Satellite Compass
STD 21 GPS

Type 110–850

1 Description
2 Operation
3 Installation and setting to work

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Please note that all ships of 500 gross tonnage and upwards according to SOLAS and other international regulations must be equipped with a gyro compass. The gyro compass must be operational. For this reason it is not allowed to have a switched-off gyro compass during voyages.

For the application “GPS Compass in combination with Gyro compass STD 22” see also respective manuals:
Manual no.: 3646 for Gyro compass STD 22
Manual no.: 3648 for Operating Unit

After an alarm message occurs and the reason for this alarm is eliminated either automatically or by repair, the displayed heading has to be checked. In case of an implausible heading value, the GPS Compass should be switched OFF and ON again.
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Parts Catalogue
Konformitätserklärung / Declaration of Conformity
gemäß / according to: ISO / IEC Guide 22
Nr. KE012.ISO_IEC.doc

Hersteller / Manufacturer:
Raytheon Marine GmbH

Produkt / Product:
Steuerkurstransmitter GNSS Methode
Transmitting Heading Device GNSS principles

Produktnname:
Satellite Compass

Typ / Type:
Anschütz Standard 21 GPS

Bestehend aus:
Processor Unit Type: 114-001
Antenna Unit Type: 114-002
Operator Unit Type: 130- 613

Das oben beschriebene Produkt ist
konform mit:
EMV-Richtlinie 89/336EWG
92/32/EWG, 93/68/ EWG

The above mentioned
equipment complies with:
EC-Directive 89/336EC
92/32/EC, 93/68/EC

und wurde geprüft gemäß/
and was tested according to:

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<th>Title</th>
<th>Edition</th>
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<tr>
<td>EN 60945</td>
<td>Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results</td>
<td>08/2002</td>
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Kiel, 11.05.2005

Raytheon Marine GmbH
Leiter Qualitätsmanagement / Head of Quality Management

Qualification / Certification

Martin Wioka

Gunther Krappe

KE012.ISO_IEC.doc 1 / 1
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1 General

The Satellite Compass STD 21 GPS uses GPS signals to produce ship's heading information. It can be used as a compass sensor for repeaters, radars, electronic chart systems, AIS, scanning sonars, autopilots, TV antennas and other commercial heading receivers.

Figure 1: STD 21 GPS -System overview-
1.1 Satellite Compass STD 21 GPS (stand-alone system)
1.2 General principle of CAN bus
(CAN = Controller Area Network)

The CAN bus is a multi-master bus allowing the connection of all devices and systems regardless of their task and function. This means that any number of devices can be connected. These devices must be designed for CAN bus technology. It is essential that every CAN bus user is addressable via a unique address. This address is set within each bus user. The usable address range is from $01_{16}$ to $3F_{16}$ (address $00_{16}$ is reserved for development purposes). Each bus user can send and receive data via the CAN bus.

The CAN bus must be terminated at both ends via an ohmic resistor (125 ohms). This terminating resistor is activated by jumpers on the respective printed circuit board (PCB).

There are 2 redundant bus systems (CAN1 and CAN2).

The maximum length of a CAN bus cabling must not be longer than 300 meters!!!

Figure 2: General principle of CAN bus technology
1.3 Principle of Operation

The Raytheon Marine/Anschütz STD 21 GPS compass uses continuous carrier phase measurements of two GPS antennas aligned to the ship’s longitudinal axis for relative positioning. Relative positioning means that state of the art algorithms exploit the carrier phase measurements and the broadcast satellite ephemeris for precise computation of the baseline vector pointing from the aft antenna to the fore antenna. Then, the baseline vector’s continuously computed north, east, and down coordinates can easily be converted to polar co-ordinates, that is, pitch and heading signals.

In order to bridge over short-term satellite signal looses, e.g. signal blockage or electromagnetic interference, the STD 21 GPS-/INS compass incorporates gyros. These hard-mounted devices measure the ship’s three-dimensional angular rates for continuous integration of the ship’s roll, pitch, and heading angles. The integration is also executed during GPS satellite signal reception. Thus, the differences between the integrated and GPS-derived pitch and heading angles may be computed. When combining these angular differences with a gyro model through an optimal estimation algorithm, the gyros become precisely calibrated, thus allowing a longer and more accurate bridging of satellite signal outages.

Availability of STD 21

A satellite compass is not an autonomous device as is a gyro compass. Thus, the STD 21 satellite compass does not have the availability of the STD 22 gyro compass.

The reasons for the slightly reduced availability which holds for any satellite compass are:

➤ Exploitation of extremely low-power satellite carrier signals,
➤ Use of statistical methods within the digital signal processing path,
➤ High sensitivity to multipath and signal blocking effects that adversely affect uninterrupted satellite signal reception at the Antenna Unit.

Nevertheless, the STD 21 has a proven – through long term testing – availability of 99.9% if installed in accordance with this manual.

Installation of the STD 21

A satellite compass like the STD 21 exploits the carrier phases of GPS satellite signals when computing the heading angle based on the principle of interferometry.
The GPS L1 carrier has a wavelength of 19 cm which is much smaller than the 100 m chip length of the modulated C/A ("Clear Access") pseudo-random noise code used for GPS satellite positioning. Thus, obstacles of correspondingly small size disturb the heading determination process. The satellite compass is much more susceptible to obstacles than a satellite positioning receiver.

Consequently, extreme care is required when installing the STD 21 Antenna Unit. Proper operation is only effective if the installation requirements detailed in Chapter 3.2 "Installation of the Antenna Unit" have been met!

1.4 Scope of delivery

For a complete system the following parts are delivered:

- Operator Unit Type 130–613
- Antenna Unit Type 114–002 (including mounting kit)
- Processor Unit Type 114–001
- Antenna cable between Antenna Unit and Processor Unit Type NB60–144 (30m)
- 2 Connection Cables between Processor Unit and Operator Unit Type NB60–143 (2x6m)
- Power cable between Processor Unit and Operator Unit Type NB60–146 (6m)

- Manuals:

  - Operator Unit Manual No: 3648
    for installation and general operating functions
  
  - STD 21 GPS Manual No: 3717
    for description, operation, installation, maintenance and trouble shooting

1.4.1 Available options

- Additional Output Box (for step output, 6 steps/degree)
- Digital and Analog Repeaters
- Bearing Repeater
- Multi Display
- NMEA Booster
- Power Supply
1.5 Technical Data

1.5.1 Mechanical Data

For mechanical data such as dimensions, weight, or type of enclosure, see the respective dimensional drawing in this manual.

1.5.2 System Data

Accuracy: 0.5° (RMS)
Min. number of satellites necessary: 5
Angular resolution: 0.1°
Interfaces:
- 2x CAN Bus (CAN 1 and CAN 2)
- 2x serial (Anschütz Course bus or NMEA 0183)
- 2 x Status Contacts (System and Heading Fault)
Supply voltage: 10–36 VDC
Operating temperature ranges:
- Processor Unit: −15°C to +55°C
- Antenna Unit: −25°C to +55°C
Power consumption (System): appr.15W

1.5.3 Display modes

- Digital heading
- Tape repeater (analog heading)
- Rate of Turn (ROT)
- Roll and Pitch
- Satellite position
- Satellite status

For information only:
- SOG (speed over ground) and COG (course over ground)
- Latitude and Longitude (displayed as WGS ‘84, WGS = World Geodetic System)
- ROT (50 Hz and 1 Hz)

NMEA messages:
For conclusions and dependencies for NMEA messages/telegrams see section 4.4.2.
2 Operation

2.1 Safety Notes

Do not disassemble or modify the equipment. Failure to observe the instruction can cause a fire, electric shock, or equipment failure.

Do not handle the power cable or operate switches with wet hands, you may suffer an electric shock.

Operate the equipment only at a supply voltage from 12 – 36 VDC. Failure to observe this instruction can cause a fire, electric shock, or equipment failure.

Do not scratch, damage, or modify the power supply and antenna cables. They may cause a fire or electric shock if they are loaded with heavy items, heated, pulled, or excessively bent.

Immediately turn the power OFF and disconnect the power cable if the equipment is generating any smoke or odour, or found overheating.

Equipment under such conditions can cause a fire or electric shock.
2.1.1 Setting into operation

Caution!
Reduced accuracy may occur in the case of unfavorable satellite constellation.
Always verify position data against other navigation devices to confirm.

After switching-ON the system (supply voltage to the Processor Unit and to the Operator Unit) the Operator Unit starts up with a display which contains a blinking “Self-Test” followed by blinking “Initialization” and “Acquisition” phases. During these blinking indications, no heading value will be present.
After finishing this initialization procedure the basic display (see Figure 3) is displayed.

Please note:
After switching ON it will take approx. up to 4 minutes before one of the below mentioned displays will appear.
After switching ON for the very first time it will take approx. up to 20 minutes before one of the below mentioned displays will appear.

Figure 3: Example of a display after it has been set into operation (STD 21 GPS only – standalone system)

NOTE
Latitude and longitude are for information only!
2.1.2 Menu Structure

Appendix (A - 1) shows the menu structure within the Operating Unit of a standalone STD 21 GPS.
2.2 General adjustments and tests

2.2.1 Adjustment of brightness and contrast

Use the “Dim up” key (Figure 4/1) to make the display and the background illumination brighter and the “Dim down” key (Figure 4/2) to make it darker. This setting is retained even after the equipment has been switched off.

To adjust the contrast, press the “Dim up” (Figure 4/1) and “Dim down” (Figure 4/2) keys simultaneously. The display now changes:

Adjust the contrast using the “Contr. Up” (Figure 5/2) and “Contr. Down” (Figure 5/3) keys.

The display reverts on pressing the “Esc” key (Figure 5/1) or after a time out period of approximately 4 seconds.
2.2.2 Lamp Test

A Lamp Test during an alarm is not possible (see also section 3.6.1 “Alarm Handling”)

Figure 6: Controls and Indicators on the Operator Unit

Press and hold the softkey “Lamp Test” (Figure 6/1) for approx. 3 seconds. The LED above this soft key lights up, an acoustic alarm occurs (with selected volume, see section 2.3.8), the brightness increases, and an information “Lamp Test” is displayed inverse (see Figure 7).

Figure 7: Controls and Indicators on the Operator Unit (During Lamp Test)
2.3 Displays

2.3.1 Display “GPS Pos.” (Basic Display)

This display is shown after finishing the initialization procedure. This display shows heading in numerical form and position values (latitude and longitude). The position is for information only.

Figure 8: Display “GPS Pos.” (Basic Display)

<table>
<thead>
<tr>
<th>Soft Key</th>
<th>Meaning</th>
<th>refer to section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Menu</td>
<td>Select additional menus to:</td>
<td>see sections 2.3.8 and 2.3.9</td>
</tr>
<tr>
<td></td>
<td>- Check CAN Bus addresses</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Check software version</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Set volume</td>
<td></td>
</tr>
<tr>
<td>GPS Config.</td>
<td>Select additional displays to evaluate satellite information or constellation.</td>
<td>see sections 2.3.6 and 2.3.7</td>
</tr>
<tr>
<td></td>
<td>Select setup menu for:</td>
<td>see section 3.5</td>
</tr>
<tr>
<td></td>
<td>- The Antenna Unit and Processor Unit installation positions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- System Configuration</td>
<td></td>
</tr>
<tr>
<td>GPS Hdg.</td>
<td>Select the display “GPS Hdg.” (Heading is displayed in large numbers)</td>
<td>see section 2.3.2</td>
</tr>
<tr>
<td>Dim up</td>
<td>Brightness control / Contrast control</td>
<td>see section 2.2.1</td>
</tr>
<tr>
<td>Dim down</td>
<td>Brightness control / Contrast control</td>
<td>see section 2.2.1</td>
</tr>
<tr>
<td>Lamp Test</td>
<td>Check the lamp, buzzer and brightness</td>
<td>see section 2.2.2</td>
</tr>
</tbody>
</table>
2.3.2 Display “GPS Hdg.”

This display is selected by operating “GPS Hdg.” button in the display “GPS Pos.” This display shows heading in large numbers.

![GPS Hdg. Display]

Figure 9: Display “GPS Hdg.”

<table>
<thead>
<tr>
<th>Soft Key</th>
<th>Meaning</th>
<th>refer to section</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS Pos.</td>
<td>Select basic menu “GPS Pos.” (Heading information together with latitude and longitude information)</td>
<td>see section 2.3.1</td>
</tr>
<tr>
<td>GPS Tape</td>
<td>Select the display “GPS Tape” (Heading in normal numbers together with a tape-formed heading information)</td>
<td>see section 2.3.3</td>
</tr>
<tr>
<td>Lamp Test</td>
<td>Check the lamp, buzzer and brightness</td>
<td>see section 2.2.2</td>
</tr>
</tbody>
</table>
2.3.3 Display “GPS Tape”

This display is selected by operating “GPS Tape” button in the display “GPS Hdg.” It displays heading in numerical form and also in tape form.

![Diagram of GPS Tape display](image)

Figure 10: Display “GPS Tape”

<table>
<thead>
<tr>
<th>Soft Key</th>
<th>Meaning</th>
<th>refer to section</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS Pos.</td>
<td>Select basic menu “GPS Pos.” (Heading information together with latitude and longitude information)</td>
<td>see section 2.3.1</td>
</tr>
<tr>
<td>GPS Config.</td>
<td>Select additional displays to evaluate satellite information or constellation.</td>
<td>see sections 2.3.6 and 2.3.7</td>
</tr>
<tr>
<td></td>
<td>Select a setup menu for:</td>
<td>see section 3.5</td>
</tr>
<tr>
<td></td>
<td>- Antenna Unit and Processor Unit installation positions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- System Configuration</td>
<td></td>
</tr>
<tr>
<td>GPS ROT</td>
<td>Selection of the display “GPS ROT” (Heading is displayed in normal numbers together with a numerical and graphical information of Rate of Turn)</td>
<td>see section 2.3.4</td>
</tr>
<tr>
<td>Dim up</td>
<td>Brightness control / Contrast control</td>
<td>see section 2.2.1</td>
</tr>
<tr>
<td>Dim down</td>
<td>Brightness control / Contrast control</td>
<td>see section 2.2.1</td>
</tr>
<tr>
<td>Lamp Test</td>
<td>Check of lamp, buzzer and brightness</td>
<td>see section 2.2.2</td>
</tr>
</tbody>
</table>
2.3.4 Display “GPS ROT”

This display is selected by operating “GPS ROT” button in the display “GPS Tape”. This display shows heading and Rate of Turn in numerical form and a tendency indication (graphically) - ROT is for information only.

![Display “GPS Tape”](image_url)

Figure 11: Display “GPS Tape”

<table>
<thead>
<tr>
<th>Soft Key</th>
<th>Meaning</th>
<th>refer to section</th>
</tr>
</thead>
</table>
| GPS Pos.   | Select basic menu “GPS Pos.”  
(Heading information together with latitude and longitude information) | see section 2.3.1 |
| GPS Config.| Select additional displays to evaluate satellite information or constellation. 
Select a setup menu for: 
- Antenna Unit and Processor Unit installation positions 
- System Configuration | see sections 2.3.6 and 2.3.7 see section 3.5 |
| GPS Angles | Select the display “GPS Angles”  
(Heading is displayed in normal numbers together with a numerical displays of SOG (Speed over Ground), COG (Course over Ground), Roll and Pitch) | see section 2.3.5 |
| Dim up     | Brightness control / Contrast control                                   | see section 2.2.1 |
| Dim down   | Brightness control / Contrast control                                   | see section 2.2.1 |
| Lamp Test  | Check the lamp, buzzer and brightness                                   | see section 2.2.2 |
2.3.5 Display “GPS Angles”

This display is selected by operating "GPS Angles" button in the display “GPS ROT”. This display shows heading, COG, SOG, Roll and Pitch information in numerical form. COG and SOG are for information only.

![Diagram of GPS display with headings and values]

Figure 12: Display “GPS Angles”

<table>
<thead>
<tr>
<th>Soft Key</th>
<th>Meaning</th>
<th>refer to section</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS Config.</td>
<td>Select additional displays to evaluate satellite information or constellation. Select a setup menu for: - Antenna Unit and Processor Unit installation positions - System Configuration</td>
<td>see sections 2.3.6 and 2.3.7 see section 3.5</td>
</tr>
<tr>
<td>GPS Pos.</td>
<td>Select basic menu “GPS Pos.” (Heading information together with latitude and longitude information)</td>
<td>see section 2.3.1</td>
</tr>
<tr>
<td>Dim up</td>
<td>Brightness control / Contrast control</td>
<td>see section 2.2.1</td>
</tr>
<tr>
<td>Dim down</td>
<td>Brightness control / Contrast control</td>
<td>see section 2.2.1</td>
</tr>
<tr>
<td>Lamp Test</td>
<td>Check the lamp, buzzer and brightness</td>
<td>see section 2.2.2</td>
</tr>
</tbody>
</table>
2.3.6 Display “Satellite Status”

This display is selected by operating “GPS Config.” button in the following displays: “GPS Pos.” (Basic Display), “GPS Tape”, “GPS ROT”, or “GPS Angles”

This display shows information about exploitable satellites. This can be useful for heading determination.

![Diagram of Satellite Status Display]

**Table: Satellite Status**

<table>
<thead>
<tr>
<th>No.</th>
<th>Number</th>
<th>Specific number of the satellite.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Az.</td>
<td>Azimuth</td>
<td>Direction (referring north) of the satellite, display 0 to 359 (degree).</td>
</tr>
<tr>
<td>El.</td>
<td>Elevation</td>
<td>Angle value, position (height) of the satellite referring to the horizon, display 0 to 90 (degree).</td>
</tr>
<tr>
<td>SNR</td>
<td>Signal to Noise Ratio</td>
<td>Dimension to judge the quality of the satellite signal. The higher the value, the better the signal.</td>
</tr>
</tbody>
</table>

**Soft Key**

<table>
<thead>
<tr>
<th>Soft Key</th>
<th>Meaning</th>
<th>refer to section</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS Pos.</td>
<td>Select basic menu “GPS Pos.” (Heading information together with latitude and longitude information)</td>
<td>see section 2.3.1</td>
</tr>
<tr>
<td>Sat Pos.</td>
<td>Select graphical satellite evaluation/correlation information</td>
<td>see section 2.3.7</td>
</tr>
<tr>
<td>Dim up</td>
<td>Brightness control / Contrast control</td>
<td>see section 2.2.1</td>
</tr>
<tr>
<td>Dim down</td>
<td>Brightness control / Contrast control</td>
<td>see section 2.2.1</td>
</tr>
<tr>
<td>Lamp Test</td>
<td>Check the lamp, buzzer and brightness</td>
<td>see section 2.2.2</td>
</tr>
</tbody>
</table>

Please note:
A minimum of 5 satellites are necessary for the normal operation modes. For synchronisation (after reaching a steady state) a minimum of 7 satellites are necessary.
2.3.7 Display “Satellite Sky Plot”

This display is selected by operating “Sat. Pos.” button in the display “Satellite Status”. This display shows the positions of the exploitable satellites. This can be useful for heading determination.

Position at the diameter shows the azimuth angle, distance from the center point shows the elevation angle, the number refers to the specific satellite number.

Figure 14: Display “Satellite Sky Plot” (Example)

<table>
<thead>
<tr>
<th>Soft Key</th>
<th>Meaning</th>
<th>refer to section</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS Pos.</td>
<td>Select basic menu “GPS Pos.” (Heading information together with latitude and longitude information)</td>
<td>see section 2.3.1</td>
</tr>
<tr>
<td>GPS Setup</td>
<td>Select menu - to align mounting angles for Antenna Unit and the Processor Unit - to set serial port data - to read out the software versions</td>
<td>see section 3.5</td>
</tr>
<tr>
<td>Dim up</td>
<td>Brightness control / Contrast control</td>
<td>see section 2.2.1</td>
</tr>
<tr>
<td>Dim down</td>
<td>Brightness control / Contrast control</td>
<td>see section 2.2.1</td>
</tr>
<tr>
<td>Lamp Test</td>
<td>Check the lamp, buzzer and brightness</td>
<td>see section 2.2.2</td>
</tr>
</tbody>
</table>
2.3.8 Panel Setup

The following instructions show how to adjust the buzzer volume and display the software version of the Operator Unit.

![Diagram of GPS display](image)

**Figure 15:** Display “GPS Pos.” (Basic display)

Start with the basic display (see Figure 15). Operate the soft key “Select Menu”, this displays the following menu (see Figure 16).

![Diagram of menu selection](image)

**Figure 16:** Display to select “Panel Setup” and “Service” Menus

With “Menu” selected in inverse, operate the soft key “Set” to display the display to select between “Panel Setup” and “Service” (see Figure 17).

Return to the basic display “GPS Pos.” by using soft key “Select Menu” to select “Exit” and then operating soft key “Set”, or automatically after approx. 10 seconds.
Select “Panel Setup” using soft key “Select Menu” and then operating the soft key “Set”. Return to the basic menu “GPS. Pos” by using “Select Menu” to select “Exit” and then operating “Set”, or automatically after approx. 10 seconds.

Operate soft key “Select” to select the desired volume.
Volume 1 is the lowest volume, volume 4 is the maximum.
Operate the soft key “Test Horn” to test the selected volume.
Operate the soft key “Set” to apply the selected volume.
Return to the basic menu “GPS. Pos” either with “Select” to “Exit” and then operating soft key “Set”, or automatically after approx. 10 seconds.
PLEASE NOTE: The volume must be adjusted in accordance with background noise. An alarm has to be recognized clearly under all operating conditions of the ship.
2.3.9 Service

The following instructions show how to display the addresses of the CAN bus participants. This menu will also serve for service information/settings in the future.

![Figure 19: Display “GPS Pos.” (Basic display)](image)

Start with the basic display (see Figure 19). Operate the soft key “Select Menu” to display the following menu (see Figure 20).

![Figure 20: Display to select “Panel Setup” and “Service” menus](image)

With “Menu” selected in inverse, operate the soft key “Set” to display the display to select between “Panel Setup” and “Service” (see Figure 21).

Return to the basic display “GPS Pos.” by using “Select Menu” to select “Exit” and then operating “Set”, or automatically after approx. 10 seconds.
Figure 21: Display to select “Service”

Select “Service” with soft key “Select Menu” and then operate the soft key “Set”. Return to the basic menu “GPS. Pos” by using soft key “Select” to select “Exit” and operating “Set”, or automatically after approx. 10 seconds.

Figure 22: Display “Service”

Select “CAN-Devices” with soft key “Select” and then operate the soft key “Set”. Return to the basic menu “GPS. Pos” by using soft key “Select” to select “Exit” and operating “Set”, or automatically after approx. 10 seconds.
Figure 23: Display “CAN-Devices” (Example)

Display “CAN-Devices” shows the CAN-Bus addresses of
- Operator Unit (OPU) = 01 (decimal)
- Processor Unit (GPS) = 10 (decimal)

Addresses are displayed in decimal form.

A CAN-Bus address should never be twice in a system.

Return to the “Service” menu by selecting “Exit” and operating “Set”, or automatically after the service time out (max. 60 seconds).
Intentionally left blank
3 Installation

For installation and the cable connections see also appended drawings:

- Processor Unit Dimensional Drawing 114-001.HP005
- Processor Unit Cable and Connection Diagram 114-001.HP009
- Antenna Unit Dimensional Drawing 114-002.HP005
- GPS Compass STD. 21 Cable and Connection Diagram (2x) 110-850.HP008
- Operator Unit Dimensional Drawing 130-613.HP005
- AC/DC Converter Dimensional Drawing 121-062.HP005
- AC/DC Converter Wiring Diagram 121-062.HP008

Overview of the installation procedure:
Follow the sequence below for a successful installation of the STD 21 GPS system
(manufacturers recommendation):

1. Installation of Antenna Unit see section 3.2
2. Installation of Processor Unit see section 3.3
3. Installation of Operator Unit see section 3.4
4. First time switching -ON see section 3.5
3.1 Safety instructions and mounting recommendations

**Warning!**
Use care during maintenance and repair to avoid contact with energized electrical conductors. Applicable safety regulations must be followed, such as VDE, BGV A3, OSHA 1919, and other consensus safety standards.
When establishing cable connections ensure that the cables are disconnected from the power supply.
It is essential to ensure that all cables are disconnected from the power supply, if necessary measure the voltage beforehand and/or disconnect the relevant distributor.

**Caution!**
Maintenance and repair must be performed by trained and qualified personnel who are knowledgeable in equipment safety requirements!

Device may be damaged!
Exchange of spare parts, a subgroup or PCB when power is on can cause severe damage to the equipment.

Observe precautions for handling electrostatic sensitive devices.

While connecting cables to the equipment, do not bend cables to an acute angle, pinch, twist, or impart excessive force. Cracks or damage to the cable coating can cause a fire or electric shock.
General recommendations for a secure installation:

- Do not install the Antenna Unit during a thunder storm.
- During installation of the Antenna Unit, no other antennas should be in active operation.
- Applicable national safety regulations must be followed while working in the ships mast.
- Do not touch PCB’s or components inside of the Processor Unit and inside of the Operator Unit (electrostatic sensitive devices).
- Do not touch the accelerometers and the 3-axis sensor (triade) inside the Processor Unit.
- Do not leave anything behind (cuttings, tools) in the housing of the Processor Unit after connecting the cables.

Install equipment at a distance away from magnetic equipment per recommendations labelled on the respective equipment.
3.1.1 General remarks for establishing cable connections

Caution
When establishing cable connections ensure that the cables are disconnected from the power supply.
It is essential to ensure that all cables are disconnected from the power supply, if necessary measure the voltage beforehand and/or disconnect the relevant distributor.

In order to ensure that the system operates correctly, it is essential that you adhere to the following procedures for establishing cable connections.

- Strip approx. 180mm off the cable.
  Do not damage the shielding layer.

- Strip off the shielding as shown in Figure 24.

![Figure 24] How to strip the connection cable

- Screw the cable gland out from the respective housing and push the screw connection components over the cable.
  It is absolutely essential that the sequence (as shown in Figure 25) is adhered to.
- Check the cone and counterpart on the earthing insert for corrosion and, if necessary, remove corrosion.
- Push the counterpart of the earthing insert as far as the end of the cable shield.
- Push the earthing insert cone below the shielding against the counterpart. Observe a shared even distribution of the shielding via the cone (see Figure 25).

Figure 25  Making the cable entry

- Insert the earthing insert, the seal, and the washer into the cable gland, place the counter nut on top and hand-tighten.
- Strip the cable cores to a length of approx. 15mm, twist slightly and clamp on the cable end sleeves. Connect the cable wires in the respective housing. Hand-tighten the terminal screws concerned.
- Check the connection is firm by pulling lightly.
Figure 26: Example of a cable connection at the Processor Unit
3.1.2 General information about establishing a common ground connection

In order to comply with the stringent EMC requirements, please abide by the information given below regarding cable connections.
Use the cable types specified.

![Warning]

It is essential to ensure that these connections have a **common** reference to the ship’s common ground.
Any additional components (options) must also be connected to the common ground!

Figure 27: Establishing a common ground connection

All common ground connections must be made as shown in Figure 27.
The earthing cable attached to the cable bracket must possess a cross-section of minimum 1.5 mm².
The cable bracket should be mounted between two toothed washers.
Common ground connections must be free of corrosion and well fastened.
3.2 Installation of Antenna Unit

3.2.1 Comments and recommendations for Antenna Unit location

The satellite signal received from the satellites by the Antenna Unit is very weak. Small signal interferences influence the reception quality and the indicated heading information quality.

Reasons for signal interferences can be:
- Masks caused by buildings or bridges (mostly in a harbor area), or mountains may prevent the Antenna Unit from receiving signals.
- Masks caused by superstructures such as bridges, masts, funnels or cranes may disturb reception.
- Signal reflections caused by metallic and/or or wet surfaces influence the signal receipt by a time-delayed reception.
- Placement of the Antenna Unit within radar or SATCOM beams may disturb reception.
- VHF-antennas may influence GPS signal receipt if the distance between the VHF-antenna and the Antenna Unit is less than 2 meters (influences caused by other antennas must be tested).

![Warning]
Observe the position of the Antenna Unit (fore and aft label).

To prevent all above mentioned influences to satellite signal reception, the best placement for the Antenna Unit is at the top of the highest mast.

Please note section 3.2.2 before installing the Antenna Unit.
### 3.2.2 Location of Antenna Unit

(See Figure 28, Figure 29, Figure 30 and Figure 31)

- Select a location where vibration and shock are minimal.
- Separate the Antenna Unit from the mast, depending on the diameter of the mast
  - Mast diameter 100mm with a distance of at least 1.5m (see Figure 28)
  - Mast diameter 300mm with a distance of at least 3.0m (see Figure 28)
- Locate the Antenna Unit at least 3.0 meters away from Inmarsat-B antenna and Radar antenna. Do not install the Antenna Unit within the transmit beam of the Inmarsat-B antenna (see Figure 30).
- Locate the Antenna Unit above the Radar antenna, out of the Radar beam (see Figure 29).
- Mount the Antenna Unit clear of interfering objects which may obstruct reception (see Figure 29).
- The mounting angles referring to ship’s centerline and ship’s baseline must not be more than 6° (see Figure 31).
- Do not install the Antenna Unit directly over funnel emissions.

<table>
<thead>
<tr>
<th>Mast Diameter</th>
<th>Distance Mast – Antenna Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>100mm</td>
<td>min 1.5m</td>
</tr>
<tr>
<td>300mm</td>
<td>min 3.0m</td>
</tr>
</tbody>
</table>

![Figure 28: Distance Mast – Antenna Unit (manufacturers recommendation)](image)

**Warning:** The Antenna Unit should not be installed on a mast made of wood or plastic material, otherwise a separate common ground connection must be made from the Antenna Unit to the common ground.
An open space from appr. 160° which allows uniform reception of satellite signals

- 10°

not within the main Radarbeam

not in shadow of a mast or a funnel

Away from the Radar antenna

Away from whip antenna

In general:
- as high as possible
- as far away from other antennas as possible

Figure 29: Principle of an Antenna Unit location
Figure 30: Antenna Unit location referring to SATCOM antennas

An installation of the Antenna Unit within the beam of SATCOM may influence the satellite signal reception.
The mounting angles (trim and course) have to be adjusted at the Operator Unit. An estimated trim angle and a course angle (compared to pier-course or other heading reference) must be set up in the Operator Unit.

Deviation from the ship's centerline and/or the baseline (within the tolerances) have to be adjusted, see section 3.5.5.
3.2.3 Connecting the antenna cable

Manufacturers recommendation:
First connect the antenna cable to the terminal board at the antenna box, then install the Antenna Unit to the ship’s mast.

The cable between the Antenna Unit and the Processor Unit is part of delivery with the part no. NB60-144. This cable should be lengthened to a practicable length.

- Strip the complete cable entry over the antenna cable (see Figure 32).
- Strip off the shielding to a practicable length of cores. The shield should be stripped off in a way such that the cores can be led from the cable inlet to the terminal board without mechanical stress.
  Too long cable cores can lead to EMC problems.
- Lead the cable through the cable inlet of the housing (strain and counter nut outside and cone with shielding crimp inside the housing)
- Connect the screen (separate core) to the cone.
- Fasten the cable inlet with the counter nut.
- Connect the cores to the terminal board B1 (note the core colors) (see Figure 33) according to appended drawings or to the table below.
### Terminal Designation and Connection

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Designation</th>
<th>connected to Processor Unit terminal board A1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PPS + (pulses per second)</td>
<td>PPS+</td>
</tr>
<tr>
<td>2</td>
<td>PPS- (pulses per second)</td>
<td>PPS-</td>
</tr>
<tr>
<td>3</td>
<td>0VDC (Antenna Unit supply)</td>
<td>0VDC</td>
</tr>
<tr>
<td>4</td>
<td>24VDC (Antenna Unit supply)</td>
<td>24VDC</td>
</tr>
<tr>
<td>5</td>
<td>TX2– (Transmit data, RS422 interface 2)</td>
<td>RX2–</td>
</tr>
<tr>
<td>6</td>
<td>TX2+ (Transmit data, RS422 interface 2)</td>
<td>RX2+</td>
</tr>
<tr>
<td>7</td>
<td>RX2– (Receive data, RS422 interface 2)</td>
<td>TX2–</td>
</tr>
<tr>
<td>8</td>
<td>RX2+ (Receive data, RS422 interface 2)</td>
<td>TX2+</td>
</tr>
<tr>
<td>9</td>
<td>TX1– (Transmit data, RS422 interface 1)</td>
<td>RX1–</td>
</tr>
<tr>
<td>10</td>
<td>TX1+ (Transmit data, RS422 interface 1)</td>
<td>RX1+</td>
</tr>
<tr>
<td>11</td>
<td>RX1– (Receive data, RS422 interface 1)</td>
<td>TX1–</td>
</tr>
<tr>
<td>12</td>
<td>RX1+ (Receive data, RS422 interface 1)</td>
<td>TX1+</td>
</tr>
<tr>
<td>13</td>
<td>Reference to RS422</td>
<td>GND</td>
</tr>
</tbody>
</table>

* Terminal board/Antenna Unit with development status E02

Figure 33: Antenna Unit, connecting the cable cores
3.3 Installation of the Processor Unit

3.3.1 Mounting recommendations

Depending on the accelerometer integrated in the Processor Unit, there is a restricted number of mounting positions.

The designation of the mounting position must be set immediately after installation or changes to the mounting position.

General recommendations to install the Processor Unit:

- Choose a location where vibration and shock are minimal.
- Install the Processor Unit away from locations subject to rain and water splash.
- Locate the Processor Unit away from air conditioner vents.
- Keep the Processor Unit out of direct sunlight to prevent overheating.
- Choose a well-ventilated location.

The Processor Unit can be installed in 8 different positions. See Figure 34 and Figure 35 for possible installation positions. See Figure 36 for restrictions on the Processor Unit mounting angle. This mounting position must be set via the Operator Unit, see section 3.5.4.

The horizontal installation of the Processor Unit may be verified by using a bubble level if there is a calm sea state and the ship’s centre line is horizontal.
Figure 34: Ceiling installation of Processor Unit
Figure 35: Floor installation of Processor Unit
Figure 36: Restrictions on mounting angle of the Processor Unit

not greater than $\pm 6^\circ$
3.3.2 Connecting the antenna cable to the Processor Unit

The cable between the Antenna Unit and the Processor Unit is part of delivery with the part no. NB60-144. This cable should be lengthened to a practicable length.

The antenna cable should be fastened with tie-wraps if it will not be internal to the mast. The cable must be routed to the Processor Unit and affixed by appropriate elements. The antenna cable must be securely fixed. Ensure there is enough slack in the cable where it attaches to the Processor Unit so that the cable connection is not stressed.

Except the Antenna Unit no additional connections should be made at this terminal board!

Figure 37: Cable connection of antenna cable at the Processor Unit

The cable has to be stripped off and laid according to section 3.1.1. The cable cores have to be connected into the terminals according to appended drawings or according to the table below.
<table>
<thead>
<tr>
<th>Terminal</th>
<th>Designation</th>
<th>connected to antenna box terminal board B1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PPS + (pulses per second)</td>
<td>PPS+</td>
</tr>
<tr>
<td>2</td>
<td>PPS- (pulses per second)</td>
<td>PPS-</td>
</tr>
<tr>
<td>3</td>
<td>0VDC (Antenna Unit supply)</td>
<td>0VDC</td>
</tr>
<tr>
<td>4</td>
<td>24VDC (Antenna Unit supply)</td>
<td>24VDC</td>
</tr>
<tr>
<td>5</td>
<td>RX2- (Transmit data, RS422 interface 2)</td>
<td>TX2-</td>
</tr>
<tr>
<td>6</td>
<td>RX2+ (Transmit data, RS422 interface 2)</td>
<td>TX2+</td>
</tr>
<tr>
<td>7</td>
<td>TX2- (Receive data, RS422 interface 2)</td>
<td>RX2-</td>
</tr>
<tr>
<td>8</td>
<td>TX2+ (Receive data, RS422 interface 2)</td>
<td>RX2+</td>
</tr>
<tr>
<td>9</td>
<td>RX1- (Transmit data, RS422 interface 1)</td>
<td>TX1-</td>
</tr>
<tr>
<td>10</td>
<td>RX1+ (Transmit data, RS422 interface 1)</td>
<td>TX1+</td>
</tr>
<tr>
<td>11</td>
<td>TX1- (Receive data, RS422 interface 1)</td>
<td>RX1-</td>
</tr>
<tr>
<td>12</td>
<td>TX1+ (Receive data, RS422 interface 1)</td>
<td>RX1+</td>
</tr>
</tbody>
</table>
3.3.3 Connecting the supply voltage to the Processor Unit and the Operator Unit

Figure 38: Power supply connection to the Processor Unit

Recommended cable type is 1.5 to 2.5mm², shielded (supply voltage to the Processor Unit).
Strip off and lay the cable according to section 3.1.1. The cable cores must be connected to the terminals according to appended drawings or to the table below.

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24 VDC supply voltage input Processor Unit–extendable for external supply</td>
</tr>
<tr>
<td>2</td>
<td>0 VDC supply voltage input Processor Unit–extendable for external supply</td>
</tr>
<tr>
<td>3</td>
<td>Case housing–extendable for external supply</td>
</tr>
<tr>
<td>4</td>
<td>24 VDC supply voltage output to Operator Unit</td>
</tr>
<tr>
<td>5</td>
<td>0 VDC supply voltage output to Operator Unit</td>
</tr>
</tbody>
</table>

The Operator Unit supply voltage also must be connected at terminal board C1. The connection cable is part of the delivery with the part no. NB60–146.
For the connections at the Operator Unit, see section 3.4.4.2.

Note: Practice has shown that a ship’s 24V DC supply may be adversely affected by generators or other power consumers. Therefore, in order to secure the proper operation of the STD 21 GPS, it is highly recommended to supply the STD 21 GPS, as well as the heading receivers connected through the Ports 3 and 4, through an AC/DC converter in accordance with the cable and connection diagrams 114–001.HP009 and 110–850.HP008.
3.3.4 Connecting the CAN bus to the Processor Unit

Connected with cable no.: NB60-143

Figure 39: Making the connections to the plugs for the CAN-Bus
3.3.4.1 Check of jumper settings for the CAN bus termination

Jumper X303 for CAN 2 termination

Jumper X302 for CAN 1 termination

Figure 40: Termination for CAN bus

For the STD 21 GPS (stand alone) both jumpers must be inserted (default). For Operator Unit CAN bus jumpers, see section 3.4.4.3.

The above mentioned jumper settings have to be set if the Processor Unit is at one end of the CAN bus.

This is true if the STD 21 GPS is a standalone system with one Processor Unit and one Operator Unit.

If more than these two devices are connected to a CAN bus, then only the end-devices of the CAN bus must be jumpered. All other devices must not be jumpered (see also section 1.2).
3.3.5 Connecting Heading Receiver to the Processor Unit

There are 2 terminal boards available to connect heading receivers to the Processor Unit. Both Port 3 and Port 4 can be set to dataformat NMEA 0183, fast NMEA 0183 or Anschütz Course Bus. The respective dataformat can be set via the Operator Unit and transmitted to the Processor Unit (see sections 3.5.2 and 3.5.3).

![Terminal Board A3 (Port #4)](image)

![Terminal Board A2 (Port #3)](image)

Figure 41: Connection of Heading Receivers

Recommended cable type is minimum 0.5mm², shielded cable. Strip off and lay the cable according to section 3.1.1. The cable cores must be connected to the terminals according to appended drawings or to the table below.

<table>
<thead>
<tr>
<th>Terminal</th>
<th>Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>TX- (to Heading Receiver)</td>
</tr>
<tr>
<td>2</td>
<td>TX+ (to Heading Receiver)</td>
</tr>
<tr>
<td>3</td>
<td>TX GND</td>
</tr>
<tr>
<td>4</td>
<td>RX+ (not used)</td>
</tr>
<tr>
<td>5</td>
<td>RX GND (not used)</td>
</tr>
<tr>
<td>6</td>
<td>RX- (not used)</td>
</tr>
</tbody>
</table>
3.3.6 Setting the DIP-switches for the STD 21 GPS at the Processor Unit
(CAN-Bus addresses and operating modes)

Devices which communicate on the CAN bus need a unique address. This address must be set with the DIP switch “Config” (see Figure 42). Switches 1 and 2 are responsible for this address. Set the switches according to the table below.

<table>
<thead>
<tr>
<th>Switch Configuration</th>
<th>CAN Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch 1 and 2 into the OFF position:</td>
<td>Company default!</td>
</tr>
<tr>
<td>Switch 1 into the ON position and switch 2 into the OFF position:</td>
<td>CAN Address 11</td>
</tr>
<tr>
<td>Switch 1 into the OFF position and switch 2 into the ON position:</td>
<td>CAN Address 12</td>
</tr>
<tr>
<td>Switch 1 and 2 into the ON position:</td>
<td>CAN Address 13</td>
</tr>
</tbody>
</table>

Switch 1 and 2 = Switch is insignificant for this function (continued on next page)
### Switch Settings

<table>
<thead>
<tr>
<th>Switch Configuration</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch 3 ON</td>
<td>ROT telegram in 1 Hz rate (otherwise in 50 Hz rate)</td>
</tr>
<tr>
<td>Switch 4 and 5 ON</td>
<td>Transmit HDT and RoT telegrams only</td>
</tr>
<tr>
<td>Switch 4 and 6 ON</td>
<td>Transmit THS heading telegrams instead of HDT telegrams</td>
</tr>
<tr>
<td>Switch 4, 5 and 6 ON</td>
<td>Transmit THS and RoT telegrams only</td>
</tr>
<tr>
<td>Standard NMEA output</td>
<td>HDT &amp; ROT &amp; GGA &amp; VTG &amp; DTM &amp; ZDA &amp; GSA</td>
</tr>
</tbody>
</table>

\[\checkmark\] = Switch is insignificant for this function

**NMEA messages:**
For conclusions and dependencies for NMEA messages/telegrams see section 4.4.2.

**ALL OTHER DIP-SWITCH SETTINGS ARE STRICTLY FORBIDDEN, THEY CAN LEAD TO MALFUNCTIONS OR DAMAGES**
3.4 Installation of Operator Unit

3.4.1 Assembly

The Operator Unit must be installed with the aid of dimensional drawing 130–613 HP005 either on an angled fixing bracket or desk-flush mounted. Make sure that the installation is resistant to sea-water.

3.4.2 Overview of switches, jumpers and plugs

1. Hexadecimal switch B24 (0 to F) for setting the device address
2. Hexadecimal switch B23 (0 to F) for setting the device address
3. Plug B1, either CAN 1 or RS422 Transmit (depending on jumper)
4. Plug B2, either CAN 2 or RS422 Receive (depending on jumper)
5. Jumper B14, CAN 2 – RS 422 (Receive)
6. Jumper B15, CAN 2 – RS 422 (Receive)
7. Jumper B13 (plugged – CAN1 Bus terminating resistor on end device only)
8. Jumper B12, CAN 1 – RS 422 (Transmit)
9. Jumper B16 (plugged – CAN2 Bus terminating resistor on end device only)
10. Jumper B11, CAN 1 – RS 422 (Transmit)
11. Plug B7, voltage supply (9–36 V d.c.)
3.4.3 Setting the device address

Use the two hexadecimal switches to set the device address for the Operator Unit. The device address is set by the manufacturer to 01 decimal. Changing this setting is only necessary if another Operator Unit is installed. The table below shows the address agreements depending on the device type within a navigation system.

<table>
<thead>
<tr>
<th>Device(s)</th>
<th>CAN-Bus-Address, decimal</th>
<th>CAN-Bus-Address, hexadecimal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator Units</td>
<td>01 to 09</td>
<td>01 to 09</td>
</tr>
<tr>
<td>GPS compass</td>
<td>10 to 13</td>
<td>0A to 0D</td>
</tr>
<tr>
<td>Sensors (Gyro Compass)</td>
<td>14 to 19</td>
<td>0E to 13</td>
</tr>
<tr>
<td>Distribution Units</td>
<td>20 to 29</td>
<td>14 to 1C</td>
</tr>
<tr>
<td>Repeaters</td>
<td>30 to 63</td>
<td>1E to 3F</td>
</tr>
</tbody>
</table>

Each device address can be allocated within a CAN bus system only once!

If the Operator Unit is operated on an RS422 interface (jumper setting), the device address has no significance.
Hexadecimal switch B23 (switch position 1 to 9 for Operator Unit)

Hexadecimal switch B24 (switch position 0 to F), always set to 0 for the Operator Unit

Figure 44: Setting the device address
3.4.4 Making the cable connections

3.4.4.1 General information about establishing on-board wiring

Caution!
When establishing cable connections ensure that the cables are disconnected from the power supply. It is essential to ensure that all cables are disconnected from the power supply. If necessary, measure the voltage beforehand and/or disconnect the relevant distributor.

In order to ensure that the compass operates correctly, it is essential that you follow the procedures described below for establishing cable connections.

Cable type CAN bus and RS422 interface (manufacturer’s recommendation): 6x0.75mm², twisted with screening.
Cable type voltage supply Raytheon cable no. WN219–401–3.0 with connected plug or 3x0.75mm², twisted.

- Strip approx. 180 mm of the cable length.
  Make sure you do not damage the screening.

- Strip off the screening leaving a remaining section of screening measuring approx. 15mm (see Figure 45).

![Figure 45: How to strip the connection cable](image-url)
- Connect the cables to the connector as shown in Figure 46.
- Plug the connector into the corresponding CAN connection.

Figure 46: Example of a CAN1 bus – CAN2 bus connection
(the Operator Unit is not the end device)
3.4.4.2 Connections to the plug connections

**Connection to supply voltage**

<table>
<thead>
<tr>
<th>Cable no.: WN219-401-3.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector pin assignment:</td>
</tr>
<tr>
<td>White</td>
</tr>
<tr>
<td>Brown</td>
</tr>
<tr>
<td>Black</td>
</tr>
</tbody>
</table>

**CAN1 or CAN 2 connection to the plug, Operator Unit CAN-Bus connection**

- CAN1 high
- CAN1 low
- GND
- CAN2 high
- CAN2 low
- GND

with terminating resistor
Jumper B13 and Jumper B16 (see section 3.4.4.3)

Figure 47: Making the connections to the plugs for supply voltage and CAN-Bus
### 3.4.4.3 Plugging in the jumpers

**Figure 48: Plugging in the jumpers**

<table>
<thead>
<tr>
<th>Jumper</th>
<th>Pin 3-2-1</th>
<th>Default</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>B11</td>
<td></td>
<td><strong>OFF</strong></td>
<td>Plug B1 - CAN 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>OFF</strong></td>
<td>Plug B1 - RS422</td>
</tr>
<tr>
<td>B12</td>
<td></td>
<td><strong>OFF</strong></td>
<td>Plug B1 - CAN 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>OFF</strong></td>
<td>Plug B1 - RS422</td>
</tr>
<tr>
<td>B13</td>
<td></td>
<td><strong>OFF</strong></td>
<td>CAN bus terminating resistor plugged in - on end device only</td>
</tr>
<tr>
<td>B14</td>
<td></td>
<td><strong>OFF</strong></td>
<td>Plug B1 - CAN 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>OFF</strong></td>
<td>Plug B1 - RS422</td>
</tr>
<tr>
<td>B15</td>
<td></td>
<td><strong>OFF</strong></td>
<td>Plug B1 - CAN 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>OFF</strong></td>
<td>Plug B1 - RS422</td>
</tr>
<tr>
<td>B16</td>
<td></td>
<td><strong>OFF</strong></td>
<td>CAN bus terminating resistor plugged in - on end device only</td>
</tr>
</tbody>
</table>
3.5  Adjustments after switching ON

After switching ON for the very first time:
- Basic adjustments for the Processor Unit must be performed at the Operator Unit.
- It will take approx. up to 20 minutes before heading information is displayed.

These adjustments must be performed completely if the Processor Unit has been replaced within a scope of repair.
These adjustments must be performed in parts if the Antenna Unit has been replaced within a scope of repair.

- The adjustment of the Antenna Unit mounting angles (see section 3.5.5) must be performed after installation of the Antenna Unit.
- The adjustment of the Antenna Unit mounting angles (see section 3.5.5) must be performed after replacement of the Antenna Unit and/or after replacement of the Processor Unit within a scope of repair.
- The adjustment of the mounting position of the Processor Unit (see section 3.5.4) must be performed after installation or after a replacement within a scope of repair.
- Setting the dataformats for the output-ports of the Processor Unit (see sections 3.5.2 and 3.5.3) must be performed after installation and/or after replacement within a scope of repair.
  These dataformats must be set only if there are heading receivers (for example, a repeater compass) connected to this ports.
To set antenna mounting values and to perform antenna mounting adjustments, operate the soft key “GPS Config”. This soft key function is available in the following displays:
- “GPS Pos.” (Basic Display)
- “GPS Tape”
- “GPS ROT”
- “GPS Angles”

It is recommended to perform these settings and adjustments initially by operating the soft key “GPS Config” in the display “GPS Pos.” (Basic Display) (see Figure 49).

![Diagram](image)

**Figure 49:** Display “GPS. Pos” (Basic Display)

Follow the following sequence to reach the display to perform settings and adjustments.

**Basic Display** → soft key “GPS Config.”
→ display “Satellite Status”
→ soft key “Sat. Pos.”
→ display “Satellite Sky Plot”
→ soft key “GPS Setup”
Figure 50: Display “GPS Setup” (Submenu “Software Versions” selected)

<table>
<thead>
<tr>
<th>Soft Key</th>
<th>Meaning</th>
<th>refer to section</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS Pos.</td>
<td>Select Basic Menu “GPS Pos.” (Heading information together with latitude and longitude information)</td>
<td>see section 2.3.1</td>
</tr>
<tr>
<td>Sat. Status</td>
<td>Display “Satellite Status” – return to the first menu after selection of “GPS Config.”</td>
<td>see section 2.3.6</td>
</tr>
<tr>
<td>Select</td>
<td>Select submenus:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Software Versions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Serial Port #3 *</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Serial Port #4 *</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- PU Mounting *</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- AU Alignment *</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(*press and hold “Set” soft key for approx. 5–10 seconds to enter submenus with an asterisk)</td>
<td>see section 3.5.1 see section 3.5.2 see section 3.5.3 see section 3.5.4 see section 3.5.5</td>
</tr>
<tr>
<td>Dim up</td>
<td>Brightness control / Contrast control</td>
<td>see section 2.2.1</td>
</tr>
<tr>
<td>Dim down</td>
<td>Brightness control / Contrast control</td>
<td>see section 2.2.1</td>
</tr>
<tr>
<td>Set</td>
<td>Enter selected submenu (*press and hold soft key for approx. 5–10 seconds to enter submenus with an asterisk)</td>
<td>-----------------</td>
</tr>
</tbody>
</table>
3.5.1 Submenu “Software Version”

This submenu displays the software versions of the Processor Unit and the Operator Unit.

![Diagram of Submenu “SW Versions”](image)

By operating the soft key “Set” the display “GPS Setup” is shown again (“Exit” is already selected).
3.5.2 Submenu “Serial Port #3”

After entering submenu “Serial Port #3”, the following display is shown:
(Note: from “GPS Setup”, press and hold “Set” for 5–10 seconds to enter this submenu)

![Diagram of Serial Port #3 settings]

Figure 52: Submenu “Serial Port #3”

- “Port Disabled” = No data output at port #3
- “Course Bus” = Anschütz specific data format
- “NMEA 0183” and “No header” = NMEA Data format, only “Heading true” data output, update rate 1sec. (see section 4.4)
- “NMEA 0183” and “Header GP” = NMEA Data format, “Heading true” data output with a source information: generated by GPS, update rate 1sec. (see section 4.4)
- “NMEA 0183” and “Header HE” = NMEA Data format, “Heading true” data output with a source information: generated (simulated) by a Gyro Compass, update rate 1sec. (see section 4.4)
- “Fast NMEA” and “No header” = NMEA Data format, only “Heading true” data output, update rate 20 msec.
- “Fast NMEA” and “Header GP” = NMEA Data format, “Heading true” data output with a source information: generated by GPS, update rate 20 msec.
- “Fast NMEA” and “Header HE” = NMEA Data format, “Heading true” data output with a source information: generated (simulated) by a Gyro Compass, update rate 20 msec.

See also section 4.4.2.

A selected item is designated with a “√” in the rectangle.
Procedure to leave “GPS Setup” with a changed configuration.

If a data format change has been made, operate the soft key “Set” and the display “GPS Setup” is shown again with additional menu options to acknowledge the change or to discard the setting.

![Diagram of GPS Setup menu options](image)

Figure 53: Display “GPS Setup” after changes have been made in one of the submenus

To store the change, select “Store settings and restart system” with the soft key “Select” and operate “Set”. The STD 21 GPS will restart and, after the initialization and acquisition procedure, the display “GPS Pos.” (Basic Display) is shown (see Figure 8).

Procedure to leave “GPS Setup” without a changed configuration.

Select “Exit” without performing a change in the submenu “Serial Port #3” (see Figure 52), the display “GPS Setup” (without additional menu option) is shown (see Figure 50).

or

Select “Discard changes” with the soft key “Select” and operate “Set”, then the display “GPS Setup” is shown again (see Figure 50).
Submenu “Serial Port #4”

After entering submenu “Serial Port #4”, the following display is shown:
(Note: from “GPS Setup”, press and hold “Set” for 5–10 seconds to enter this submenu)

![Serial Port #4 Menu](image)

Figure 54: Submenu “Serial Port #4”

<table>
<thead>
<tr>
<th>Option</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port Disabled</td>
<td>No data output at port #4</td>
</tr>
<tr>
<td>Course Bus</td>
<td>Anschütz specific data format</td>
</tr>
<tr>
<td>NMEA 0183 and “No header”</td>
<td>NMEA Data format, only “Heading true” data output, update rate 1sec. (see section 4.4)</td>
</tr>
<tr>
<td>NMEA 0183 and “Header GP”</td>
<td>NMEA Data format, “Heading true” data output with a source information: generated by GPS, update rate 1sec. (see section 4.4)</td>
</tr>
<tr>
<td>NMEA 0183 and “Header HE”</td>
<td>NMEA Data format, “Heading true” data output with a source information: generated (simulated) by a Gyro Compass, update rate 1sec. (see section 4.4)</td>
</tr>
<tr>
<td>Fast NMEA and “No header”</td>
<td>NMEA Data format, only “Heading true” data output, update rate 20 msec.</td>
</tr>
<tr>
<td>Fast NMEA and “Header GP”</td>
<td>NMEA Data format, “Heading true” data output with a source information: generated by GPS, update rate 20 msec.</td>
</tr>
<tr>
<td>Fast NMEA and “Header HE”</td>
<td>NMEA Data format, “Heading true” data output with a source information: generated (simulated) by a Gyro Compass, update rate 20 msec.</td>
</tr>
</tbody>
</table>

See also section 4.4.2.
A selected item is designated with a “√” in the rectangle.
Procedure to leave “GPS Setup” with a changed configuration.

If a data format change has been made, operate the soft key “Set” and the display “GPS Setup” is shown again with additional menu options to acknowledge the change or to discard the setting.

![Display “GPS Setup” after changes have been made in one of the submenus](image)

To store the change, select “Store settings and restart system” with the soft key “Select” and operate “Set”. The STD 21 GPS will restart and, after the initialization and acquisition procedure, the display “GPS Pos.” (Basic Display) is shown (see Figure 8).

Procedure to leave “GPS Setup” without a changed configuration.

Select “Exit” without performing a change in the submenu “Serial Port #4” (see Figure 54), then the display “GPS Setup” (without additional menu) is shown (see Figure 50).

or

Select “Discard changes” with the soft key “Select” and operate “Set”, then the display “GPS Setup” is shown again (see Figure 50).
3.5.4 Submenu “PU Mounting”

After selecting submenu “PU Mounting”, the following display is shown:
(Note: from “GPS Setup”, press and hold “Set” for 5–10 seconds to enter this submenu)

![Image of the display showing the PU Mounting options]

Figure 56: Submenu “PU Mounting”

It is absolutely necessary to set this position immediately after installation or changes to the PU Mounting position. It defines the position of the accelerometers which are built into the processor unit, see also section 3.3.

- Ceiling bow = Processor Unit is installed on the ceiling and the cable inlets show into direction bow.
- Ceiling port = Processor Unit is installed on the ceiling and the cable inlets show into direction port.
- Ceiling aft = Processor Unit is installed on the ceiling and the cable inlets show into direction aft.
- Ceiling starboard = Processor Unit is installed on the ceiling and the cable inlets show into direction starboard.
- Floor bow = Processor Unit is installed on the floor and the cable inlets show into direction bow.
- Floor port = Processor Unit is installed on the floor and the cable inlets show into direction port.
- Floor aft = Processor Unit is installed on the floor and the cable inlets show into direction aft.
- Floor starboard = Processor Unit is installed on the floor and the cable inlets show into direction starboard.
From all possible settings, only one setting may be selected in the PU Mounting Menu. A selected item is designated with a “✓” in the rectangle.

Procedure to leave “GPS Setup” with a changed configuration.

If a PU Mounting position change has been made, operate the soft key “Set” and the display “GPS Setup” is shown again with additional menu options to acknowledge the change or to discard the setting.

Figure 57: Display “GPS Setup” after changes have been made in one of the submenus

To store the change, select “Store settings and restart system” with the soft key “Select” and operate “Set”. The STD 21 GPS will restart and, after the initialization and acquisition procedure, the display “GPS Pos.” (Basic Display) is shown (see Figure 8).

Procedure to leave “GPS Setup” without a changed configuration.

Select “Exit” without performing a change in the submenu “PU Mounting” (see Figure 56), the display “GPS Setup” (without additional menu) is shown (see Figure 50).

or

Select “Discard Changes” with the soft key “Select” and operate “Set”, then the display “GPS Setup” is shown again (see Figure 50).
3.5.5 Submenu “AU Alignment”

After selecting submenu “AU Alignment”, the following display is shown:
(Note: from “GPS Setup”, press and hold “Set” for 5–10 seconds to enter this submenu)

![Diagram of AU Alignment submenu]

Figure 58: Submenu “AU Alignment” (example)

It is absolutely necessary to set these corrections immediately after installation or changes to the mounting position. It defines the position of the Antenna Unit, see also section 3.2.2.

Pitch Correction:
By adjusting this angle value, the horizontal difference between the Antenna Unit mounting position and the ship’s baseline (horizon) is corrected. The mechanical mounting angle must not exceed ±6°. Differences which are below this ±6° must be estimated (sign–corresponding) and entered into the Processor Unit.
Please note: Values up to ±6° are highly recommended, possible settings are ±12°

![Diagram of sign correspondence for mounting angles]

Figure 59: Sign–corresponding input of mounting angle (pitch)
The measured angles should be noted in case of a replacement of the Processor Unit.

Heading Correction:
By adjusting the vertical difference between the mounting position of the Antenna Unit and the ship's centerline, the heading is corrected.
The mechanical mounting angle must not exceed ±6°. Differences which are below ±6° must be measured (sign–corresponding) and entered into the Processor Unit.
Referring sources of this difference can be:
- Heading of the pier versus STD 21 GPS heading value.
- Heading values from other heading sensors versus STD 21 GPS heading value (Attention: Tolerances may be added).

Figure 60: Sign–corresponding input of mounting angle (heading)
Examples to calculate the correction heading–value:

If there is a difference from the pier–heading value (reference) and heading value from the display of appr. 180°, then the antenna–cable connections in the Processor Unit have to be checked (they may be mixed up).

<table>
<thead>
<tr>
<th>Nominal value (heading from the pier or other heading reference)</th>
<th>Heading value at the display of Operator Unit</th>
<th>Correction value</th>
</tr>
</thead>
<tbody>
<tr>
<td>358°</td>
<td>4°</td>
<td>-6°</td>
</tr>
<tr>
<td>4°</td>
<td>358°</td>
<td>6°</td>
</tr>
<tr>
<td>17°</td>
<td>25°</td>
<td>-8°</td>
</tr>
<tr>
<td>25°</td>
<td>17°</td>
<td>8°</td>
</tr>
</tbody>
</table>

The measured angle should be noted in case of a replacement of the Processor Unit.

Indicated values can be changed after selection with soft key “Select” and will be stored into the processor unit by soft key “Set”.

In general: Settings are possible in a range of ±12° but the installation should be made within a tolerance of ±6° (manufacturers recommendation).
Procedure to leave “GPS Setup” with a changed configuration.

If an AU Alignment value change has been made, operate the soft key “Set” and the display “GPS Setup” is shown again with additional menu options to acknowledge the change or to discard the setting.

Figure 61: Display “GPS Setup” after changes have been made in one of the submenus

To store the change, select “Store settings and restart system” with the soft key “Select” and operate “Set”. The STD 21 GPS will restarted and, after the initialization and acquisition procedure, the display “GPS Pos.” (Basic Display) is shown (see Figure 8).

Procedure to leave “GPS Setup” without a changed value.

Select “Exit” without performing a change in the submenu “AU Alignment” (see Figure 58), the display “GPS Setup” (without additional menu) is shown (see Figure 50).

or

Select “Discard changes” with the soft key “Select” and operate “Set”, then the display “GPS Setup” is shown again (see Figure 50).
3.6 Troubleshooting

3.6.1 Alarm Handling

An alarm is indicated in three ways:
- the two-colour LED (Figure 62/1) flashes red
- the buzzer emits an audible signal
- the reason for the alarm is displayed in alphanumeric characters

In the event of an error, no heading information will be displayed (---.--.--°).

If the alarm is acknowledged by pressing the soft key “Alarm Quit” (Figure 62/2) but the cause of the error is not remedied, the LED stays red and the audible signal stops. The LED will turn off if the cause of the alarm has been remedied.

If the error is still present but not displayed (the LED is red), it is possible to display the error text by operating the soft key “Alarm Quit” again.

After an alarm message occurs and the reason for this alarm is eliminated either automatically or by repair, the displayed heading has to be checked. In case of an implausible heading value, the GPS Compass must be switched OFF and ON again.
The following alarm messages or errors may be indicated at the Operator Unit:
(to view details and remedies for each alarm message, see section 3.7)

A. “Accel. Error”
B. “Bow GPS Bit”
C. “Bow GPS Com.”
D. “Data I/F #3 Error”
E. “Data I/F #4 Error”
F. “Gyro Triad Error”
G. “Heading Failure”
H. Heading receiver indicates erroneous heading
I. “IMU I/F Error”
J. “Init. Failure”
K. “No connection”
L. “No Data on Bus”
M. “Poor Sat. Signals”
N. “Stern GPS Bit”
O. “Stern GPS Com.”
P. “Sync. Failure”
3.7 Fault/Alarm table

After an alarm message occurs and the reason for this alarm is eliminated either automatically or by repair, the displayed heading must be checked. In the case of an implausible heading value, the GPS Compass must be switched OFF and ON again.

Please note: The remedy for an error/fault depends on the transition from one system status to the next.
<table>
<thead>
<tr>
<th></th>
<th>Error (Message)</th>
<th>Meaning/Cause</th>
<th>Previous PU Operating Mode</th>
<th>Actual PU Operating Mode</th>
<th>Remedies</th>
</tr>
</thead>
</table>
| A | “Accel. Error”          | Acceleration sensors supply bad data.      | “Power-on Self Test” or “Acquisition” or “Compassing” | “Fault”                  | 1. Acknowledge alarm. The Operator Unit LED will remain red.  
2. Since this may be a latent error it is highly recommended to stop using the system and replace the Processor Unit. |
|   | “Bow GPS BIT”           | Bow GPS receiver reports an error.         | “Acquisition” or “Compassing”    | “Initialisation”         | 1. Acknowledge alarm. The Operator Unit LED will remain red.  
2. Wait for successful initialisation. |
2. Check connectors and verify all cable core connections of the following plug connections:  
- Connection PCB A1 (Processor Unit, Terminal Board A1, see Section 3.3.2, Figure 37)  
- PPS Converter PCB B1 (Antenna Unit, Terminal Board B1, see Section 3.2.3, Figure 33)  
- PPS Converter PCB B3. (Antenna Unit, Terminal Board B3, see Section 3.2.3, Figure 33)  
3. Restart the system (power off, wait 15 seconds, then power on).  
4. If this remedy is repeatedly unsuccessful, replace the Antenna Unit. |
<table>
<thead>
<tr>
<th>#</th>
<th>Error (Message)</th>
<th>Meaning/Cause</th>
<th>Previous PU Operating Mode</th>
<th>Actual PU Operating Mode</th>
<th>Remedies</th>
</tr>
</thead>
</table>
| C1 | "Bow GPS Com."                          | Communication to bow GPS receiver is interrupted.                              | "Acquisition" or "Compassing" | "Initialisation"          | 1. Acknowledge alarm. The Operator Unit LED will remain red.  
2. Wait for successful initialisation.                                                                                                       |
| C2 | "Bow GPS Com."                          | Communication to bow GPS receiver is interrupted.                              | "Power-on Self Test"       | "Fault"                  | 1. Acknowledge alarm. The Operator Unit LED will remain red.  
2. If Connection PCB LED RX2 is flashing green, then the Processor Unit is not running properly. (LED RX2, see Figure 63)  
3. If Connection PCB LED RX2 is either green or off, check connectors and verify all cable core connections of the following plug connections:  
   - Connection PCB A1 (Processor Unit, Terminal Board A1, see Section 3.3.2 Figure 37)  
   - PPS Converter PCB B1 (Antenna Unit, Terminal Board B1, see Section 3.2.3, Figure 33)  
   - PPS Converter PCB B3. (Antenna Unit, Terminal Board B3, see Section 3.2.3, Figure 33)  
4. Restart the system (power off, wait 15 seconds, then power on).  
5. If this remedy is repeatedly unsuccessful, replace the Processor Unit (2.) or the Antenna Unit (3.). |
<table>
<thead>
<tr>
<th>#</th>
<th>Error (Message)</th>
<th>Meaning/Cause</th>
<th>Previous PU Operating Mode</th>
<th>Actual PU Operating Mode</th>
<th>Remedies</th>
</tr>
</thead>
</table>
| D. | “Data I/F #3 Com” | Interface to Port #3 cannot be established. | “Initialisation” | “Acquisition” | 1. Acknowledge alarm. The Operator Unit LED will remain red.  
2. Check Serial Port #3 connector at Connection PCB A2 (Processor Unit, Terminal A2, see Appendix A-2 #27).  
3. Restart the system (power off, wait 15 seconds, then power on).  
4. If this remedy is repeatedly unsuccessful:  
   - Change connection to Port #4, if available, and set corresponding settings in Operator Unit (see Section 3.5.3).  
   - Replace the Processor Unit.  
   Note: Does not affect normal system operations. |
| E. | “Data I/F #4 Com” | Interface to Port #4 cannot be established. | “Initialisation” | “Acquisition” | 1. Acknowledge alarm. The Operator Unit LED will remain red.  
2. Check Serial Port #4 connector at Connection PCB A3 (Processor Unit, Terminal A3, see Appendix A-2 #25).  
3. Restart the system (power off, wait 15 seconds, then power on).  
4. If this remedy is repeatedly unsuccessful:  
   - Change connection to Port #3, if available, and set corresponding settings in Operator Unit (see Section 3.5.2).  
   - Replace the Processor Unit.  
   Note: Does not affect normal system operations. |
<table>
<thead>
<tr>
<th>#</th>
<th>Error (Message)</th>
<th>Meaning/Cause</th>
<th>Previous PU Operating Mode</th>
<th>Actual PU Operating Mode</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>“Gyro Triad Error”</td>
<td>Angular rate sensors supply bad data.</td>
<td>“Power-on Self Test” or</td>
<td>“Fault”</td>
<td>1. Acknowledge alarm. The Operator Unit LED will remain red.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>“Acquisition” or “Compassing”</td>
<td></td>
<td>2. Since this may be latent a latent error it is highly recommended to stop using the system and replace the Processor Unit.</td>
</tr>
<tr>
<td>G</td>
<td>“Heading Failure”</td>
<td>Heading accuracy has dropped to level below tolerance.</td>
<td>“Compassing”</td>
<td>“Acquisition”</td>
<td>1. Acknowledge alarm. The Operator Unit LED will remain red.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Check displays “Satellite Status” (see Section 2.3.6) and “Satellite Sky Plot” (see Section 2.3.7) for sufficient satellites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Verify the Antenna Unit’s unobstructed view to the open sky.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Wait for successful heading angle acquisition.</td>
</tr>
<tr>
<td>H</td>
<td>Heading receiver indicates erroneous heading</td>
<td>Heading receiver does not receive (correct) heading telegrams.</td>
<td>“Compassing”</td>
<td>“Compassing”</td>
<td>1. Check power supply of the concerned heading receiver.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Check proper Serial Port #3/#4 setting in GPS Setup menu (see Sections 3.5.2 and 3.5.3).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Check connector and verify all cable connections of Connection PCB plug connection A2/A3 (Processor Unit, Terminal A2 and A3, see Appendix A-2 #25 and #27).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Note: If Connection PCB LED TXT3/TXT4 (see Figure 63) is off, then the concerning Serial Port #3/#4 is disabled or not working properly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Restart the system (power off, wait 15 seconds, then power on).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5. If this remedy is repeatedly unsuccessful, replace the Processor Unit.</td>
</tr>
<tr>
<td>#</td>
<td>Error (Message)</td>
<td>Meaning/Cause</td>
<td>Previous PU Operating Mode</td>
<td>Actual PU Operating Mode</td>
<td>Remedies</td>
</tr>
<tr>
<td>----</td>
<td>----------------</td>
<td>-------------------------------------------------------------------------------</td>
<td>----------------------------</td>
<td>--------------------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| I1.| “IMU I/F Error”| Interface to angular rate and/or acceleration sensors do not work properly.    | “Acquisition” or “Compassing” | “Initialisation”         | 1. Acknowledge alarm. The Operator Unit LED will remain red.  
2. Wait for successful initialisation.                                                                                                     |
| I2.| “IMU I/F Error”| Interface to angular rate and/or acceleration sensors do not work properly.    | “Power on Self Test”        | “Fault”                 | 1. Acknowledge alarm. The Operator Unit LED will remain red.  
2. Check connectors and cable connections to the angular rate sensors (see Appendix A-2 #30).  
3. Restart the system (power off, wait 15 seconds, then power on).  
4. If this remedy is repeatedly unsuccessful, replace the Processor Unit.                                                                 |
2. Restart the system (power off, wait 15 seconds, then power on).  
3. If this remedy is repeatedly unsuccessful replace, the Processor Unit.                                                                     |
<table>
<thead>
<tr>
<th>#</th>
<th>Error (Message)</th>
<th>Meaning/Cause</th>
<th>Previous PU Operating Mode</th>
<th>Actual PU Operating Mode</th>
<th>Remedies</th>
</tr>
</thead>
<tbody>
<tr>
<td>K.</td>
<td>“No Connection”</td>
<td>Operator Unit does not detect any other CAN bus participants.</td>
<td>N/A</td>
<td>N/A</td>
<td>1. Acknowledge alarm. The Operator Unit LED will remain red.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Check power supply of Processor Unit.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Check all connectors and verify all cable core connections of:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Connection PCB (all connectors, see Appendix A-2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Operator Unit plug connections B1 and B2 (see Figure 47).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Check Connection PCB terminators X302 and X303 (see Appendix A-2 # 18 and #22).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5. Restart the system (power off, wait 15 seconds, then power on).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6. If this remedy is repeatedly unsuccessful, replace the Processor Unit.</td>
</tr>
<tr>
<td>L.</td>
<td>“No Data on Bus”</td>
<td>Operator Unit has detected other CAN bus participants but has not detected message traffic.</td>
<td>N/A</td>
<td>N/A</td>
<td>1. Acknowledge alarm. The Operator Unit LED will remain red.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Restart the system (power off, wait 15 seconds, then power on).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. If this remedy is repeatedly unsuccessful, replace the Processor Unit.</td>
</tr>
<tr>
<td>M.</td>
<td>“Poor Sat. Signals”</td>
<td>System can not find a heading angle to due poor satellite signals.</td>
<td>“Acquisition”</td>
<td>“Initialisation”</td>
<td>1. Acknowledge alarm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Check displays “Satellite Status” (see Section 2.3.6) and “Satellite Sky Plot” (see Section 2.3.7) for sufficient satellites.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Verify the Antenna Unit’s unobstructed view to the open sky.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Wait for successful heading angle acquisition.</td>
</tr>
<tr>
<td>#</td>
<td>Error (Message)</td>
<td>Meaning/Cause</td>
<td>Previous PU Operating Mode</td>
<td>Actual PU Operating Mode</td>
<td>Remedies</td>
</tr>
<tr>
<td>----</td>
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<td>----------------------------</td>
<td>--------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>N1</td>
<td>“Stern GPS BIT”</td>
<td>Stern GPS receiver reports an error.</td>
<td>“Acquisition” or Compassing</td>
<td>“Initialisation”</td>
<td>1. Acknowledge alarm. The Operator Unit LED will remain red.</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Wait for successful initialisation.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Check connectors and verify all cable core connections of the following plug connections:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Connection PCB A1 (Processor Unit,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Terminal Board A1, see Section 3.3.2, Figure 37)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- PPS Converter PCB B1 (Antenna Unit,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Terminal Board B1, see Section 3.2.3, Figure 33)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- PPS Converter PCB B2. (Antenna Unit,</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Terminal Board B2, see Section 3.2.3, Figure 33)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Restart the system (power off, wait 15 seconds, then power on).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. If this remedy is repeatedly unsuccessful, replace the Antenna Unit.</td>
</tr>
<tr>
<td>#</td>
<td>Error (Message)</td>
<td>Meaning/Cause</td>
<td>Previous PU Operating Mode</td>
<td>Actual PU Operating Mode</td>
<td>Remedies</td>
</tr>
<tr>
<td>----</td>
<td>-----------------------------------------</td>
<td>----------------------------------------------------</td>
<td>-----------------------------</td>
<td>--------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
<tr>
<td>O1</td>
<td>“Stern GPS Com.”</td>
<td>Communication to stern GPS receiver is interrupted.</td>
<td>“Acquisition” or Compassing</td>
<td>“Initialisation”</td>
<td>1. Acknowledge alarm. The Operator Unit LED will remain red.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Wait for successful initialisation.</td>
</tr>
<tr>
<td>O2</td>
<td>“Stern GPS Com.”</td>
<td>Communication to stern GPS receiver is interrupted.</td>
<td>“Power-on Self Test”</td>
<td>“Fault”</td>
<td>1. Acknowledge alarm. The Operator Unit LED will remain red.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. If Connection PCB LED RX1 (see Figure 63) is flashing green, then the Processor Unit is not running properly.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. If Connection PCB LED RX1 is either green or off, then check connectors and verify all cable core connections of the following plug connections:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Connection PCB A1 (Processor Unit, Terminal Board A1, see Section 3.3.2 Figure 37)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- PPS Converter PCB B1 (Antenna Unit, Terminal Board B1, see Section 3.2.3, Figure 33)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- PPS Converter PCB B2 (Antenna Unit, Terminal Board B2, see Section 3.2.3, Figure 33)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Restart the system (power off, wait 15 seconds, then power on).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5. If this remedy is repeatedly unsuccessful, replace the Processor Unit (2.) or the Antenna Unit (3.).</td>
</tr>
<tr>
<td>#</td>
<td>Error (Message)</td>
<td>Meaning/Cause</td>
<td>Previous PU Operating Mode</td>
<td>Actual PU Operating Mode</td>
<td>Remedies</td>
</tr>
<tr>
<td>---</td>
<td>---------------------</td>
<td>-------------------------------------------------------</td>
<td>-----------------------------</td>
<td>--------------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>P.</td>
<td>“Sync. Failure”</td>
<td>System’s sensors cannot be synchronized.</td>
<td>“Acquisition”</td>
<td>“Fault”</td>
<td>1. Acknowledge alarm. The Operator Unit LED will remain red.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Check that Connection PCB LED 1 PPS (see Figure 63) is off or steadily on (not flashing).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Check connectors and verify all cable core connections of the following plug connections:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Connection PCB A1 (Processor Unit, Terminal Board A1, see Section 3.3.2, Figure 37)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- PPS Converter PCB B1 (Antenna Unit, Terminal Board B1, see Section 3.2.3, Figure 33)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- PPS Converter PCB B2. (Antenna Unit, Terminal Board B2, see Section 3.2.3, Figure 33)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Restart the system (power off, wait 15 seconds, then power on).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5. If this remedy is repeatedly unsuccessful, replace the Antenna Unit.</td>
</tr>
</tbody>
</table>
Figure 63: 1PPS, Transmit and Receive LEDs on the Processor Unit Connection PCB
4 Service

4.1 Care and Maintenance

The Antenna Unit, Processor Unit and Operator Unit are maintenance free.

⚠️

When cleaning the surface, do not use any organic solvent such as thinner or benzine.
For surface cleaning, remove the dust and debris and wipe with a clean dry cloth.
### Troubleshooting and Repair (for Service only)

(see also Fault/Alarm table section 3.7).
Following table could be helpful for a fault diagnostics.
This table has to be read together with figure A–2 in the appendix.

> Information in the table below should only be used by trained service personnel.

<table>
<thead>
<tr>
<th>Pos. No</th>
<th>Designation</th>
<th>Sense</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Plug “C1”</td>
<td>Connection of Power supply for Processor Unit</td>
</tr>
<tr>
<td>2</td>
<td>LED “POU”</td>
<td>Lights green for Operator Unit supply (24VDC).</td>
</tr>
<tr>
<td>3</td>
<td>LED “PAU”</td>
<td>Lights green for Antenna Unit supply (24VDC).</td>
</tr>
<tr>
<td>6</td>
<td>LED “PPS”</td>
<td>Blinks red with an interval of 1 second. If blinking there is an usable satellite–information available. LED could be dark for appr. 20 minutes after switching on.</td>
</tr>
<tr>
<td>7</td>
<td>LED 5 VDC</td>
<td>Lights green, if 5VDC are available. Used for supplying the gyro group and the accelerometer.</td>
</tr>
<tr>
<td>8</td>
<td>LED 3.3 VDC</td>
<td>Lights green, if 3.3VDC are available. Used to supply piggy back processor.</td>
</tr>
<tr>
<td>9</td>
<td>Jumper “X204”</td>
<td><strong>Development purpose only.</strong></td>
</tr>
<tr>
<td></td>
<td>Description</td>
<td>Notes</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>10</td>
<td>DIP Switch “CONFIG”</td>
<td>Switch to adjust system configuration and service/development modes.</td>
</tr>
<tr>
<td>11</td>
<td>Plug “JTAG”</td>
<td>Development purpose only.</td>
</tr>
<tr>
<td>12</td>
<td>Plug</td>
<td>Development purpose only.</td>
</tr>
<tr>
<td>13</td>
<td>LED for μP-control</td>
<td>Lights green (constant) ⇒ system is o.k.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blinks if the system is still in BIOS-mode (not booted system), for development purpose only.</td>
</tr>
<tr>
<td>14</td>
<td>LED for μP-control</td>
<td>Development purpose only.</td>
</tr>
<tr>
<td>15</td>
<td>LED for μP-control</td>
<td>Development purpose only.</td>
</tr>
<tr>
<td>16</td>
<td>LED for μP-control</td>
<td>Development purpose only.</td>
</tr>
<tr>
<td>17</td>
<td>LED 5 VDC</td>
<td>Lights green if the supply voltage 5 VDC is available. (Interface supply a.o.).</td>
</tr>
<tr>
<td>18</td>
<td>Jumper “X303”</td>
<td>Terminator for CAN Bus 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Has to be inserted if the Processor Unit is connected at one end of the CAN bus 2, see also section 3.3.4.1</td>
</tr>
<tr>
<td>19</td>
<td>LED “PCAN”</td>
<td>Lights green, if the supply voltage for the CAN bus is available.</td>
</tr>
<tr>
<td>20</td>
<td>Plug B2</td>
<td>Connection for CAN 2 bus.</td>
</tr>
<tr>
<td>21</td>
<td>Jumper “X900”</td>
<td>Terminator for Interface RS422 at plug A3.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Should be inserted in general.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Has to be inserted if the processor unit is connected at one end of the CAN 1 bus, see also section 3.3.4.1</td>
</tr>
<tr>
<td>23</td>
<td>Plug B1</td>
<td>Connection for CAN 1 bus.</td>
</tr>
<tr>
<td>24</td>
<td>Plug D1</td>
<td>Connection for relay contacts (normally open). Status information</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- relay 1 = heading fail</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- relay 2 = system fail</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>25</strong></td>
<td>Plug A3</td>
<td>Connection for a RS422 interface</td>
</tr>
<tr>
<td><strong>26</strong></td>
<td>Jumper “X800”</td>
<td>Terminator for Interface RS422 at plug A2. Should be inserted in general.</td>
</tr>
<tr>
<td><strong>27</strong></td>
<td>Plug A2</td>
<td>Connection for a RS422 interface</td>
</tr>
</tbody>
</table>
| **28** | Three LED’s (LED group) | Interface information for all four RS422 interfaces:  
- Upper LED (green)  
  - RX-data:  
    Is blinking with the rhythm of received data.  
    Is dark if there is no data to receive.  
- Intermediate LED (yellow) is:  
  - Constant yellow if the program has been started and the interface driver is o.k.  
  - Is dark if the interface is disturbed.  
- Lower LED (red)  
  - TX-data:  
    Is blinking with the rhythm of transmitted data.  
    Is dark if there is no data to transmit. |
| **29** | Plug “A1” | Connection of Antenna Unit |
4.3 Replacement of defective parts

The Antenna Unit has to be replaced completely.

After replacement of the Antenna Unit, the angles “Antenna Unit versus ship's centerline” and “Antenna Unit versus ship's baseline” must be adjusted.

The Processor Unit has to be replaced completely.

After replacement of the Processor Unit the angles “Antenna Unit versus ship's centerline” and “Antenna Unit versus ship's baseline” must be adjusted. The noted values have to be entered into the Processor Unit.

Replacement information for the Operator Unit, see manual no. 3648
4.4 NMEA 0183 Formats

- **NMEA 0183 Format DTM**
  
  DTM ⇒ Datum Reference

  \[
  \$--DTM,ccc,a,x.x,a,x.x,a,x.x,a,x.x,ccc*hh<CR><LF>
  \]

  - Reference datum code
  - Altitude offset, meters
  - Lon offset, minutes, E/W
  - Lat offset, minutes, N/S
  - Local datum subdivision code
  - Local Datum code

  **Update rate 1 Hz**

- **NMEA 0183 Format HDT**

  HDT ⇒ Heading, True

  \[
  \$--HDT,x.x,T*hh<CR><LF>
  \]

  - Reading, degrees True

  **Update rate 1 Hz and Update rate 50 Hz**
• **NMEA 0183 Format GGA**

  GGA ⇒ Global Positioning System Fix Data

  \$--GGA,hhmmss.ss,llll.ll,a,yyyy.yy,a,x,xx,x,x,x,M,x,M,x,xxxx,xxxx**hh<CR><LF>

  - Differential reference station ID, 0000-1023
  - Age of Differential GPS data
  - Geoidal separation, meters
  - Altitude re: mean-sea-level (geoid), meters
  - Horizontal dilution of precision
  - Number of satellites in use, 00-12, may be different from the number in view
  - GPS Quality indicator
  - Longitude - E/W
  - Latitude - N/S
  - UTC of position

  Update rate 1 Hz

• **NMEA 0183 Format GSA**

  GSA ⇒ GNSS DOP and Active Satellites

  \$--GSA,a,x,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,xx,x.x*hh<CR><LF>

  - VDOP
  - HDOP
  - PDOP
  - ID numbers of satellites used in solution
  - Mode: 1 = Fix not available, 2 = 2D, 3 = 3D
  - Mode: M = Manual, forced to operate in 2D or 3D mode
  - A = Automatic, allowed to automatically switch 2D/3D

  Update rate 1 Hz
• **NMEA 0183 Format ROT**

  **ROT** ⇒ Rate Of Turn

  \[
  \$--ROT,x.x,A*hh<CR><LF>
  \]

  Status

  | A = Data valid |
  | V = Data invalid |

  Rate of turn, degrees/minute, "- -" = bow turns to port

  Update rate 1 Hz and Update rate 50 Hz

• **NMEA 0183 Format VTG**

  **VTG** ⇒ Course Over Ground and Ground Speed

  \[
  \$--VTG,x.x,T,x.x,M,x.x,N,x.x,K,a*hh<CR><LF>
  \]

  Status

  | Mode Indicator |
  | Speed over ground, km/hr |
  | Speed over ground, knots |
  | Course over ground, degree Magnetic |
  | Course over ground, degrees True |

  Update rate 1 Hz

• **NMEA 0183 Format ZDA**

  **ZDA** ⇒ Time & Date

  \[
  \$--ZDA,hhmss.ss,xx,xxxx,xx,xx,*hh<CR><LF>
  \]

  Status

  | Local zone minutes, 00 to +59 |
  | Local zone hours, 00 to +/- 13 hrs |
  | Year |
  | Month, 01 to 12 |
  | Day, 01 to 31 |
  | UTC |

  Update rate 1 Hz
• **NMEA 0183 Format PANZHRP**

  HRP ⇒ Heading, Roll, Pitch

  PANZ = Private identifier propriety Anschütz

  \[
  \$--\text{HRP},x,x,x,x,x,x,x,x,x,a,a*hh<CR><LF>
  \]

<table>
<thead>
<tr>
<th>Checksum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Selection (optional) (set to A)</td>
</tr>
<tr>
<td>A = sentence selected in the system</td>
</tr>
<tr>
<td>V = redundant sentence</td>
</tr>
<tr>
<td>Status</td>
</tr>
<tr>
<td>A = valid</td>
</tr>
<tr>
<td>V = invalid</td>
</tr>
<tr>
<td>S = simulation</td>
</tr>
<tr>
<td>M = manual</td>
</tr>
<tr>
<td>D = degraded</td>
</tr>
</tbody>
</table>

  not used(2)

  Pitch angle +/- 90°, positive for bow up(1)

  Roll angle +/- 90°, positive for starboard down(1)

  Heading angle 0...(360LBS)°, positive clockwise, true north 0=0(1)

  Source (set to 1)
  1 = single MINS or MINS 1 in dual systems
  2 = MINS2 (in dual systems only)

  Sentence identifier
  HRP = Heading, Roll, Pitch

  (1) The number of digits behind the decimal point can be variable but the standard resolution for angles is 0.001 degrees.

  (2) The number of digits behind the decimal point can be variable but the standard resolution for rates is 0.01 degrees.

  Hint: The data field Roll-, Pitch- and Heading angles may be empty if rates are not available.

  Hint: Only in mode “Fast NMEA”.

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3717/110–850.DOC020002
• **NMEA 0183 Format THS**

  HRP ⇒ True Heading and Status

  
  \[ \$-\text{THS},x.x,a*hh<CR><LF> \]

  - Sentence identifier
  - THS = True Heading and Status
  - Heading, degrees true
  - Mode indicator (see note)
  - Checksum

  **NOTE** Mode indicator: This field should **not** be null.

  - A = Autonomous
  - E = Estimated (dead reckoning)
  - M = Manual input
  - S = Simulator mode
  - V = Data not Valid (including standby)
4.4.1 Standard NMEA set with transmitting rate

--HDT or --THS  (DIP-switches 4 and 6 into ON position)
  - 50Hz for FAST NMEA settings
  - 1 Hz for NMEA
GPROT  - 50Hz for FAST NMEA settings
  - 1 Hz for NMEA or FAST NMEA with DIP-switch 3 into ON position

Messages/NMEA telegrams for information only:
in 1 Hz transmitting rate for all configurations
  IIIGA
  IIVTG
  IIZDA
  IIIGSA
  IIIDTM
### 4.4.2 NMEA messages - conclusions/dependencies

For configuration of “Serial Port #3” and “Serial Port #4” (see sections 3.5.2 and 3.5.3).

Depending on position of the DIP-switches 4, 5 and 6 (see section 3.3.6) different NMEA telegrams can be adjusted for Port#3 and Port#4.

<table>
<thead>
<tr>
<th>DIP-switches 4 OFF or DIP-switch 4 and 5 ON</th>
<th>DIP-switches 4 and 6 ON or DIP-switch 4, 5 and 6 ON</th>
<th>--HDT (IIHDT)</th>
<th>--THS (IITHS)</th>
<th>no header means Integrated Instrumentaion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>GPHDT</td>
<td>GPTHS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>HEHDT</td>
<td>HETHS</td>
<td></td>
</tr>
</tbody>
</table>

If DIP-switches 4 and 5 are in “ON” position

then

following NMEA telegrams are inactive:
- **GPROT** = Rate of Turn from a Satellite compass
- **IIGGA** = Global positioning system fixed data, time, position and fix related data for Satellite receiver
- **IIDTM** = Calender data being used
- **IIGSA** = GPS DOP and active satellites
- **IIZDA** = Time & Date - UTC, day, month, year and local time zone
- **IIVTG** = Track made good and ground speed
1. Terminal board “C1” Connection Power Supply Processor Unit
2. LED “POU” Power Operator Unit
3. LED “PAU” Power Antenna Unit
4. Jumper “X700” Terminator RS422 for Plug A1 Com Port #2
5. Jumper “X600” Terminator RS422 for Com Port #1
6. LED “PPS” Pulse Per Second (blinks once per sec.)
7. LED 5VDC analogue voltage
8. LED 3.3VDC power supply
9. Jumper “X204” Development only (Do not use !!!)
10. Dip switch “CONFIG”
11. Plug “JTAG” Development only (Do not use !!!)
12. Plug Development only
13. µP Control
14. µP Control
15. µP Control
16. µP Control
17. LED 5VDC digital voltage
18. Jumper “X303” Terminator CAN 2
19. LED “PCAN” Power CAN bus
20. Plug “B2” CAN 2
21. Jumper “X900” Terminator RS422 for Plug A3 Com Port #4
22. Jumper “X302” Terminator CAN 1
23. Plug “B1” CAN 1
24. Terminal board “D1” status signals
25. Terminal board “A3” RS422 interface
26. Jumper “X800” Terminator RS422 for Plug A2 Com Port #3
27. Terminal board “A2” RS422 interface
28. 3 LED group for each respective RS422 interface
   LED green: Receive data, blinks in the sequence of received data
   LED yellow: Interface active, constant yellow
   LED red: Transmit data
     blinks 1 Hz sequence - NMEA
     blinks 50 Hz sequence (visually constant red)
     - fast NMEA or Course Bus
29. Terminal board “A1” Connection Antenna Unit
30. Connections to the Angular Rate Sensors

Jumpers, plugs, LED's and switches
MAX.8 CABLE INLETS M16x1.5 DIN 89280
MAX.4 CABLE INLETS M24x1.5 DIN 89280

- WALLMOUNTING I.ST NOT ADMITTED
- ONLY HORIZONTAL MOUNTING INCL. CEILING ALLOWED
- THE ALIGNMENT ACCURACY TO THE PITCH AND ROLL AXIS
- AND THE SHIP'S CENTERLINE HAS TO BE <6

**OPTIONAL:**
- CABLE INLETS: 1x 146-607 (4xM16, 4xM24)
- SHIELDING CLAMP: 3x 146-606 (8xØ=20)

ON 146-606 (SHIELDING CLAMP) APPLICATIONS, TYPE OF ENCLOSURE IP20

**TYPE OF ENCLOSURE EN 60529 IP 22**

**REFERRING TO DRILLING SCHEME ON BOARD**

**DIMENSIONS WITHOUT TOLERANCES ARE MAXIMUM DIMENSIONS**

---

**DISTANCE FROM MAGNETIC COMPASS**

<table>
<thead>
<tr>
<th>STANDARD TYPE</th>
<th>STEERING TYPE</th>
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</thead>
<tbody>
<tr>
<td>0.30 m</td>
<td>0.30 m</td>
</tr>
</tbody>
</table>

**CABLE**

**SCALE:**

**WEIGHT:** ca. 3.5 Kg

**DRAWN BY:**

**CHECKED BY:**

**APPROVED BY:**

**DRAWING TITLE:** Processor Unit

**DIMENSIONAL DRAWING**

**DRAWING NO.:** 114-001.HP005

**REV:** 1
THE MOUNTING POSITION OF THE ANTENNA CARRIER HAS TO BE 6 TO SHIP'S BASELINE.

TYPE OF ENCLOSURE EN 60529 IP56

DIMENSIONS WITHOUT TOLERANCES ARE MAXIMUM DIMENSIONS.
Satellite Compass Standard 21
Type 110–850

All depicted items which are not mentioned in the text are not applicable for this unit. Since further development may necessitate making modifications to existing equipment, its conformity with the relevant illustrations and drawings is not always ensured. Raytheon Anschütz will be under no liability whatever that may arise from any such differences.

<table>
<thead>
<tr>
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<td>1</td>
<td>4003063</td>
<td>Antenna Unit STD.21</td>
<td>Antenna Unit STD.21</td>
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<td>2</td>
<td>4003082</td>
<td>Processor Unit</td>
<td>Processor Unit</td>
<td>114–001.NG001 E02</td>
<td>1</td>
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<tr>
<td>3</td>
<td>4002278</td>
<td>Operator Unit, neu</td>
<td>Operator Unit, brandnew</td>
<td>130–613.NG010 E01</td>
<td>1</td>
<td>D2865</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4002603</td>
<td>Operator Unit, AT</td>
<td>Operator Unit, reconditioned</td>
<td>130–613.NG010 E01 AT</td>
<td>D2865</td>
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<tr>
<td>4</td>
<td>4003174</td>
<td>AC/DC Converter</td>
<td>AC/DC Converter</td>
<td>121–062.NG001 E01</td>
<td>D2865</td>
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<td>5</td>
<td>4002522</td>
<td>Additional Output Box</td>
<td>Additional Output Box</td>
<td>146–103.NG001 E01</td>
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optional:

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</thead>
<tbody>
<tr>
<td>4</td>
<td>4003082</td>
<td>Processor Unit</td>
<td>Processor Unit</td>
<td>114–001.NG001 E02</td>
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<td>D2865</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>4002603</td>
<td>Operator Unit, AT</td>
<td>Operator Unit, reconditioned</td>
<td>130–613.NG010 E01 AT</td>
<td>D2865</td>
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<tr>
<td>6</td>
<td>4003174</td>
<td>AC/DC Converter</td>
<td>AC/DC Converter</td>
<td>121–062.NG001 E01</td>
<td>D2865</td>
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<tr>
<td>7</td>
<td>4002522</td>
<td>Additional Output Box</td>
<td>Additional Output Box</td>
<td>146–103.NG001 E01</td>
<td>D2865</td>
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<td></td>
</tr>
</tbody>
</table>

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