveniently entered from all Autopilot operating modes (STANDBY, ON, TRACK etc.) by single press operation of the "**CONTROLS**" key.

Adjustable control parameters are listed on the right side of the operational display (as shown) and each item is selected by further use of the "CONTROLS" key accompanied by "flashing" to confirm parameter selected. The value – or state – of the chosen item is then changed via the rotary (+/-) illumination control.



2.4 (i) Adaptive / Non Adaptive Selection

The Adaptive and Non Adaptive operating modes are briefly discussed in Section 2.3 and, in most cases, Adaptive selection will be preferred.

NB. Adaptive (automatic) "Weather" control adjustment is a Type Approval requirement of High Speed Craft (HSC) Autopilots thus the Adaptive Mode must be selected for HSC applications.

a) Use the "**CONTROLS**" key to enter the Controls Menu.

b) Use the "**CONTROLS**" key again to select "**ADAPT**" box followed by flashing "**ON/OFF**".

c) Use the rotary (+/-) illumination control to select "**ON**" or "**OFF**" as required (Adaptive mode "**ON**" or "**OFF**" where OFF = PID).

2.4 (ii) Rudder Control

In the Adaptive Mode, the "value" of the **RUDDER** parameter will be found automatically (after initial Sea Trial calibration) by reference to input speed and draft data etc. Even so, the **RUDDER** value can be manually changed – if required to immediately optimise the steering performance – via the **CONTROLS** Menu.

If Non Adaptive operation is in use, it will always be necessary to adjust the **RUDDER** value manually – again via the **CONTROLS** Menu.

The Rudder Control defines the angle of Rudder that shall be applied in relation, or proportion to course error (degrees off course).

The Control value is 1 to 9 (as shown against **RUDDER** in the **CONTROLS** Menu) and minimum Rudder is applied at a setting of 1. Maximum Rudder is therefore applied at a setting of 9 and a 3:1 ratio exists between minimum and maximum settings.

The factory default setting (accessible via the Set Up Menu) initially provides a Rudder Control range of 0.5° to 1.5° of Rudder per degree course error.

The Rudder Control value (1 to 9) is adjustable as follows:-

a) Use the "**CONTROLS**" key to enter the Controls Menu

b) Use the "**CONTROLS**" key again to select "**RUDDER**" box followed by flashing value "**1-9**"

c) Use the rotary (+/-) illum. control to set value "**1-9**" as required

The Rudder Control is principally employed to prevent Autopilot "Understeer" and "Oversteer" and the operator control band may be optimised by use of Loop Gain adjustment (Section 2.22) during later Sea Trials.

2.4 (iii) YAW Control

This control defines the sensitivity of the Autopilot to course error and is manually adjusted in the Non Adaptive Mode. It also requires manual adjustment in the Adaptive Mode unless HSC (High Speed Craft) operation is selected when the automatic "Weather" function becomes active.

Rated 1 to 9, a "**YAW**" value of 1 specifies minimum Yaw (max. sensitivity) when the Autopilot will respond to course error of ±0.5°. At maximum Yaw (9) a deadband of approx ±10° is prescribed. (Whilst the term "Deadband" is used it should be noted that provided the **AUTOTRIM** feature is operational, the Autopilot will ensure that the average course is maintained whilst disregarding short term course errors arising from pitch and roll etc. thus avoiding unnecessary Rudder movement)

As a general rule the Yaw control should be set to provide good sensitivity, which would normally be reduced in heavy weather. (See Section 2.25).

To adjust the YAW value:-

a) Use the "**CONTROLS**" key to enter the Controls Menu.

b) Use the "**CONTROLS**" key again to select "**YAW**" box followed by flashing value "**1-9**".

c) Use the rotary (+/-) illum. control to set value "**1-9**" as required.

2.4 (iv) COUNTER Control

Like the RUDDER Control, in the Adaptive Mode, the "value" of the **COUNTER** (Rudder) parameter will be found automatically (after initial Sea Trial calibration) by reference to input speed and draft data etc. Even so, the **COUNTER** value can be manually changed – to immediately optimise the steering performance – if required via the **CONTROLS** Menu.

The "**COUNTER**" value (1 to 9) prescribes how much opposite rudder is applied to prevent overshoot in a turn, or, how much additional rudder is applied to arrest a sudden or fast and unspecified departure from the Set Heading. (Section 2.24 refers).

To adjust the COUNTER value:-

a) Use the "**CONTROLS**" key to enter the Controls Menu

b) Use the "**CONTROLS**" key again to select "**COUNTR**" box followed by flashing value "**1-9**"

c) Use the rotary (+/-) illum. control to set value "**1-9**" as required.

2.4 (v) Autothrust

The Autothrust Mode refers to Autopilot control of the Thruster(s) which may be confined to Thruster ONLY or combined with Rudder to provide Rudder AND Thruster response to Autopilot steering demands.

The amount of Thruster power required – whether alone or combined with Rudder – will vary over a very wide range dependent upon vessel speed, laden condition and external forces (towing/windage/Set etc.).

From the viewpoint of Adaptive Autopilot control and performance, automatic adjustment of the Thrust value (amount) is time consuming and inefficient compared with the straightforward and immediate result gained by manual adjustment.

For this reason, the Autothrust parameter may often be changed manually via access to the **CONTROLS** Menu.

(Related operational conditions would involve vessels underway at low speeds due to towing, winching or navigational considerations, where all conditions combined to degrade Autopilot course keeping when using Rudder(s) only. In this case, the Rudder Mode of control would be retained but would be assisted by the introduction of Bowthruster action via selection of the Autopilot **RUDDER + THRUSTER** Mode. Manual value adjustment of the Thruster contribution would then be made to rapidly optimise steering performance).

To adjust AUTOTHRUST gain:-

a) Use the "**CONTROLS**" key to enter the Controls Menu.

b) Use the "**CONTROLS**" key again to select "**AUTOTHRUST**" box followed by flashing value "**1-9**" (where 9 = max. thrust).

c) Use the rotary (+/-) illum. control to set value "**1-9**" as required.

2.4 (vi) Turn Type (ROT or RAD)

Rate of Turn (ROT) and Radius of Turn (RAD) control is provided by the Autopilot system and can be active - if selected via the **CONTROLS** Menu - in both the Adaptive and Non Adaptive Autopilot operating modes.

If no ROT or RAD control is required, the facility can be set to "OFF".

Radius of Turn Operating Note:-

It should be noted that Speed input data is essential to Radius of Turn control in the form of Speed over the Ground (SOG). If SOG data is absent, or, if vessel SOG is too low to maintain the constant radius turn demanded versus prevailing conditions, Autopilot alarms will result.
NO SOG DATA = NO RADIUS OF TURN CONTROL FACILITY.

Rate of Turn Operating Note:-

Rate of Turn (ROT) is reliant upon Autopilot system internal calculation based on change of heading and does not require Speed input although it must be noted that Speed through the water (STW) is essential for Speed Adaptive Autopilot operation.
NO STW DATA = NO SPEED ADAPTIVE AUTOPILOT OPERATION.

ROT or RAD Control Selection:-

Under normal operating conditions, it is only possible to select one or other (ROT or RAD) control type (as preferred) although it should be noted that both types – and their internally set Autopilot values – can be overruled if/when the Autopilot is used in the "TRACK" mode with a Track Control System (TCS) that provides comprehensive Track data via the $HTC sentence. (Section 2.9 & 2.38 refers).

Rate (ROT) or Radius (RAD) control type is selected via the CONTROLS Menu as follows:-

a) Use the "**CONTROLS**" key to enter the Controls Menu.

b) Use the "**CONTROLS**" key again to select "**TURN TYPE**" box followed by flashing "**ROT**" or "**RAD**".

c) Use the rotary (+/-) illum. control to set as required (ROT, RAD or OFF).

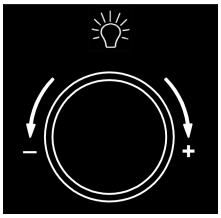
See Sections 2.6 (v) & (vi) for ROT & RAD calibration respectively.

2.5 The Rotary (+/-) Illumination Control

This is a dual function device used as a dimmer control for the Autopilot Control Unit keypad LED's and display backlight illumination level and, also, for parameter state/value adjustment when any of the Autopilot Menus are accessed.

Dimmer Function:-

When fully anticlockwise, all red signal LED's are at maximum brilliance. All other legends are unlit. When the control is rotated clockwise, the LED's dim and then increase in brilliance at the same rate as the control panel legends. In this manner all aspects can be unobtrusively illuminated in all conditions.



The illumination control is not operational when the Autopilot MODE switch is "OFF".

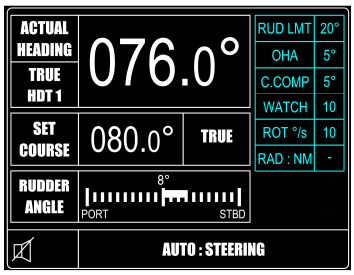
The Menu Parameter Adjust Function:-

When any of the three Autopilot Menus have been entered (**Set Up** Menu, **Controls** Menu or **Limits** Menu) the parameter highlighted by the cursor is adjusted using the rotary (+/-) illumination control which, in this mode, does not alter control panel/display illumination levels.

2.6 The LIMITS Menu

The Limits Menu is rapidly and conveniently entered from all Autopilot operating modes (STANDBY, ON, TRACK etc.) by single press operation of the "**LIMITS**" key.

Adjustable Limits parameters are listed on the right side of the operational display (as shown) and each item is selected by further use of the "**LIMITS**" key accompanied by "flashing" box to confirm parameter selected. The value – or state – of the chosen item is then changed via the rotary (+/-) illumination control.



2.6 (I) Rudder Limit

This is always a manually set control via the LIMITS Menu and specifies the maximum angle of Rudder that the Autopilot is normally permitted to apply. However, the Limit set can be exceeded if the Autopilot system is obliged to demand a greater angle of rudder to check high rates of turn.

The required **Rudder Limit** angle can be set "**OFF**" or between 5° and 45° in 5° steps and an audible and visual warning is generated when the specified rudder limit angle is reached.

2.6 (II) Off Heading Alarm

Any departure by the vessel from the Set Course by a predetermined angle specified via the LIMITS Menu will be signaled both audibly and visually as "**OFF HEADING**". (In addition to the Control Unit alarm, volt free contacts also exist in the Distribution Unit for Auxiliary alarm use).

To avoid unnecessary alarms, a time delay between 10 and 60 seconds can be set via the Autopilot **SET UP** Menu to allow the vessel to return within the limits set (+/-4° etc.) to accommodate natural yaw or course changes to a new heading. (The OHA & CCA delays are always identical).

To set the Off Heading Limit:-

a) Use the "**LIMITS**" key to enter the Limits Menu.

b) Use the "**LIMITS**" key again to select "**O.H.A.**" box followed by flashing current value (**2° to 30° or OFF**).

c) Use the rotary (+/-) illum. control to set as required.

To set the OHA delay time:-

a) Simultaneously press the "**CANCEL**" and "**CONFIRM**" keys for 5 seconds until the **Set Up** Menu is displayed with a black cursor highlighting the Set Up parameter currently selected.

b) Rotate the Autopilot **Set Course** Control to move the cursor to parameter number **35** (**OHA DELAY**).

c) Use the rotary (+/-) illum. control to set **10-60 SECs** as required.

2.6 (III) Course Comparator Alarm

This facility compares the Heading data received by the Autopilot system and registers any difference between the Heading values received by the two highest priority inputs (nominated via the Set Up Menu) and produces an audible and visual alarm if the difference exceeds the value set in the LIMITS Menu.

The Heading input comparisons can be NMEA vs NMEA or NMEA vs HSC2 (i.e. whichever inputs are prioritised as No.1 and No.2).

To switch the Course Comparator Alarm Mode ON/OFF:-

a) Simultaneously press the "**CANCEL**" and "**CONFIRM**" keys for 5 seconds until the **Set Up** Menu is displayed with a black cursor highlighting the Set Up parameter currently selected.

b) Rotate the Autopilot **Set Course** Control to move the cursor to parameter number **36** (**COURSE COMPARATR**).

c) Use the rotary (+/-) illum. control to set **ON/OFF** as required.

To set the two highest priority heading inputs:-

a) If not already in the Autopilot **Set Up** Mode, simultaneously press the "**CANCEL**" and "**CONFIRM**" keys for 5 seconds until the **Set Up** Menu is displayed with a black cursor highlighting the Set Up parameter currently selected.

b) Rotate the Autopilot **Set Course** Control to move the cursor to parameter numbers **32** and **33** (**MAG & NMEA PRIORITIES**).

c) Use the rotary (+/-) illum. control to select as appropriate.

To set the CCA delay period (10-60 seconds):-

The CCA delay period cannot be independently set and always takes the delay time set for the Off Heading Alarm. (See item 2.6 (ii) above).

To set the CCA alarm (difference limit) level:-

a) Use the "**LIMITS**" key to enter the Limits Menu.
b) Use the "**LIMITS**" key again to select "**C.COMP**" box followed by flashing current value (**4° to 16°**).
c) Use the rotary (+/-) illum. control to set the required value.

2.6 (IV) Watch Alarm

The built in Autopilot Watch Alarm can be set to provide an audible and visual alarm level at operator selectable intervals from **3** to **12** minutes in one minute steps - or may be switched **OFF** if the facility is not required.

At the end of the time interval selected (3 to 12 mins) the Control Unit alarm will sound and is cancelled by single operation of the **TEST/OFF** keypad. A new timing period will automatically commence.

If the Control Unit alarm is not cancelled (after the initial time interval) within a further one minute period, a relay within the Autopilot Distribution Unit provides volt free contacts to activate an auxiliary (external) alarm if fitted.

To set the Watch Alarm time interval (OFF or 3 to 12 mins.):-

a) Use the "**LIMITS**" key to enter the Limits Menu.

b) Use the "**LIMITS**" key again to select "**WATCH**" box followed by flashing current value (**OFF or 3 to 12**).

c) Use the rotary (+/-) illum. control to set the required condition.

2.6 (V) Rate of Turn (ROT) Calibration & Display (°/sec or °/min)

The required ROT operational parameters must be entered into both the Autopilot **SET UP** and **LIMITS** Menus to specify maximum permissible safe Rate of Turn and normal operating Rate of Turn respectively.

Max. Permissible Safe Rate of Turn & Display Mode (°/min or °/sec):-

It should be noted, that a maximum permissible safe Rate of Turn can – and should for safety reasons – be entered into the Autopilot **SET UP** Menu (on Masters advice) during installation.

This maximum level will be the absolute maximum allowed by the Autopilot even if a higher ROT is later ordered by the operator or by a Track Control system (and which, in either case, will result in an Autopilot alarm).

To set maximum safe Rate of Turn:-

a) If not already in the **Set Up** Table, simultaneously press the "**CANCEL**" and "**CONFIRM**" keys for 5 seconds until the Set Up Table is displayed with a black cursor highlighting the Set Up parameter currently selected.

b) Rotate the Autopilot **Set Course** Control to move the cursor to parameter number **27** (**ROT MAXIMUM**).

c) Use the rotary (+/-) illum. control to set the maximum safe value of ROT in **°/SEC (0.1-10)** or **°/MINUTE (6-600)**.

Normal Operational Rate of Turn or Radius of Turn Setting:-

The required Rate of Turn for normal operational duties – up to the maximum safe Rate of Turn value stored in the Set Up Menu – can be set (or changed) via the **LIMITS** Menu.

NB. If ROT has not been selected in the CONTROLS Menu (i.e. RAD Turn Type selected) the ROT setting in the LIMITS Menu will not respond to cursor selection/adjustment.

To set the operational ROT value:-

a) Use the "**LIMITS**" key to enter the Limits Menu.

b) Use the "**LIMITS**" key again to select "**ROT°/S**" box followed by flashing current value.

c) Use the rotary (+/-) illum. control to set "**ROT**" value required.

Display Mode (°/sec or °/min):-

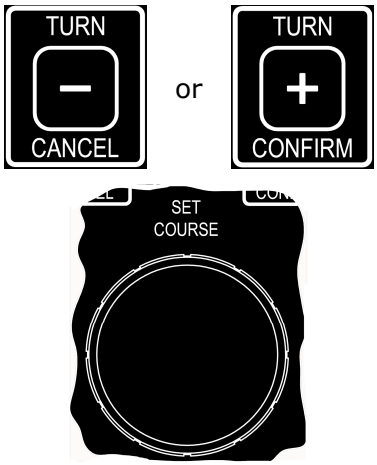
Dependent upon operator preference, the Autopilot Control Unit display can show the values of **Actual** and **Set** ROT in **°/min** or **°/sec** as required.

To set display type (°/min or °/sec):-

a) Simultaneously press the "**CANCEL**" and "**CONFIRM**" keys for 5 seconds until the **Set Up** Menu is displayed with a black cursor highlighting the Set Up parameter currently selected.

b) Rotate the Autopilot **Set Course** Control to move the cursor to parameter number 6 (**ROT SCALING**).

c) Use the rotary (+/-) illum. control to set **°/SEC** or **°/MINUTE**.



2.6 (VI) Radius of Turn (RAD) Calibration

Provided Radius of Turn (RAD) control mode has been selected via the Autopilot CONTROLS Menu (Section 2.4 (vi)) the required RAD operational level must be entered into the LIMITS Menu.

NB. Speed over the Ground (SOG) input data is essential for Radius of Turn control when the Autopilot is in Stand Alone Operation. When used to receive complex data from a Track Control System ($HTC sentence) the TCS can override the RAD value set in the Autopilot LIMITS Menu or even command ROT control operation in the Track Steering Mode. (Sections 2.4 and 2.9 refer).

To set the operational Radius of Turn (RAD) value:-

a) Use the "**LIMITS**" key to enter the Limits Menu.

b) Use the "**LIMITS**" key again to select "**RAD:nm**" box followed by flashing current value (**0.1 to 9.9**).

c) Use the rotary (+/-) illum. control to set "**RAD:nm**" value required.

2.6 (VII) Dodge Angle Calibration

The Dodge facility allows the operator to instruct a temporary Autopilot course change by a preprogrammed amount stored in the "**LIMITS**" Menu.

To set the DODGE value (5° to 90°):-

a) Use the "**LIMITS**" key to enter the Limits Menu.

b) Use the "**LIMITS**" key again to select "**DODGE**" box followed by flashing current value (**5° to 90°**).

c) Use the rotary (+/-) illum. control to set "**DODGE**" value required.

2.6 (VIII) Custom Turn Calibration

The **CUSTOM** turn facility allows the operator to instruct a permanent Autopilot course change by a pre-programmed amount stored in the "**LIMITS**" Menu from 5° to 180° in 5° steps.

To set the CUSTOM value (5° to 180°):-

a) Use the "**LIMITS**" key to enter the Limits Menu.

b) Use the "**LIMITS**" key again to select "**CUSTOM**" box followed by flashing current value (**5° to 180°**).

c) Use the rotary (+/-) illum. control to set "**CUSTOM**" value required.

2.7 The AUTOTRIM Key (Automatic Permanent Helm)

AUTOTRIM (Automatic Permanent Helm) is applied by the Autopilot over a period of time when underway to offset the rudder and eliminate heading errors caused by windage or vessel trim etc.

The Autotrim function can be permanently switched off if required (confirmed by illumination of the "**AUTOTRIM**" key red corner LED) or can be used to instantaneously assess the required rudder "offset" angle when the Autotrim key "**SET**" facility is used.

NB. The **AUTOTRIM** key is also used simultaneously with the **TRACK** key to enter the Diagnostic Mode. (Installation and Tech Manual Section TM5).

Most of the Autotrim Set Up parameters are determined during Sea Trials and include the APH Time Constant and Autotrim Trip Angle, the values of which are set/altered via the Set Up Menu. (Installation and Tech Manual Section 3.11 to 3.13).

The Set Up Menu also offers special Autotrim operating modes but standard (STD) mode is normally chosen. In the standard mode, the "**AUTOTRIM**" key is used as follows:-

(i) Factory default setting is AUTOTRIM active (ON) when the Autopilot is switched from "**STANDBY**" to "**ON**".

(ii) To switch the Autotrim facility OFF, press the "**AUTOTRIM**" key for 5 seconds until the red corner "**OFF**" LED illuminates. (Autotrim will automatically revert to the active state when the Autopilot is switched "OFF" and "ON" again).

(iii) Single press the "**AUTOTRIM**" key to switch Autotrim ON again if the red corner LED is illuminated (Autotrim off).

(iv) Single press the "**AUTOTRIM**" key to automatically assess and instantaneously apply the correct angle of rudder (APH).

2.8 The Alarm TEST/OFF Key

The Autopilot Control Unit is equipped with an audible alarm which, in most cases, accompanies display indications of alarm and warning conditions.

Under normal operating conditions, the alarm is silent but becomes active consistent with Watch Alarm timeout period, OHA level, input data fail etc. and is cancelled/acknowledged by single press of the "**TEST/OFF**" keypad.

The audible alarm function can also be permanently turned **OFF** (muted) by continuous 5 second press of the "**TEST/OFF**" keypad and is confirmed by the Alarm icon at the bottom left corner of the Control Unit display.

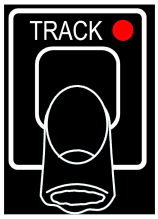
Once muted, the audible alarm can be restored by double press operation of the same keypad.

An alarm **TEST** function is available at any time during the **STANDBY** or **ON** operating modes via double press of the "**TEST/OFF**" key. This is followed by sequential illumination of all nine keypad corner LED lights accompanied in each case by an audible bleep and a 10th bleep at test end.

2.9 The TRACK Key

Track Mode Steering operation is only possible when the Autopilot System is engaged (**ON**) and Track Steer data is available to the Autopilot from an external source such as Track Plotter/ECDIS or Track Control System etc.

The Track data type required by the Autopilot is Heading to Steer (HTS) and provided valid HTS data is available, operation of the **TRACK** key will be confirmed by a "vessel towards distant waypoint" graphic shown in the display with related Track information of heading to waypoint and vessel aspect left or right of the required heading.



The Track key corner red LED will also be illuminated and the operating mode shown on the display will be "**AUTO TRACK STEERING**".

Received Track data type ($HTC, $HSC or $APB) will be shown in the Track steer section of the display every 18 seconds and the main display area will show heading to waypoint/new heading to next waypoint accompanied – in some cases – by audible alarm requesting operator "**CANCEL/CONFIRM**" key acknowledgement.

An alarm will also sound in the event of Track data fail.

The Track Mode can be turned off at any time by single press use of the Track key (red corner LED off).

2.10 The REMOTE Key

Operation of the "**REMOTE**" key (red corner LED illuminated) specifies that the use of Remote Autopilot Control Units and/or Remote Power Steer Units (Follow Up, Non Follow Up etc.) is permitted and that their input signals will be accepted by the Autopilot system.

Without "**REMOTE**" key operation, Remote Control Units/Power Steer Units will not function.

The "**REMOTE**" key condition described above is applicable to all ALPHASEAPILOT MFC Autopilot systems employing a single ALPHASEAPILOT MFC Control Unit but, in systems employing two or three (maximum) Control Units, only one of these units will be the "**Master**" and the others will only gain access to the Autopilot system when the "Master" Control Unit Remote key permits.

Under normal conditions, a Control Unit with address code **No. 1** nominates itself automatically for "Master" status and if two more (subordinate) stations are involved, these will be programmed with address code **Nos. 2 and 3** (all Control Units must have their own unique address code).

If it is later required to alter "**Master**" status from Control Unit No. 1 to No. 2 (or 3) the "**REMOTE**" key of No. 1 should be activated (red LED on) to allow entry by Nos. 2 and 3.

The nominated new "Master" (No. 2 or No. 3) should then be switched "**ON**" after which the "**ON**" and "**REMOTE**" keys should be pressed simultaneously for a period of 5 seconds to complete "Master" status transfer.

When the High Speed Craft (**HSC**) operating mode is specified, all Remote station inputs are "**REMOTE**" key dependent for system access as described above with the exception of the **OVERRIDE** control which is active regardless of the "**REMOTE**" key status.

2.11 The TURN MODE Keys

There are two **TURN MODE** keys which provide two special types of turn selection:-

(i) **U TURN** – permanent 180º course change.

(ii) **NEXT COURSE** – preprogrammed and stored next (new) permanent course change facility

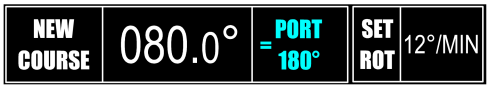
2.11 (i) The 'U TURN' Key

The Autopilot software is programmed to order a 180º permanent course change from whatever heading is currently ordered by the Set Course knob confirmed by the Set Course value on the Control Unit display.

When the **U TURN** key is operated (confirmed by flashing corner LED) the direction of turn required to the new (reciprocal) heading must be defined within a timeout period of 30 seconds by operation of the - (Port) or + (Stbd) Control Panel key.

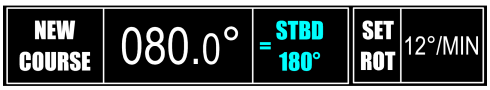
NB. Second operation of the U TURN key at any time will exit the U TURN mode.

The required direction of turn is acknowledged by the Control Unit display which will show :-

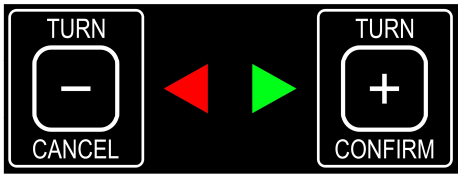


"NEW COURSE PORT 180º"

or **"NEW COURSE STBD 180º"**



The Control Panel "CANCEL" and "CONFIRM" chevrons will now flash accompanied by an audible beep.



Use the "**CONFIRM**" key to execute the 180º turn, or the "**CANCEL**" key to abort and exit the 180º turn instruction mode.

2.11 (ii) The 'NEXT COURSE' Key

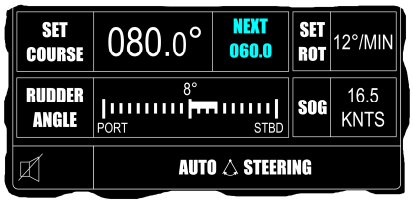
Operation of the '**NEXT COURSE'** key enables the Autopilot to be programmed for a later permanent course change by an amount specified via rotation of the COURSE SET control with the new (next) course heading confirmed on the Control Unit display.

NB. Second operation of the NEXT COURSE key at any time will exit the NEXT COURSE mode.

a) Press the NEXT COURSE key confirmed by flashing red corner LED and display change to show NEXT XXX.

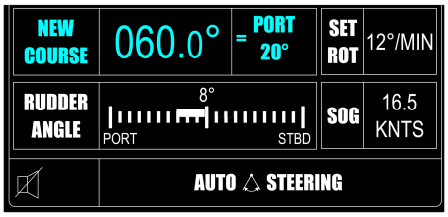
b) Rotate the **COURSE SET** control until the new course required is shown in the NEXT box on the display flashing **NEXT XXX**.

Note that rotation of the Course Set control must have stopped for a period of 5 seconds before the flashing NEXT heading shown will be adopted and confirmed by an audible beep.



c) The direction of turn required to the new heading must now be specified :-

Use the "- (**Port**)" or the "+ (**Stbd**)" key as required noting that the display will now change to show **NEW COURSE XXX** in the main box and = **PORT or STBD XX/XXX** to indicate the direction and angle through which the vessel will turn to the specified next course when the "**CONFIRM**" key is operated.



This display mode will be accompanied by an audible beep.

d) The Control Panel "CANCEL" & "CONFIRM" keys will now flash accompanied by an audible beep.

Use the "**CONFIRM**" key to execute the turn to the new heading or the "**CANCEL**" key to abort and exit the next course instruction mode.

2.11 (iii) The +/-1° / +/-5° Key

When this TURN MODE key is selected, subsequent use of the "**TURN +**" or "**TURN –**" keys will produce permanent incremental Autopilot course changes to Stbd (+) or Port (-).

Single press key operation (TURN) will order course changes in 1° steps.

Continuous key operation will produce increasing course change orders at the rate of approx 2 per second (2Hz) by an amount defined by the length of time the key is pressed:-

- First 5 steps in 1° increments.
- Second 5 steps in 5° increments.
- Thereafter in 10° increments.

In this manner, prolonged operation of the key will produce large course change orders as required quickly and conveniently.

To use the +/-1° / +/-5° key function:-

The Autopilot should be engaged (**ON**) steering the vessel on the **SET COURSE**.

(i) Select "**+/-1° / +/-5°**" on the **TURN MODE** keys
(ii) To Turn to Stbd – press the "**TURN +**" key
To Turn to Port – press the "**TURN –**" key

(The actual value of course change ordered will be shown in the **SET COURSE** area of the display).

2.12 The Rotary SET COURSE Control

The rotary Course Selector produces permanent course change orders when turned anticlockwise (Port) or clockwise (Stbd). Course changes up to a maximum of 359° can be ordered when it should be noted that the Autopilot system will turn the vessel in the direction of Course Selector rotation even if this is "the long way around".

Typically, course changes will be much less than 359° and the smallest incremental change that can be "felt" by hand and seen/confirmed by **SET COURSE** display indication is 0.5°.

Single step rotation will produce 0.5° step changes in Set Course and, if the Course Selector is continuously turned, the step change values will increase as follows:-

- First 6 clicks in 0.5° step changes.
- Second 6 clicks in 1° step changes.
- Next 6 clicks in 5° step changes.
- Thereafter in 10° steps.

In this manner, prolonged rotation of the Course Selector produces large course change orders which would otherwise require many turns geared to a fixed 0.5° per step.

NB. Course changes ordered by the rotary **SET COURSE** Control are always displayed in the **SET COURSE** area of the display and will be shown as a flashing "**NEW COURSE**" value if "**CONFIRM**" key operation is required to turn to the new heading.

A **SET COURSE** alarm is programmable between the limits 10° to 90° in 5° steps via the **SET UP** Menu which, dependent on level set, produces an audible warning when a new course is requested by Course Selector rotation.

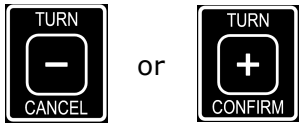
"**CONFIRM**" key operation will initiate turn to the new heading and "**CANCEL**" key operation will abort the new course request.

If neither key is used within a programmable timeout period after the Course Selector is turned, the new course request will be automatically cancelled.

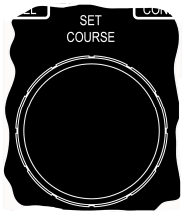
A **NEW COURSE TIMEOUT PERIOD** programmable between the limits 20 to 60 seconds is available via access to the **SET UP** Menu.

To Set the New Course Alarm & New Course Timeout Period:-

a) Simultaneously press the "**CANCEL**" and "**CONFIRM**" keys for 5 seconds until the **Set Up** Menu is displayed with a black cursor highlighting the Set Up parameter currently selected.



b) Rotate the Autopilot **Set Course** Control to move the cursor to parameter number **45** (**SET COURSE ALARM**).



c) Use the rotary (+/-) illum. control to set **10° to 90°** as required.

d) Rotate the Autopilot **Set Course** Control to move the cursor to parameter number **47** (**NEW COURSE T/OUT**).

e) Use the rotary (+/-) illum. control to set **20 to 60 secs**.

To alter course to a new heading:-

(i) Turn the Set Course knob to order the required course change to Port (anticlockwise) or Stbd (clockwise) as required and confirmed by the **SET COURSE** or **NEW COURSE** display box.

(ii) If the New Course alarm is activated, use the "**CANCEL**" or "**CONFIRM**" keys to abort or execute the turn as required.

2.13 The CANCEL & CONFIRM KEYS

The purpose of these keys is self explanatory in virtually all cases with the exception of **SET UP** Menu entry and exit which, in each case, requires simultaneous operation of the "**CANCEL**" and "**CONFIRM**" keys for a period of 5 seconds.

Normal operational functions can be summarized as follows :-

(i) **NEW COURSE** and **NEXT COURSE** modes :-
Execute (**Confirm**) or abort (**Cancel**).

(ii) **COURSE AGAIN** (Resume Course) function and **Latched NFU** :-
See Operating Manual Section 2.43 (iii).

(iii) **+/- 1º, 5º & 10º** Step Course Changes :-

When the Autopilot is engaged (ON) in a normal operating mode (not NEXT COURSE, U TURN, TRACK mode etc.) use of the "**TURN +**" or "**TURN –**" keys will produce permanent incremental Autopilot course changes to Stbd (+) or Port (-).

Single press key operation (TURN) will order course changes in 1º steps whilst continuous key operation will produce increasing course change orders at the rate of approx 2 per second (2Hz) by an amount defined by the length of time the key is pressed :-

- First 5 steps in 1º increments.
- Second 5 steps in 5º increments.
- Thereafter in 10º increments.

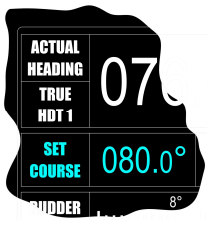
In this manner, prolonged operation of the key will produce large course change orders as required quickly and conveniently.

To use the +/-1º / +/-5º key function :-

The Autopilot should be engaged (**ON**) steering the vessel on the **SET COURSE**.

a) To Turn to STBD – press the "TURN +" key.

b) To Turn to Port – press the "TURN –" key.



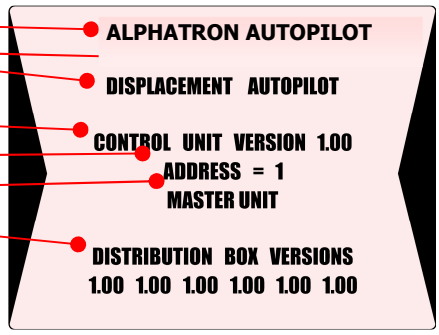
(The actual value of course change ordered will be shown in the **SET COURSE** area of the display).

2.14 The Control Unit Start Up Display (Splash Screen)

When the ALPHASEAPILOT MFC Autopilot is powered up ("**OFF/STBY**" key) the Control Unit start up display (or splash screen) provides various important aspects of information relevant to the software and Set Up standards of the system.

This information includes:-

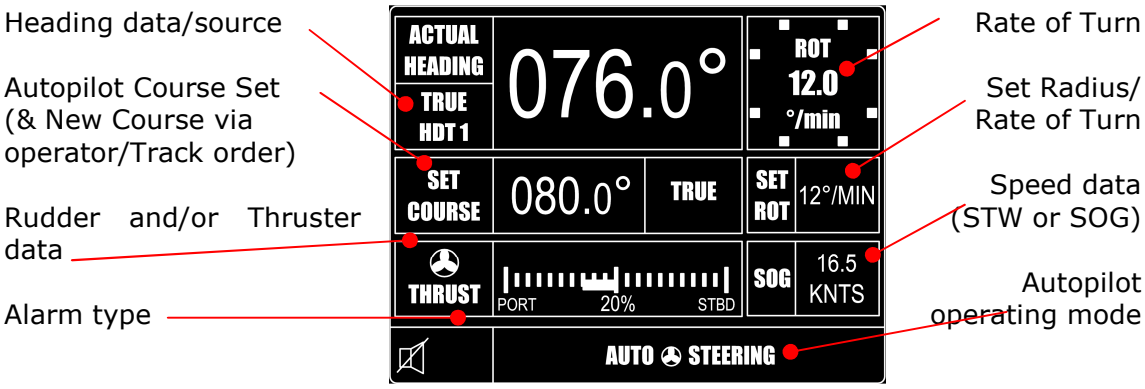
(i) Supplier and model number.
(ii) Autopilot type selected in Set Up Menu (flashing).
(iii) Control Unit software version.
(iv) Control Unit Address identity.
(v) Master status (if applicable).
(vi) Distribution Unit software versions (6 items).



The message "WAITING" (flashing) may also be shown here to indicate that the Control Unit and Distribution Unit are establishing communication.

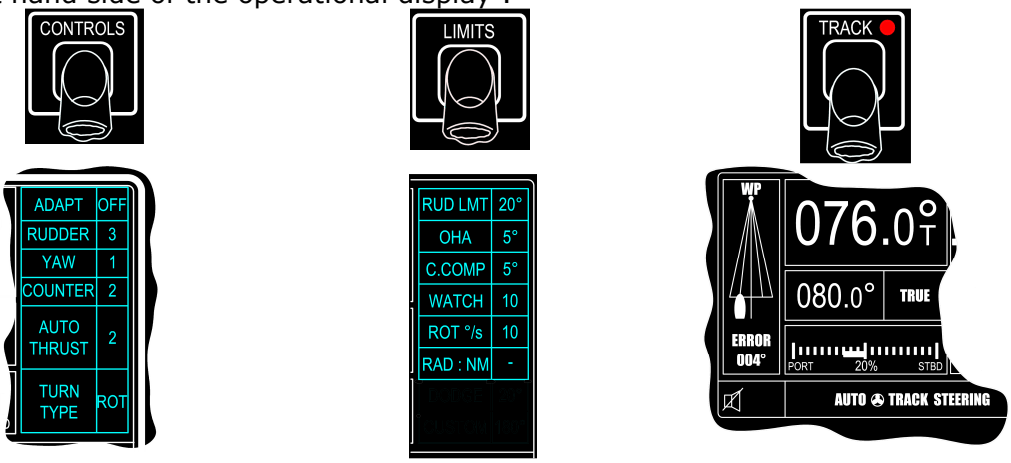
2.15 The Control Unit Operational Display

During normal steering operation, the Autopilot display will continuously show Actual values and Limit settings etc. as follows:-



Use of the **CONTROLS** key will display the Controls Menu and use of the **LIMITS** key will display the Limits Menu on the right hand side of the normal operational display.

Track Mode operation selected via the **TRACK** key will result in display of the track graphic on the left hand side of the operational display :-



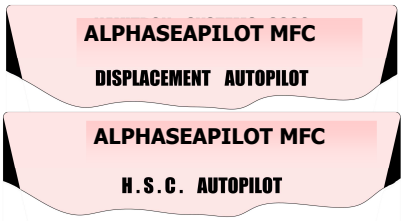
The Control Unit display also provides reference to the comprehensive installation "Set Up" Menu (Installation and Technical Manual Section 3) and is accessed via simultaneous 5 second operation of the **CANCEL** and **CONFIRM** keys.

2.16 Sea Trials and Autopilot Type Selection

It is essential to note that the ALPHASEAPILOT MFC Autopilot has dual Type Approvals covering conventional displacement vessels up to typically 30 knots and High Speed Craft for speeds up to 70 knots.

The Control parameters are very different in each case therefore it is most important that the correct vessel type (DISP or HSC) is entered in the Autopilot SET UP Menu before Sea trials are attempted.

The displacement (DISP) or High Speed Craft (HSC) Mode of operation set is always displayed on the autopilot Control Unit splash screen at power up.



If it is required to alter the vessel type set:-

(i) With the Autopilot in **"STANDBY"** simultaneously press the **"CANCEL"** and **"CONFIRM"** keys for 5 seconds to display the Set Up table parameters.

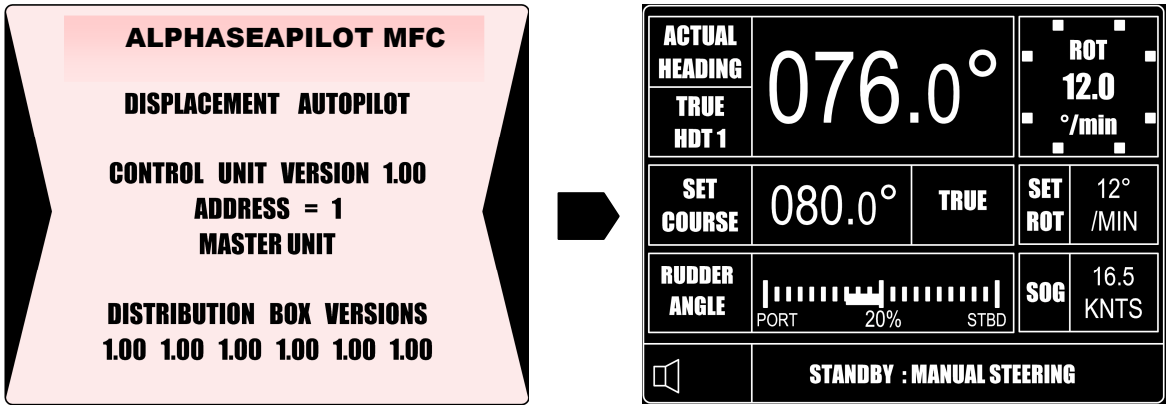
(ii) Use the rotary Set Course Control to select the 5th parameter **(VESSEL TYPE)**.

(iii) Press the **"AUTOTRIM"** key for a period of 5 seconds noting that this is confirmed by a countdown of 5 short bleeps – on completion of which – a longer bleep and a "toggle" (change) of operating mode **(DISP** or **HSC)** is confirmed on the display. (i.e. 5 sec op. as above to change from DISP to HSC or vice versa).

All necessary Set Up parameters and installation procedures should now have been completed in accordance with section 3 of the Installation and Technical Manual.

(i) Check that the Autopilot Isolators are **ON.**
(ii) Press the **OFF/STANDBY** key to enter the Standby mode.

The red corner LED in the STANDBY keypad will illuminate and a short self test period will elapse during which a start up screen will be displayed followed by the normal Standby mode display labelled "**STANDBY: MANUAL STEERING**".



2.17 Mag/True Heading Assessment

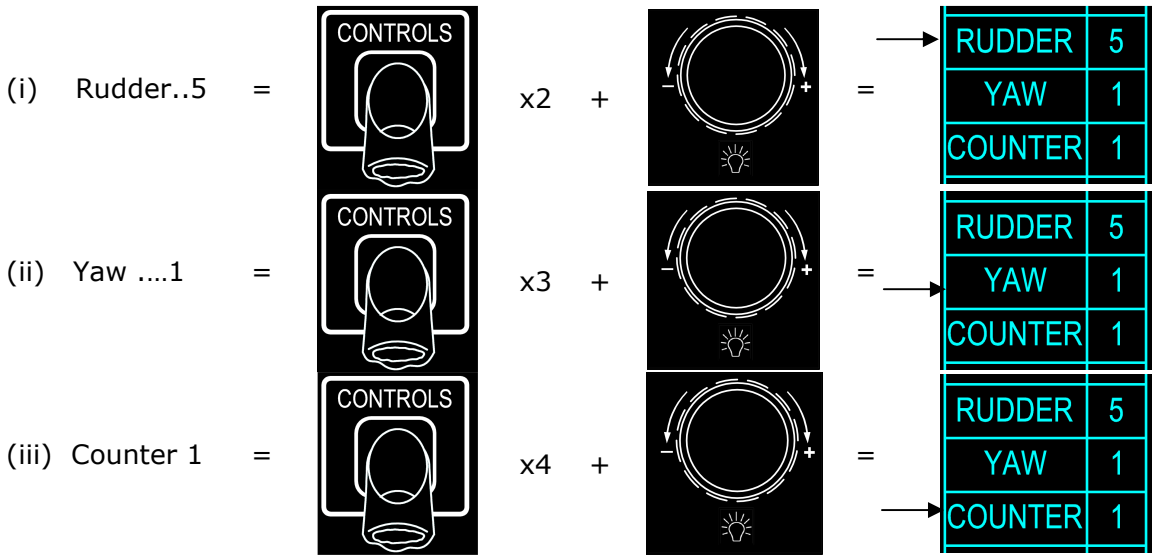
With the Autopilot set to **STANDBY** and self test completed:-

(i) Manually steer the vessel and check that the **ACTUAL HEADING** and **SET COURSE** values displayed follow ships head movement accurately and in unison.

(The rudder angle indicator display should also function normally).

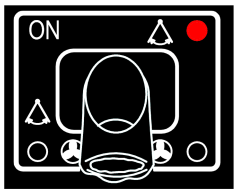
2.18 Autopilot Engagement (ON)

Manually steer the vessel dead ahead at normal/typical operating speed and adjust the following Control settings via the CONTROLS Menu:-



To engage the Autopilot:-

(iv) Press the **ON** key which will be confirmed by illumination of the red corner LED in the "ON" keypad and by a new display label of
AUTO △ STEERING



The Autopilot should now steer the vessel dead ahead.

(The AUTOTRIM function defaults to ON whenever the Autopilot is switched from STANDBY to ON – unless reprogrammed in Set Up. As a result, provided the rudder is positioned to steer the vessel dead ahead immediately prior to Autopilot engagement, any rudder offset angle (Trim or Permanent Helm) manually determined for this purpose will be sampled and held by the Autopilot and the vessel will continue to steer dead ahead).

2.19 Initial Course Keeping Performance

Provided the Autopilot YAW value is set to No.1 (minimum Yaw) in the CONTROLS Menu, corrective rudder will be demanded and applied by the Autopilot system for any short term yaw angle in excess of 0.7 degree.*

* (The ultimate addition of Counter rudder and Autotrim significantly increases heading resolution in practice – i.e. increases sensitivity to Yaw).

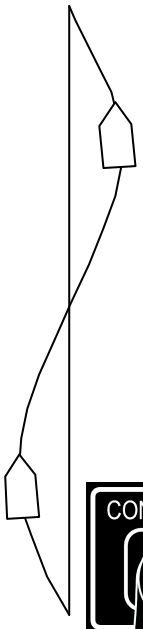
PORT Yaw will result in STBD rudder application confirmed by illumination of the GREEN chevron situated immediately above the Set Course knob. Conversely Starboard Yaw will initiate PORT rudder and the RED chevron.

The actual angle of corrective rudder applied to correct Yaw will be directly proportional to the Yaw angle and to the Controls Menu setting of the RUDDER value.

Too much applied rudder will promote OVERSTEER (Overcorrection).
Insufficient applied rudder will promote UNDERSTEER (Undercorrection).

Understeer Characteristics

Large deviations or protracted periods off the Heading Set due to insufficient rudder application in response to Yaw: -

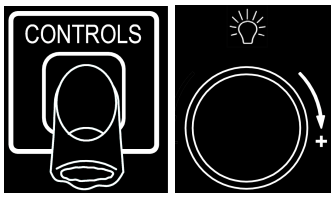


Typical stretched 'S' characteristic of Understeer

Action required: -

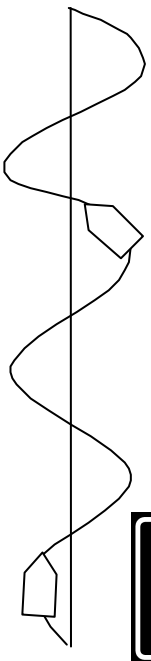
Increase Rudder Control Setting.

(Clockwise)



Oversteer Characteristics

Autopilot applying too much rudder causing vessel 'weave' which may increase to a tight 'S' pattern: -

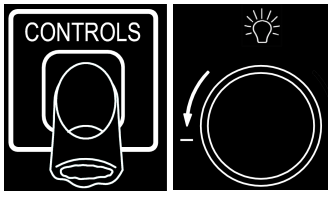


Typical tight 'S' characteristic of Oversteer

Action required: -

Reduce Rudder Control Setting.

(Anticlockwise)



2.20 Optimising the Rudder Control Setting

The RUDDER control provides the operator with the means to increase or decrease the angle of rudder applied in relation to course error and should be adjusted to provide positive correction of Yaw without oversteer (Section 2.19 refers).

NB. Certain types of vessel steering characteristics benefit greatly from the anticipation afforded by a competent helmsman in applying short term exaggerated angles of rudder in order to check or 'counter' yaw inertia as soon as 'felt'. The Autopilot Counter Rudder function produces a similar effect and it may prove beneficial at a later stage to increase the COUNTER control setting by an amount, which fully optimises the straight-line steering performance.

Under normal operating conditions (normal cruising speed and average sea state) the RUDDER value will ideally be set at approximately mid range (No. 5 in the Controls Menu) to provide operator scope for increase or decrease in significantly changed operating conditions.

In heavy following sea conditions or at very slow speeds, it is likely that the operator will need to increase the RUDDER control setting whereas at full speed or when beating into sea the RUDDER control setting will need to be decreased.

NB. Once the Adaptive calibration has been optimised versus Speed & Draft input data, the RUDDER parameter adjustment will be automatic in the Adaptive operating mode. (Sections 2.29 & 2.30 refer).

If it is found that the maximum (No. 9) RUDDER value typically does not produce enough rudder or, conversely, if the minimum (No. 1) RUDDER value typically provides too much rudder, the entire band of control available to the operator can be increased or decreased by corresponding Loop Gain adjustment via the Autopilot Set Up Menu as specified in section 2.21.

2.21 Optimising the Rudder Control Band

A RUDDER control value of No. 1 (Controls Menu) will produce 1/3rd (33%) of the angle of rudder otherwise produced by a control setting of No. 9. The resultant 3:1 range available to the operator can be calibrated via access to the Set Up Menu to produce actual degree of rudder per degree of course error ranges (or bands) as follows:-

Loop Gain values:-

Minimum: 0.33°/° (N°1) to 1°/° (N°9) = rudder/degree of course error.

Maximum: 1°/° (N°1) to 3°/° (N°9) = rudder/degree of course error.

The factory default range setting for loop gain provides 0.5° to 1.5° of rudder per degree of course error but as a general rule, the operating band via Loop Gain calibration should initially be set as follows: -

Fast planing/semi planing vessels (HSC)	-	0.33° to 1° per degree
Deep sea fishing vessels etc.	-	0.5° to 1.5° per degree
Heavy displacement ocean going vessels	-	1.0° to 3.0° per degree

2.22 Loop Gain Calibration

(i) Switch the Autopilot to STANDBY and enter the Set Up Menu per section 2.12 a). (Vessel now under manual steering control).

(ii) Use the Autopilot Set Course knob to scroll through the Set Up parameters until 'LOOP GAIN' is displayed (4th parameter) and read the number of degrees (1.5°, 1.8° etc.) displayed in the centre column.

(iii) Rotate the illum. control (+/-) to increase or decrease the value shown (as required).

(iv) Exit the Set Up Menu (simultaneous 5 sec. operation of CANCEL and CONFIRM keys).

2.23 Autotrim (Automatic Permanent Helm) Assessment

Functional Description.

The Autopilot system is equipped with an Integrator, which enables the electronic control stages to monitor the instantaneous position of the rudder in the STANDBY mode and to control the mean position of the rudder in the ON mode.

In the STANDBY mode, the Autotrim (APH) integrator memorises and adopts any angle of rudder offset (up to 20°) which exists at the instant that the Autopilot is switched from STANDBY to ON.

This function is always operational when the Autopilot is switched from STANDBY to ON and permits the Autopilot to copy the angle of offset rudder manually applied to steer the vessel dead ahead on the desired heading (i.e. Trim compensated) at the instant of Autopilot engagement.

In the ON mode, the Autotrim (APH) function continuously monitors any long term differences between the Autopilot Heading Set and the mean course actually steered. Any apparent long-term difference is compensated for by automatic trim reassessment over a period of time to ensure the correct mean direction of the vessel through the water.

NB. The Autotrim function can be disabled if required by 5 second AUTOTRIM key operation confirmed by illumination of the red corner keypad (OFF) LED.

The Autotrim timing period is factory set at 300 seconds for displacement vessels (5 minutes) and 50 seconds for High Speed Craft for a maximum of 20° of rudder, but is re-programmable via the Set Up Menu and is identified as Autotrim Secs (7th parameter).

APH timing periods of less than 200 seconds (3.3 minutes) are likely to degrade Autopilot steering performance on vessels other than high-speed craft with planing/semi planing hull forms. Timing periods greater than 300 seconds may benefit larger ocean going displacement vessels subject to seagoing appraisal.

Autotrim Operating Modes.

(i)	Autopilot switched from STANDBY to ON	-	Autotrim function operational.
(ii)	Autotrim key to OFF (5 second press) offset angle and disables	-	Immediately cancels any permanent helm rudder the Autotrim function.

Seagoing Autotrim (APH) Assessment.

(i) Note the mean & steady course manually steered in the STANDBY mode by reference to the Autopilot **ACTUAL HEADING** display immediately prior to Autopilot engagement.

(ii) Engage the Autopilot (switch from STANDBY to ON) and note that the mean and steady course now steered is as previously observed.
(This confirms that any permanent helm rudder offset manually determined to steer the vessel dead ahead has been copied by the Autopilot).

(iii) If the mean course steered ultimately differs from the Autopilot Heading Set (Magnetic deviation excluded) this will be automatically corrected over the timing period associated with the Autotrim (APH) integrator to correct the mean direction through the water.

(**i.e.** the mean course actually steered will be the same as the course actually set).

Manual Cancellation of Autotrim (APH) Rudder Offset:

Press the **AUTOTRIM OFF/SET** key for a period of 5 seconds to initiate immediate cancellation of any existing permanent helm rudder offset. (The Autotrim 'OFF' condition will be confirmed by the keypad red corner LED). Single press **AUTOTRIM** keypad operation will re-instate the Autotrim function.

Manual Reset of Autotrim (APH) Rudder Offset:

A permanent Helm Offset angle, which is correct on an existing heading, may prove to be totally incorrect immediately after shooting a trawl etc. or on a new heading particularly when large course changes are ordered. This might result in the wrong mean direction through the water when initially settling on the new heading but would ultimately be automatically corrected by the time based automatic AUTOTRIM correction process.

The time based waiting period can be shortened by manual **SET** intervention as follows: -

(iv) Allow the vessel to settle on the new heading (which may differ from the Course actually set due to incorrect APH rudder offset).

(v) Press the **SET** keypad which will immediately accelerate the APH correction process by automatically estimating and applying the new rudder offset angle required.

NB. Programmable facilities via the Set Up Menu are also included for automatic Autotrim (APH) reset as follows:-

Automatic Cancellation of Autotrim (APH) Rudder Offset:

A permanent Helm Offset angle which is correct on an existing heading, may prove to be totally incorrect on a new heading particularly when large course changes are ordered.

This might result in the wrong mean direction through the water when initially setting on the new heading but would ultimately be automatically corrected by the time based automatic AUTOTRIM correction process.

However, the Autopilot is equipped to automatically 'trip' or cancel any existing TRIM (APH) rudder offset for any course change ordered in excess of 20° (i.e. 20° to Port or Stbd of the current course). This automatic trip point is reprogrammable via the Set Up Menu and can be lowered in one-degree steps from ±180° to ±20°.

NB. The factory default level is 60° and lowering of the trip level should normally be avoided unless it is determined that the operational performance of the vessel will benefit accordingly.

Automatic Autotrim Trip Level Calibration.

(i) Switch the Autopilot to **STANDBY** and enter the **Set Up Menu** via simultaneous 5 second operation of the **CANCEL** & **CONFIRM** keys.
(Vessel now under manual steering control).

(ii) Use the Autopilot Set Course knob to scroll through the Set Up parameters until **AUTOTRIM TRIP** is displayed (8th parameter) and read the number of degrees (60°, 70° etc.) displayed in the centre column.

(iii) Rotate the illum. control (+/-) to set the required trip level.

(iv) Exit the Set Up Menu (5 sec Op CANCEL & CONFIRM keys).

Evaluating/Altering the Autotrim (APH) Time Constant:

In most cases the factory set AUTOTRIM time constant of 300 seconds will be found to be optimum for a wide range of displacement vessels High Speed Craft will normally use lower time constants (factory default 50 seconds). However, adjustment to reduce or increase the time may sometimes be required.

To Evaluate Autotrim Time Constant: -

(i) The Autopilot must be set to ON, the ship stable on course and the heading noted.

(ii) By altering the trim of the vessel (i.e. shooting a trawl, reducing engine revs on one engine of twin prop. vessels etc.) The heading will initially change and will remain incorrect (i.e. difference between course set and course steered) until the requisite amount of Autotrim is applied.

Correction Period Too Long	Reduce time constant *
Correction Period Too Short	Increase time constant

*** NB.** Unnecessary reduction of time constant can degrade overall steering performance. If in doubt consult Alphatron Marine.

To Alter the Autotrim Time Constant: -

The Autotrim time constant is accessed via the Setup Menu: -

(i) Set the Autopilot to **STANDBY** and enter the Set Up Menu (simultaneous 5 secs operation of **CANCEL & CONFIRM** keys)

(ii) Use the Set Course knob to scroll through the Set Up parameters until **AUTOTRIM SECS** is displayed (7th parameter) and read the number of seconds in the centre column.

(iii) Rotate the illum. control (+/-) to to set the required time constant.

(iv) Exit the Set Up Menu (simultaneous 5 sec operation of the **CANCEL & CONFIRM** keys).

2.24 The Counter Rudder Control Setting

Evaluating the Counter Rudder Setting:

The Autopilot Counter rudder function continuously monitors the rate of change of heading (Rate of Turn) of the vessel and is principally responsible for the application of 'Counter' or 'Opposite' rudder as follows: -

Counter - Counters or 'checks' any sudden departure from the steady course steered by applying exaggerated short-term angles of rudder measured against the rate of turn away from the specified heading.

Evaluating the Counter Rudder Setting:

Opposite - Monitors the closing rate towards a new course to prevent 'overshoot' by removing rudder early and applying opposite rudder to 'meet' and stabilise the vessel on the new heading specified.

Adjusting the Counter Rudder Setting:

The Counter Rudder effect may be increased or decreased by adjustment of the Autopilot **COUNTER** value via the **CONTROLS** Menu between the Limits of 1 to 9 where 9 produces maximum counter rudder.

(i) With the Autopilot engaged (ON) and the vessel underway on a stable heading, use the Autopilot Set Course knob to order a course change of 30° Port or Stbd of the current heading.

(ii) Observe the response of the vessel noting whether overshoot occurs or whether the vessel is prematurely arrested in it's turn to the new heading.

(iii) Repeat the 30° course change in the opposite direction to gain an average evaluation.

Vessel Consistently Overshoots - Increase the Counter Rudder Value
Vessel Prematurely Arrested - Decrease the Counter Rudder Value

The optimum Counter setting has been achieved when the vessel turns efficiently to the new heading and stabilises without overshoot.

To increase / decrease the Counter Rudder value: -

(iv) Use the **CONTROLS** key 4 times to select "**COUNTR**" in the Menu.

(v) Rotate the illum. control (+/-) to increase or decrease the flashing **"COUNTR" No**. (1 to 9) as required.

(The flashing counter value will timeout after a period of 30 seconds and the display will automatically revert to the standard operational mode).

NB. If overshoot persists despite a high Counter Control setting it is likely that the AUTOTRIM Timing Period is too short and can be evaluated as follows: -

(vi) Set the Autotrim key **OFF**.

(vii) Use the Autopilot Set Course Control to order a 30° course change.

(viii) If there is now no overshoot or the vessel is prematurely arrested turning to the new heading the AUTOTRIM Time Constant must be increased. (See Section 2.23).

2.25 Optimising the Yaw Control Setting

The YAW control setting defines the Autopilot sensitivity to short term yaw or course error and determines how much short term error will be tolerated before corrective rudder is ordered.

A minimum YAW setting (N°1) prescribes maximum Autopilot sensitivity (±0.7°) increasing linearly to a maximum setting (N°9) for minimum sensitivity (±10°) (i.e. minimum yaw = maximum sensitivity and vice versa).

NB. The minimum yaw setting limit of ±0.7° referred to above does not restrict the Autopilot in it's ability to maintain heading control more accurately than ±0.7°. In practice, the cumulative effects of Counter Rudder and Autotrim (APH) combine to produce an overall resolution of ±0.2°.

This combined effect is particularly important in heavy sea conditions when the YAW control setting can be increased to prevent unnecessarily frequent rudder movements in response to sea state induced yaw. In such conditions and despite the wider deadband (increased tolerance to natural yaw) the Autopilot will continue to monitor and control the mean course accuracy as a function of the Autotrim (APH Integrator) with a higher long term resolution than the Yaw control setting would otherwise permit.

As a general rule, the Yaw control should be set at the lowest number that provides the required course keeping sensitivity and 'straight wake' performance but avoids unnecessary rudder movements in response to natural Yaw.

The Yaw control is adjusted via the **CONTROLS** Menu:-

(i) Use the **CONTROLS** key three times to enter the Controls Menu and select **YAW** (followed by flashing digit 1 to 9).

(ii) Rotate the illum. control (+/-) to increase or decrease the setting as required.

(iii) Timeout and retention of new setting will occur automatically when the display will revert to the standard operating mode.

2.26 STW Speed Data Input (Speed through the Water)

It is essential to note that Speed through the water (STW) input data is the primary requirement for the Autopilot Speed Adaptive operating mode.

In the absence of STW data – Speed Adaptive operation is not possible and any attempt to calibrate (section 2.29) or engage the Adaptive mode will be rejected and accompanied by an audible alarm and display message **NO STW DATA**.

2.27 SOG Speed Data Input (Speed over the Ground)

It is essential to note that Speed over the Ground (SOG) input data is the primary requirement for Autopilot **RADIUS** of **TURN** control when operating in a stand alone mode.

(When operating in the Track Control Mode based on complex $HTC data received from an Approved Track Control System, all necessary parameters – including SOG – will be available from the $HTC sentence). In the event that SOG data is absent, or fails, an audible alarm and display – **NO SOG DATA** – will be displayed.

If SOG data is present but the SOG is too slow to sustain the specified **RADIUS** of **TURN**, audible and visual alarms will result – **SPEED LOW**.

2.28 Draft Input (Laden State)

Draft Input data is an Adaptive operating mode parameter but its absence will not prevent Adaptive Autopilot calibration and operation provided STW Speed input data is available.

However, if draft Input data was present in previous/original Adaptive calibration procedures, it's subsequent absence or failure will generate an audible alarm and display message **'DRAFT IN FAIL'**.

Ongoing Speed Adaptive operation will still be possible but the audible alarm will persist until/unless Draft data is restored or the audible alarm is muted by 5 second operation of the TEST/OFF key.

NB. If the alarm is muted in this manner – **ALL** audible alarms will be muted.

2.29 Calibration of Adaptive Steering Performance vs Speed

The Speed Adaptive operating mode is based on the 'capture' of known steering characteristics over a range of operating conditions which can be used as the initial (start) conditions when the Autopilot is engaged.

Once engaged, further adaptive measures are taken to automatically adjust control parameters geared to changes in speed, draft and sea state etc. to maintain optimum steering performance.

In addition, Override Controls are also calibrated against speed to ensure that potentially dangerous angles of rudder are not inadvertently applied – particularly where High Speed Craft (HSC) operation is involved.

NB. Where possible, it is strongly recommended that Adaptive data is taken at 3 speed levels (although 2 will be accepted). The speeds should reflect minimum likely for Autopilot Control, Normal working/cruising speed and maximum speed.

2.29 (i) Adaptive Calibration Input Requirements:-

(a) Optimum steering performance should have been assessed and achieved by manual adjustment of PID controls via the CONTROLS menu per sections 2.19 to 2.25.

(b) Speed Through the water (STW) input data must be available (An alarm will be generated if Adaptive calibration or mode entry is attempted in the absence of STW input data).

2.29 (ii) Calibration of Power Steer Override Controls vs Speed:-

(a) Use the Autopilot **STANDBY** key to enter the Standby mode. Enter controls menu by pressing **CONTROLS** Key.

(b) Press the **CONTROLS** and **LIMITS** keys simultaneously for a period of 5 seconds to enter the Calibration mode confirmed by the **ADAPT** box flashing **'CAL1'**.

(c) Set the speed of the vessel at the lowest realistic working speed likely for Autopilot control and – using manual steering control(s) – enter and maintain the vessel into a turn at the maximum safe level (rate of turn) commensurate with this speed.

(d) Use the **CONTROLS** key for a period of 5 seconds to 'capture' the Rudder angle/speed data for future Autopilot Override control use confirmed when completed by the flashing display message '**CAL2**'.

(e) Repeat (c) and (d) at normal working speed and maximum speed (CAL2 and CAL3 respectively) to capture and store the related Rudder/Speed data.

(f) Enter controls menu by pressing **CONTROLS** key and ensure ADAPT value box is flashing. Simultaneous 5 second **CONTROLS** and **LIMITS** key operation to exit the calibration mode.

2.29 (iii) To calibrate Adaptive Autopilot Steering vs Speed:-

Calibration parameters 4, 5 and 6 require minimum, normal working and maximum vessel speeds in a fully laden condition.

(a) Engage the Autopilot system (**ON** key) and manually adjust the PID controls for optimum steering performance (sections 2.19 – 2.25 refer) at the lowest realistic working speed likely for Autopilot control.

(b) Enter controls menu by pressing **CONTROLS** key and ensure ADAPT value box is flashing. Simultaneously press **CONTROLS** and **LIMITS** keys for a period of 5 seconds to enter the Adaptive calibration mode confirmed by **ADAPT** followed by a flashing **CAL1** message.

(c) Use the rotary illumination (±) control to step through to parameter **'CAL4'**.

(d) With the vessel at minimum operating speed and the autopilot steering performance optimised (per item (a) above) use the **CONTROLS** key for 5 seconds to 'capture' the Autopilot control parameters/speed correlation commensurate with this speed.

(e) Repeat (c) and (d) at normal working and maximum speeds in the fully laden condition to calibrate **CAL5** and **CAL6** requirements respectively.

NB. If draft input data is available, remain in the Adaptive Calibration mode to calibrate **CAL7**, **CAL8** and **CAL9**. (Section 2.30)

(f) Enter controls menu by pressing **CONTROLS** key and ensure ADAPT value box is flashing. Exit the Adaptive calibration mode by simultaneous 5 second operation of the **CONTROLS** and **LIMITS** keys confirmed by normal operating display presentation.

(g) Use the **'CONTROLS'** key to display the CONTROLS menu and use the rotary illumination (±) control to set the flashing **ADAPT** box condition to **'ON'**.

The Autopilot system is now calibrated and set to work in the Adaptive mode but it should be noted that entry to the 'CONTROLS' menu (**CONTROLS** key operation) will permit manual intervention/update of any current control parameters (RUDDER, COUNTER, YAW etc.) at any time if required.

2.30 Calibration of Adaptive Steering Performance vs Draft

Adaptive mode calibration will normally have been completed based on an assumed fully laden condition (per section 2.29 (iii)). The availability of Draft Input data permits minimum draft (unladen state) characteristics also to be 'captured' for adaptive mode use:-

(a) Engage the Autopilot system (**ON** key) and manually adjust the PID controls for optimum steering performance (sections 2.19 – 2.25 refer) at the lowest realistic working speed likely for Autopilot control. Enter the Controls Menu by pressing the **CONTROLS** key.

(b) Simultaneously press **CONTROLS** and **LIMITS** keys for a period of 5 seconds to enter the Adaptive calibration mode confirmed by **ADAPT** followed by a flashing **CAL1** message.

(c) Use the rotary illumination (±) control to step through to calibration parameter **CAL7**. (FIG 2.30 refers)

(d) With the vessel at minimum operating speed and the Autopilot steering performance optimised (sections 2.19 – 2.25) use the **CONTROLS** key for 5 seconds to 'capture' the Autopilot control parameters/speed correlation commensurate with this speed.

(e) Repeat (c) and (d) at normal working and maximum speeds in the unladen condition to calibrate **CAL8** and **CAL9** requirements respectively.

(f) Enter controls menu by pressing **CONTROLS** key and ensure ADAPT value box is flashing. Exit the Adaptive calibration mode by simultaneous 5 second operation of the **CONTROLS** and **LIMITS** key confirmed by normal operating display presentation.

(g) Use the **'CONTROLS'** key to display the CONTROLS menu and use the rotary illumination (±) control to set the flashing **ADAPT** box condition to **'ON'**.

The Autopilot system is now calibrated and set to operate in the Adaptive mode taking account of Speed and Laden state (draft) input data.

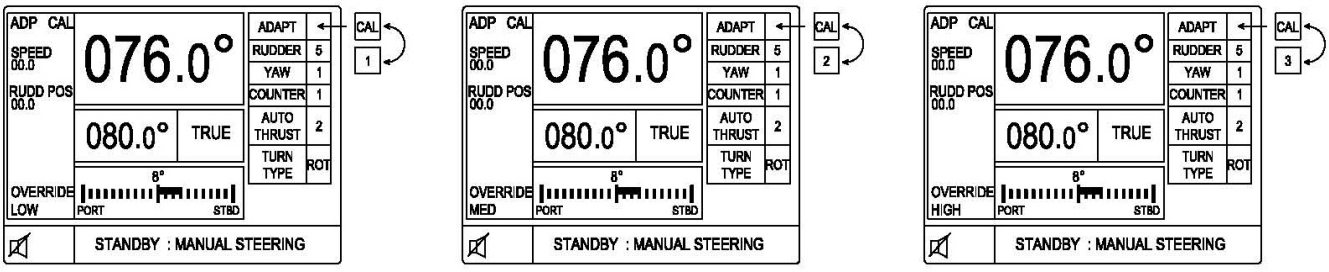


FIG 2.29 (ii) Override Cal

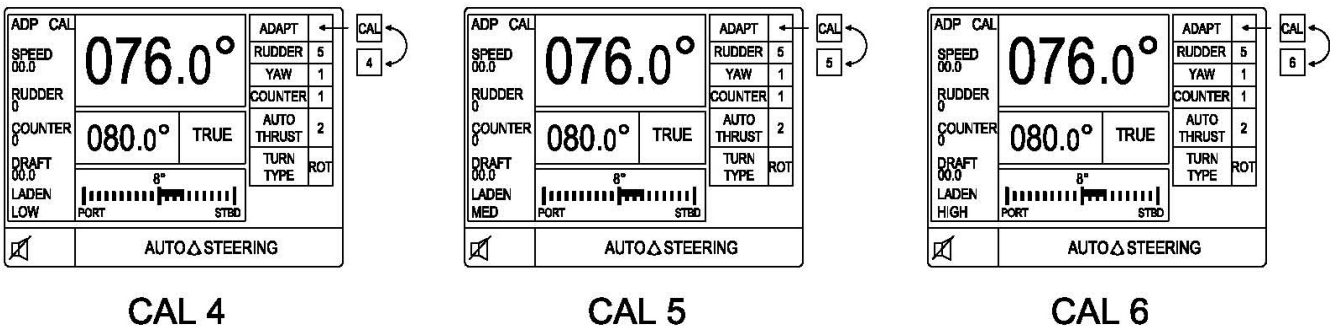


FIG 2.29 (iii) Speed Cal

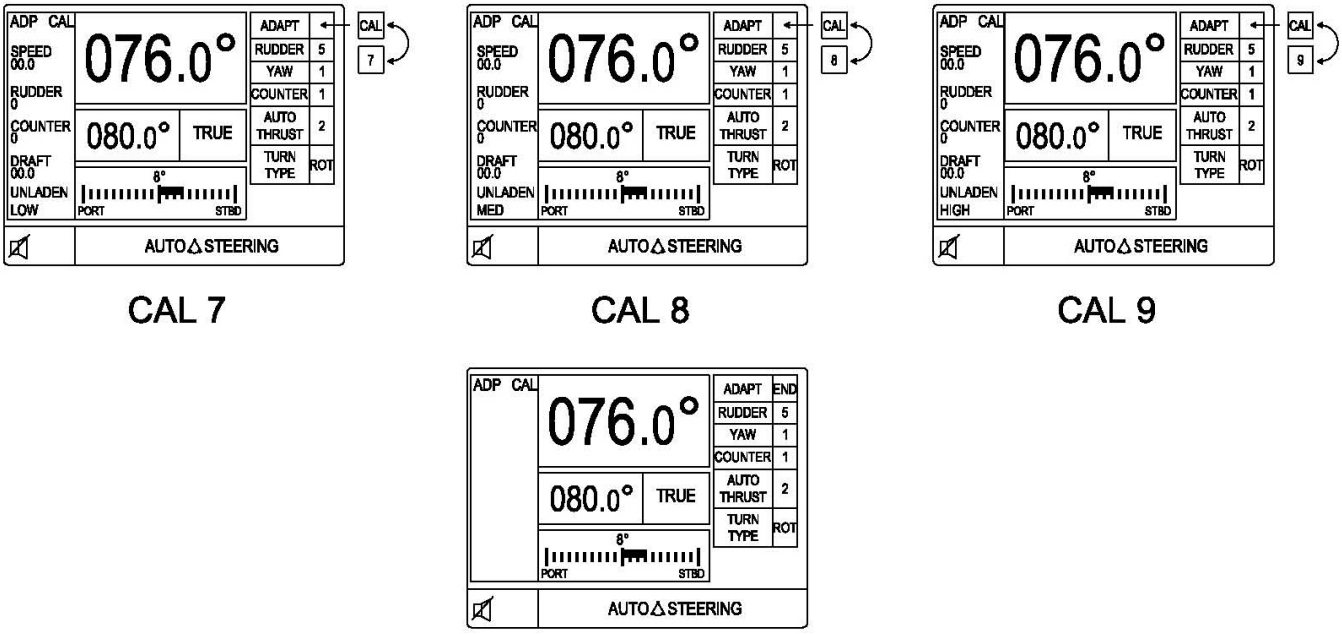


FIG 2.30 Draft Cal

2.31 Setting the Rudder Limit Control

The Rudder Limit Control defines the maximum angle of rudder that the Autopilot is able to apply with the exception of Counter Rudder, which overrides the Rudder Limit setting.

NB. This results in a safe operating mode wherein rudder angle is limited for any angle of course change ordered to a new heading and for any angle of rudder ordered by the Autotrim process (APH). However, high rates of departure from the course steered will continue to attract large angles of 'check' rudder that might be necessary to quickly arrest the vessel in a potential broach condition etc.

The Rudder Limit control can be set from 5° to 50° in 5° steps or switched OFF via the LIMITS Menu.

When the limit of prescribed angle is reached, single bleep and a flashing RUDDER LIMIT message appears in the Alarm box (bottom left of Control Unit main display).

As a general rule, the Rudder Limit control should be set to limit the angle of rudder applied such that any angle of course change ordered can be safely executed within the turning capability of the vessel and it's operational considerations (warp tensions if towing etc.)

NB. If Track Steering mode is operational using the HTC sentence, it is possible for the Track Control system to override the Rudder limit value set within the Autopilot LIMITS Menu.

2.32 Setting Rate of Turn Control

(i) **RATE OF TURN** (ROT) is internally calculated by the Autopilot system and does not rely on data input from external transducers although it should be noted that the internally set Rate of Turn value can be overridden by a Type Approved Track Control system via the complex $HTC sentence.

NB. The operational ROT (deg/sec or deg/min) is programmed within the Autopilot via the **LIMITS** Menu (section 1.9) and can be overruled by Track command but absolute MAXIMUM Safe Rate of Turn can also be set via the **SET UP** Menu and is unaffected by Track data. (See Section 2.33).

a) TO SET RATE OF TURN (Operational):-

Once Rate of Turn mode has been selected and set, any turns or heading changes ordered will be limited to the °/sec or °/min level set and any attempt to increase the operational value will be ultimately limited by the absolute safe maximum ROT programmed. (Section 2.33).

The Control Unit display continuously shows ACTUAL and SET ROT thus current operational values are always available provided:-

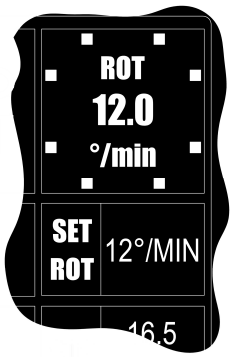
ROT Mode selected (vs Radius) via CONTROLS Menu (Sect. 2.4 (vi)).
Deg/Sec or Deg/Min units selected via SET UP Menu (Sect. 2.6 (v)).

REQUIRED OPERATIONAL ROT:-

(i) Use the "**LIMITS**" key to enter the Limits Menu.

(ii) Use the "**LIMITS**" key again to select "**ROT°/S**" box followed by flashing current value.

(iii) Use the rotary (+/-) illum. control to set "**ROT**" value required.



2.33 Setting Maximum Safe Rate of Turn

Unlike the operational Rate of Turn (Section 2.32) that can be overridden by Track data commands from an Approved Track Control System, the Safe Rate of Turn value can be specified by the Master, entered and stored in the Autopilot SET UP Menu and will not be affected by external factors such as Track Control data etc.

Accordingly, the maximum Safe Rate of Turn limit set is the absolute maximum the Autopilot will permit during automatic heading control.

To set maximum Safe Rate of Turn:-

(i) Simultaneously press the "**CANCEL**" and "**CONFIRM**" keys for 5 seconds until the Set Up Table is displayed with a black cursor highlighting the Set Up parameter currently selected.

(ii) Rotate the Autopilot **Set Course** Control to move the cursor to parameter number **27** (**ROT MAXIMUM**).

(iii) Use the rotary (+/-) illum. control to set the maximum safe value of ROT in **°/SEC (0.1-10)** or **°/MINUTE (6-600)**.

In the event that maximum Safe Rate of Turn is reached during Autopilot Control, the Autopilot system will limit to prevent further increase and the Control Unit **ACTUAL ROT** display will show actual ROT value alternating with **MAX**.

2.34 Setting Radius of Turn

RADIUS OF TURN control is reliant on the availability of externally sourced Speed over the Ground (SOG) data without which Radius of Turn control will not function.

NB. The operational Radius of Turn (nM) is programmed within the Autopilot via the **LIMITS** Menu (Section 2.6 (vi)) but can be overruled by Track data command received from a Type Approved Track Control System.

a) TO SET RADIUS OF TURN:-

Once Radius of Turn mode has been selected and set, any turns or heading changes ordered will be limited by the Autopilot to the Radius (in Nautical Miles) set provided:-

Radius Mode selected (vs ROT) via Controls Menu (Sect. 2.4 (vi)).
Speed over the Ground (SOG) data available (Control Unit display).

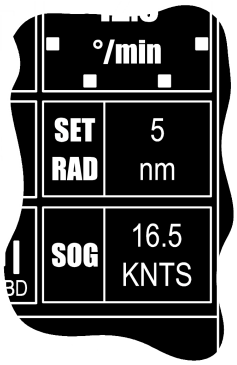
The Control Unit display continuously shows the value of SET RADIUS OF TURN thus the current operational value is always available.

REQUIRED OPERATIONAL RADIUS OF TURN:-

(i) Use the "**LIMITS**" key to enter the Limits Menu.

(ii) Use the "**LIMITS**" key again to select "**RAD:nm**" box followed by flashing current value(**0.1 to 9.9**).

(iii) Use the rotary (+/-) illum. control to set "**RAD:nm**" value required.



In the event that Speed over the Ground (SOG) data is absent or that SOG is to slow to adequately control specified Radius of Turn geared to external forces etc. at that speed, the Autopilot will generate alarms accordingly:-

No Speed data = flashing "**NO SOG DATA**" in bottom left alarm box of Control Unit display accompanied by audible bleep.

SOG too slow = flashing "**SPEED LOW**" in bottom left alarm box of Control Unit display accompanied by audible alarm.

2.35 Optimising the Off Heading & Course Comparator (CCA) Alarms

The Autopilot **OFF HEADING ALARM** (**OHA**) continuously monitors and compares the difference between the heading set and the actual heading steered to generate an audible and visual alarm if the specified limit is exceeded.

The OHA function differs greatly from the **COURSE COMPARATOR ALARM** function (**CCA**) which does not compare actual heading with heading set but instead compares the values of two Autopilot heading inputs to generate an audible and visual alarm if one value (heading) differs by more than a programmed amount from the other.

Alarm Trip Level.

The specified limit (Alarm trip level) is operator selectable at 2° to 30° in 2° steps – or can be switched OFF - via entry to the **LIMITS** Menu.

NB. When in TRACK steering mode using HTC sentence data received from an Approved Track Control System, the Off Heading Alarm limit may be set to a value demanded by the Track system – or switched OFF - if ordered.

Alarm Cancellation.

The audible/visual display alarm can be cancelled by use of the alarm **TEST** key but is programmable via the SET UP Menu in two categories:-

(i) **OHA DELAY** – Parameter No. 35 in the Set Up Menu, this can be programmed from 10 to 60 seconds in 2 sec steps as the delay time from exceeding the alarm trip level to generation of audible and visual alarms. This feature prevents unnecessary alarms due to natural yaw/periodic motion of the vessel.

(ii) **OHA ALARM TIMEOUT** – Parameter No. 48 in the Set Up Menu, this can be programmed from 30 to 120 seconds in 1° steps as the delay time to allow the vessel to turn to a new course when ordered by the Autopilot.

If required, the audible alarm can also be permanently switched **OFF** via **LIMITS** Menu.

To alter/set OHA Delay or OHA Alarm Timeout:-

a. Simultaneously press the "**CANCEL**" and "**CONFIRM**" keys for 5 seconds until the **Set Up** Menu is displayed with a black cursor highlighting the Set Up parameter currently selected.

b. Rotate the Autopilot **Set Course** Control to move the cursor to parameter number **35** (**OHA DELAY**) or **48** (**OHA TIMEOUT**).

c. Use the rotary (+/-) illum. control to set time (secs) as required.

To set the OHA Trip Level or switch the Off Heading Alarm OFF:-

d) Use the "LIMITS" key to enter the Limits Menu.

e) Use the "**LIMITS**" key again to select "**O.H.A.**" box followed by flashing current value (**2° to 30° or OFF**).

f) Use the rotary (+/-) illum. control to set as required.

(iii) **Course Comparator Alarm (CCA) Operating Note** –

The CCA will only function when two heading inputs are connected to the Autopilot system with nominated priorities of No. 1 and No. 2.

(Heading input types can be 2 x NMEA or 1 x NMEA & 1 x HSC2).

The CCA function can be programmed via the Autopilot Menus:-

For CCA ON or OFF – Parameter No. 36 in the SET UP Menu.
For Heading difference level – C.COMP in the LIMITS Menu.

NB. The CCA delay time is always identical to the OHA DELAY time (a,b,c above) and it must be noted that if only one heading input is available, the CCA function must be switched **OFF**.

To switch ON/OFF the Course Comparator Alarm (CCA):-

a. Simultaneously press the "**CANCEL**" and "**CONFIRM**" keys for 5 seconds until the **Set Up** Menu is displayed with a black cursor highlighting the Set Up parameter currently selected.

b. Rotate the Autopilot **Set Course** Control to move the cursor to parameter number **36** (**COURSE COMPARATR**).

c. Use the rotary (+/-) illum. control to set **ON/OFF** as required.

To set the Course Comparator Alarm (CCA) Trip Level:-

d. Use the "**LIMITS**" key to enter the Limits Menu.

e. Use the "**LIMITS**" key again to select "**C.COMP**" box followed by flashing current value (**4° to 16°**).

f. Use the rotary (+/-) illum. control to set the required value.

2.36 Setting and Confirming New Autopilot Courses

New Autopilot Courses can be manually entered by:-

SET COURSE rotary control movement (**clockwise = Stbd**).
CANCEL/CONFIRM key use to initiate **DODGE**, **CUSTOM**, **+/-1°** turns.

New Autopilot courses can be automatically ordered by:-

TRACK CONTROL command data – new heading to next waypoint.

Rotation of the Set Course control clockwise (Stbd) or anticlockwise (Port) will order 0.5° (minimum) changes per "click".

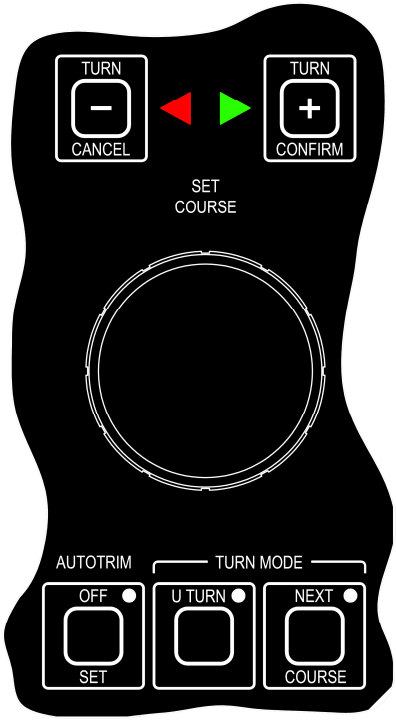
Prolonged rotation will automatically result in larger changes "per click" to make large course changes viable by avoiding the need for multiple turns.
(6 clicks @ 0.5°, 6 @1°, 6 @ 5° then 10°).

A new course can be ordered up to 359° when the vessel will always turn in the direction of rotation of the Set Course Control.

The need for new course confirmation (if required) can be programmed via the SET UP Menu in 5° steps from 10° to 90°.

Actual set course and new course data is shown on the Control Unit display whether manually or automatically (Track) ordered.

TURN MODE key selection of U TURN or NEXT COURSE always requires CONFIRM (+) or CANCEL (-) key use to specify direction of turn (+ = Stbd, - = Port).



Single CANCEL/CONFIRM key operation is all that is required to initiate a turn to new course following Set Course control rotation or to order 1º step course changes.
(Sections 2.12 & 2.13 refer).

A Control Unit generated alarm requesting confirmation (CONFIRM key) is subject to a programmable timeout period (20 to 60 seconds via the SET UP Menu) during which confirmation is required – and beyond which – the new course request will automatically be cancelled. (Section 2.12 refers).

U TURNS and NEXT COURSE programmed turns could be potentially dangerous if inadvertently activated. A second CONFIRM key operation is therefore required after ordering direction of the turn and, if the U TURN Mode is selected without follow up action, the mode will automatically be deselected after a timeout period of 30 seconds. (Section 2.11 refers).

2.37 Setting the Watch Alarm Period

The Autopilot Watch Alarm provides a simple audible and visual timing function programmable from 3 to 12 minutes (or may be switched OFF) via the LIMITS Menu.

At the end of the time interval selected (3 to 12 mins) the Control Unit alarm will sound and is cancelled by single operation of the **TEST/OFF** keypad. A new timing period will automatically commence whenever the **TEST/OFF** key is operated.

If the Control Unit alarm is not cancelled by TEST/OFF key operation within a further one minute period, a relay within the Autopilot Distribution Unit provides volt free contacts to activate an auxiliary (external) alarm if fitted.

To set the Watch Alarm time interval (OFF or 3 to 12 mins.):-

a) Use the "**LIMITS**" key to enter the Limits Menu.

b) Use the "**LIMITS**" key again to select "**WATCH**" box followed by flashing current value (**OFF or 3 to 12**).

c) Use the rotary (+/-) illum. control to set the required condition.

2.38 The Track Function

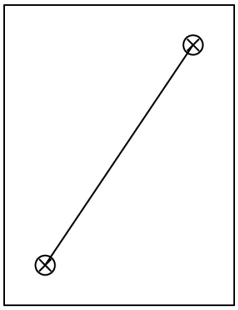
The Autopilot may be operated in "TRACK" mode when it will steer the vessel along a pre-planned track or multiple tracks in response to "Heading to Steer" data received from a proprietary Track Control System.

NB. The ALPHASEAPILOT MFC is a "Wheelmarked" Autopilot (IMO A342(ix) as amended by MSC 64/67 Annex 3) in addition to HSC Certification (ISO 16329) with an approved Track steering facility provided the latter is used in conjunction with a Type Approved Track Control System compliant with IEC 60625.

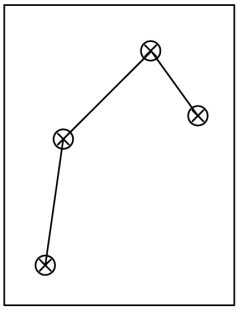
When the appropriate track and waypoint coordinates have been entered into a proprietary Track Control System, resultant Track data is received by the Autopilot system via the Track data input terminals in IEC 61162 / 1 or IEC 61162 / 2 or NMEA 0183 serial data formats.

The sentence types accepted by the Autopilot system and their order of priority are (i) $ XX HTC, (ii) $ XX APB, (iii) $ XX HSC.

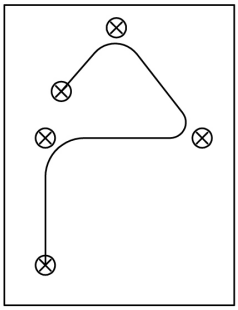
"Heading to Steer" data is in each sentence type and is continuously "read" by the Autopilot system to provide automatic heading changes to next waypoint or to perform complex manoeuvres based on multiple waypoint entries.



Single Straight Leg Track



Multiple Straight Leg Tracks



Multiple Straight and curved Tracks (If supported by Track Control System)

Other commands may also be present in the Track data sentence type received by the Autopilot which will respond accordingly to alter various of its Menu set steering parameters during Track Mode as follows: -

a) Rudder Limit.
b) Rate of Turn.
c) Off Heading Limit.
d) Heading Source in use.

NB. Safeguards are an inherent feature of the Autopilot software to ensure safe track steering operation.

e) The Autopilot will prevent the Track Control System from carrying out a Rate of Turn which exceeds the Autopilots internal maximum set limit. (section 2.33)

f) If no rudder limit value is specified by the Track Control System the Autopilot will use its own (LIMITS Menu set) value.

Track Data is only accepted when the Autopilot TRACK keypad is activated confirmed by illumination of the red corner LED. Without TRACK keypad acceptance (corner LED OFF), the Track Steering function is "OFF".

2.38 (i) Track Mode Display and Status Information

Autopilot Track Mode operation is confirmed by the illuminated corner LED in the **TRACK** key and by the display which shows a graphic representation of the vessel with direction to waypoint. The display is also labelled "**AUTO TRACK STEERING**"

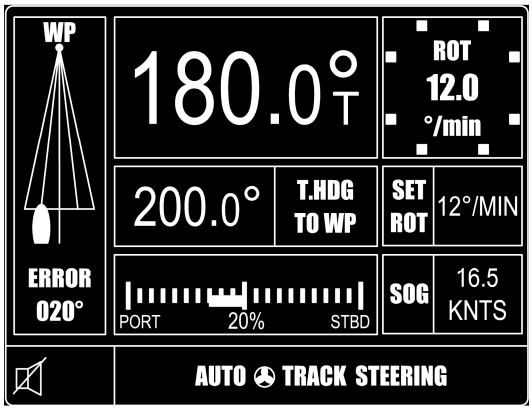
Only Heading to Steer (HTS) Track Mode operation is possible and the display information provides HTS related data accordingly.

Heading to Steer (HTS) Mode Displays:-

In the HTS mode, the graphic vessel to waypoint representation shows heading error to waypoint which is confirmed by the amount shown in degrees.

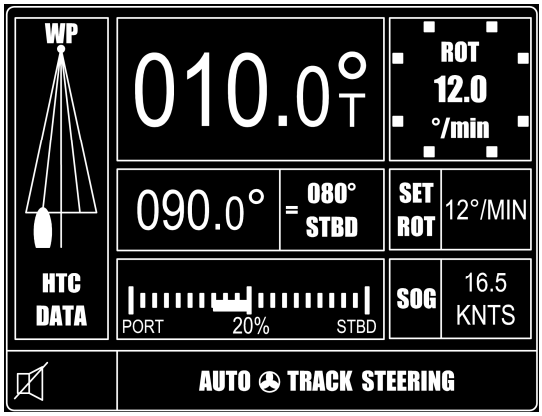
i.e. **ERROR 020°**

(this is the difference between **ACTUAL HEADING** and **HEADING TO WP** shown).



Every 18 seconds, this display is interrupted for a period of 1 sec to display the received HTS data sentence type ($HTC, $APB or $HSC).

i.e. **HTC DATA**



Since arrival at a waypoint may involve a significant course change (**080° PORT**) or (**060° STBD**) etc. based on **NEW HDG TO WP** data received, this value is displayed and will generate an alarm for **CANCEL or CONFIRM** key operation as appropriate:-

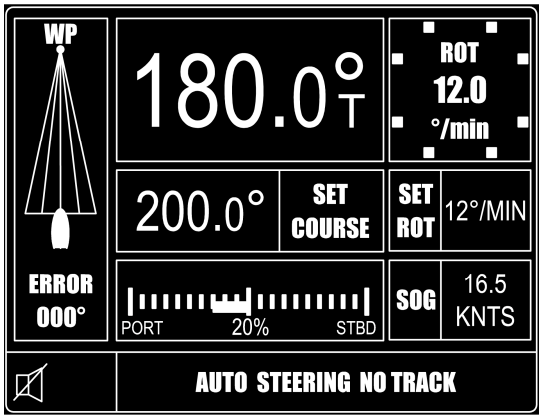
i.e. **NEW HDG TO WP XXX.X° = 080° STBD**

NB. CANCEL/CONFIRM key confirmation is only applicable to $HSC and $APB data – complex data type $HTC received from an Approved Track Control System will be acted upon fully automatically (no CANCEL/CONFIRM action required) per full Track Control System steering performance specs.

CONFIRM key operation (APB/HSC data only) cancels the audible alarms and permits the Autopilot to execute the turn (80° to Stbd in the example above).

CANCEL key operation (APB/HSC data only) temporarily suspends the heading change alarm for a fixed period of 15 seconds beyond which the alarm will sound again until effective action is taken (Confirm key operated or Track key operated to disable Track Mode Steering).

In the event that Track steering Mode is selected but the Track data orders "stand alone" Autopilot operation, the Autopilot system will revert to the SET Course which will be confirmed by the display message "AUTO STEERING NO TRACK" as shown.



2.38 (ii) Track Mode Alarms

Two alarm types may be generated during the Track Steering Mode:-

a) No data/data fail:-
The NMEA Track Data fail/no data alarms are both audible and visual appearing in the bottom left corner of the display as **HTS DATA FAIL** etc. and persist until the Track key is used to disable the Track Steering Mode.

b) New Heading (course change) to new waypoint:-
(Item (i) above refers).

2.38 (iii) Engaging the Track Function

Provided the Autopilot is engaged (switched to the **ON** mode) and suitable NMEA Track Data is available, the Track function is simply engaged by operation of the **TRACK** key and will be confirmed by the Control Unit display and illumination of the red corner LED in the **TRACK** key.

2.39 Manual and Auto Deviation Correction

Magnetic Deviation:

A Navitron Heading Sensor Coil (type HSC 1 or HSC 2) attached above or below a magnetic compass to transmit heading information to the Autopilot system will be subject to any deviation errors associated with the compass.

Provided such errors are not totally abnormal they can be electronically corrected by the Autopilot system via access to the set up Menu.

Two deviation correction procedures are available (Set Up Menu Parameter No. 50) as **MANUAL** or **AUTO** and an existing deviation table can be cleared down using the **CLEAR** facility.

Automatic Deviation Correction:

This is only available when NMEA (HDT sentence) heading information is connected to the Autopilot in addition to the Sensor Coil (i.e. when swinging the vessel, the Sensor Coil information can automatically be compared with the NMEA HDT sentence input and electronically corrected accordingly).

Manual Deviation Correction:

This is the only facility for electronic deviation correction if the Sensor Coil is the solitary heading input for the Autopilot.

2.39 (i) Automatic Deviation Correction Procedure

(a) Enter the Set Up Menu by 5 second simultaneous **CANCEL/CONFIRM** key operation and use the Set Course knob to scroll to Parameter No. 50 (**MAN/AUTO/CLEAR)**.

(b) Use the rotary illumination control (+/-) to set **AUTO**.

(c) Press the **AUTOTRIM** key to display current Mag (HSC2 Coil) Heading.
NB. If no TRUE NMEA Heading data is available to the Autopilot the **AUTO** Mode selected will be forced to **MANUAL**.

(d) Use the rotary illumination Control (+/-) to adjust the displayed Heading to agree with any known ships head Magnetic Heading reference (Steering compass etc.).

(e) Press the **AUTOTRIM** key which will be confirmed by an alternating display showing "**TURN → STARBRD**".

(f) Turn the ship slowly to STARBOARD through a minimum of 360° noting, that at 30° intervals during the turn, "bleeps" will be heard confirming that Heading data comparisons are being made and stored until, finally, the display shows **SAVE?**.

(g) Press the **AUTOTRIM** key to save the data which will be confirmed by the message **END**.

2.39 (ii) Manual Deviation Correction Procedure

(a) Enter the Set Up Menu by 5 second simultaneous **CANCEL/CONFIRM** key operation and use the Set Course knob to scroll to Parameter No. 50 (**MAN/AUTO/CLEAR)**.

(b) Use the rotary illumination control (+/-) to set **MAN**.

(c) Press the **AUTOTRIM** key confirmed by an alternating display **01 → 000°** instructing that the first course to be manually steered is North (000°).
Steer the vessel on 000° and when steady press the **AUTOTRIM** key to save the data confirmed by a new display of **02 → 030°**.

(d) Steer the vessel on 030° and when steady press the **AUTOTRIM** key to save the data confirmed by a new display of **03 → 060°**.

(e) Repeat the **AUTOTRIM** key and new courses steered through 360° every 30° as instructed by the display until the **SAVE?** message appears.

(f) Press the **AUTOTRIM** key to save the data which will be confirmed by the display message **END**.

NB. If Deviation in excess of 12.5° is detected, the heading value is rejected and is confirmed by a double "bleep". Additionally, the display will not change to instruct the next Heading.

2.39 (iii) To Clear the Programmed Deviation Table

(a) Enter the Set Up Menu by 5 second simultaneous **CANCEL/CONFIRM** key operation and use the Set Course knob to scroll to Parameter No. 50 (**MAN/AUTO/CLEAR)**.

(b) Use the rotary illumination control (+/-) to set **CLEAR**.

(c) Press and hold the **AUTOTRIM** key confirmed by a display countdown of **5 secs, 4 secs etc.** until **RESET** is shown.

(d) Release the **AUTOTRIM** key to complete clear down.

2.40 ALPHASEAPILOT MFC Second Station Control Units

All ALPHASEAPILOT MFC Autopilot system Control Units are identical and may be used in Master/Slave configurations as required up to a maximum of 3 Control Units per system.

NB. Where one than one Control Unit is involved it is important to note that each must have its own dedicated address (No.1, No.2 or No.3).

(At power up, all Control Units display a splash screen – Section 2.14 – showing current address status details etc. If two addresses are the same, this will produce a communication conflict thus address changes will be required. (See Section 3.0 of the Installation and Technical Manual).

When two or three Control Units are correctly installed with different address numbers, address No. 1 will normally assume Master status. If it is required to change Master status to No.2 or No.3, this can be achieved by simultaneous operation of the subject **ON** and **REMOTE** keys as follows:-

a) Check that the current Master unit (normally address No.1) is switched ON with its REMOTE key also ON to enable other stations entry to the Autopilot system.

   NB. If there is doubt which Control Unit is the current "Master", note that initial power up will display either Master or 2nd station on the splash screen. (See Section 2.14).

b) Set the new required Master station to **STANDBY**.

c) Use the **ON** and **REMOTE** keys simultaneously for a period of 5 seconds to transfer Master status to the subject Control Unit confirmed by a double bleep.

d) Check transfer by powering down and powering up again when the splash screen should confirm "Master Station" on the subject Control Unit. (Similarly, the previous Master station should now show "2nd Station" on its splash screen when powered down and up again).

This will produce a communication conflict thus address changes will be required. (See Section 3.0 of the Installation and Technical Manual).

When two or three Control Units are correctly installed with different address numbers, address No. 1 will normally assume Master status. If it is required to change Master status to No.2 or No.3, this can be achieved by simultaneous operation of the subject **ON** and **REMOTE** keys as follows:-

a) Check that the current Master unit (normally address No.1) is switched ON with its REMOTE key also ON to enable other stations entry to the Autopilot system.

   NB. If there is doubt which Control Unit is the current "Master", note that initial power up will display either Master or 2nd station on the splash screen. (See Section 2.14).

b) Set the new required Master station to **STANDBY**.

c) Use the **ON** and **REMOTE** keys simultaneously for a period of 5 seconds to transfer Master status to the subject Control Unit confirmed by a double bleep.

d) Check transfer by powering down and powering up again when the splash screen should confirm "Master Station" on the subject Control Unit. (Similarly, the previous Master station should now show "2nd Station" on its splash screen when powered down and up again).

The Control Unit REMOTE Key.

It must be noted that only the designated Master Control Unit is capable of independent operation since it does not require "permission" from any other Autopilot system component to become active.

The Master station is also the only station that can grant "permission" to any other Control Unit(s) – (2nd stations) – which are only enabled when the Master station "**REMOTE**" key is activated (red corner LED of keypad illuminated).

The Master Control Unit will immediately disable any other Control Unit(s) if the Master station **REMOTE** key is deactivated (red corner keypad LED off).

In this way, the Master station has unconditional control of the Autopilot system.

2.41 NT920 NFU Power Steering – Refer to Section 1.21

2.42 NT990 FU Power Steering – Refer to Section 1.22

2.43 Special Latched and Non Latched Power Steer Controls

In addition to the Follow Up (NT990 FU) and Non Follow Up (NT920 NFU) Power Steer options, the Autopilot will accept proprietary unit power steer inputs via a dedicated opto isolated input port for special uses.

Power Steer inputs to this port can provide one of three installation selectable working modes programmed via the Autopilot **SET UP** Menu.

2.43 (i) Normal proprietary Follow Up Power Steer:-

Typically, a proprietary unit of this type will be fitted with a lever operated linear potentiometer and the angle of rudder applied will be directly related to the angle through which the lever is moved – often against a graduated scale.

When the Follow Up lever is central, the rudder will be at mid ships and, if the lever is moved and left at mid scale, the rudder will be positioned and will remain at the mid scale value accordingly.

This is conventional Follow Up Power Steer operation and can be selected via the Autopilot **SET UP** Menu (Parameter No.62 set to **NORM**).

Application notes in Section TM3 of the Installation and Technical Manual.

2.43 (ii) Non Latched Jog Lever (Non Follow Up) Override Control:-

When the Autopilot is engaged (ON) and steering the required Set Course, it may on occasions be required to override this Set Course temporarily to avoid potential hazards/optimise leeway etc. (**REMOTE OVERRIDE** Mode). This can be done by connection of a proprietary "sprung to centre" jog lever which in its central position demands no rudder movement allowing the Autopilot full control of the rudder for steering purposes.

Movement left (Port) or right (Stbd) of the sprung lever will initiate a fixed and safe angle of rudder (speed related and calibrated during Sea Trials).

Release of the jog lever (sprung back to centre) will cancel the rudder order and steering control will automatically revert to the Autopilot system which will reassume the Set Course.

This non latched power steer operation provides an immediate override function and can be selected and calibrated via the Autopilot **SET UP** Menu (Parameter Nos.62 - set to **JOG** - and 64).

Application notes in Section TM3 of the Installation and Technical Manual.

2.43 (iii) Latched Jog Lever (NFU) Override & Resume Course Control:-

When the Autopilot is engaged (ON) and steering the required Set Course, it may on occasions be required to override this Set Course for a prolonged period to avoid potential hazards/optimise leeway etc.

This can be done by connection of a proprietary "sprung to centre" jog lever which in its central position demands no rudder movement allowing the Autopilot full control of the rudder for steering purposes.

Movement left (Port) or right (Stbd) of the sprung lever will initiate a fixed and safe angle of rudder (speed related and calibrated during Sea Trials).

Release of the jog lever (sprung back to centre) will leave the rudder at the calibrated angle but further movement of the jog lever in the opposite direction will move the rudder towards mid ships and beyond to the opposite maximum calibrated angle if the lever movement is prolonged. The rudder movement will stop at any time the lever is returned to the sprung mid ships position, but power steer control will be retained by the NFU Jog Lever confirmed by flashing red and green chevrons on the Autopilot Control Unit panel.

The flashing red and green chevrons are accompanied by an audible "bleep" and the display message "**REMOTE OVERRIDE**". This condition (latched power steer mode) will persists until either the CANCEL or CONFIRM key is operated.

CANCEL (**Resume Course**) key operation will cancel the Power Steer mode and the Autopilot will automatically take up the original Set Course.

CONFIRM key operation will cancel the Power Steer mode and will confirm the current heading as the new Autopilot course which will automatically be adopted.

This latched power steer operation provides an immediate longer term override function and can be selected and calibrated via the Autopilot **SET UP** Menu (Parameter Nos.62 - set to **HSC LATCH** - and 64).

Application notes in Section TM3 of the Installation and Technical Manual.

2.43 (iv) To Select the Isolated Input Steering Mode:-

a) Simultaneously press the "**CANCEL**" and "**CONFIRM**" keys for 5 seconds until the **Set Up** Menu is displayed with a black cursor highlighting the Set Up parameter currently selected.

b) Rotate the Autopilot **Set Course** Control to move the cursor to parameter number **62** (**NORM/HSC LATCH/JOG**).

c) Use the rotary (+/-) illum. control to select as required.

2.43 (v) To Calibrate Isolated Input Steering Modes against Speed:-

Refer to Adaptive Mode Calibration Section 2.29.

Section 3: Display Messages, Alarms and Status Indicators

The Autopilot system is comprehensively equipped with alarm mechanisms that continuously monitor the operational integrity of a wide range of functions from heading input data to steering gear response.

These are brought to the attention of the watch by audible and visual means as follows: -

3.1 Displays at Power Up (Self Test)

3.2 Failure Messages at Power Up (Self Test Failure)

3.3 Operational Display Messages

3.4 Alarm Display Messages

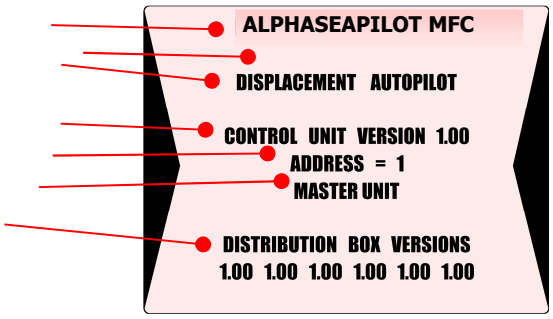
3.5 Operational Status LED's

3.1 Display at Power Up

When the ALPHASEAPILOT MFC Autopilot is powered up ("**OFF/STBY**" key) the Control Unit start up display (or splash screen) provides various important aspects of information relevant to the software and Set Up standards of the system.

This information includes:-

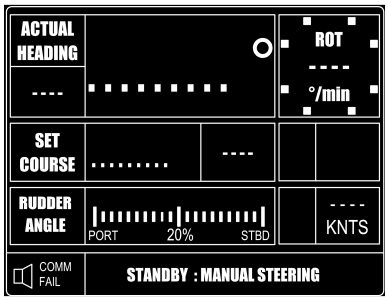
(i) Supplier and model number.
(ii) Autopilot type selected in Set Up Menu (flashing).
(iii) Control Unit software version.
(iv) Control Unit Address identity.
(v) Master status (if applicable).
(vi) Distribution Unit software versions (6 items).



The message "**WAITING**" (flashing) may also be shown on the splash screen to indicate that the Autopilot Control Unit and Distribution Unit are establishing communication.

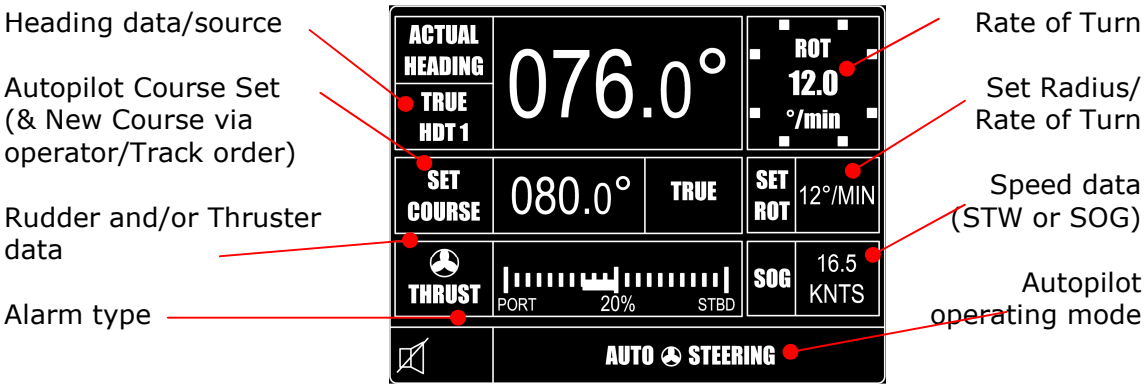
3.2 Possible Failure Messages at Power Up

In the event that communication between Autopilot Control Unit and Distribution Unit is not established after approx 30 seconds, the Operational display will appear with dots (instead of display values)
and the message "**COMM.FAIL**" in the alarm box (as shown).



3.3 Operational Display Messages

When the self test and associated splash screen display has completed at power up, the operational display will appear as shown:-



All Autopilot operating modes are continuously shown (as appropriate):-

(i) **STANDBY: MANUAL STEERING**

(ii) **REMOTE STANDBY** – External Steering selector switch forcing the Autopilot system to "Standby" Mode

(iii) **AUTO △ STEERING** – Autopilot engaged to control Rudder only

(iv) **AUTO ✇ STEERING** – Autopilot engaged to control Thruster only

(v) **AUTO △ + ✇ STEERING** – Autopilot engaged for Rudder & Thruster

(vi) **REMOTE AUTO △ STEERING** – 2nd Station Control – Rudder only

(vii) **REMOTE AUTO ✇ STEERING** – 2nd Station Control – Thruster only

(viii) **REMOTE AUTO △ + ✇ STEERING** – 2nd Station – Rudder & Thruster

(ix) **AUTO △ TRACK STEERING** – Autopilot engaged in Track Steer Mode controlling Rudder only

(x) **AUTO ✇ TRACK STEERING** – Autopilot engaged in Track Steer Mode controlling Thruster only

(xi) **AUTO △ + ✇ TRACK STEERING** – Autopilot engaged in Track Steer Mode with Rudder & Thruster

(xii) **REM AUTOTRACK △ STEERING** – 2nd Station/Track Mode/Rudder

(xiii) **REM AUTOTRACK ✇ STEERING** – 2nd Station/Track Mode/Thruster

(xiv) **REM AUTOTRACK △ + ✇ STEERING** – 2nd Station – Track Mode with Rudder & Thruster

(xv) **TRACK STBY MANUAL STEERING** – Track system forcing Autopilot to STANDBY Mode

(xvi) **TRACK POWER STEER** – Track system forcing Autopilot to act as a simple rudder positioning device

(xvii) **AUTO STEERING: NO TRACK** – Track system forcing Autopilot into normal stand alone steering mode

(xviii) **REMOTE OVERRIDE** – Latched or non latched Power Steer Mode via special isolated input facility

(xix) **MANUAL WHEEL** – Follow Up wheel Power Steer Mode via special isolated input facility

(xx) **REMOTE F.U. STEERING** – Navitron/proprietary FU/NFU active

(xxi) **REMOTE N.F.U. STEERING** – Navitron/proprietary NFU active

(xxii) **REMOTE DODGE STEERING** – Navitron/proprietary DODGE active

Changes to the operational display occur automatically when Track Steering Mode is selected and when new Autopilot courses are ordered via the rotary Set Course Control or the Turn Mode keys.

New Autopilot course display details are shown in Section 2.36.

Track Mode display details are shown in Section 2.38 (i).

3.4 Alarm Display Messages

(Accompanied by audible alarms when the Autopilot is engaged)

The following alarm messages will be displayed (if appropriate) in the alarm box at bottom left and will be accompanied by an audible "bleep" unless the audible alarm has been muted. (Section 2.8 refers).

3.4 (i) Heading Sensor Fail Messages:-

CPS HI FAIL - Signal from HSC is too large

CPS LO FAIL - Signal from HSC is too small

CPS PHS FAIL – Compass phase connection or HSC2 Coil defect

COMPASS FAIL – Potential HSC2 Coil defect

HDT 1 FAIL – NMEA Channel 1 $HDT Heading sentence fail

HDG 1 FAIL – NMEA Channel 1 $HDG Heading sentence fail

HDM 1 FAIL – NMEA Channel 1 $HDM Heading sentence fail

HCC 1 FAIL – NMEA Channel 1 $HCC Heading sentence fail

HDT 2 FAIL – NMEA Channel 2 $HDT Heading sentence fail

HDG 2 FAIL - NMEA Channel 2 $HDG Heading sentence fail

HDM 2 FAIL - NMEA Channel 2 $HDM Heading sentence fail

HCC 2 FAIL - NMEA Channel 2 $HCC Heading sentence fail

NO NMEA H`DG IN – No NMEA Heading data available of any type

CCA DAT FAIL – No Heading data or only one Heading data input available

3.4 (ii) Miscellaneous Failure Messages:-

MAIN PWR FAIL – Main 11-40Vdc power supply fail

BACK PWR Fail – Back up 11-40Vdc power supply fail

D.BOX FAIL – Internal Distribution Unit processor communication fail

REMOTE FAIL – No data received by Distribution Unit from Control Unit

NO DATA – No user data stored based on previous Set Up data adopted

RRU FAIL – Rudder Ref Unit pot defect or associated connections suspect

L/SW OPEN – Open circuit limit switch

STEER`G FAIL – No rudder movement in response to Autopilot order

MASTER REM. OFF/REMOTE

1 (2) (3) REQUEST – 2nd station request for control denied because Master station **REMOTE** key not activated

+7V FAIL – Analogue voltage regulation defect

+3.5V FAIL - Analogue voltage regulation defect

+2.5V FAIL - Analogue voltage regulation defect

NO ORIDE CAL – Override power steer control requested but not calibrated

DRAFT IN FAIL – 4-20mA Draft input signal fail

3.4 (iii) Speed Data Alarms:-

NO SOG DATA – NMEA Speed over the Ground input data absent

NO STW DATA – NMEA (or pulse) Speed through Water input data absent

SPEED LOW – SOG too low for Autopilot to perform spec`d Radius of Turn

3.4 (iv) Track Mode Data, Warnings & Alarms:-

NO HTS DATA – No Heading To Steer data available

3.4 (v) Operational Warnings/Alarms:-

>x° OFF HEADING – Off Heading limit (degrees) exceeded

CCA LIMIT – Difference between 2 Heading data types exceeded

WATCH xx MIN – Watch alarm timeout period completed

RUDDER LIMIT – Specified rudder angle reached

3.5 Operational Status LED's

There are a total of 11 LED's on the ALPHASEAPILOT MFC Control Unit panel:-

(i) **O STBY** – Red corner LED illuminated confirms STANDBY Mode

(ii) **O ON** – Red corner LED confirms Autopilot ON/Rudder only Mode

(iii) **O ON** – Red corner LED confirms Autopilot ON/Thruster only Mode

(iv) **O ON** + – Autopilot ON/Rudder & Thruster Mode

(v) **O TRACK** – Red LED confirms Track mode engaged

(vi) **O REMOTE** – Red LED on confirms 2nd stations/power steer permitted

(vii) **O AUTOTRIM** – Red LED warns that AUTOTRIM function is OFF

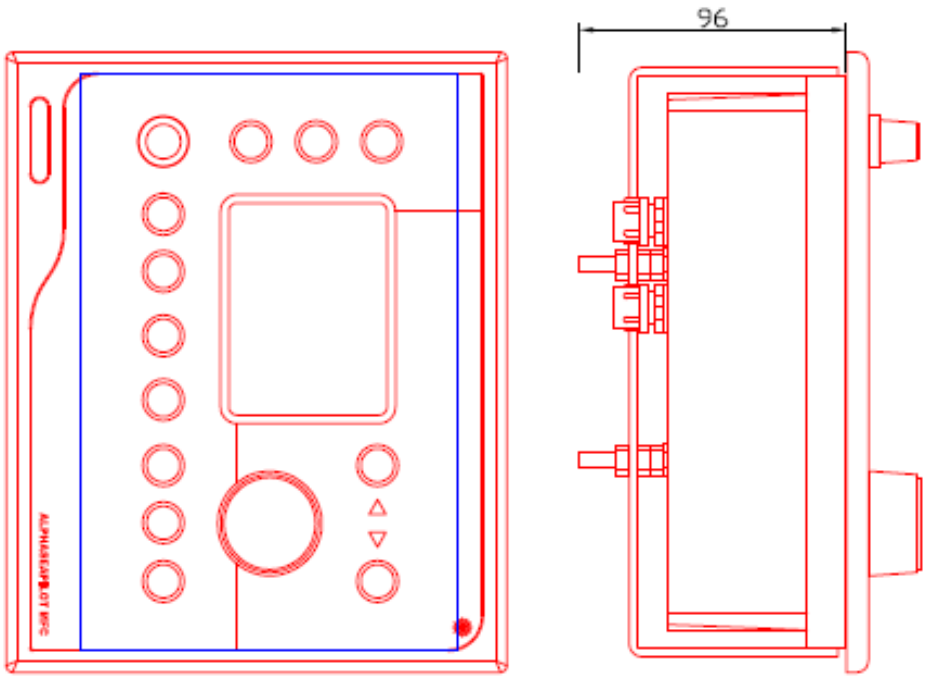
(viii) **O U TURN** – Flashing Red LED confirms U TURN turn mode selected

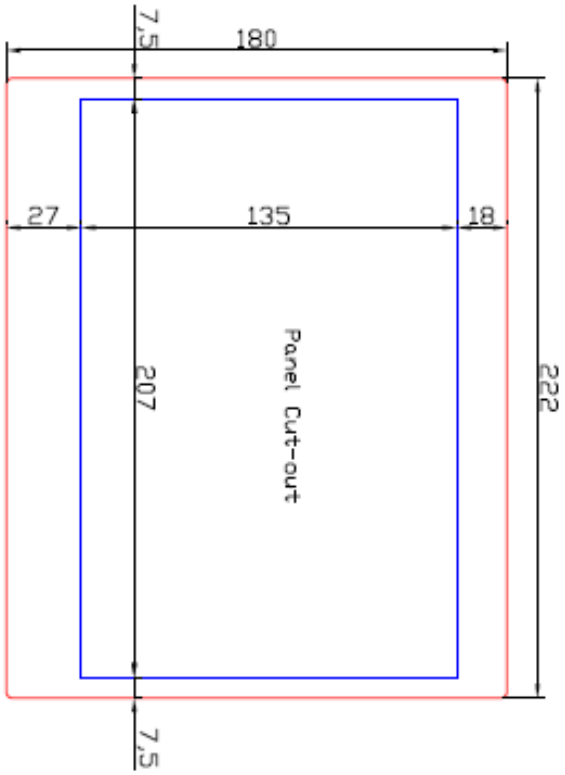
(ix) **O NEXT** – Flashing Red LED confirms NEXT COURSE turn mode selected

(x) **RED** – Red arrow confirms Port order or CANCEL key request

(xi) **GREEN** – Green arrow confirms Stbd order or CONFIRM key request

Dimensions ALPHASEAPILOT MFC





Connectiondiagram ALPHASEAPILOT MFC

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