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## I. Preface

The Alphasat AlphaPilot MFS is a type approved Heading Control System (i.e. Autopilot), designed to fit vessels of any size, including high speed crafts. It is a modern and technologically advanced digital vessel control unit that is intended to reduce the operator's workload, increase the vessel motion efficiency and improve operational safety.

The AlphaPilot MFS Control Unit is the main control module of the AlphaPilot MFS system. It is used for control and monitoring of autopilot operation, setting vessel heading or rudder angle, selection of autopilot operating modes.

- Thoroughly read this operation manual before operating the equipment.
- We recommend keeping this manual nearby the equipment to ensure ready access to it.

## Revision History

| Revision No. | Date       | Description                                              | Author    |
|--------------|------------|----------------------------------------------------------|-----------|
| 1.0          | 02-12-2020 | First issue                                              | J. Kreeft |
| 1.1          | 18-02-2021 | Completeley updated Appendix A. Removed MFS model.       | J. Kreeft |
| 1.2          | 19-02-2021 | Additional updates on Appendix A. Minor textual updates. | J. Kreeft |
| 1.3          | 11-03-2021 | Removed alarm test. Change C into T symbol.              | J. Kreeft |
|              |            |                                                          |           |
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|              |            |                                                          |           |
|              |            |                                                          |           |

## Glossary

The glossary contains a list of abbreviations and a list of definitions.

## Abbreviations

Abbreviations as used in this manual are explained in the table below.

| Abbreviation | Description                                     |
|--------------|-------------------------------------------------|
| AUTO         | Automatic ('Heading Control mode')              |
| APH          | Automatic Permanent Helm                        |
| CCA          | Course Comparator Alarm                         |
| COG          | Course over ground                              |
| DNC          | Digital Nautical Charts                         |
| ECDIS        | Electronic Chart Display and Information System |
| ENC          | Electronic Navigational Charts                  |
| FU           | Follow-Up                                       |
| GPS          | Global Positioning System                       |
| HCS          | Heading Control System                          |
| HSC          | High Speed Craft                                |
| HMS          | Heading Monitor System                          |
| IMO          | International Maritime Organization             |
| NFU          | Non-Follow-Up                                   |
| OHA          | Off Heading Alarm                               |
| PID          | Proportional, Integral, Derivative              |
| PS           | Port Side                                       |
| RAD          | Radius                                          |
| RFU          | Rudder Feedback Unit                            |
| ROT          | Rate Of Turn                                    |
| SB           | Starboard Side                                  |
| SOG          | Speed over ground                               |
| SOLAS        | Safety of Life at Sea                           |
| STW          | Speed through the Water                         |
| TCS          | Track Control System                            |

## Definitions

The meaning of standard definitions as used in this manual are explained in the table below.

| Definition     | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Alert          | <p>Announcement of abnormal situations and conditions requiring attention. Alerts are divided in four priorities: emergency alarms, alarms, warnings, and cautions:</p> <ul style="list-style-type: none"> <li>- Emergency alarm:<br/>Highest priority of an alert. Alarms which indicate <u>immediate danger to human life or to the ship</u> and its machinery exits and require immediate action.</li> <li>- Alarm:<br/>An alarm is a high-priority alert. Condition <u>requiring immediate attention and action</u> by the bridge team, to maintain the safe navigation of the ship.</li> <li>- Warning:<br/>Condition <u>requiring immediate attention, but no immediate action</u> by the bridge team. Warnings are presented for precautionary reasons to make the bridge team aware of changed conditions which are not immediately hazardous, but may become so if no action is taken</li> <li>- Caution:<br/><u>Lowest priority of an alert</u>. Awareness of a condition which does not warrant an alarm or warning condition, but still <u>requires attention</u> out of the ordinary consideration of the situation or of given information.</li> </ul> <p>An alert provides information about a defined state change in connection with information about how to announce this event in a defined way to the system and the operator.<br/>Alerts are separated for the alert handling into three categories of alerts:</p> <ul style="list-style-type: none"> <li>- Category A alerts:<br/>Alerts for which information at the task station directly assigned to the function generating the alert is necessary, as decision support for the evaluation of the alert-related condition.</li> <li>- Category B alerts:<br/>Alerts where no additional information for decision support is necessary besides the information which can be presented at the CAM-HMI.</li> <li>- Category C alerts:<br/>Alerts that cannot be acknowledged on the bridge but for which information is required about the status and treatment of the alert, e.g., certain alerts from the engine.</li> </ul> |
| AlphaPilot MFS | Alphatron brand name for the heading control system                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Assisted turn  | Manoeuvre of a vessel from one straight leg to the next automatically controlled by a pre-set radius or rate of turn but not based on the vessel's position.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

| Definition                                              | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Autopilot                                               | A Heading Control System.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| COG (Course Over Ground)                                | COG is the actual direction of progress of a vessel, between two points, with respect to the surface of the earth. The vessel's heading may differ from the COG because of wind, tide and currents.                                                                                                                                                                                                                                                                                                                                          |
| Course                                                  | A vessel's course is the cardinal direction along which the vessel is to be steered. It is to be distinguished from the vessel's heading, which is the compass direction in which the craft's bow is pointed.                                                                                                                                                                                                                                                                                                                                |
| Cross track distance                                    | Perpendicular distance of the vessel from the track including direction (negative if the vessel is left of the intended track)                                                                                                                                                                                                                                                                                                                                                                                                               |
| Cross track error                                       | See 'Cross track distance'                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Cross-track limit                                       | Maximum cross track distance before an alert is activated.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Curved track                                            | Non-straight track between two straight legs.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| ECDIS (Electronic Chart Display and Information System) | A geographic information system used for nautical navigation that complies with IMO regulations as an alternative to paper nautical charts.<br>An ECDIS displays the information from ENC or DNC and integrates position information from position, heading and speed through water reference systems and optionally other navigational sensors. Other sensors which could interface with an ECDIS are radar, Navtex, Automatic Identification Systems (AIS), and depth sounders.                                                            |
| Electronic Navigational Charts                          | An official database created by a national hydrographic office for use with an ECDIS.                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Heading                                                 | The horizontal direction in which a vessel points or heads at any instant, expressed in angular units from a reference direction, usually from 000° at the reference direction clockwise through 360°.                                                                                                                                                                                                                                                                                                                                       |
| Heading control                                         | Control of the vessel's heading.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| HCS (Heading Control System)                            | A system which enables a vessel to keep a pre-set heading with minimum operation of the vessel's steering gear, within limits related to the vessel's manoeuvrability in conjunction with their sources of heading information. The HCS may work together with a TCS.<br>A turn rate control or a turning-radius control for performing turns may be provided.<br>The term HCS differentiates the automatic pilot (autopilot) from a system designed to keep a vessel on a pre-determined track throughout its passage, which is called TCS. |
| Heading Monitor System                                  | This system monitors the actual heading sensor by an independent second source.                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Helm                                                    | A wheel or tiller by which a vessel is steered.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| IEC                                                     | A non-profit, non-governmental international standards organization that prepares and publishes International Standards for all electrical, electronic and related technologies.                                                                                                                                                                                                                                                                                                                                                             |
| Indication                                              | Visual display of any message to the user which may be accompanied by a low intensity acoustic signal to gain attention.                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Latitude and Longitude                                  | The units that represent the coordinates at geographic coordinate system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| LOG                                                     | Speed data from Water Speed Log                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

| Definition                    | Description                                                                                                                                                                                                                                                                        |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Leg                           | Line between two waypoints defining the track.                                                                                                                                                                                                                                     |
| Main steering gear            | The machinery, rudder actuators, steering gear power units, if any, and ancillary equipment and the means of applying torque to the rudder stock (e.g. tiller or quadrant) necessary for effecting movement of the rudder for steering the vessel under normal service conditions. |
| Magnetic compass              | The Earth has a magnetic field which is approximately aligned with its axis of rotation. A magnetic compass is a device that uses this field to determine the cardinal directions.                                                                                                 |
| Manual (steering) mode        | Method of controlling steering gear manually in contrast with automatic steering control mode (course control mode). Both Follow-Up and Non-Follow-Up modes may be considered as manual steering mode.                                                                             |
| Radius of turn                | Radius of a curved track                                                                                                                                                                                                                                                           |
| Rate-Of-Turn                  | The speed (or rate) at which a vessel is turning at, or can turn at, measured in degrees per minute.                                                                                                                                                                               |
| Relative bearing              | The direction of a target from own vessel expressed as an angular displacement from own vessel's heading.                                                                                                                                                                          |
| Relative course               | The direction of motion of a target relative to own vessel's position expressed as an angular displacement from north. It is deduced from several measurements of target range and bearing on own vessel's radar.                                                                  |
| Relative speed                | The speed of a target relative to own vessel's position. It is deduced from several measurements of target range and bearing on own vessel's radar.                                                                                                                                |
| Rudder Feedback Unit          | The Rudder Feedback Unit can be used in a rudder angle indicator system and as a part of the control loop in a steering control system.                                                                                                                                            |
| SOLAS (Safety of Life at Sea) | An international maritime treaty which requires signatory flag states to ensure that vessels flagged by them comply with minimum safety standards in construction, equipment, and operation.                                                                                       |
| Speed                         | The absolute value of velocity. May either be the vessel's speed through the water, or the speed made good over the ground.                                                                                                                                                        |
| SOG (Speed over ground)       | The speed of the vessel relative to the surface of the earth.                                                                                                                                                                                                                      |
| Steering gear                 | The equipment provided on vessels to turn the vessel.                                                                                                                                                                                                                              |
| Autopilot mode switch         | An external switch on the navigational bridge provided for the selection of manual steering and automatic steering devices.                                                                                                                                                        |
| Tiller                        | A device that is used to turn the rudder, which then steers the boat.                                                                                                                                                                                                              |
| Track                         | Path to be followed over ground.                                                                                                                                                                                                                                                   |
| Track control                 | Control of the vessel's movement along a track, where corrections made by the controller to compensate for wind, drift and other influences, are based on the cross-track error and not only on the bearing to the destination waypoint.                                           |
| TCS (Track Control System)    | System designed to keep a vessel on a pre-determined track throughout its passage.                                                                                                                                                                                                 |

| Definition | Description                                                                                                                                                                                                                                                                                                                                                                              |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            | Track Control systems must be interfaced with an electronic position fixing system. SOLAS Regulation 19, 2.8.2 requires Heading Control or Track Control Systems to be fitted to all vessels of 10000 GT and upward. There is no requirement to fit a Track Control system to any class of vessel. Track Control Systems include the functional capabilities of Heading Control systems. |
| Waypoint   | An intermediate point or place on a route or line of travel, a stopping point or point at which course is changed.                                                                                                                                                                                                                                                                       |

## II. Safety Information

The signal words DANGER, WARNING and CAUTION used in this manual indicate the degree of hazard that may be encountered by the user. These words are defined as follows:



### **DANGER**

Indicates a hazardous situation which, if not avoided, will result in death or serious injury. This signal word is limited to the most extreme situations.



### **WARNING**

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



### **CAUTION**

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

The signal word NOTICE used in this manual indicates information considered important but not related to injury. It is typically used to prevent damage to equipment or property.

To safely operate this system, the following DANGERS, WARNINGS, and CAUTIONS must be adhered to. Failure to comply with the precautions or with specific dangers, warnings, and cautions elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment. ALPHATRON MARINE assumes no liability for the customer's failure to comply with these requirements.

AlphaPilot MFS is a very useful navigational aid but DOES NOT UNDER ANY CIRCUMSTANCES REPLACE A HUMAN NAVIGATOR.

Do not use automatic steering in the following conditions:

- In heavy traffic areas or in narrow waters;
- In poor visibility or extreme sea conditions;
- When in areas where the law prohibits use of autopilot.



### **WARNING**

When using AlphaPilot MFS:

- Do not leave the helm unattended;
- Do not place any magnetic material or equipment near the heading sensor used in the AlphaPilot MFS system;
- Verify at regular intervals the course and position of the vessel;
- Always switch to Standby mode in due time to avoid hazardous situations



### **WARNING**

Do not disassemble or modify the equipment. Otherwise, it may cause a fire, or you may suffer an electrical shock.

**WARNING**

Immediately turn off the power and disconnect the power supply cable if the equipment is generating any smoke or odour or is overheated. Immediately inform your local service agent of the symptom to have it repaired. Prolonged equipment operation under such a condition can cause a fire or electric shock.

---

**WARNING**

Do not place a container containing liquid on the equipment. Otherwise, it may cause a fire, or you may suffer an electrical shock if knocked over.

---

**WARNING**

When unplugging the instrument, be sure to remove the cord terminal correctly. If the cord is pulled, the cord may get damaged resulting in a fire or an electrical shock.

### III. Warranty

To not to adversely affect the warranty, the following notices must be adhered to.

|               |                                                                                                                                                                                                                                               |
|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>NOTICE</b> | Operating personnel must not remove equipment covers. Only personnel trained and certified by ALPHATRON MARINE must make component replacement and internal adjustment.                                                                       |
| <b>NOTICE</b> | Do not disassemble or modify the equipment. Failure to observe this instruction may cause equipment failure, and it will void the warranty.                                                                                                   |
| <b>NOTICE</b> | Any modification to this equipment without prior written permission from ALPHATRON MARINE will void the warranty.                                                                                                                             |
| <b>NOTICE</b> | Installation of this product shall only be done by a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor. Acting otherwise will void the warranty.                              |
| <b>NOTICE</b> | This product contains no operator serviceable parts. Service and repair shall only be carried out by personnel trained and certified by ALPHATRON MARINE.                                                                                     |
| <b>NOTICE</b> | Do not place a container containing liquid on the equipment. The equipment can be damaged if knocked over.                                                                                                                                    |
| <b>NOTICE</b> | When cleaning the surface, do not use any organic solvent such as thinner or benzine. Otherwise, the paint and markings on the surface may get damaged. For cleaning the surface, remove the dust and debris and wipe with a clean dry cloth. |

## IV. About the manual

### Intended readers

This manual is an operation manual for the AlphaPilot MFS system and its control unit. The manual is intended for end users.

### Manual overview

This manual has the following chapters:

- **Introduction** contains a description of the Alphatron AlphaPilot MFS system.
- **AlphaPilot MFS Control Unit** contains a description of the Control Unit and its interface.
- **Operating modes** contains a description of the autopilot operating modes.
- **Controls and functions** contains a description of the basic functions such as dimming, alert handling.
- **Menus** contains a description of the accessible menus and menu items.
- **Alarms, warnings, and cautions** contains a description of alerts displayed on the AlphaPilot MFS Control Unit.

## 1 Introduction

The Alpatron AlphaPilot MFS system is a type approved heading control system, designed to fit vessels of any size, including high speed crafts. It is a modern and technologically advanced digital vessel control unit that is intended to reduce the operator's workload, increase the vessel motion efficiency and improve operational safety.

The AlphaPilot MFS Control Unit is the main operator control unit of the AlphaPilot MFS system. It is used for control and monitoring of autopilot operation, setting vessel heading or rudder angle, selection of autopilot operating modes.

The AlphaPilot MFS Control Unit works in conjunction with the AlphaPilot MFS Distribution Unit, which connect to the steering system or to the steering gear. Refer to the Alpatron AlphaPilot MFS Installation manual for more details about the Distribution Unit.



**WARNING!** AlphaPilot is a very useful navigational aid but **DOES NOT UNDER ANY CIRCUMSTANCES REPLACE A HUMAN NAVIGATOR.**

Do not use automatic steering in the following conditions:

- In heavy traffic areas or in narrow waters;
- In poor visibility or extreme sea conditions;
- When in areas where the law prohibits use of autopilot.

When using AlphaPilot:

- Do not leave the helm unattended;
- Do not place any magnetic material or equipment near the heading sensor used in the AlphaPilot MFS system;
- Verify at regular intervals the course and position of the vessel;
- Always switch to Standby mode (e.g. switch external steering mode selector to NFU position) in due time to avoid hazardous situation.

### Compliance

The Alpatron AlphaPilot MFS system meets the following carriage and performance requirements:

MED/4.16 Heading Control Systems (HCS):

- SOLAS 74 Reg. V/18 & V/19
- IMO Res.A.342(IX)
- IMO Res.A.694(17)
- IMO Res.MSC.191(79)
- IMO Res.MSC.64(67) Annex 3
- IMO Res.MSC.302(87)

MED/4.40 Heading Control System (HCS) for High Speed Craft (HSC):

- SOLAS 74 Reg. X/3
- IMO Res.MSC.36(63)-(1994 HSC Code) 13
- IMO Res.MSC.97(73)-(2000 HSC Code) 13
- IMO Res.A.694(17)
- IMO Res.A.822(19)
- IMO Res.MSC.191(79)
- IMO Res.MSC.302(87)
- IMO MSC.1/Circ.1349

**‘Fail-to-safety’ principle**

‘Fail-to-safety’ principle is implemented in the AlphaPilot MFS system design, i.e. any failure results in the least critical of any possible new conditions.

## 2 AlphaPilot MFS Control Unit

The AlphaPilot MFS Control Unit has a touch screen display, rotary knob, and a ON/OFF button.

The touch screen display shows information such as heading, current mode and settings, and alerts. The touch screen display is also used to set parameters (see Figure 2 on page 18).

The rotary knob, which is used for various purposes such as, changing heading, and setting parameters. It can be used instead of the **LEFT**, **RIGHT**, and **CONFIRM/SET** buttons (for more information, refer to the next page).

The ON/OFF button is used to reset the AlphaPilot MFS.



Figure 1: AlphaPilot MFS Control Unit

All information, menus and functions are by default in English. Information shown on the display depends partly on the operating mode. Figure 2 and Table 1 on the next page are provided as an

example to highlight generic information. For information displayed in a specific operation mode, refer to the respective section (see section 'Operating modes' on page 21).

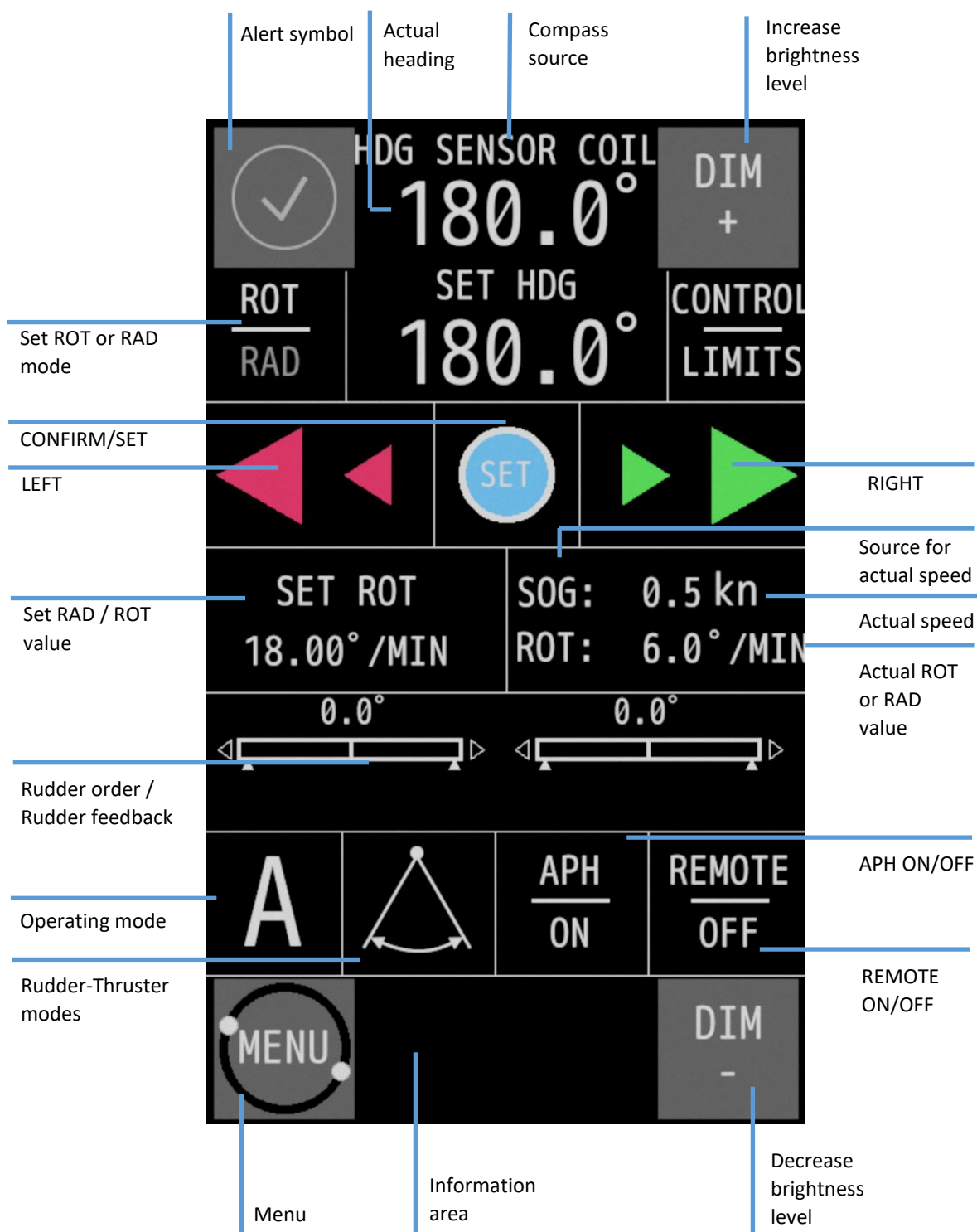


Figure 2: AlphaPilot MFS Control Unit - Displayed information

| Item                      | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Actual heading            | Actual heading taken from compass source.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Actual ROT or RAD value   | Actual operating ROT or RAD value. Operating ROT value is shown in degrees per minute. Operating RAD value is shown in nautical miles.<br>ROT value can be received from sensor (i.e. ROT:S) or it can be calculated (i.e. ROT:C).                                                                                                                                                                                                                                                                                                                                                     |
| Actual speed              | Speed value in knots.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Alert symbol              | Symbol for active alarm or notification. For detailed descriptions of alerts, see section 'Alarms, warnings, and cautions' on page 15.                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| APH ON/OFF                | APH (Automatic Permanent Helm) - also referred to as Autotrim - is applied by the Autopilot over a period when underway to offset the rudder and/or thruster level to eliminate heading errors caused by windage or vessel trim etc.                                                                                                                                                                                                                                                                                                                                                   |
| Compass source            | Source from which the actual heading is taken. The following sources may be displayed: HDG SENSOR COIL, TRUE HDG, MAGNETIC HDG, COMPASS HDG, STEP HDG                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| CONTROL LIMITS            | Parameters can be configured via the <b>CONTROL LIMITS</b> button.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Decrease brightness level | For simultaneous brightness level control of all interconnected modules.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| CONFIRM/SET               | Button to confirm/set a chosen value.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Increase brightness level | Increase brightness level of all modules simultaneously.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Information area          | Info depends on the heading control mode. The following information can be displayed: <ul style="list-style-type: none"> <li>- Vessel position (LON/LAT) is available in all operating modes if position source is available from GPS or ECDIS.</li> <li>- COG-SOG data and its type is available in all operating modes if COG/SOG data is available from GPS or ECDIS.</li> <li>- Alarm, warning, and caution messages. For more information. For detailed descriptions of alarm, warning, and caution messages, see section 'Alarms, warnings, and cautions' on page 15.</li> </ul> |
| LEFT                      | Button to select a new heading value.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| MENU                      | The <b>MENU</b> button is used to enter the menu, which enables changing of the AlphaPilot MFS operating parameters. For more information, see section 'Menus' on page 29.                                                                                                                                                                                                                                                                                                                                                                                                             |
| Operating mode            | Shows the active operating mode (for more information, see section 'Operating modes' on page 21) and is used to select the desired control mode.<br>Press the button to change the control mode (the identifier of the next available control mode appears on the display). When new mode is confirmed by pressing the <b>CONFIRM/SET</b> button, the AlphaPilot goes into selected mode. If a mode is not confirmed within 20 seconds, AlphaPilot MFS remains in previous control mode.                                                                                               |
| RIGHT                     | Button to select a new heading value.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

| Item                           | Description                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| REMOTE ON/OFF                  | Button to allow or not allow remote control from another Alphasat MFS Control Unit. A request for system control from another Control Unit will be denied when the button on the master Control Unit has not been activated. Other Control Units can only gain system control when the master Control Unit permits (via the REMOTE ON/OFF button). |
| Rudder angle limit (not shown) | Shows the pre-set limit for the angle of the rudder. Rudder limit can be set via the <b>CONTROL   LIMITS</b> button. See section 'Change the Rudder Limit' on page 24.                                                                                                                                                                             |
| Rudder order / Rudder feedback | Rudder order and rudder feedback of the RFU (Rudder Feedback Unit). Presented as rudder angle (in degrees).<br>NOTE: Rudder feedback should follow the rudder order.                                                                                                                                                                               |
| Rudder-Thruster modes          | This button is used select Rudder only, Thruster only, or Rudder and Thruster.                                                                                                                                                                                                                                                                     |
| Set ROT or RAD mode            | Set steering method to ROT or RAD mode.                                                                                                                                                                                                                                                                                                            |
| Source for actual speed        | Source from which the speed is taken. The following sources may be displayed:<br>SOG or STW.                                                                                                                                                                                                                                                       |

**Table 1: Description of AlphaPilot MFS displayed information**

## 3 Operating modes

### 3.1 Introduction

The operating modes are displayed on the AlphaPilot MFS Control Unit (see Figure 2 on page 18) and explained in this section. Symbols are used to clearly indicate the active autopilot operating mode.

To enable a heading control mode, press the **MODE|AUTO** button to change the control mode (the identifier of the next available control mode appears on the display). When the desired control mode is shown, confirm it, and the Autopilot goes into selected mode (the respective symbol appears in 'Operating mode' field on the display).

| Symbol                                                                              | Mode    | Description                                                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    | Standby | Autopilot is in Standby mode (not in control).                                                                                                                                                                                                                                                                                                                              |
|                                                                                     |         | Autopilot is in Follow-Up mode (not in control).                                                                                                                                                                                                                                                                                                                            |
|   | FU      | In FU mode, the vessel can be hand steered by using the FU Tiller or Steering wheel. Hand steering is typically used when the vessel is manoeuvring, and navigating in restricted waters, channels, and areas with traffic density.                                                                                                                                         |
|  | Auto    | Autopilot is (in control) in Automatic heading control mode. The autopilot steers the vessel to the reference course as shown on the display. When wind and/or current will push the vessel off course, the Autopilot will measure and counteract to keep the vessel to the set heading. The reference course will be the course the vessel has when Auto mode is selected. |
|  | Track   | Autopilot is in Track control mode.*                                                                                                                                                                                                                                                                                                                                        |
|  | NFU     | Autopilot is in Non-Follow-Up mode (not in control). In NFU mode, the vessel can be hand steered by using the NFU Tiller.                                                                                                                                                                                                                                                   |
|  | Dodge   | Short-term manual FU steering via the Autopilot MFS Control Unit. Autopilot is in control.                                                                                                                                                                                                                                                                                  |

\* Track control mode combines an ECDIS with the Autopilot. The navigator can program a voyage plan into the ECDIS that contains one or more tracks. The Track Control System (TCS) is used together with the input from the sensors for position, course and speed and is designed to keep the vessel on the plotted route.

### 3.2 Standby (S) mode

Autopilot is not operating for vessel heading control.

In this mode, the AlphaPilot MFS 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.

#### NOTICE

The Autopilot can be switched OFF at any time by a continuous two seconds ON/OFF button operation.

Autopilot will go into Standby (S) mode automatically when the external steering mode selector is switched to the 'NFU' position.

### 3.3 FU (F) mode

Autopilot is not operating for vessel heading control. In FU mode, the vessel can be hand steered by using a FU Tiller or Steering wheel. Hand steering is typically used when the vessel is manoeuvring, and navigating in restricted waters, channels, and areas with traffic density.

Autopilot will go into FU (F) mode automatically when the external steering mode selector is switched to the 'FU' position.

### 3.4 Auto (A) control mode

#### 3.4.1 Introduction

Automatic steering by means of heading (course) control. Auto (A) control mode is the main autopilot control mode which automatically steers the vessel to a pre-set heading.

When wind and/or current will push the vessel off course, Auto (A) control mode will measure and counteract to keep the vessel to the pre-set heading.

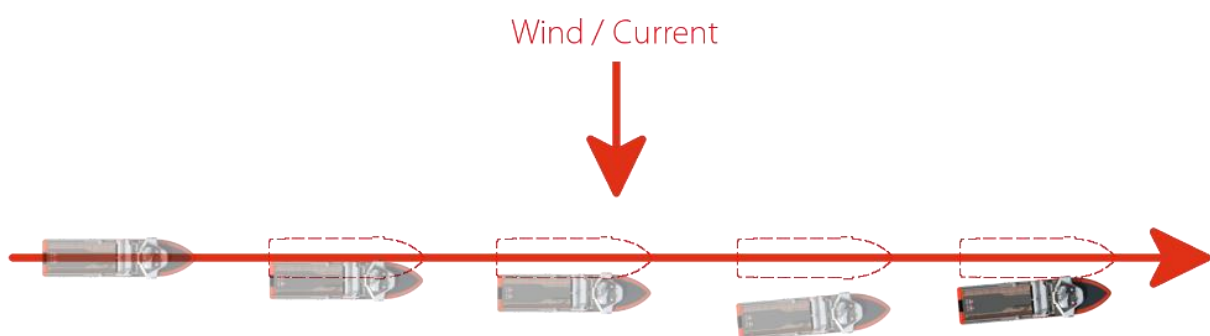


Figure 3: A mode - Wind and current factor

The following information is displayed in Auto (A) control mode: actual heading, pre-set heading, actual speed, actual ROT in degrees per minute or actual RAD in nautical miles, rudder(s) feedback, and steering method.

NOTE: While in Auto (A) control mode, the system continuously checks for the availability and quality of heading and speed information. In case of no heading data, the audible and visual alert is generated.

NOTE: A warning message appears on the display if operating parameters 'SET ROT' or 'SET RAD' are not corresponding with the actual 'Rudder Limit' value. Decrease the value for 'SET ROT' or increase the value for 'SET RAD'.

NOTE: An alert is generated when the difference between the vessel's actual heading and pre-set heading exceeds the 'Heading Alarm'.

### 3.4.2 Enable Auto (A) control mode

Press the **MODE|AUTO** button to change the control mode (the identifier of the next available control mode appears on the display). When the Auto (A) control mode is shown, press the **CONFIRM/SET** button, and the Autopilot goes into selected mode (the 'A' symbol appears in 'Operating mode' field on the display).

### 3.4.3 Steering in Auto (A) control mode

#### 3.4.3.1 Change the heading

To change the heading, press the **LEFT** or **RIGHT** button to select a new heading value, and press the **CONFIRM/SET** button to confirm. The autopilot starts changing the actual heading to the new heading.

**NOTICE** In Adaptive Mode, a course change executed by the autopilot system may be controlled by pre-programmed ROT/RAD data. These limiting factors can also apply in the Non-Adaptive (PID) operating mode provided the autopilot has been programmed - for Radius controlled turns - and that Speed (SOG) input data is available.

### 3.4.3.2 *Enable or disable Adaptive control*

The Alphasatron AlphaPilot MFS is Speed Adaptive and – provided it is used in Adaptive Mode and calibrated for the correct vessel type (DISP or HSC) – will automatically set its own control parameters for optimum steering performance. In most cases, Adaptive Mode will be preferred.

Perform the following procedure to enable or disable Adaptive control:

**NOTICE** 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.

1. Press the **CONTROL|LIMITS** button once.
2. Use the < or > button to select **ADAPT**.
3. Use the - or + button to select **ON** or **OFF** as required
  - a. ON = Adaptive mode
  - b. OFF = Non-Adaptive mode (i.e. PID control).

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.

### 3.4.3.3 *Change the Rudder Limit*

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.

Perform the following procedure to change the Rudder Limit:

1. Press the **CONTROL|LIMITS** button twice.
2. Use the < or > button to select **RUDDER LIMITS**.
1. Use the - or + button to change the value.
3. Press the **ACCEPT** button to confirm the chosen value.

### 3.4.3.4 *Change the steering method*

Two steering methods are available for Auto (A) control mode, namely steering by ROT or steering by RAD. The selected steering mode is shown on the top left part of the display (SET ROT or SET RAD).

To change the steering method, press the **ROT|RAD** button.

### 3.5 Track (T) control mode

#### 3.5.1 Introduction

Track (T) control mode (also referred to as 'Track steering') combines an ECDIS with the Autopilot. The navigator can program a voyage plan into the ECDIS that contains one or more tracks.

The TCS (Track Control System) is used together with the input from the sensors for position, course and speed and is designed to keep the vessel on the plotted route.



#### **WARNING**

This functionality is not compliant to the SOLAS convention unless approved. Otherwise, Track (T) control mode can be only used on non-SOLAS ships and leisure crafts.

NOTE: Autopilot receives commanded Heading-To-Steer (HTS), commanded radius or commanded ROT from TCS.

NOTE: While in Track (T) control mode, the system continuously checks for the validity (age), format and check sum of 'HTC' / 'HSC' messages. If one of these messages are missing, an alarm is generated.

NOTE: 'Rudder Limit', 'SET ROT' and 'SET RAD' parameters are not used during operation in Track (T) control mode. AlphaPilot uses incoming HTC sentences (commanded HTS, ROT or RAD) from an external TCS.

#### 3.5.2 Enable Track (T) control mode

Press the **MODE|AUTO** button to change the control mode (the identifier of the next available control mode appears on the display). When Track (T) control mode is shown, press the **CONFIRM/SET** button, and the Autopilot goes into selected mode (the 'T' symbol appears in 'Operating mode' field on the display).

#### 3.5.3 Steering in Track (T) control mode

Commanded heading to steer and rate of turn (HTC, HSC or proprietary messages) is set by an external TCS.

## 3.6 Dodge (D) control mode

### 3.6.1 Introduction

Short-term manual FU steering (set angle of rudder(s)) via external Dodge controller. Dodge control mode operation is available when the Autopilot is in Auto (A) control mode or in Track (T) control mode.

NOTE: Dodge (D) control mode may not be available, as it can be enabled or disabled (see AlphaPilot MFS Installation Manual).

The following information is displayed in Dodge (D) control mode: actual heading, actual speed, actual ROT in degrees per minute, rudder(s) order, rudder(s) feedback.

NOTE: 'Rudder Limit', 'SET ROT' and 'SET RAD' parameters are not used during operation in Dodge (D) control mode.

### 3.6.2 Enable Dodge (D) control mode

Enable the external Dodge controller. The Autopilot goes into Dodge (D) control mode (the 'D' symbol appears in 'Operating mode' field on the display).

NOTE: External Dodge controller demands will result in Follow Up or fixed rudder angle application to produce **TEMPORARY** course change since, when the external Dodge controller is switched 'OFF', the vessel head will automatically be returned to the original Autopilot course.

### 3.6.3 Steering in Dodge (D) control mode

Use the External Dodge controller to change the rudder angle.

NOTE: For vessels with two independent rudders; In Dodge (D) control mode; control operations for both rudders are implemented synchronously.

## 4 Controls and functions

This section describes other controls and functions (not related to operating modes as described in the previous section).

### 4.1 Turn on

To turn on the AlphaPilot MFS Control Unit, push the ON/OFF button.

The AlphaPilot MFS system will start-up (and performs system testing). After start-up, the AlphaPilot MFS system will go into Standby (S) mode (the AlphaPilot is not operating for vessel heading control).

The AlphaPilot MFS system is ready for operation.

### 4.2 Turn off

First put the AlphaPilot MFS Control Unit in Standby (S) mode; switch the external steering mode selector in the appropriate position (e.g. NFU position).

To turn off the device, push and hold the ON/OFF button.

### 4.3 Enabling control

When not in control, the AlphaPilot MFS Control Unit is in Standby mode.

Control is enabled automatically when the external steering mode selector is switched to the AUTO position.

### 4.4 Autotrim

Autotrim – also referred to as APH (Automatic Permanent Helm) - is applied by the Autopilot over a period when underway to offset the rudder and/or thruster level to eliminate heading errors caused by windage or vessel trim etc.

This feature is always operational when the Autopilot is switched from STANDBY to ON and permits the Autopilot to copy the angle of offset rudder and/or direction and level of thruster compensation 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 feature continuously monitors any long-term differences between the Autopilot Heading Set and the mean course actually steered. Any apparent long-term difference is corrected by automatic trim reassessment over a period of time to ensure the correct mean direction of the vessel through the water.

The Autotrim feature can be permanently switched off if required or can be used to instantaneously assess the required rudder 'offset' angle (not thruster level) when **APH ON/OFF** button is used.

NOTE: Most of the Autotrim set-up parameters are determined during Sea Trials and include the APH Time Constant and Autotrim Trip Angle. By default, the **APH ON/OFF** button 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 feature OFF, use the **APH ON/OFF** button (Autotrim will automatically revert to the active state when the Autopilot is switched OFF and ON again). (iii) Single press the APH ON/OFF button to switch Autotrim ON again. (iv) Single press the **APH ON/OFF** button to automatically assess and instantaneously apply the correct angle of rudder (APH).

#### 4.5 Rudder-Thruster modes

Use the Rudder-Thruster modes button to select the desired mode. The Autopilot can be engaged in the following modes (see Figure 4):

- Rudder only mode
- Thruster only mode
- Combined rudder and thruster mode



Figure 4: Screen 'Rudder-Thruster modes'

#### 4.6 Alert handling

When an alarm or warning occurs, the speaker will beep in an uninterrupted sequence.

When the alarm or warning message (is read and) acknowledged on the AlphaPilot MFS Control Unit, the speaker will be muted. When the alarm is deactivated (problem solved), the alarm or warning will disappear.

See section 'Alarms, warnings, and cautions' on page 35 for more information.

#### 4.7 Dimming

The **DIM -** and **DIM +** buttons are dimmed to a pre-set brightness level. Control is always allowed.

#### 4.8 Remote control

The **REMOTE ON/OFF** button can be used to allow or not allow control from another Alphasatron MFS Control Unit.

A request for system control from another Control Unit will be denied when the **REMOTE ON/OFF** button on the master Control Unit has not been activated. Other Control Units can only gain system control when the master Control Unit permits (via the **REMOTE ON/OFF** button).

## 5 Menus

The AlphaPilot MFS has generic and advanced settings. All users are authorized to use the generic settings. Only a commissioning engineer has access to the advanced settings (**ADV SET** and **ALPHAPILOT** button), which are only needed during commissioning or troubleshooting.

All menu items are explained in the following subsections.

Press the **←** button to go back to the previous screen. Press the **ACCEPT** button to save a change. Press the **DISCARD** button to discard changes. Parameters can be adjusted with the **+** and **-** buttons.

### 5.1 Menu 'Main Menu'

This menu is primarily used to quickly change settings during operation.

To enter the main menu, single press the **MENU** button.

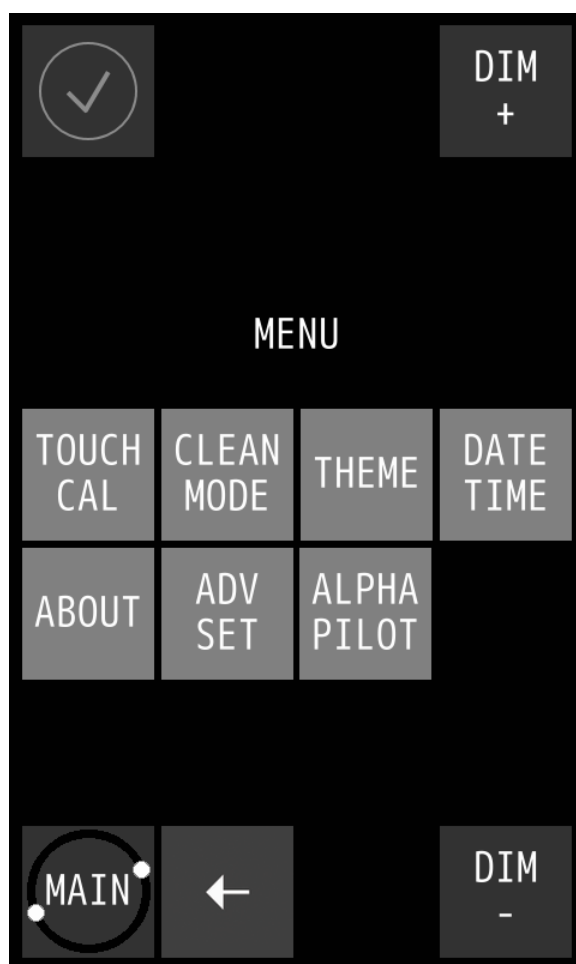


Figure 5: Menu 'Main Menu'

| Menu item  | Description                                                                          |
|------------|--------------------------------------------------------------------------------------|
| TOUCH CAL  | To calibrate the touch screen.                                                       |
| CLEAN MODE | To clean the surface of the touch screen without accidentally activating a function. |

| Menu item  | Description                                                                                                                                                                                                                                                                |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| THEME      | To change contrast brightness (i.e. illumination) and to set the language.                                                                                                                                                                                                 |
| DATE TIME  | To change the date and/or time.                                                                                                                                                                                                                                            |
| ABOUT      | The show the name and version of the software and when it was built.                                                                                                                                                                                                       |
| ADV SET    | To change Advanced settings of the AlphaPilot MFS Control Unit. Only a commissioning engineer has access to the Advanced settings, which are only needed during commissioning or troubleshooting.                                                                          |
| ALPHAPILOT | To change Advanced settings of the AlphaPilot MFS Distribution Unit. Only a commissioning engineer has access to the Advanced settings, which are only needed during commissioning or troubleshooting.<br>NOTE: If Autopilot is engaged, then this menu is not accessible. |

Select a menu item or press the ← button to return to exit the menu.

#### 5.1.1 Touch screen calibration

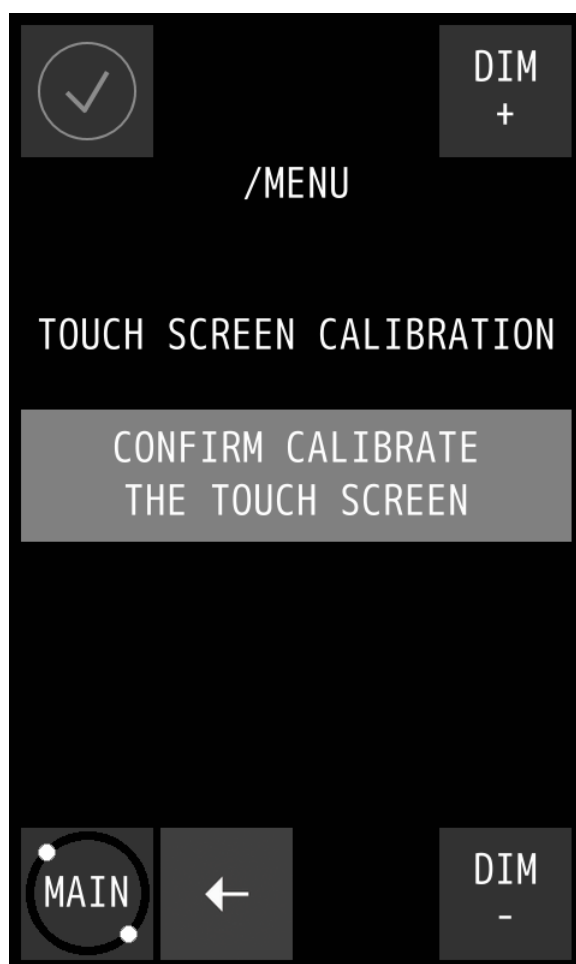


Figure 6: Menu item 'Touch screen calibration'

Calibrate the screen by performing the following procedure:

1. Press the **CONFIRM CALIBRATE THE TOUCH SCREEN** button.  
The calibration screen appears with text requesting to touch the four numbered reference points that appear on the screen.
2. Touch the four reference points in sequence 1 to 4, as they light up.  
The application will determine whether the sequence is carried out correctly. If the text **VALID CALIBRATION** appears, then the calibration is performed accurately.
3. Test calibration for accuracy by dragging a finger across the screen.  
The line that appears on the screen should follow the finger.
4. Press the **ACCEPT** button if calibration is correct or touch the **AGAIN** button to repeat the calibration procedure.  
If the text **INVALID CALIBRATION...PLEASE RETRY** appears, touch the **AGAIN** button to repeat the calibration procedure.

## 5.1.2 Display cleaning

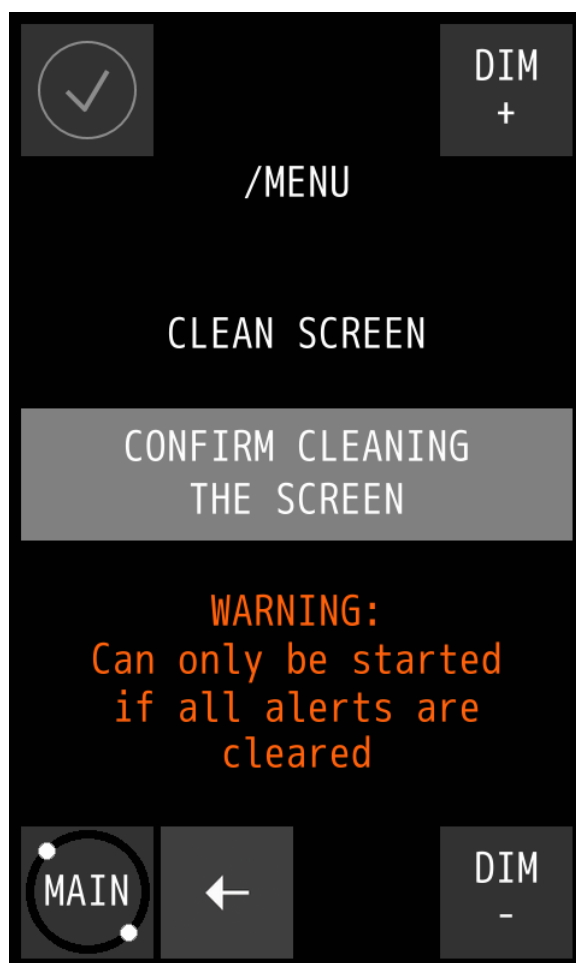


Figure 7: Menu item 'Display cleaning'

The purpose of the Clean Mode feature is to clean the surface of the touch screen without accidentally activating a function. When the Clean mode is started, the touch screen will be deactivated for 60 seconds. Within this period the instrument will remain functional, but it is not operable. Except when an indication is activated, then the touch screen will be activated immediately, and the instrument will be operable again.

To start Clean Mode, perform the following procedure:

1. Press the **CONFIRM CLEANING THE SCREEN** button to start the Clean Mode.
2. The AlphaPilot MFS Control Unit starts the countdown sequence. The touch screen is now deactivated, and the surface can be cleaned. After 60 seconds, or at an active alert, the instrument will become operable again.

### NOTICE

For safety reason, if an alert is active and needs attention of the operator, Clean Mode can not be started.

### 5.1.3 Theme

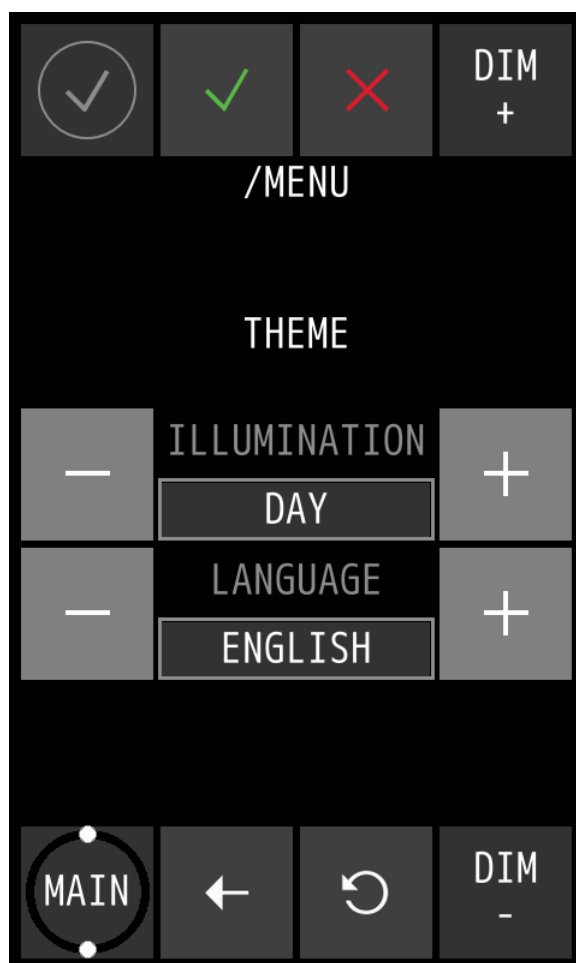


Figure 8: Menu item 'Theme'

#### 5.1.3.1 Contrast brightness

Contrast brightness can be easily adjusted to Day, Dusk and Night settings.

To change the contrast brightness, perform the following procedure:

1. Press the + or – button to select the desired **ILLUMINATION** value.  
Three different illumination pre-sets can be selected, in accordance with ambient light: DAY, DUSK and NIGHT.
2. Press the **ACCEPT** button to confirm the chosen setting.

#### 5.1.3.2 Language

In all inland applications (river), three languages may be selected: ENGLISH, GERMAN, and DUTCH.

To change the language, perform the following procedure:

2. Press the + or - button to select the desired **LANGUAGE**.
3. Press the **ACCEPT** button to confirm the chosen setting.

#### 5.1.4 Date and time

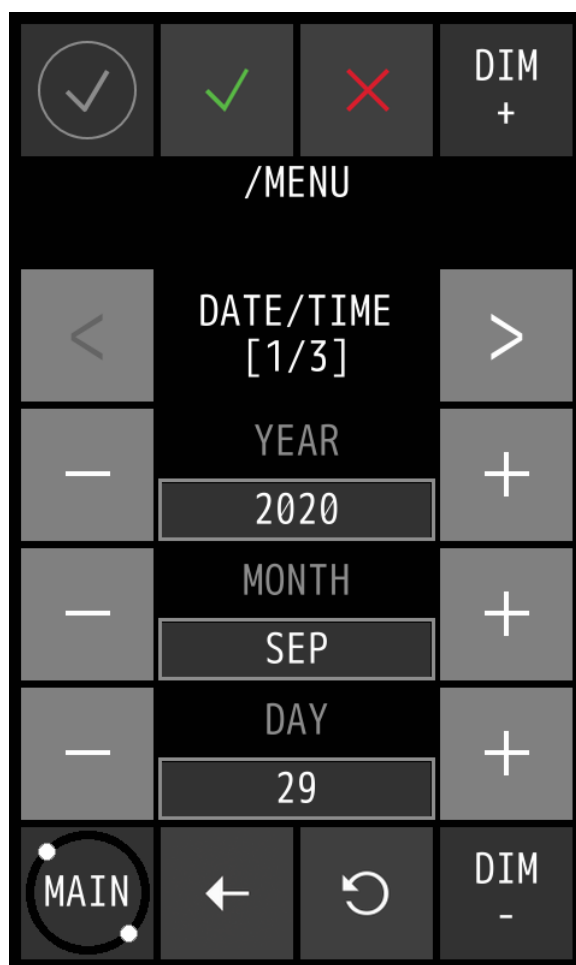


Figure 9: Menu item 'Date and time'

To change the date and/or time, perform the following procedure:

1. Press the + and/or – button to set the correct **DATE** values.
2. Press the > button to select the TIME screen.
3. Press the + and/or – button to set the correct **TIME** values.
4. Press the **ACCEPT** button to confirm the chosen values and return to the Main Menu.
5. To abort, press the ← button to return to the Main Menu.

#### 5.1.5 About

The About screen contains the name and version of the software and when it was built.

**NOTICE** When asking for support, this information will be useful.

## 6 Alarms, warnings, and cautions

The AlphaPilot MFS 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.

Alarms, warnings, and cautions are displayed on the AlphaPilot MFS Control Unit. An Alert symbol will be shown, accompanied with or without an audible signal.

The alert messages listed Appendix A: Alphontron MFS Alerts will be displayed (if appropriate) and will be accompanied by the appropriate Alert symbol.

Warnings and alarms are accompanied by an audible signal unless the audible alarm has been muted.

The alert messages are also transmitted to BAM (Bridge Alert Management) system if applicable.

Alerts are acknowledged by pressing the Alert indicator or via the BAM system.

NOTE: The Off-heading alert is defined by DNV/GL as a category A alert and therefore it is not possible to acknowledge this alert remotely from the BAM system.

The following alert indicators are applicable:

| Symbol                                                                              | Symbol behaviour | Audible signal                                                                | Status                             | Priority       |
|-------------------------------------------------------------------------------------|------------------|-------------------------------------------------------------------------------|------------------------------------|----------------|
|    | Flashing         | Three short audible signals, repeated within every 10 s                       | Alarm active, not acknowledged     | High           |
|    | Flashing         | Silent                                                                        | Alarm active, silenced             |                |
|    | Flashing         | One short audible signal, repeated within every 5 min or replaced by an alarm | Warnings active, not acknowledged  |                |
|  | Flashing         | Silent                                                                        | Warnings active, silenced          |                |
|  | Steadily shown   | Silent                                                                        | Rectified — unacknowledged alarm   |                |
|  | Steadily shown   | Silent                                                                        | Rectified — unacknowledged warning |                |
|  | Steadily shown   | Suppression of audible signal (Silent)                                        | Alarm active, acknowledged         |                |
|  | Steadily shown   | Silent                                                                        | Warnings active, acknowledged      |                |
|  | Steadily shown   | Silent                                                                        | Caution active                     | Low            |
|  | Steadily shown   | Silent                                                                        | Normal state                       | Not applicable |

**Table 2: Alert indicators**

**Alarm**

The situation requires an immediate response, or the Autopilot system will go out-of-order.

**Warning**

The system has degraded, but it still functions. It is possible to reduce the quality of control. A response to this message is required.

**Caution**

The system does not require an immediate reaction and informs about the degradation of the system without deterioration of the quality of management.

An Alert is indicated via the Alert symbol and an audible signal. The Alert message is displayed when by pressing on the Alert symbol. The audible signal is silenced and flashing of the Alert symbol stops by pressing on the Alert message. An alert message is maintained until the issue is resolved.

For more information such as recommended actions, refer to Appendix A: Alphatron MFS Alerts.



## Appendices

## Appendix A: Alpatron MFS Alerts

### Alert display messages and BAM alert types

| Alert Text        | Message Text                                     | BAM Alert Type  |
|-------------------|--------------------------------------------------|-----------------|
| No alert          | None                                             |                 |
| Lost HDG control  | HCS Failed. Switch to Manual steering            | Alarm           |
| Doubtful heading  | Deviation between heading sources exceeded limit | Warning / Alarm |
| Doubtful heading  | Heading monitor function is impossible           | Warning / Alarm |
| HCS power fail    | HCS working normally on Backup Power only        | Caution         |
| HCS power fail    | HCS working normally on Main Power only          | Caution         |
| Off-heading       | Yawing is too big: take helm to keep steady      | Alarm           |
| Off-heading       | Yawing is too big: take helm to keep steady      | Warning         |
| HCS unavailable   | Internal Distribution Unit Failure               | Caution         |
| HCS unavailable   | Internal Distribution Unit +7V Error             | Caution         |
| HCS unavailable   | Internal Distribution Unit +3.5V Error           | Caution         |
| HCS unavailable   | Internal Distribution Unit +2.5V Error           | Caution         |
| HCS unavailable   | No HDG source available, Step HDG failed         | Caution         |
| HCS unavailable   | No HDG source available, Step HDG not aligned    | Caution         |
| HCS unavailable   | No HDG source available                          | Caution         |
| HCS unavailable   | No HDG source available, Mag Compass failed      | Caution         |
| HCS fault         | Track steering failed. No input data             | Warning / Alarm |
| HCS fault         | HCS fault. Switch to manual steering             | Warning / Alarm |
| HCS fault         | HSC unavailable. Control unit fault.             | Warning / Alarm |
| HCS fault         | No Setup data                                    | Caution         |
| HCS fault         | Control unit interface error                     | Caution         |
| HCS fault         | Rudder feedback A failed                         | Caution         |
| HCS fault         | Rudder feedback B failed                         | Caution         |
| HCS fault         | Draft adaptive control unavailable, no data      | Caution         |
| Low speed         | Ship's speed too low for HDG control             | Warning / Alarm |
| HDG in fallback   | Step HDG lost, normal HC using Gyro 1            | Caution         |
| HDG in fallback   | Step HDG lost, normal HC using Gyro 2            | Caution         |
| HDG in fallback   | Step HDG lost, normal HC using Mag Compass       | Caution         |
| HDG in fallback   | Gyro 1 lost, normal HC using Gyro 2              | Caution         |
| HDG in fallback   | Gyro 1 lost, normal HC using Mag Compass         | Caution         |
| HDG in fallback   | Gyro 1 lost, normal HC using Step HDG            | Caution         |
| HDG in fallback   | Gyro 2 lost, normal HC using Gyro 1              | Caution         |
| HDG in fallback   | Gyro 2 lost, normal HC using Mag Compass         | Caution         |
| HDG in fallback   | Gyro 2 lost, normal HC using Step HDG            | Caution         |
| HDG in fallback   | Mag Compass lost, normal HC using Gyro 1         | Caution         |
| HDG in fallback   | Mag Compass lost, normal HC using Gyro 2         | Caution         |
| HDG in fallback   | Mag Compass lost, normal HC using Step HDG       | Caution         |
| No radius control | Radius control unavailable, no SOG data          | Caution         |
| No SPD adaptive   | SPD adaptive control unavailable, no STW data    | Caution         |

#### *Lost HDG control*

The BAM alarm “Lost HDG control: HCS Failed. Switch to Manual steering” will be shown if one or more of the following failure conditions occur when the Autopilot is engaged:

- i) Internal Distribution unit failure\*.
- ii) Internal Distribution Unit +7V failure\*.
- iii) Internal Distribution Unit +3.5V failure\*.
- iv) Internal Distribution Unit +2.5V failure\*.
- v) No heading source available\*.
- vi) Rudder reference A failure (if it is being actively used for rudder positioning) \*\*.
- vii) Rudder reference B failure (if it is being actively used for rudder positioning) \*\*.
- viii) Steering A failure\*\*.
- ix) Steering B failure\*\*.

This alert informs the operator that the Autopilot is no longer able to control the ship’s heading. Manual Steering must be engaged immediately.

If the ‘Lost HDG control’ alarm is not acknowledged within 30 seconds and the alarm has not been terminated, then a Backup Navigator Call (BNC) is generated.

\* When the Autopilot is set to standby mode (disengaged) these failure conditions will generate a new BAM alert message containing details of the specific error condition.

\*\* When the Autopilot is set to standby mode (disengaged) these failure conditions will be cleared.

**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**

#### *Doubtful heading*

- i) The Autopilot is equipped with an integral Course Comparator which compares data received from 2 inputs (1 x HSC and 1 x NMEA or 2 x NMEA). If one input is absent or disagrees with the other by more than the preset limit (preset in the **LIMITS** menu (accessible via the **CONTROL|LIMITS** button). the BAM warning “Doubtful Heading: Deviation between heading sources exceeded limit” will be activated.
- ii) The BAM warning “Doubtful Heading: Heading monitor function is impossible” will be shown if only one heading source (no second heading data input) is available for comparison purposes. The CCA will function with 2 heading inputs and will compare the 2 highest priority sources nominated via the Autopilot Set Up Menu.

Both Doubtful Heading warnings will escalate to alarms if not acknowledged within 30 seconds.

**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**

#### *HCS power fail*

- i) In the event of Main Power supply failure, the BAM caution “HCS Power fail: HCS working normally on Backup Power only” message will be displayed on the Control Unit.
- ii) In the event of Back Up power supply failure, the BAM caution “HCS Power fail: HCS working normally on Main Power only” message will be displayed on the Control Unit.

**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**

#### *Off-heading*

The Autopilot **LIMITS** menu (accessible via the **CONTROL|LIMITS** button) allows the integral Off Heading Alarm (OHA) trip level to be set such that if the vessel alters course or yaws more than the level specified (+/-3°, +/-5° etc.) the BAM warning “Off-Heading: Yawing is too big: take helm to keep steady” will be activated.

The Off-Heading warning will escalate to an alarm if not acknowledged within 30 seconds.

**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**

#### *HCS unavailable*

There are several failure conditions that will result in a “HCS Unavailable” caution alert, see below for details.

- i) HCS Unavailable: Internal Distribution Unit Failure.
- ii) HCS Unavailable: Internal Distribution Unit +7V Error.
- iii) HCS Unavailable: Internal Distribution Unit +3.5V Error.
- iv) HCS Unavailable: Internal Distribution Unit +2.5V Error
- v) HCS Unavailable: No HDG source available, Step HDG failed.
- vi) HCS Unavailable: No HDG source available, Step HDG not aligned.
- vii) HCS Unavailable: No HDG source available.
- viii) HCS Unavailable: Mag Compass failed.

**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**

#### *HCS fault*

There are several failure conditions that will result in an “HCS Fault” alert, see below for details.

- i) HCS Fault: Track steering failed. No input data. (warning / alarm)  
NOTE: The “HCS fault: Track steering failed. No input data” warning will escalate to an alarm if not acknowledged within 30 seconds.  
This alert message will result when the Autopilot is operating in the TRACK mode and no valid (HTC, HSC or APB) track data is being received.  
**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**
- ii) HCS fault: No Setup data. (caution).

The Autopilot Set Up Data is stored in the Distribution Unit non-volatile memory and read at power up. The integrity of this data is verified when read and will only be used if no errors are detected. A checksum is included to guard against corrupted data being used.

If the current Set Up Data is unable to be loaded at power up for any reason, the “HCS fault: No Setup data” message will be displayed. The Autopilot will continue to function, but all setup parameters will be set to their factory default values.

If the “HCS fault: No Setup data.” message appears, switch the Autopilot “OFF”. Wait a few seconds then set the Autopilot to STANDBY. If the “HCS fault: No Setup data.” message is again shown when the Autopilot is re-powered, it is likely that the Set Up Menu data is corrupted thus the integrity of the stored setup data must be considered suspect and should be cleared down.

**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**

iii) HCS fault: Control unit interface error. (caution).

This condition indicates no data received by the Control Unit.

**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**

iv) HCS fault: Draft adaptive control unavailable, no data. (caution).

The Draft failure alarm will only be activated if the Autopilot has previously been installed using such data (4 – 20 mA draft input signal) which is later absent (check 4 – 20 mA Draft Data Source).

**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**

### *Low speed*

The Low Speed: Ship’s speed too low for HDG control (warning / alarm) relates to Speed over the Ground and warns that SOG is too low for the Autopilot system to undertake the programmed/required radius of turn due to prevailing conditions (SOG too low vs drift etc.). **Speed increase required.**

NOTE: The “Low Speed: Ship’s speed too low for HDG control” warning will escalate to an alarm if not acknowledged within 30 seconds.

**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**

### *HDG in fallback*

The “HDG in Fallback: <source 1> lost, normal HC using <source 2>” caution message will be activated if the Autopilot is engaged and an alternative heading source is used (<source 2>) due to the failure of the heading source in use.

Possible messages are:

- HDG in Fallback: Step HDG lost, normal HC using Gyro 1
- HDG in Fallback: Step HDG lost, normal HC using Gyro 2
- HDG in Fallback: Step HDG lost, normal HC using Mag compass
- HDG in Fallback: Gyro 1 lost, normal HC using Gyro 2
- HDG in Fallback: Gyro 1 lost, normal HC using Mag compass
- HDG in Fallback: Gyro 1 lost, normal HC using Step HDG
- HDG in Fallback: Gyro 2 lost, normal HC using Gyro 1
- HDG in Fallback: Gyro 2 lost, normal HC using Mag compass
- HDG in Fallback: Gyro 2 lost, normal HC using Step HDG
- HDG in Fallback: Mag compass lost, normal HC using Gyro 1
- HDG in Fallback: Mag compass lost, normal HC using Gyro 2
- HDG in Fallback: Mag compass lost, normal HC using Step HDG

**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**

#### *No radius control*

Speed over the Ground (SOG) data is essential to Autopilot constant radius turn performance for which IEC61162-1 or -2-sentence-types \$XXVTG or \$XXVBW must be available.

If these sentence types are absent, the “No radius control: Radius control unavailable, no SOG data” caution message will be activated (check SOG Speed Data Source).

**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**

#### *No SPD adaptive*

Speed through the Water (STW) data is essential to Autopilot Speed Adaptive performance for which IEC 61162-1 or -2 sentence types \$XXVHW or \$XXVBW must be available.

Pulse log input (200 or 400 ppNm) is also acceptable but if none of these input types are present (No IEC61162 or Pulse) the “No SPD Adaptive: SPD adaptive control unavailable, no STW data” caution message will be activated (check STW Speed/Pulse Data Source).

**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**

## Operational Alarms

### *REM STR ON*

This alarm occurs if a AlphaPilot MFS Control Unit **REMOTE ON/OFF** button is operated to enable Remote Controls when a proprietary Remote Power Steer Control is already in an ON condition (**REMOTE ON/OFF** button action is suspended in this case and prevents inadvertent rudder application due to remotely located Power Steer Unit demands).

Switch 'off' Remote Power steer Station.

### *MASTER REM. OFF/REMOTE REQUEST*

This condition advises that another AlphaPilot MFS Control Unit request for system control has been denied because a Master Control Unit has been nominated and the **REMOTE ON/OFF** button of the master Control Unit has not been set to ON.

Another Control Unit will only gain entry when the master Control Unit has set the **REMOTE ON/OFF** button to ON.

### *NO ORIDE CAL*

No override cal – HSC requirement.

This alarm confirms that no cal data has been entered during initial High Speed vessel (HSC) installation and sea trials to provide safe angles of rudder - based on vessel speeds and associated safe rate of turns – when single or dual override controls are operated.

**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**

### *REMOTE FAIL*

This condition indicates no data received by the AlphaPilot MFS Distribution Unit from the selected Control Unit.

**NOTE: Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.**

### *RUDDER LIMIT*

The rudder limit setting is the maximum angle of rudder that the AlphaPilot MFS system is normally permitted to apply and is set – in degrees – via the **LIMITS** menu (accessible via the **CONTROL|LIMITS** button). If the maximum (limit) angle is attained, the alarm is activated.

## Diagnostic failure messages: Heading Sensors

### *CPS HI FAIL*

Signal from HSC is too large.<sup>1</sup>

### *CPS LO FAIL*

Signal from HSC too low.<sup>1</sup>

### *CPS PHS FAIL*

Signals from the 3 sense lines not consistent.<sup>1</sup>

### *COMPASS FAIL*

High ROT/Rate of change.<sup>1</sup>

### *HDT 1 FAIL*

Channel 1 input. An unreasonable rate of change of heading has been detected in the HDT (NMEA 0183) heading data. The HDT sentence has been inhibited and will not be re-enabled until the Autopilot Mode Switch set to **STANDBY**.<sup>1</sup>

It is also noteworthy that should the HDT data still be suspect when the AlphaPilot MFS system is switched ON, the next (lower) priority NMEA sentence will be read, and if the higher priority sentence is restored, this will automatically be accepted provided the heading value is within 15° of the current heading.

### *HDG 1 FAIL*

Channel 1 input. An unreasonable rate of change of heading has been detected in the HDG (NMEA 0183) heading data. The HDG sentence has been inhibited and will not be re-enabled until the Autopilot Mode Switch set to **STANDBY**.<sup>1</sup>

NOTE: The comments made in 'HDT 1 FAIL' reference filtering and 15° restoration provided within 15° of current heading are applicable to the HDG sentence.

### *HDM 1 FAIL*

Channel 1 input. An unreasonable rate of change of heading has been detected in the HDM (NMEA 0183) heading data. The HDM sentence has been inhibited and will not be re-enabled until the Autopilot Mode Switch set to **STANDBY**.<sup>1</sup>

NOTE: The comments made in 'HDT 1 FAIL' reference filtering and 15° restoration provided within 15° of current heading are applicable to the HDM sentence.

### *HCC 1 FAIL*

Channel 1 input. An unreasonable rate of change of heading has been detected in the HCC (NMEA 0183) heading data. The HCC sentence has been inhibited and will not be re-enabled until the Autopilot Mode Switch set to **STANDBY**.<sup>1</sup>

NOTE: The comments made in 'HDT 1 FAIL' reference filtering and 15° restoration provided within 15° of current heading are applicable to the HCC sentence.

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<sup>1</sup> Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.

#### *HDT 2 FAIL*

Channel 2 Input. Ditto HDT 1 FAIL.

#### *HDG 2 FAIL*

Channel 2 Input. Ditto HDG 1 FAIL.

#### *HDM 2 FAIL*

Channel 2 Input. Ditto HDM 1 FAIL.

#### *HCC 2 FAIL*

Channel 2 Input. Ditto HCC 1 FAIL.

#### *NO NMEA H`DG IN*

This alarm condition confirms that no NMEA heading data of any type is being received by the AlphaPilot MFS system.<sup>2</sup>

#### *CCA DAT FAIL*

This alarm condition occurs if only one heading data input (no second heading data input) is available for comparison purposes. The CCA will function with two heading inputs and will compare the two highest priority sources nominated via the AlphaPilot MFS system Set Up Menu.<sup>2</sup>

#### *STEP FAIL*

This alarm condition confirms that no valid step-by-step data is available to the AlphaPilot MFS system.<sup>2</sup>

#### *STEP ALIGN*

This alarm condition occurs if step-by-step heading input data is interrupted requiring that the Autopilot heading indication be realigned when the step data is restored.<sup>2</sup>

#### Diagnostic failure messages: Miscellaneous

##### *L/SW OPEN*

This is an operational status alarm applicable to both Port and Starboard limit switches and is displayed on the AlphaPilot MFS Control Unit if either limit switch is rendered open circuit.<sup>2</sup>

##### *STEER`G FAIL*

Steering System Fail.<sup>2</sup>

#### **Solenoid Steering System**

This alarm is activated if the AlphaPilot MFS system has issued a rudder movement demand, but the steering system has failed to respond within a period of two seconds.

The alarm is automatically cancelled when the rudder starts to move and likely causes of this type of failure are as follows:

- i) Steering pump(s) not running.
- ii) Air in hydraulic system causing delayed rudder response.

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<sup>2</sup> Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.

- iii) Rudder at maximum limit as defined by limit switch settings.

NOTE: An open circuit limit switch (whether due to adjustment or defect) is signalled by the **L/SW OPEN** alarm.

- iv) No rudder demand outputs from AlphaPilot MFS Control Unit or defective solenoid(s):

### **ASI Analogue Steering Systems**

Provided continuous rudder position feedback is available and the ASI Steering Fail monitor is turned ON, the AlphaPilot MFS system will monitor the Rudder position (as indicated by the Rudder Feedback signal) and compare it to the demanded position.

When the Rudder approaches the demanded position, if the final position when the rudder has stopped remains greater than the set limit value for more than two seconds, and the rudder is not moving towards the correct position, then the steering fail alarm is activated. The alarm is automatically cancelled if the rudder moves towards the correct position or the error is within the set limit.

Likely causes are:

- i) Analogue steering machine not operating or not set for AlphaPilot MFS system control.
- ii) Rudder at maximum physical limit.
- iii) Rudder not at demanded angle due to incorrect calibration of AlphaPilot MFS Distribution Unit Output Gain.

### *RRU FAIL*

This error message warns that an abnormally high rate of change or step voltage – 40 change has been detected from the RRU potentiometer, which is used to signal rudder position.<sup>3</sup>

This might be caused by a 'noisy' or open circuit potentiometer track, damaged wiring, or intermittent feedback connections. Loose joints or 'backlash' in the mechanical linkage between RRU and rudder stock may also be a contributory factor.

The AlphaPilot MFS Control Unit display provides two-digit rudder angle data and can be used to provide an accurate indication of the RRU potentiometer integrity as follows:

Set the AlphaPilot MFS system to standby and use manual steering control to move the rudder from hard over Port to hard over Starboard observing the two-digit display in the process. If the indicated rudder angle fails to follow the rudder smoothly and accurately, a potentiometer fault is indicated.

### *Ethernet Alarms*

#### *ETHERNET FAIL*

No Data received on Ethernet.<sup>3</sup>

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<sup>3</sup> Contact a certified installation company approved by either ALPHATRON MARINE or by an official ALPHATRON MARINE distributor for support.