Saab TransponderTech

R6 Navigation System

OPERATION & INSTALLATION MANUAL

SAAB TECHNOLOGIES SAAB

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i Copyright

ii Disclaimer

While reasonable care has been exercised in the preparation of this manual, Saab TransponderTech AB shall incur no liability whatsoever based on the contents or lack of contents in the manual.

iii Firmware

This manual reflects the capabilities of the R6 Navigation System with either the R5 Navigation Sensor MkIII or the R6 NAV PRO Compass F/W 1.5.4 and R6 CDU (Control & Display Unit) with Firmware version 1.2.4

For R6 NAV PRO Compass+ System an IMU with FW version 1.1.0 or later is required.

System has the ability to be firmware updated after delivery. Therefore the product label can specify a firmware different from the actual firmware in the product. Current firmware versions in the system can always be verified in the F/W information view as described in Section 6.3.

iv Manual Part Number and Revision

Part number 7000 125-304, revision F1.

v Disposal Instructions

Broken or unwanted electrical or electronic equipment parts shall be classified and handled as ‘Electronic Waste’. Improper disposal may be harmful to the environment and human health. Please refer to your local waste authority for information on return and collection systems in your area.

vi Contact Information

For installation, service, ordering info and technical support please contact your local Saab TransponderTech representative. A list with dealers, OEM partners and service stations can be found at our website, listed under the corresponding product page.

www.saab.com/maritime

For the latest manual, firmware and certificates visit:
https://www.saab.com/transpondertechsupport

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1 SAFETY INSTRUCTIONS

1.1 General

Saab TransponderTech assumes no liability for customer not complying with requirements in this section or warnings and cautions elsewhere in this document.

This safety instruction section refers to all components of the R6 Navigation System, referred to as “equipment” in this section.

1.2 Installation and Service

Only qualified technicians shall do installation and servicing of equipment. Electrical fuses must be replaced with correct types.

To prevent electrical chock hazard and damage to the equipment, the equipment shall be connected to electrical ground. A power supply corresponding to the voltage rating of the equipment shall be used. Failure to comply with this requirement may damage the equipment.

To ensure proper functioning of the equipment, only signal cables and antennas specified in this document may be used. Failure to comply with this requirement may cause unexpected behaviour of the equipment.

The equipment may not in any way be modified; doing so may cause fire, shock hazard or serious injury.

1.3 Compass Safety Distances

Measured distances according to ISO25862:2019, IEC 60945:2008

Equipment	**R5 Navigation Sensor, R6 NAV PRO Compass**	**R6 CDU**
Safe Distance to		
Standard-Magnetic-Compass	0,60 m	0,65 m
Steering-Magnetic-Compass	0,30 m	0,40 m
Reduced Safe Distance to		
Standard-Magnetic-Compass	0,30 m	0,40 m
Steering-Magnetic-Compass	0,30 m	0,30 m

Table 1-1 - Compass safe distances

2 SYSTEM OVERVIEW

2.1 Product Description

The stand-alone R6 Navigation System consists of two central parts

- The R5 Navigation Sensor or the R6 NAV PRO Compass
- The R6 CDU (Control and Display Unit)

The R6 Navigation System, providing robust and highly secure position information to external equipment through a large number of integrated interfaces.

The R6 CDU is a graphical display with touch and keypad input, type tested to meet Navigation MKD (Minimum Keyboard and Display) requirements, and is used to control and monitor the system. The colour LCD together with the touch interface provides a graphical user-friendly interface to the system. The rubber keypads may be used for many basic operations instead of the capacitive touch interface, in cases such as under rough sea or with gloved hands. The CDU can also be used to perform configuration as well as supervise the Navigation Sensor status. The front of the CDU is designed to easily be panel mount installed or gimbal mounted, and the rear of the CDU has an SD card slot for service and Firmware updates.

For installations without the CDU, a web-interface is built-in to the Navigation sensor. The Web-interface allows for status monitoring, interface configuration, change of positioning parameters and FW updates.

The GNSS sensor receiver is capable of multi-GNSS reception on multiple frequency bands with a high update rate. The combined use of more than one satellite based navigation systems yield increased robustness and reliability of the navigation solution, ensuring maximum possible coverage world-wide.

The dual GNSS Antenna interface provided in the R6 NAV PRO Compass configuration also provides and additional dimension to the system with the possibility to calculate high precision heading.

2.2 Product Configuration

Feature / Product	GPS	Glonass	Galileo	Bei Dou	Galileo HAS	RTK	Atlas	Beacon	Heading	Multi-frequency	Jam-ming	Spoof-ing
GNSS	X	X	X	X							X	
DGNSS	X	X	X	X				X			X	
DGNSS PRO	X	X	X	X			(X)	X			X	
DGNSS PRO RTK	X	X	X	X	X	X	(X)	X		X	X*	
PRO COMPASS	X	X	X	X	X	X	(X)	X	X	X	X*	X

Note: Atlas is a Satellite based RTK source that can be received by adding an active subscription in the PRO versions of the R6 Navigation Systems

*Note: * Extended jamming resilience*

3 INSTALLATION

3.1 Equipment part numbers

The R6 Navigation System typically consists of the R5/R6 Navigation Sensor and the R6 CDU and a number of optional accessories. The most common parts and accessories are listed below. Delivery note.

NOTE: This is not a list of supplied parts, as contents may vary depending on ordered configuration option.

Name	Part number
R5 GNSS Navigation Sensor MkIII R5 DGNSS Navigation Sensor MkIII R6 NAV PRO Compass	7000 118-910 alt 7000 118-911 alt 7000 125-500
R6 CDU	7000 123-500
Power Cable	7000 121-134 alt 7000 118-077
Document set Including: Short Instructions/Document CD/Certificates	7000 121-310 alt 7000 125-303
Ethernet Cable 5m	7000 000-525
MGA-3 GNSS Antenna MGL-5 DGNSS Antenna (Combined GNSS / Beacon) A31 DGNSS Antenna (Combined GNSS / Beacon) A43 DGNSS Antenna (Combined Multi-Frequency GNSS / Beacon)	7000 000-554 7000 000-555 7000 000-780 7000 000-651
R6 CDU Gimbal Mount kit	7000 123-140
R6 CDU Flush Mount kit	7000 123-142
R6 CDU Frame Mount kit	7000 123-119
C6 COM	7000 125-702
I6 IMU	7000 125-602
U6 UPS	7000 125-800

Table 3-1 - R6 Navigation System and accessories

3.2 Equipment Installation Environment

The table below lists the IEC 60945 equipment classification for the system.

Name	Part number	IEC 60945 installation category
R5 GNSS Navigation Sensor MkIII R5 DGNSS Navigation Sensor MkIII R6 NAV PRO Compass	7000 118-910 alt 7000 118-911 7000 125-500	Protected
R6 CDU	7000 125-500	Protected
C6 COM	7000 125-702	Protected
I6 IMU	7000 125-602	Protected
U6 UPS	7000 125-800	Protected
MGA-3 GNSS Antenna	7000 000-554	Exposed
MGL-5 Combined GNSS / Beacon Antenna	7000 000-555	Exposed
A31	7000 000-780	Exposed
A43	7000 000-651	Exposed

Table 3-2 - IEC 60945 equipment classification

3.3 Cables

3.3.1 Power Cable

Marking: 7000 118-077 / 7000 123-130

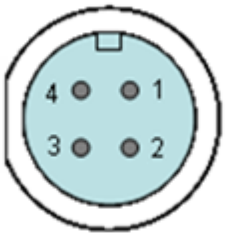
Type: Unshielded 4 wire cable x 1.3 mm^2 / Unshielded 2 wire cable x 1.3 mm^2

Length: 2 m

Diameter: 6 mm

Connector: ConXall Mini-Con-X 6382-4SG-311 (female)

3.3.1.1 Interconnection specification



Function	Pin	Cable Color	Included in 7000 123-130
12 / 24 VDC	1	Red	X
0 VDC	2	Black	X
NC	3	Brown	-
NC	4	Orange	-

Table 3-3 - Interconnector pins

3.3.2 GNSS/Heading antenna cable

Type and Length: See section 3.8.2 GNSS Cabling

Connector: TNC (Male)

3.3.3 Ethernet cable 5m

Type: Cat-6, LSZH, IEC 60332-1

Length: 5 m

Connector: RJ-45

Part number: 7000 000-525

3.3.4 Minimum cable bending radius

When installing the cables the recommended minimum bending radiuses are as follows:

Signal and power cables: 10 times cable diameter

Coaxial cables: 5 times cable diameter

3.4 System interconnection overview

3.4.1 Basic system setup (CDU + Sensor/Compass)

There are numerous ways to install the system using the redundant network interfaces of the R5 Navigation Sensor (or R6 NAV PRO Compass) and the R6 CDU. Below is a simple system setup without interface to external networks. External sensors and systems shall in this case be connected to the Navigation Sensor's serial interfaces. The R5 Navigation Sensor is critical if used as primary position source. The R6 CDU is non-critical. To achieve full redundancy two parallel systems needs to be installed.

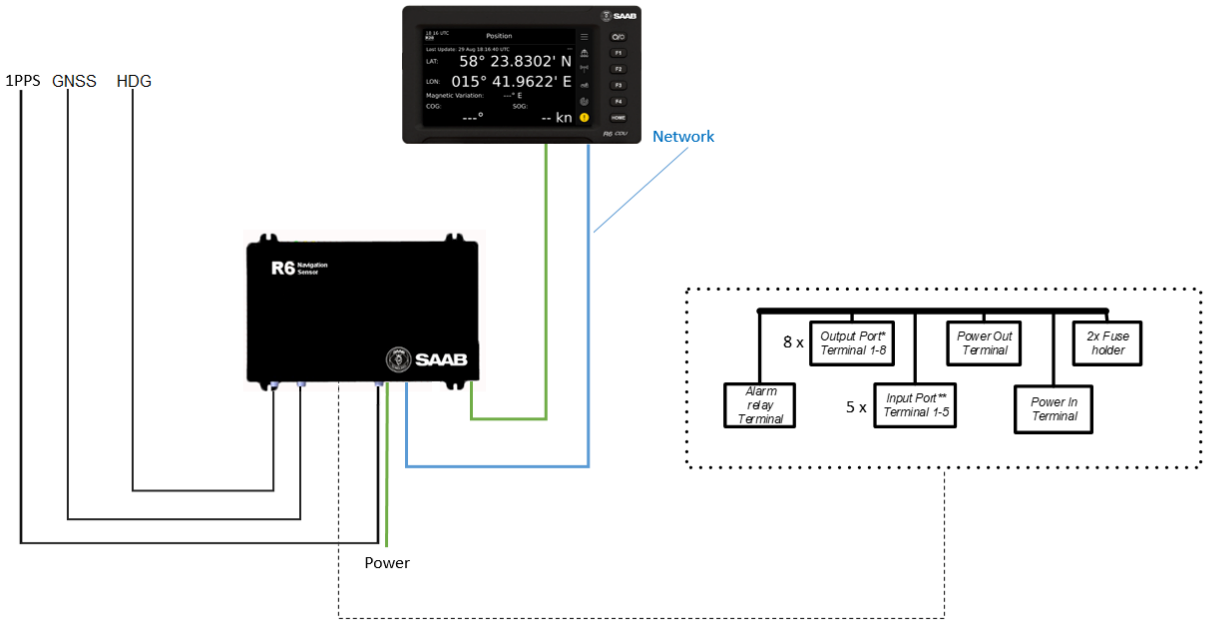


Figure 3-1 - System overview

Note: HDG interface is only available in the R6 NAV PRO Compass.

3.5 Installation Procedure

When installing the R6 Navigation System it is recommended to follow the steps described in this installation manual. Details of the installation procedure can be found in the coming sections of the manual.

Note: For full R6 NAV NEO installation see *7000 125-314, R6 NAV NEO installation instruction* and *7000 125-315, R6 NAV NEO System Setup*

Recommended installation steps:

1. Mount the CDU at conning station
2. Mount the Navigation Sensor

3. Mount the GNSS/DGNSS antenna(s)
4. Unmount the Navigation Sensor lid
5. Connect the CDU's Power Cable to the Navigation Sensor's CDU Power port
6. Connect the CDU to the Navigation Sensor by using a Ethernet Cable
7. Connect a GNSS Antenna to the Navigation Sensor by a GNSS Antenna Cable
8. Connect external systems via the internal serial (RS-422) in- and output terminals, optionally connect Alert Relay signal to bridge alert
9. Match the cables to the suitable, T-shaped, strain relief on the unit's cover board and attach the cables with cable ties or equivalent
10. Connect the Navigation Sensor's Power Input to an external 12/24 Volt power source (Cable not supplied by Saab TransponderTech)
11. Remount the Navigation Sensor lid
12. Power up the units
13. Run CDU Setup Wizard to set CDU and sensor network settings and pairing of the units
14. Perform system functional verification.

3.6 Installing the R6 CDU

3.6.1 CDU Location

The R6 CDU should be mounted close to the position from which the ship is normally operated, preferably on the bridge console close to the conning position.

When mounting the CDU, please consider the following:

- The temperature and humidity should be moderate and stable,

  operating temperature: -15ºC to +55ºC
- Select a location away from excessive heat sources
- Avoid areas where there is a high flow of humid salt air
- Avoid places with high levels of vibrations and shocks
- Avoid mounting the CDU in direct sunlight. Prolonged exposure to direct sunlight may have adverse effects to the system.
- Ensure that there is enough airflow to avoid high ambient temperatures
- The units can affect magnetic compasses.
  - The minimum compass safe distance from the CDU is 0.65 meters to a standard magnetic compass and 0.40 meters to a steering magnetic compass.

3.6.2 R6 CDU Mounting Options

The R6 CDU can be mounted in three different ways.

- Panel mount - Using the R6 CDU Flush Mount Kit (7000 123-142)
- Gimbal mount - Using the R6 CDU Gimbal Mount Kit (7000 123-140)
- Frame mount - Using the R6 CDU Mounting Frame (7000 123-119)

  NOTE: This Frame is designed to cover a Panel hole equivalent to R4 CDU cut-out.
- Frame mount - Using the R6 CDU Mounting Frame (7000 123-120)
- *NOTE: This Frame is designed to cover a Panel hole equivalent to R5 CDU cut-out.*

3.6.2.1 CDU Gimbal Mount

The gimbal mount allows for a quick installation, and is suitable for panel as well as ceiling mounting. It will give the benefit of a tilt-able display for optimal viewing angle.

The gimbal mount is fastened with four screws in the mounting surface. The CDU is attached to the gimbal mount with two wing knobs.

Make sure any connected cables that could transport water are installed in a way that will allow for drip off before reaching the CDU. The connectors are not water protected and shall not be the lowest point for external cables if there is a risk of water transport along the cable.

The CDU Gimbal mount is offered as an accessory to the CDU, and may be optional in some sale packages.

3.6.2.2 Panel Mount

Panel mounting will reduce bridge clutter and reduce the space needed for installation. A cut-out fitting the CDU profile must be made. See Section 18.3 for dimensions.

With the panel mount kit (7000 123-142), a panel mount is possible.

- Kits with Rev A or B, includes 4 corner mounting bracket and fasteners.
- Kits with Rev C or higher include two mounting brackets and fasteners.
- Kits with Rev D or higher also includes a gasket.

The CDU is fastened in place using the bracket and the threaded pin/bolts included in the flush mount kit 7000 123-142.

Figure 3-2 - R6 CDU Flush Mount Kit, Rev A or B.

For the Rev C or higher, screws can be use if the R6 CDU is mounted in the R6 CDU Frame mount or a thin (2 -10 mm) panel. In thick panels (5-25mm) the pin bolts is preferable.

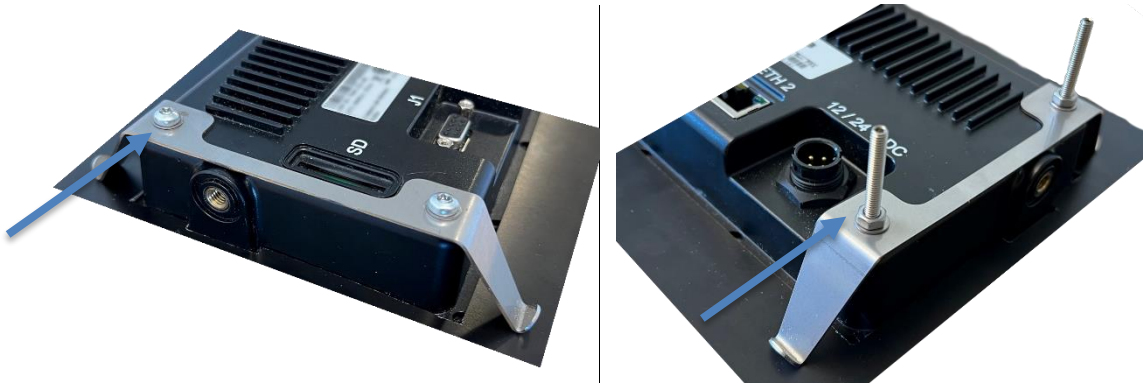


Figure 3-3 - R6 CDU Flush Mount Kit, Rev C or higher.

For the Rev D or higher, include a gasket that should be mounted between the CDU and panel. This will create a water tight seal between the CDU and a flat panel.

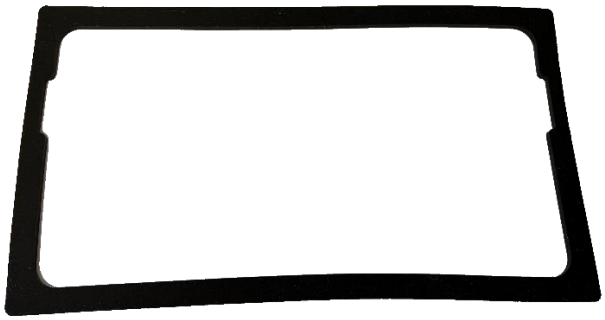


Figure 3-4 - R6 CDU Flush Mount Kit, Rev D or higher, includes a Gasket.

3.6.2.3 Frame Mount

The frame mount is used to install the R6 CDU in the rectangular cut hole bigger than the CDU. The Frame Mount is used in combination with the R6 CDU Flush mount kit.

The frame mount exists in two sizes:

- 7000 123-119, This will cover a R4 CDU holes. (272x200mm)
- 7000 123-120, This will cover a R5 CDU holes. (255x140mm)

3.7 Installing the R5 Navigation Sensor / R6 Compass

3.7.1 Sensor Location

The unit may be wall mounter or shelf mounted. When wall mounting, it is recommended to mount the unit with the LEDs facing up, and the cable opening downwards. This reduces the risk of water ingress.

When mounting the Navigation Sensor, please consider the following:

- Mount the unit so that the LEDs can be observed if needed for troubleshooting purposes.
- The temperature and humidity should be moderate and stable, +15ºC to +35ºC. (Operating temperature: -15ºC to +55ºC.)
- Select a location away from excessive heat sources.
- Avoid areas where there is a high flow of humid salt air.
- Avoid places with high levels of vibrations and shocks.
- Ensure that there is enough airflow to avoid high ambient temperatures.
- Ensure that the different cables can be connected without violating their maximum bending radius.
- The unit can affect magnetic compasses. The minimum compass safe distance is 0.6 meters to a standard magnetic compass and 0.3 meters to a steering magnetic compass.

3.7.2 Sensor Clearance Area

Leave a clearance around the R5/R6 Navigation Sensor to facilitate service and installation. See recommended clearance area in figure below. Make sure the LEDs are visible on the front for easier system function verification. Minimum bending radius on the connected cables should also be observed as well (see section 3.8.2).

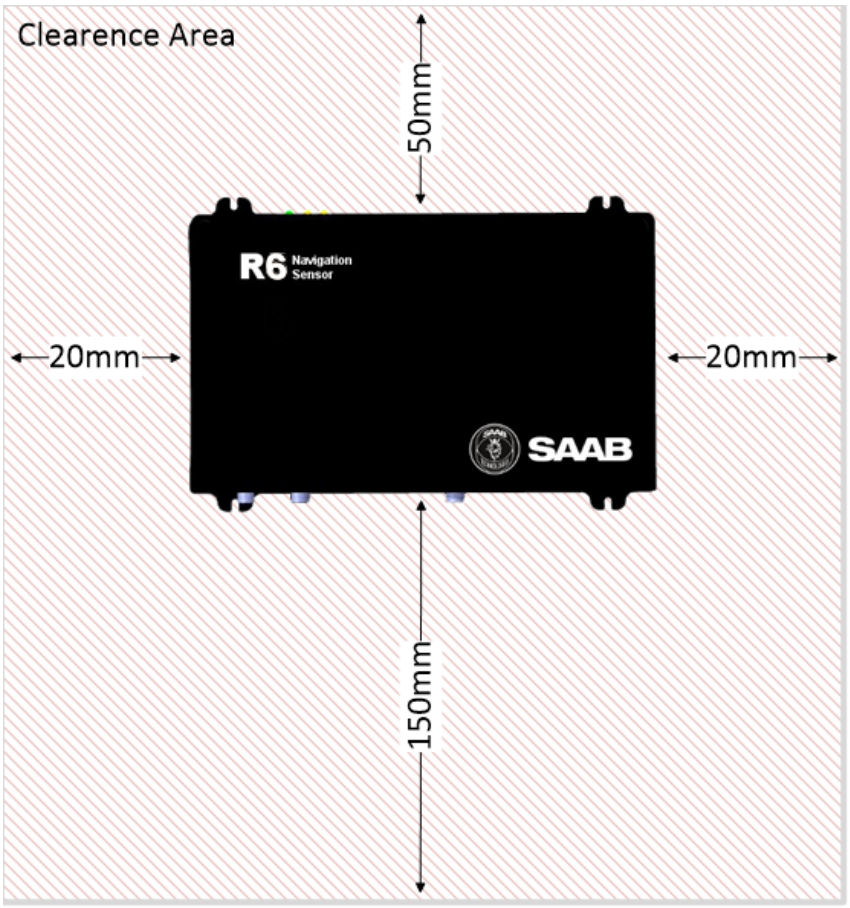


Figure 3-5 - Clearance Area for Navigation Sensor

3.8 Mount the GNSS Antenna

The R5/R6 Navigation Sensor shall be connected to one or two of the approved GNSS antenna types. 5V DC is supplied through the antenna leads for the antenna preamplifier.

Attention should be paid to the location and installation of the different antennas on the ship in order to obtain the best possible performance. Special attention should be paid to the installation of mandatory antennas like the AIS units antennas.

Therefore, installation of the GNSS antenna is a crucial part of the system installation. How and where you install your GNSS antenna and cable will greatly affect its sensibility.

3.8.1 GNSS Antenna Location

The GNSS antennas must be installed where it has a clear view of the sky. The objective is to see the horizon freely throughout 360 degrees with a vertical observation of 5 to 90 degrees above the horizon. Small diameter obstructions, such as masts and booms do not significantly degrade signal reception, but such objects should not eclipse more than a few degrees of any given bearing. Do not mount the antenna in the top of a mast or tower, as this may degrade the COG and SOG readings.

Locate the GNSS antennas at least 3 meters away from and out of the transmitting beam of, high-power transmitters such as S-Band Radar (typically ±15° vertically from the array's centre point) and/or Inmarsat systems (A, B, C, or M; typically ±10º from the array's centre point in any of the possible transmitting directions).

Locate the GNSS antennas at least 3 meters away from HF or VHF radios or their antennas. This includes the ship's own AIS VHF antenna if it is designed and installed separately.

In Compass/Heading installation both antennas shall be positioned at the same height in relationship to each other.

3.8.2 GNSS Cabling

The gain of the GNSS antennas built-in pre-amplifier shall match the cable attenuation. The resulting installation gain (pre-amplifier gain minus cable attenuation) shall be within 0 to 26 dB. A minimum value of 10 dB is recommended for optimum performance. Poor signal strength may have particular impact on RTK operations and the ability to reach full accuracy performance.

Double shielded coaxial cable is recommended. The coaxial cable should be routed directly between the GNSS antenna and the R5/R6 Navigation Sensor's GNSS connectors in order to reduce electromagnetic interference effects. The cable should not be installed close to high-power lines, such as radar or radio-transmitter lines or the AIS VHF antenna cable. A separation of 1 meter or more is recommended to avoid interference due to RF-coupling. Crossing of antenna cables should be done at 90 degrees to minimise magnetic field coupling.

The table below gives recommendation on cables that can be used for the system's GNSS-antenna connections. Due to the high frequency it's important that the attenuation in the cable is low for the specific frequency (1.5-1.6GHz GHz for single frequency, and 1.2-1.6 GHz for multi frequency).

Type	Attenuation @ 1.5 GHz (dB/m)	∅ (mm)	Weight (kg/100m)
RG 58	0.9	5	3.7
RG 400	0.6	4.95	6.3
RG 223	0.6	5.40	5.5
RG 214	0.35	10.8	18.5
RG 225	0.3	10.9	23.3

Table 3-4 - GNSS Antenna Cables

For optimum performance approximately +10dB gain should be available when the cable attenuation has been subtracted from the GNSS-antenna preamplifier gain; even more if the intention is to work with RTK corrections. The net gain shall not exceed +26dB.

Example:

Cable type	Preamplifier gain (dB)	Required min. cable length (m)	Recommended max. cable length (m)
RG 58	12	0	2
RG 58	26	0	18
RG 58	30	4.5	22
RG 223	12	0	3.5
RG 223	26	0	26.5
RG 223	30	6.5	33.5
RG 214	12	0	6
RG 214	26	0	46
RG 214	30	11.5	57

Table 3-5 - GNSS Antenna Cable Examples

Min length = (Preamp. Gain - 26 dB)/Cable attenuation per meter.

Max length = (Preamp. Gain - 10 dB)/Cable attenuation per meter.

3.8.3 GNSS Cable Mounting

Coaxial cables should be installed in separate signal cable channels/tubes and at least 10 cm away from power supply cables. Crossing of cables should be done at right angles (90°).

Coaxial cables should not be exposed to sharp bends, which may lead to a change of the characteristic impedance of the cable. The minimum bending radius should be 5 times the cable's diameter.

All outdoor installed connectors should be weather proofed, e.g. with shrink tubing, watertight seal tape or butyl rubber tape and plastic tape sealing, to protect against water penetration into the antenna cable.

Secure the cable properly near the cable ends.

3.8.4 GNSS Cable Grounding

Coaxial down-leads must be used. The coaxial shielding screen should be connected to ground.

4 CONFIGURATION

When the physical and electrical installation of the system is complete, the R6 Navigation System needs to be configured. This section describes what the installer is required to do before the R6 Navigation System is fully operational.

The R6 CDU menu system is divided into three categories: Operative, Status and Configuration. Views belonging to the Configuration Menus will be described in the following section.

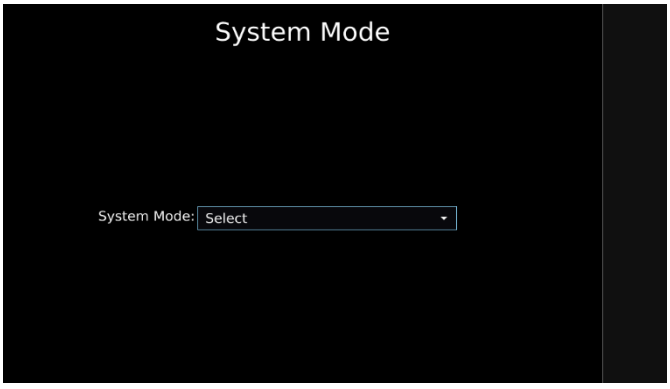
4.1 Configuration Wizard

The first time the R6 CDU is started, a configuration wizard will be shown. This wizard is a helpful guide to configure the basic functionality of the R6 Navigation System. The following sections describe the different steps in the configuration wizard.

It is possible to skip a part in the wizard by using the **[Skip]** button. This will jump to the next part in the configuration wizard.

4.1.1 Select System mode

Select/Configure “R6 Navigation System” as system mode in the CDU to get correct visualization.



View 4-1 - Wizard System Mode

4.1.2 CDU network Configuration

View 4-2 - Wizard CDU Network

The CDU uses UDP Multicast as defined by IEC 61162-450, to communicate with the Navigation Sensor. It is therefore necessary to configure an IP number and a System Function

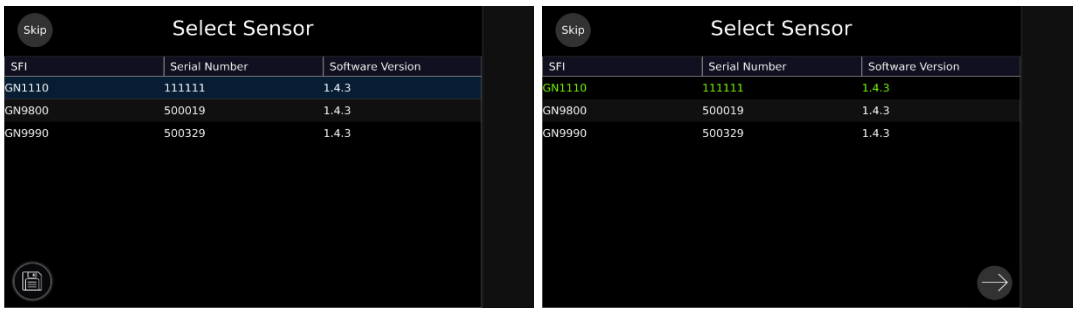
ID (SFI) for the CDU. The SFI consists of two letters (always “SN” for the R6 CDU) and four digits. Enter SFI, press **[Save]**, and thereafter **[Next]**, .

To learn more about this view, please consult section 4.3.2.

The IP and SFI must be unique for all equipment connected to the same IEC 61162-450 network. The system will require that the default SFI “SN9999” is reconfigured, because this SFI is not valid during normal operation in accordance with IEC 61162-450.

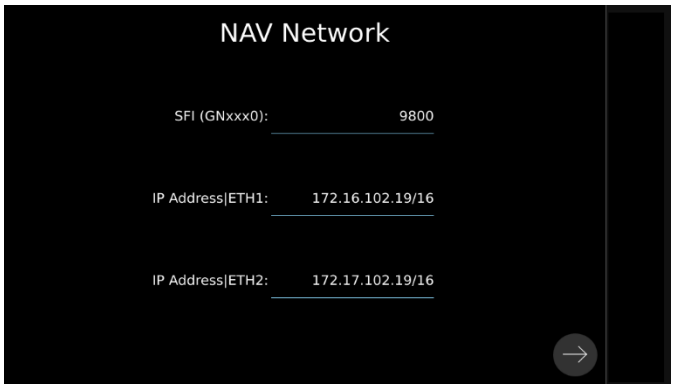
4.1.3 Select Sensor

When the R6 CDU is configured to be used in an R6 Navigation System, a navigation sensor must be detected and selected on the network. Make sure that the Navigation Sensor has power and is connected to the same network as the CDU. In the “Select Sensor” view the CDU will automatically search for navigation sensors on the network. Select the sensor that the CDU should communicate with and press **[Save]**, and thereafter **[Next]**, , to go to the “NAV Network” configuration view.



View 4-3 - Wizard Select Sensor

4.1.4 Sensor Network Configuration



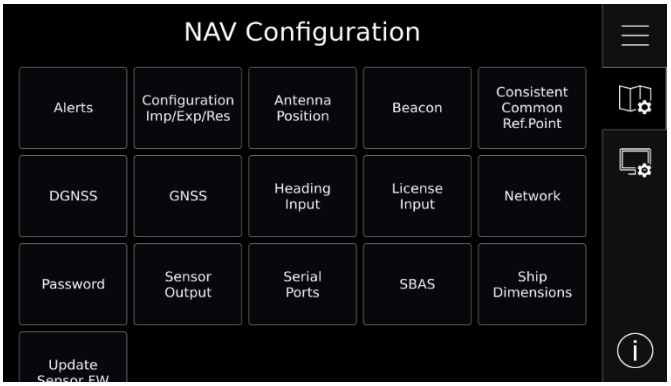
View 4-4 - Wizard NAV Network

When a sensor has been selected by the CDU it is possible to configure the sensor IP address and SFI. Navigation Sensor must have a unique SFI that consists of two letters (always “GN” for a Navigation Sensors with the requirement on the SFI to be evenly divisible by 10) and four digits. Press **[Save]**, to save changes and thereafter **[Next]**, to finish the configuration wizard.

The IP and SFI must be unique for all equipment connected to the same IEC 61162-450 network. The system will require that the default SFI "GN9999" is reconfigured, because this SFI is not valid during normal operation in accordance with IEC 61162-450.

4.2 NAV Configuration Menu

This section describes the different configuration parameters that can be set in the R6 Navigation System under the NAV Tab. For navigation in the CDU see section 5.



View 4-5 - NAV Configuration

NOTE: Menus may differ dependent on installed licenses and FW versions.

4.2.1 Alert Settings

In this view all alerts can be configured to either be "Enabled" or "Disabled" by checking or unchecking corresponding check boxes. When the alert is enabled, an active alert will affect the external alarm relay as well as the buzzer in the CDU.

For more information about the alert view, refer to Section 5.13 "Alert List". For a list of all the alerts that can occur, refer to Section 10.3 "Troubleshooting with Alert Messages."

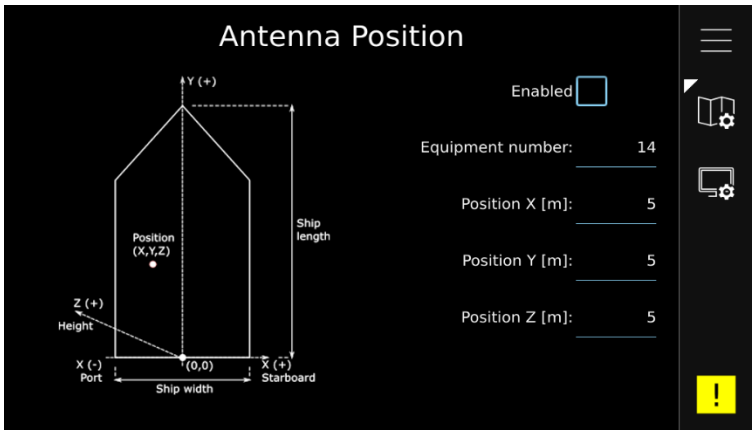
View 4-6 - NAV Alerts

4.2.2 Antenna Position

The GNSS Antenna Position settings can be used to inform navigation equipment (such as ECDIS) of the exact position of the GNSS antenna relative to the stern of the vessel.

By setting “Position” to Enabled, the Navigation Sensor will provide the configured information by means of the “POS” sentence (For more information regarding the POS sentence, see Section 14).

Note: Output of POS sentence must also be configured under “Sensor Output”.



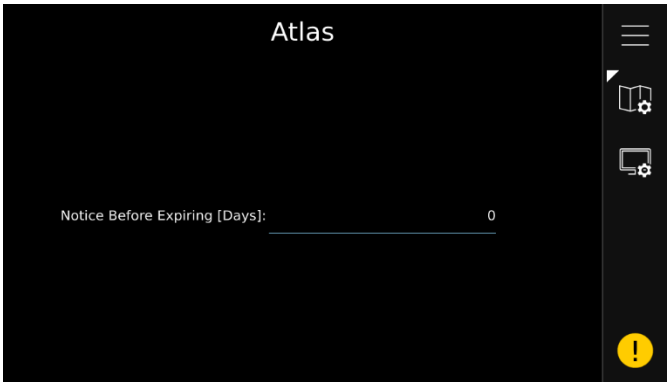
View 4-7 - Antenna Position

Parameter Name	Description
Enabled	This parameter is used to enable/disable the Antenna Position function.
Equipment Number	Device’s identification number
Position	This parameter is used to enable/disable the GNSS antenna position function.
Position X	Parameter to set the GNSS antenna offset from the starboard centre. Positive value (starboard), negative value (port) or zero (centre).
Position Y	Parameter to set the GNSS antenna offset from the stern. Positive value or zero (forward distance from the ship’s stern).
Position Z	Parameter to set the GNSS antenna height offset. Positive value (height from IMO summer load line).

Table 4-1 - Antenna Position Parameters

4.2.3 Atlas

The *Atlas configuration* view is accessible when R6 Compass sensor or a R5 NAV Pro sensor are connected and have an active “Atlas” subscription



View 4-8 - Atlas Configuration

Parameter Name	Description
Days Before Expires	Parameter sets how long before the Atlas subscription expiration date the system will give an indication. Default this parameter is set to 0 days, which disables the output of an Atlas subscription notification. *This setting is only available when using a Navigation Sensor holds a “PRO” license.*

4.2.4 Beacon

View 4-9 - Beacon Configuration

Parameter Name	Description
Tuning Mode	The Tuning Mode parameter sets the frequency selection mode of the DGNSS Navigation Sensor internal radio beacon receiver. The mode can be Frequency Scan, Manual or Database (Auto). In Frequency Scan mode, the beacon receiver will search available frequencies and tune to the strongest

	beacon signal. In this mode, the Navigation Sensor continuously performs background search to discover higher quality differential signals. While performing background searches, the navigation Sensor continues to receive differential corrections from the current radio beacon station. In Manual tuning mode, the Navigation Sensor tunes to the specified beacon frequency for receiving DGNSS signals. In Database mode, the receiver will search for the closest station based on its current location and distance to the internal list of station locations. The frequency and bit rate specified in the station database will be used and therefore these parameters are hidden when the Tuning Mode parameter is set to Database (Auto).
Frequency (kHz)	The Frequency parameter is used to set the frequency to use for receiving DGNSS Beacon signals, when the frequency mode parameter is set to manual. Valid frequencies are between 283.5 and 325 KHz, at 0.5 kHz intervals. This parameter is only available when Tuning Mode is set to manual.
Bit Rate	The Bit Rate Mode parameter sets the bit rate mode to either Automatic or Manual (50, 100 or 200 bps). In Automatic mode the DGNSS Navigation Sensor will automatically select the correct bit rate to use for demodulating the radio beacon signal. In Manual mode, the DGNSS Navigation Sensor will use the specified bit rate. This parameter is automatically set to Auto when Tuning Mode is set to Database (Auto) since the bit rate specified in the database will automatically be used.

Table 4-2 - Beacon Parameters

4.2.5 Consistent Common Reference Point

The Consistent Common Reference Point (CCRP) is a location on own ship, to which all horizontal measurements such as target range, bearing, relative course, relative speed, closest point of approach (CPA) or time to closest point of approach (TCPA) are referenced, typically the conning position of the bridge.

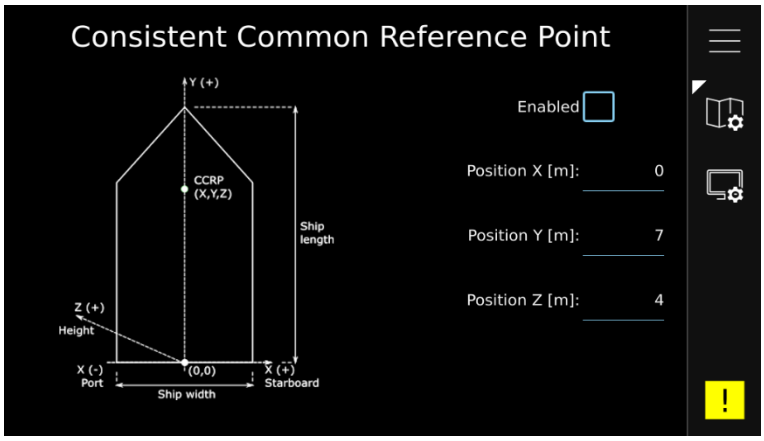
This feature can adjust the system position in Latitude, Longitude and Elevation using a preselected offset input.

This allows the GNSS antenna to be located anywhere on a vessel, and still have the position from a different reference point on the vessel.

This feature is useful to prevent big shifts in position when a backup GNSS system takes over from a primary GNSS system, and the two systems have a large GNSS antenna separation.

By enabling the CCRP, the inputted offset will be included in the configurable output sentence “POS” if heading is available (For more info about the POS sentence see section 11.6

NOTE: True heading data is required to calculate position offset. CCRP will be zero if there is no valid heading data received.



View 4-10 - Consistent Common Reference Point (CCRP)

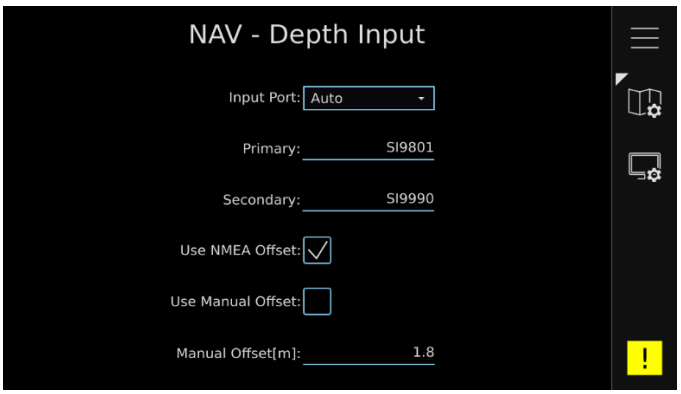
Parameter Name	Description
Enabled	This parameter is used to enable/disable the Consistent Common Reference Point function.
Position X	Parameter to set the CCRP from the starboard centre. Positive value (starboard), negative value (port) or zero (centre).
Position Y	Parameter to set the CCRP offset from the stern. Positive value or zero (forward distance from the ship’s stern).
Position Z	Parameter to set the CCRP height offset. Positive value (height from IMO summer load line).

Table 4-3 - CCRP Parameters

4.2.6 Configuration Import/Export/Reset

See Section 4.4 for detailed description.

4.2.1 Depth Input

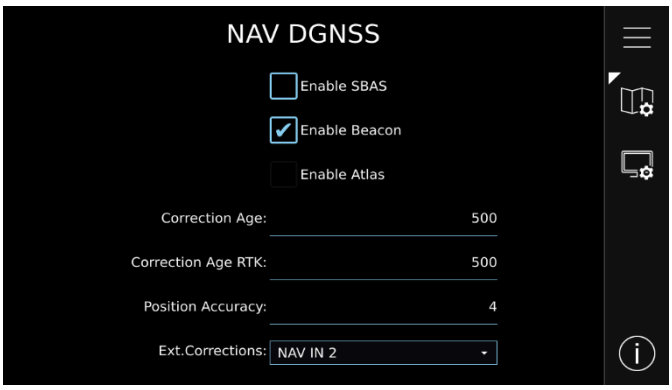


View 4-11 - Depth Input

Parameter Name	Description
Input Port	Specifies the input port that should be used for depth sensor data. It can be set to NAV User 3, NAV IN 1→ 5 or “Auto”. Depth sensor data received on a port that does not correspond to this setting is ignored.
Primary SFI (Network)	SFI of primary depth source used on Light Weight Ethernet network. Only applied if Input Port is set to “Auto”.
Secondary SFI (Network)	SFI of secondary depth source used on Light Weight Ethernet network. Only applied if Input Port is set to “Auto”.
Use NMEA Offset	If checked, any depth offset information available in the DPT sentence is added to the depth value taken from this sentence.
Use Manual Offset	If checked, the manual offset is added to the reported depth (regardless of sentence type).
Manual Offset	Specifies the manual offset for depth, if positive it is added to the reported depth. If negative, the manual offset is subtracted from the reported depth.

Table 4-4 - Depth Input Parameters

4.2.2 DGNSS



View 4-12 - NAV DGNSS

Parameter Name	Description
Enable SBAS	This setting allows the system use SBAS satellite signals as source for differential corrections.
Enable Beacon	In this setting the system will allow signals from IALA radio Beacon stations to be used as source for differential corrections. This setting is only available when using a DGNSS Navigation Sensor.
Enable Atlas	In this setting the system will allow signals from Atlas satellites to be used as source for differential corrections. This setting is only available when using a Navigation Sensor holds a “PRO” license with an “Atlas” subscription.
Enable HAS	In this setting the system will allow signals from Galileo HAS to be used as source for differential corrections. This setting is only available when using a Navigation Sensor holds a “PRO RTK” license.
Correction Age (Differential/RTK)	This parameter sets the maximum allowed age (in seconds) for correction data. The Navigation Sensor is capable of working with old correction data for extended periods of time. The default setting is 120 seconds for correction with quality “Differential” and 2700 seconds for “RTK”. The lowest allowed value is 10 seconds and the highest 2700 seconds. When increasing the allowed correction age, ensure that the new setting meets your requirements, as accuracy will degrade with increasing correction age.
Position Accuracy (Decimal Places)	This parameter controls the number of decimals used in to present latitude and longitude in position sentences.

	Note: If this parameter is configured to be higher than 5 decimals, the IEC 61162-1 required of maximum length of 82 characters for PI sentences will possibly be exceeded and may cause issues for receiving equipment. Verify receiving equipment supports longer sentences before exceeding 5 decimals.
External Corrections	This parameter allows fixed selection of source for external differential corrections to be forwarded to the internal GNSS receiver. "IN1" → "IN5". These settings will command the system to apply external differential corrections, received in RTCM SC-104 format, on the selected input port. If the unit holds a "RTK" license it is also capable to handle following input formats as well: • ROX • CMR/CMR+ • RTCM 2/2.3/3 "None" makes the system operate in autonomous mode, not using any externally inputted differential corrections.

Table 4-5 - DGNSS Parameters

4.2.3 GNSS Settings

View 4-13 - NAV GNSS

Parameter Name	Description
Enable GPS*	This parameter specifies if the American Satellite System "GPS" should be included in the GNSS/Navigation solution.
Enable GLONASS*	This parameter specifies if the Russian Satellite System "GLONASS" should be included in the GNSS/Navigation solution.

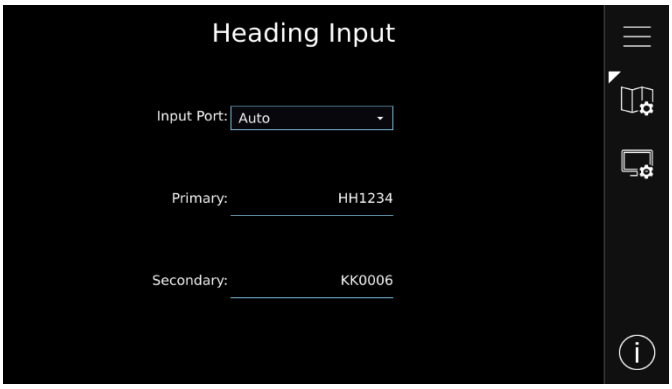
Enable Galileo*	This parameter specifies if the European Union Satellite System “Galileo” should be included in the GNSS/Navigation solution.
Enable BeiDou*	This parameter specifies if the Chinese Satellite System “BeiDou” should be included in the GNSS/Navigation solution.
RAIM Level	This is the currently used RAIM accuracy limit used in the RAIM calculations.
Elevation Mask	This parameter sets the elevation cut-off mask angle, in degrees, for satellites. Any satellites below this mask angle will be ignored, even if available. The value should be between 0° and 60°, and the default value is 5°.
SOG Smoothing	The SOG Smoothing parameter allows you to adjust the level of responsiveness of the speed over ground (SOG) measurement, as displayed by the R6 CDU and provided in the $GPVTG and $GPRMC sentences. The default value is zero, and increasing the value will increase the level of SOG smoothing. The setting of this parameter depends upon the expected dynamics of the vessel. If a ship is highly dynamic, this value should be set to a lower value since the filtering window needs be shorter in time, resulting in a more responsive measurement. However, if a vessel is very large and has much more resistance to change in its motion, this value can be increased to reduce measurement noise. The following formula provides some guidance on how to set this value: SOG smoothing = 10 / maximum acceleration (in m/s^2). **If unsure on which value to set, it's best to be conservative and leave this parameter at the default setting of 0.00 seconds.**
COG Smoothing	The COG Smoothing parameter allows you to adjust the level of responsiveness of the course over ground (COG) measurement, as displayed by the R6 CDU and provided in the $GPVTG and $GPRMC sentences. The default value is zero, and increasing the value will increase the level of COG smoothing. As with the SOG smoothing parameter, the setting of this parameter depends upon the expected dynamics of the vessel. If a ship is highly dynamic, this value should be set to a lower value since the filtering window needs be shorter in time, resulting in a more responsive measurement. However, if a vessel is very large and has much more resistance to change in its motion, this value can be increased to reduce measurement noise. The

	following formula provides some guidance on how to set this value initially. It is however recommended that you test how the revised value works in practice. COG smoothing = 10 / maximum rate of change in course (in °/s). Note: The ship needs to be moving to calculate a valid COG value. Do not use COG values output while the ship is at rest as a basis for adjusting this parameter. *If unsure on which value to set, it's best to be conservative and leave this parameter at the default setting of 0.00 seconds.*
Force WGS84	This parameter supports a suppression of NAD-83 Datum and force a reporting of WGS84 or not *Note: Datum is only changed from WGS84 in the R6 Navigation System if correction based on another Datum is used in the GNSS solution.*

***The multi GNSS mode can improve reliability in areas with poor GPS reception, and also make the sensor less sensitive to interference**

Table 4-6 - GNSS Parameters

4.2.4 Heading Input Port



View 4-14 - Heading Input

NOTE: R6 NAV PRO Compass use internal heading, these parameters will therefore not be available in this product configuration

NOTE: The same port is used for input of magnetic heading and magnetic variation.

Parameter Name	Description
Input Port	Specifies the input port that should be used for heading sensor data. Can be set to Input Port 1→5 or “Auto”.

Primary SFI (Network)	Set to SFI of the primary Heading source used on the Light Weight /*Ethernet network. Only applied if “Input Port” is set to “Auto”.
Secondary SFI (Network)	Set to SFI of the secondary Heading source used on the Light Weight Ethernet network. Only applied if “Input Port” is set to “Auto”.

Table 4-7 - Heading Input Parameters

4.2.5 Import/Export Routes

The import and export of routes view offers functionality for importing and exporting route and waypoint data with a SD card. The view shows the SD card’s file system filtered on the valid route file format,*.routewp.

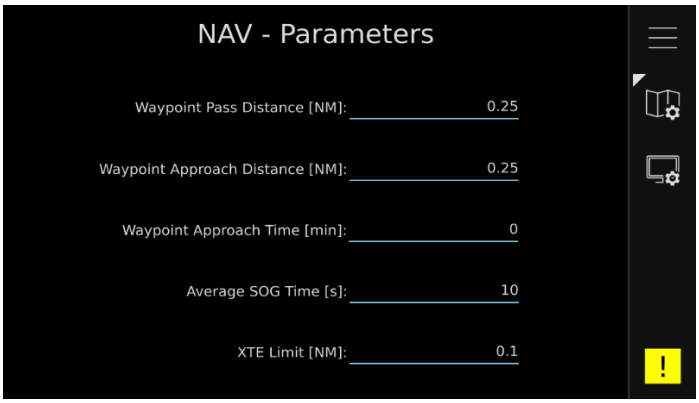
To import route data, select a file and press the button with a cloud and an arrow pointing towards the cloud.

To export current route data stored in the CDU, press the button with a cloud and an arrow pointing away from the cloud.

4.2.6 License input

See Section 4.5 for detailed description.

4.2.1 Navigation Parameters

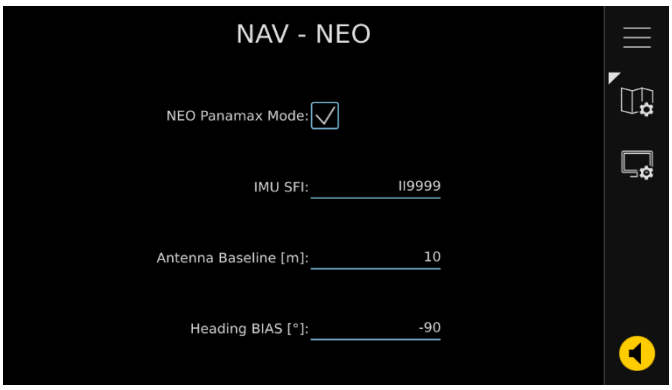


Parameter Name	Description
Waypoint Pass Distance	The distance that should be used to determine if the waypoint has been passed or not.
Waypoint Approach Distance	The distance to next waypoint, a “Waypoint Approaching” alert is raised when distance is reached.
Waypoint Approach Time	The estimated time (in minutes) before arrival to the next waypoint, a “Waypoint Approaching” alert is raised when time is reached.

Average SOG Time	The time period over which average speed is calculated when estimating time of arrival (ETA) to the end of the active route.
XTE Limit	The default cross track distance that is used if no limit is defined in the current leg of the route.

Table 4-8 - Navigation Parameters

4.2.2 NAV - NEO



View 4-15 - NAV NEO Parameters

NOTE: These configuration parameters is only available in the R6 NAV PRO Compass product configuration

Parameter Name	Description
NEO Panamax Mode	If NEO Panamax mode is active (*default*) a group of configuration parameters will be overridden all times, and some will be automatically applied when entering the Panama Canal area by a static Geo-Fencing. **Automatically applied in the area of the Panama Canal in NEO Panamax mode (Geo-fenced):** • All **GNSS System** is *Enabled* • **Elevation Mask** is forced to *5 degrees* • **SBAS and SBAS Auto search** is *Enabled* • **Beacon** is forced *Enabled* • **Beacon Tuning Mode** is forced to **Auto** • **All Correction Ages** is forced to *60 sec* **Applied at all times in NEO Panamax Mode:** • Serial Port **1 OUT** is forced to **Bitrate:** *115200* and **Function:** *C6 COM* • Serial Port **1 IN** is forced to **Bitrate:** *115200* and **Function:** *RTK* • **External Corrections** is forced to *NAV IN1* • Serial Port **2 IN** is forced to **Bitrate:** *115200* and **Function:** *C6 COM* • **LWE Output GNS/HDT** is forced to *10Hz* • **CCRP Enabled** is forced to *Disabled*

	See Chapter 21, Appendix B for more detailed information about which parameters that are fixed override and within which area.
I6 IMU SFI	Set to SFI of the I6 IMU unit intendent to be used on the Ethernet network.
Separation (Baseline)	This parameter specifies/shall be set to the reference distance between the GNSS and the Heading antenna for monitoring of unwanted
Heading Bias	With this parameter, Heading Bias can be added to unit's heading (according to default setup) so that the vessel's heading is accurately reflect by the system.

If the installation is Pitch Oriented and matches right example in figure below, set Heading Bias to **0**.

If the installation is Roll Oriented and matches left example in figure below, set Heading Bias to -**90**.

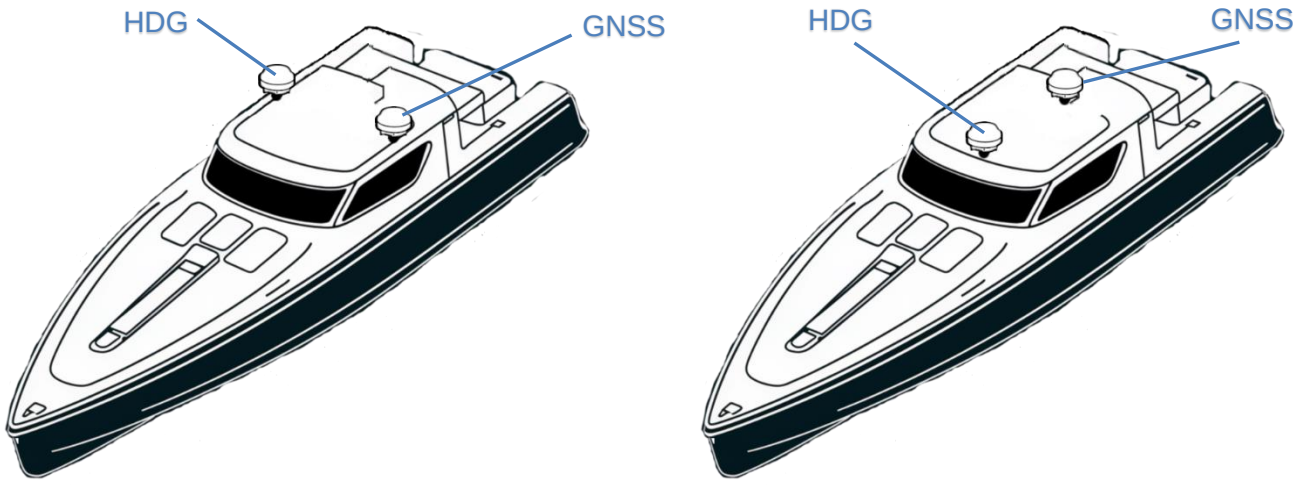
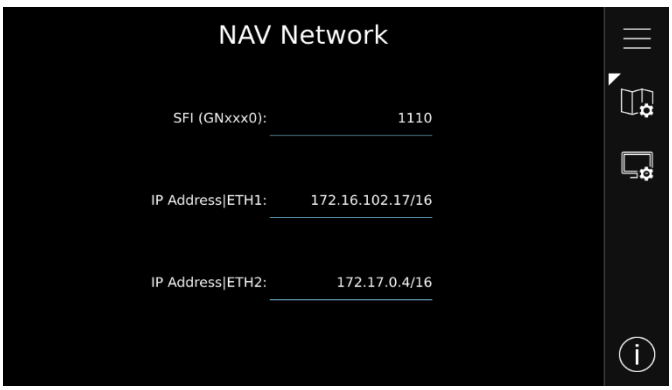


Figure 4-1 - Heading Orientation of the antenna installation

4.2.3 **NAV - Network Settings**

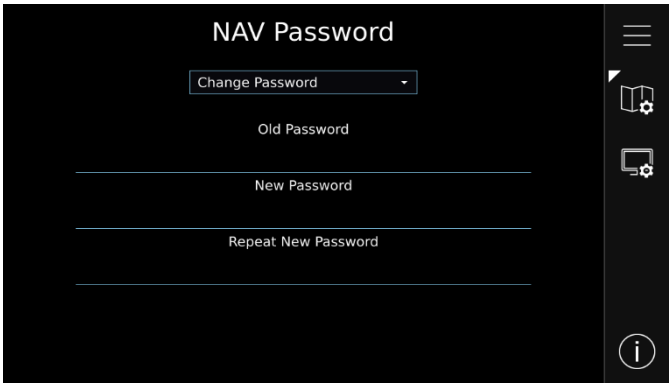


View 4-16 - NAV Network

Parameter Name	Description
SFI	The unique ID that is used on the network. This configured ID must be evenly divisible by ten, the following 8 IDs will be automatically allocated to the Compass/Sensor serial ports (“IN1” through “IN5”, “OUT1” through “OUT8”). For example, if this parameter is set to “3140”; the R6 Navigation Sensor will transmit navigation-related messages on the network with the SFI “GN3140”. Additionally; data received on “IN5” would be transmitted over the network using the SFI “SI3145”, and data transmitted over the network to the destination SFI “SI3148” would be sent out from serial port “OUT8”. This ID must be unique for all equipment connected to the same network. **The IP and SFI must be unique for all equipment connected to the same IEC 61162-450 network. The system will require that the default SFI “SN9999” is reconfigured, because this SFI is not valid during normal operation in accordance with IEC 61162-450.**
IP Address ETH1	The IP Address and network mask used for the R5/R6 Navigation Sensor port ETH1. Example: 172.16.0.1/16
IP Address ETH2	The IP Address and network mask used for the R5/R6 Navigation Sensor port ETH2. Example: 172.17.0.1/16

Table 4-9 - NAV Network Parameters

4.2.4 NAV - Password Settings



View 4-17 - NAV Password

Strong passwords shall *always* be used. A strong password is characterized by the following three criteria

- Does not contain the user name or parts of the user's full name such as first name, company name, product name etc.
- Does not contain dictionary words.
- Is meaningless and random.

The R5 Navigation Sensor further imposes restrictions on acceptable passwords:

- Minimum length of 8 characters
- Must contain at least 3 of the 4 categories *Upper case*, *Lower case*, *Digits*, and *Special characters*.

Parameter Name	Description
Change Password	Changes the optional -password for the Navigation Sensor. **By default, no password is set.**
Restore Passwords	It is possible to restore both user password and admin password to the default values above with a secret restore key. To obtain the restore key, contact TransponderTech Support and be prepared to provide the **serial number** of the **Navigation Sensor** unit.

Table 4-10 - NAV Password Parameters

Note: For CDU Password see Section 4.3.3

4.2.5 RTK Base

The *RTK Base configuration* view is accessible, if the unit has a "RTK" license,

Parameter Name	Description
Base Id	Parameter to set the reference id on the output corrections.
Base Mode	If this parameter is enabled the receiver will stop re-averaging of own position and no external RTK inputs will be included in the calculations of output corrections. *Recommended to use if setting up an Navigation Sensor as a RTK Base.*
Output Format	Parameter sets which format the corrections are output with. The selectable options are: • CMR • ROX

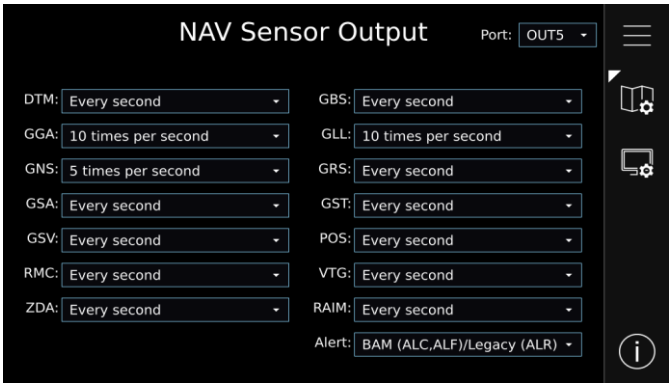
	• RTCM 3 • None If parameter set to “None” (default setting) no RTK data will be output on the configured output ports, refer to Section 4.2.7 Serial Ports.
Ellipsoid height	Parameter sets the height for the RTK Base reference positon. *Input height above the reference ellipsoid approximating the earth’s surface.*
Latitude	Parameter sets the geographical latitude for the RTK Base reference position. *The parameter is divided into three parts: degrees, minutes and cardinal direction.*
Longitude	Parameter sets the geographical longitude for the RTK Base reference position. *The parameter is divided into three parts: degrees, minutes and cardinal direction.*

Note: To get good corrections form a RTK Base set up, it is crucial that the reference position (Base position) is accurately determined.

Table 4-11 - RKT Base Parameters

4.2.6 Sensor Output

The Sensor Output view is used to configure which NMEA sentences is output on the R5/R6 Navigation Sensor’s Output Ports and the Ethernet port on both the Navigation Sensor, and how often they are sent.



View 4-18 - NAV Sensor Output

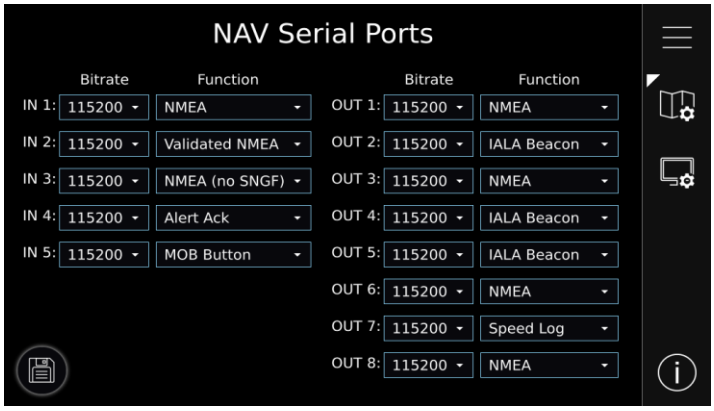
Parameter Name	Description
Port	Specifies the output port that is under configuration

GGA/GLL/GNS/ZDA/VTG/RMC/ HDT	GNSS sentences that the R5/R6 Navigation Sensor is capable to output and has configurable output interval. The interval can be set between 10 time per second up to 1 per minute *See section 14.1 for message examples and explanation.*
DTM/GBS/GRS/GSA/GST/GSV POS/PSTT,501	GNSS sentences that the Navigation Sensor is capable to output and has configurable output interval. The interval can be set between 1 time per second up to 1 per minute *See section 14.1 for message examples and explanatory.*
Alert (Sensor)	The Navigation Sensor output alert in two formats, Legacy Alarms (ALR) and Bridge Alert Management (ALF/ALC) Default is both formats output. If this parameter is set to “BAM”, ALF sentences will be output on events and ALC each 30 second. If this parameter is set to “Legacy”, ALR sentences will be output each 60s if there is no active alert otherwise each 30s.
AAM/APB/BOD/HSC/RMB/WPL/ RNN/RTE/XTE/	Navigation sentences that the Navigation Sensor is capable to output. The value can be set to “Disabled” or “Every Second” which outputs the sentence each second.
BWC/BWR	Navigation sentence that the Navigation Sensor is capable to output. Can be set to “Disabled”, “BWC”, “BWR”, “Both” or “Auto”. If “BWC” or “BWR” is selected, the selected sentence is sent each second. If “Both” is selected, both BWR and BWC sentences are sent each second. If “Auto” is selected and the CDU configuration parameter “Route Distance Algorithm” is set to “Rhumb Line”, then the BWR sentence is sent each second. If “Auto” is selected and the CDU configuration parameter “Route Distance Algorithm” is set to “Great Circle”, then the BWC sentence is sent each second. See **Error! Reference source not found. Error! Reference source not found.** for more information about “Route Distance Algorithm”.

Upload	If set to “Enabled”, WPL and RTE sentences are uploaded on configured port. See 5.15.2 Upload route or waypoint for more information about upload of routes and waypoints.

Table 4-12 - Sensor Output Parameters

4.2.7 Serial Ports



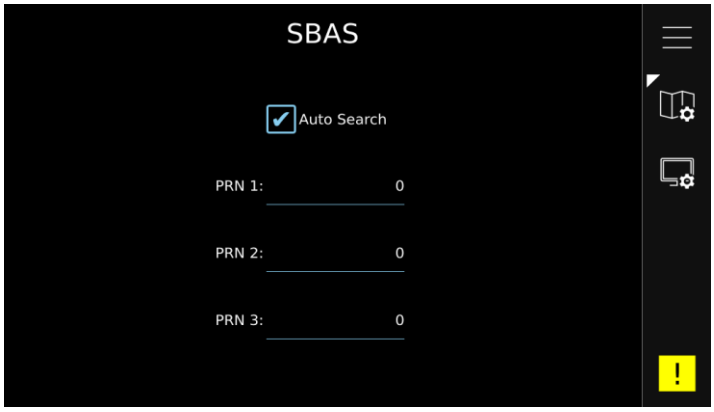
View 4-19 - Serial Ports

Parameter Name	Description
In 1 - 5	Specifies if the input port shall be used to receive “NMEA” messages or if it shall act as an “Alert Acknowledgement”/”Man Over Board” Button reacting on external switching. • NMEA (SNGF) • Validated NMEA (SNGF) • NMEA (no SNGF) • Alert Ack (see 17.3.5.2)
Out 1 - 8	Specifies if the input port shall be used to receive “NMEA” messages or if it shall act as an “Alert Acknowledgement”/”Man Over Board” Button reacting on external switching. • If set to “NMEA”, the selected Output Port will output a message stream following the “NMEA 0183” Standard. *See section 14 for message examples and allowed sentences.* • If set to “IALA Beacon”, the selected Output Port will output correction data from the internal beacon receiver (RTCM2 format).

	This function is available only if the R6 CDU is used together with an DGNSS Navigation Sensor. • If set to “RTK”, the selected Output Port will, if RTK format configured, output correction data internally calculated. This function is available only if the Navigation Sensor has “RTK” license. *See section 4.2.5 for configuration of RTK output.* • If set to “Speed Log” Pulses, the selected Output Port will output a pulse signal which frequency is dependent on the current speed.
Bitrate	The serial ports can be set to: • 4800 bps • 9600 bps • 19200 bps • 38400 bps • 57600 bps • 115200 bps *The higher the baud rate, the more sentences can be output on the specific port. In the “Output Config” views (see section) an estimated port load is calculated depending on the selected baud rate and the configured output sentences.*

Table 4-13 - Serial Port Parameter

4.2.8 SBAS



View 4-20 - SBAS

Parameter Name	Description
PRN Search Mode	Change between Automatic or Manual search mode.

	In Manual search mode, the Navigation sensor will try to acquire signals from satellites with id (PRN) numbers input by the parameters PRN 1 and PRN 2 in the view. If only one particular satellite is to be tracked, input same number for both parameters. In Automatic search mode, the Navigation Sensor will try to identify and track SBAS signals without user control of satellite selection.
PRN 1 (Primary)	The PRN of the primary satellite that should be used when operating in Manual PRN Search Mode.
PRN 2 (Secondary)	The PRN of the secondary satellite that should be used when operating in Manual PRN Search Mode.
PRN 3	The PRN of the third satellite that should be used when operating in Manual PRN Search Mode.

Table 4-14 - SBAS Parameters

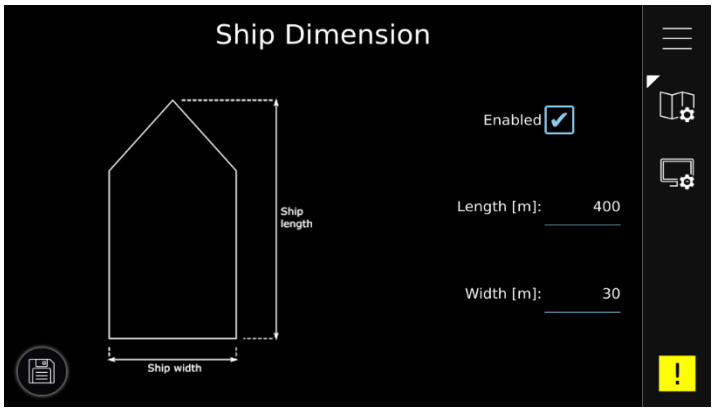
4.2.9 Ship Dimension

The Ship Dimensions settings can be used to inform navigation equipment (such as ECDIS) of the width and length of the vessel.

By setting “Ship Dimension” to Enabled, the Navigation Sensor will provide the configured information by means of the “POS” sentence (For more information regarding the POS sentence, see Section 14).

Note: output of POS sentence must also be configured under “Sensor Output”, 4.2.6

The Ship Dimension feature can be configured for inform the environment about the ship’s size. By enabling the Ship Dimension, will the inputted dimensions be included in the configurable output sentence “POS” (For more info about the POS sentence see section 11.6 and 14).



View 4-21 - Ship Dimension

Parameter Name	Description
Enabled	This parameter is used to enable/disable the Ship Dimension function.

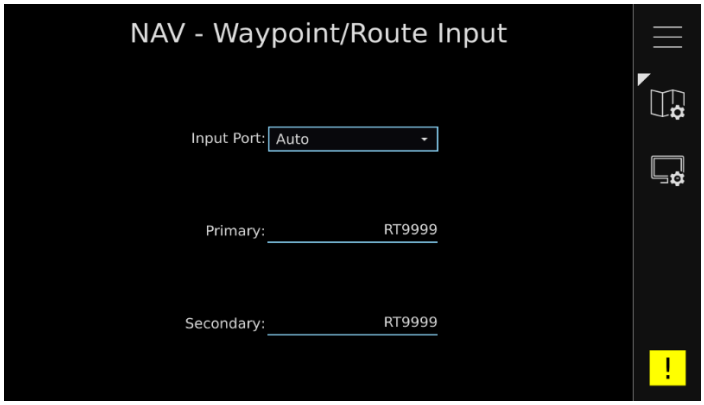
Ship Length	Parameter to set ship length.
Ship Width	Parameter to set ship width.

Table 4-15 - Ship Dimension Parameters

4.2.10 Update Firmware

For more information about the upgrade procedure, refer to Section 8, Firmware Upgrade.

4.2.1 Waypoint/Route Input



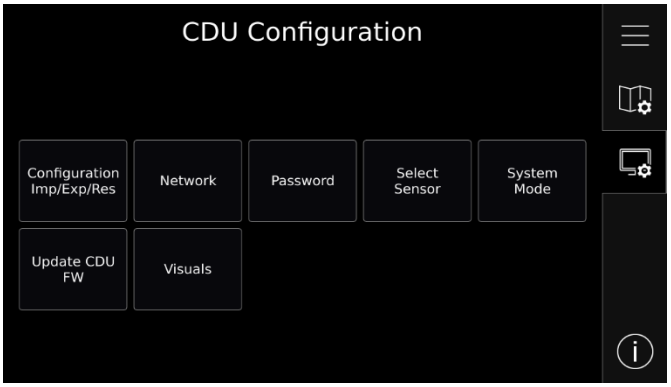
View 4-22 - Waypoint/Route Input

Parameter Name	Description
Input Port	Specifies the input port that is used for input of routes and waypoints. Input Port can be set to NAV IN 1→5 or “Auto”. Waypoints and routes received on a port that does not correspond to the configured input port is ignored.
Primary SFI (Network)	Set to SFI of the primary Waypoint/Route source used on the Light Weight Ethernet network. Only applied if Input Port is set to “Auto”.
Secondary SFI (Network)	Set to SFI of the secondary Waypoint/Route source used on the Light Weight Ethernet network. Only applied if Input Port is set to “Auto”.

Table 4-16 - Waypoint/Route Input Parameters

4.3 CDU Configuration Menu

This section describes the different configuration parameters that can be set in the R6 Navigation System under the CDU Tab.



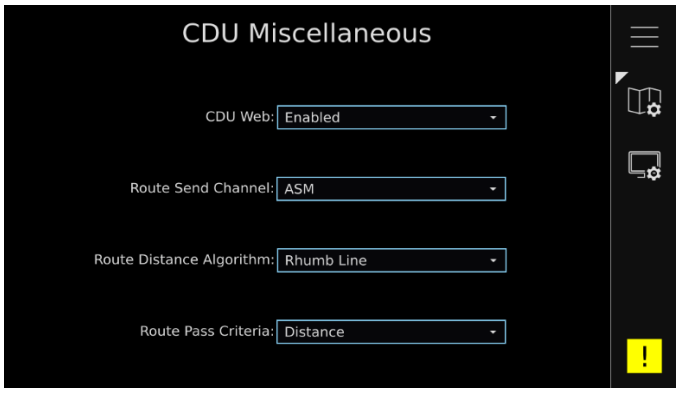
View 4-23 - CDU Configuration Menu

NOTE: Menus may differ dependent on installed licenses and FW versions.

4.3.1 Configuration Import/Export/Reset

See Section 4.4 for detailed description.

4.3.1 Miscellaneous Interfaces



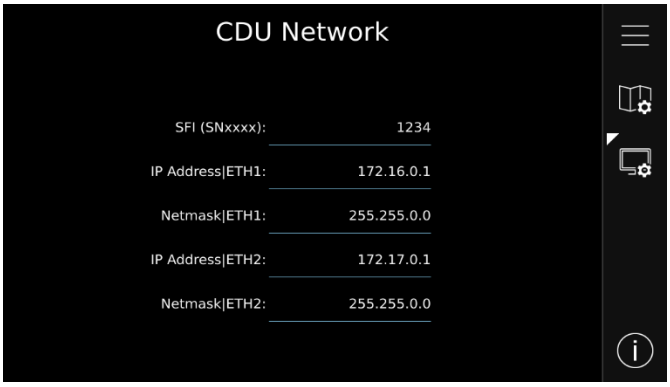
View 4-24 - CDU Miscellanous Interfaces

Parameter Name	Description
CDU Web	Enables or disables the CDU Web Interface.
Route Send Channel	Specifies on which radio interface the route message is sent. This requires the R6 CDU to be connected to a R6 Transponder. Can be set to “None”, “ASM” or “VDE”.
Route Distance Algorithm	Specifies which distance algorithm to use when calculating distances during sailing. Route Distance Algorithm is used if current leg’s distance algorithm is not set. Can be set to “Rhumb Line” or “Great Circle”.
Route Pass Criteria	Specifies which waypoint pass criteria to use when passing a waypoint. Route Pass Criteria is used if

	current leg's pass criteria is not set. Can be set to "Distance", "Perpendicular" or "Bisector".

Table 4-17 - CDU Miscellanous Parameters

4.3.2 CDU - Network Settings

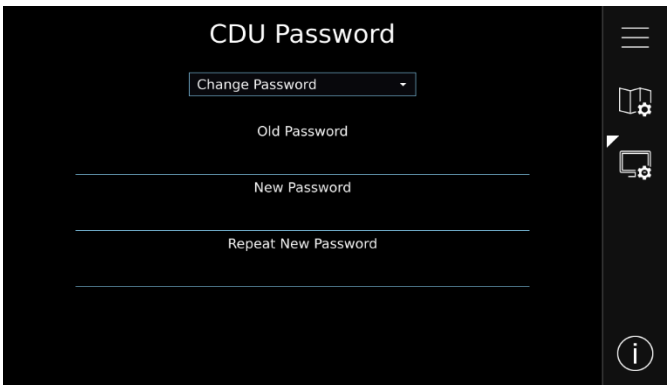


View 4-25 - Network CDU Configuration

Parameter Name	Description
SFI	The unique ID that is used on the network. For example, if this parameter is set to "3141" the CDU will transmit messages on the network with the SFI "SN3141". This ID must be unique for all equipment connected to the same network. **The system will not allow the SFI SN9999, because this SFI is not valid during normal operation in accordance with IEC 61162-450.**
IP Address ETH 1	The IP address used for port ETH1 of the CDU.
Netmask ETH1	IP-address Subnet mask used for port ETH1 of the CDU.
IP Address ETH2	The IP address used for port ETH2 of the CDU.
Netmask ETH2	IP-address Subnet mask used for port ETH2 of the CDU.

Table 4-18 - CDU Network Parameters

4.3.3 CDU - Password Settings



View 4-26 - CDU Password

Strong passwords shall *always* be used. A strong password is characterized by the following three criteria

- Does not contain the user name or parts of the user's full name such as first name, company name, product name etc.
- Does not contain dictionary words.
- Is meaningless and random.

The R6 CDU further imposes restrictions on acceptable passwords:

- Minimum length of 8 characters
- Must contain at least 3 of the 4 categories Upper case, Lower case, Digits, and Special characters.

Parameter Name	Description
Change Password	Changes the CDU password for the R6 CDU. **The default password is "cdupwd"**
Restore Password	It is possible to restore the CDU password to the default with a unit unique restore key. To obtain the restore key, contact TransponderTech Support and be prepared to provide the **serial number** of the **CDU** unit.

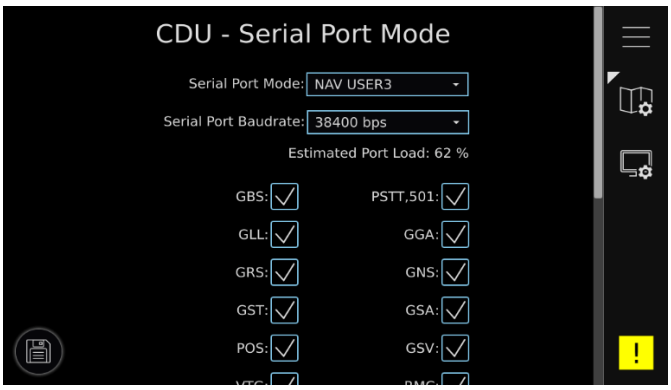
Table 4-19 - CDU Password Parameters

Note: For NAV Password see Section 4.2.4

4.3.4 Select Sensor

See Section 4.1.3.

4.3.1 CDU - Serial Port Mode



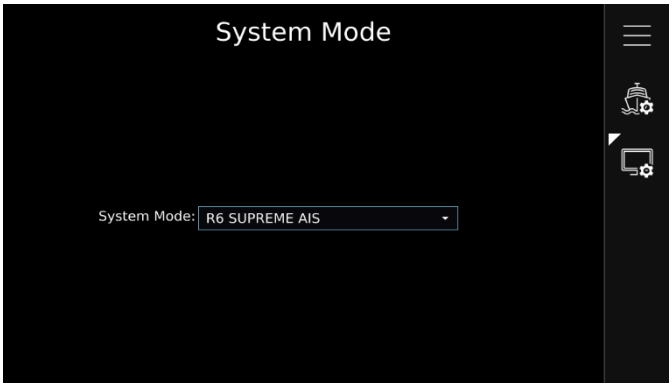
View 4-27 - CDU Serial Port Mode

Parameter Name	Description
Serial Port Mode	Specifies the type of data output on the serial port. Can be set to “AIS Pilot Port”, “”NAV USER3” or “Generic SNGF”.
Serial Port Baudrate	Specifies the serial port baud rate. This option is only available if Serial Port Mode is set to “NAV USER3” or “Generic SNGF”. Can be set to 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps or 115200 bps. If Serial Port Mode is set to “AIS Pilot Port” the baud rate is defaulted to 38400 bps.
SNGF Group	Specifies the SNGF group (Light Weight Ethernet). This option is only available if Serial Port Mode is set to “Generic SNGF”. Can be set to “NAVD” or “TGTD”.
GBS/PSTT,501/GLL/GGA/GRS/ GNS/GST/GSA/POS/GSV/RMC/ VTG/ZDA/DTM/Alert/ Upload(RTE&WPL)/AAM/APB/ BOD/BWx/HSC/RMB/RNN/RTE/ XTE	Specifies which sentences that shall be output on serial port. Only available if Serial Port Mode is set to “NAV USER3”.

Table 4-20 CDU Serial Port Mode Parameters

4.3.2 System Mode

Select the System mode.



View 4-28 - System Mode

Options to select from:

- **R6 Supreme AIS -** Type approved Class A AIS System, **Not** Described in this manual
- **R6 Navigation System -** Type approved Navigation System, Described in this manual
- **R6 Combined (AIS/NAV) -** When using one R6 CDU for both AIS and Navigation
- **R6 SUPREME AIS Read Only –** A read only Class A AIS mode**, Not** Described in this manual
- **R6 Navigation System Read O nly –** A read only Navigation mode, Described in this manual

4.3.2.1 Read-Only Mode

The read-only option provides the same status views as the full R6 Navigation System mode, but it excludes configuration views required for system setup—specifically, the “Routes” and “Anchor Watch” operational views. This mode does not affect R6 CDU operation; its sole function is to hide specific views.

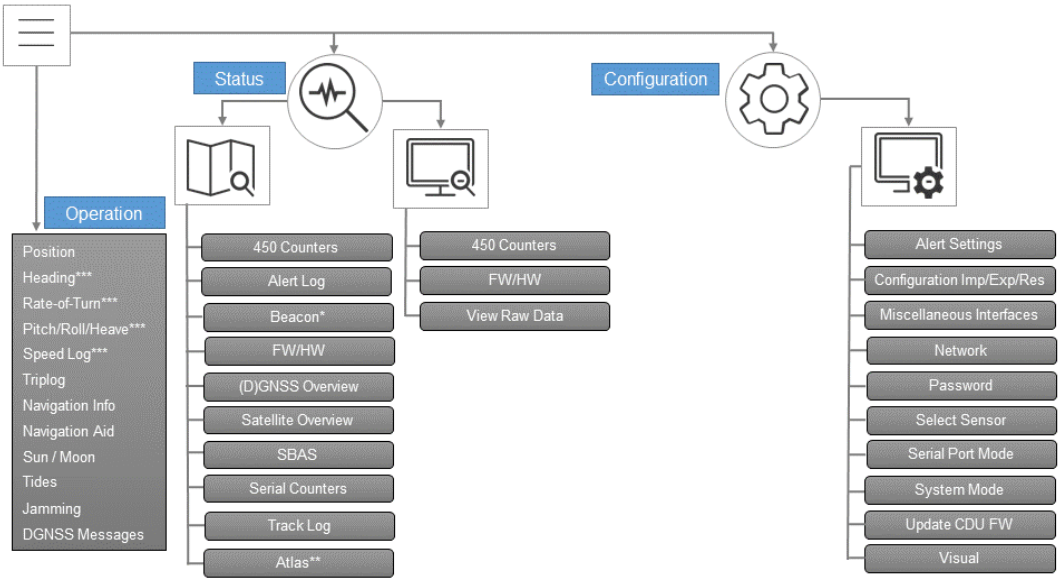


Figure 4-2 – Tree view - Read Only mode

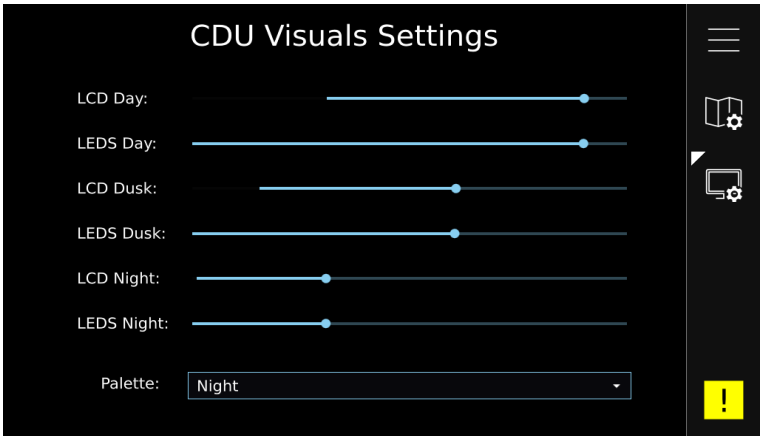
*NOTE: * Only for DGNSS/Beacon compatible system*
*NOTE: *** Only for NAV PRO Compass system configurations*

4.3.3 Update CDU Firmware

For more information about the upgrade procedure, refer to Section 8, “Firmware Upgrade”.

4.3.4 Visual Settings

To quickly change backlight mode on the R6 CDU, press the **PWR/Dimming** button on the front panel of the CDU to cycle between Day/Dusk/Night/Off brightness modes.



View 4-29 - Backlight settings

The settings to be applied in day/dusk/night brightness modes are configured in the CDU “Visuals Settings” view. While touching any of the settings sliders, instantaneous feedback is given. Some settings have a range limitation to ensure reliable performance.

*NOTE: Central dimming can be externally controlled. Pressing the **PWR/Dimming** button will override central dimming, until a new instruction is received from the central dimming source.*

Parameter Name	Description
LCD Day	Controls LCD backlight intensity to use in Day brightness mode.
LEDS Day	Controls Keypad LEDS backlight intensity to use in Day brightness mode.
LCD Dusk	Controls LCD backlight intensity to use in Dusk brightness mode.
LEDS Dusk	Controls Keypad LEDS backlight intensity to use in Dusk brightness mode.
LCD Night	Controls LCD backlight intensity to use in Night brightness mode.
LEDS Night	Controls Keypad LEDS backlight intensity to use in Night brightness mode.
Palette	There are two color schemes available, Day and Night. The Day palette uses primarily black text on white background, where the Night palette does the opposite.

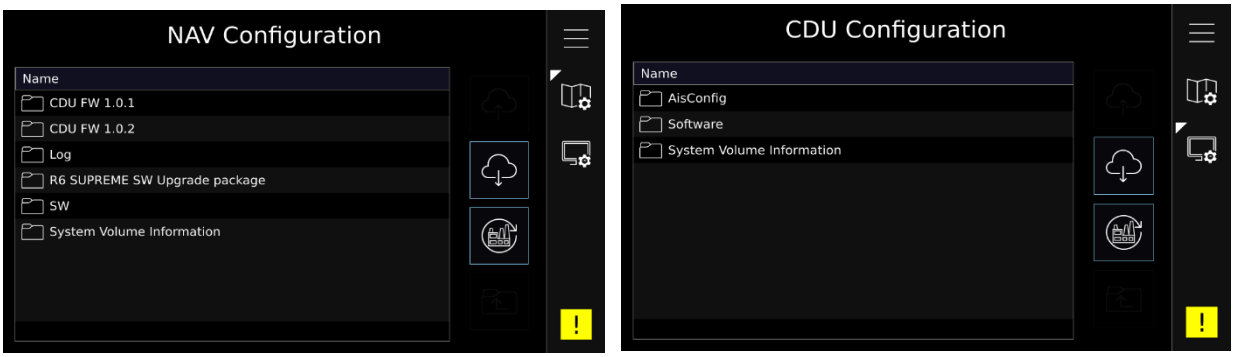
Table 4-21 - Visual Parameters

4.4 Configuration Import/Export/Reset

Enter the “Configuration Imp/Exp/Res” views found under NAV and CDU configuration Menus in order to save, restore, and/or reset configuration settings for the respective device.

Settings can be stored and retrieved to/from an SD-Card inserted into the SD-Card slot on the rear of the R6 CDU.

Note: When restoring or resetting settings of the R6 CDU, the CDU password is required. When restoring or resetting settings of the Navigation Sensor, the optional NAV password is required, if set.



View 4-30 - Configuration Imp/Exp/Res

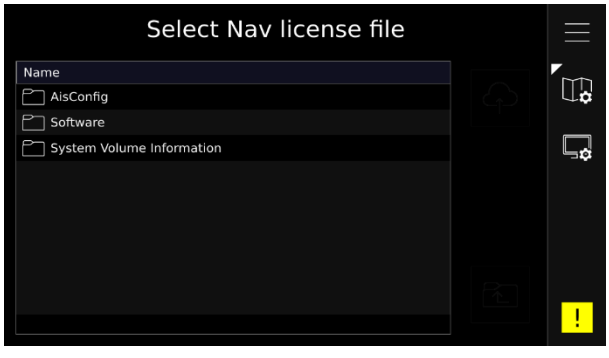
4.5 Input of Licenses

Some features in the R6 Navigation System require a firmware license to be unlocked by a special license file. A license file is unique for each single unit. The license file name has the following structure:

500001 - 7000 118-XXX [License Name].lic

In this example: 7000 118-XXX - The part number of this license key.

500001 - The serial number of the Sensor unit this key works with.



View 4-31 - License Input

To upgrade the license in the R6 Navigation System, perform the following:

- Place the license file on a SD-Card.

- Make sure that the CDU and Navigation Sensor communicates with each other via Ethernet.
- Insert the SD-Card in the rear of the CDU.
- Select License file and press the “Upload” button.

Note: Input of license by web-interface see section 7.4.3

5 OPERATION

These sections describe all the features related to everyday operation and various views found in the “Main Menu”.

5.1 General usage

This chapter describes how to use and interpret the system’s units as well as operate and navigate through the system menus.

5.2 LEDs on R5/R6 Navigation Sensor

The R5 Navigation Sensor has three LEDs that indicate its status.

Figure 5-1 - LEDs on R6 Navigation PRO Compass

1. **Status LED (Multi-colour)**

   The Status LED is multi-coloured; it will either be red or green. When this LED is continuously lit green the system has position and no active alerts. If the LED is continuously lit red the system has active alerts that has been acknowledged. If an alert has not been acknowledged the status LED will instead be flashing red.

2. **GNSS LED**

   The yellow GNSS LED indicates when continuously lit that the Sensor has obtained a solid GNSS lock and is able to provide position data.

3. **DGNSS LED**

   The yellow DGNSS LED indicates when continuously lit that the Sensor has achieved a solid differential data lock with marginal data error rate.

4. **HDG LED**

   The yellow HDG LED indicates when continuously lit that the Sensor has obtained a solid heading lock and is able to provide heading data.

   Note: HDG LED inactive in hardware with serial number (S/N 518257-518276)

5.3 R6 CDU HMI

This section describes the controls and status indications of the R6 CDU.

Key elements that are used to control and observe the system are identified below. Note that the physical function keys F1 - F4 have different function in CDU **Operative views, Status views/menus** and **Configuration views/menus** as indicated by the corresponding symbols in the HMI area no.7 described below. The physical function key descriptions below, are applicable to the **Operative Mode** view.

Figure 5-2 - Key HMI elements of the R6 CDU

***1* - Power / Dimmer button (multi-colour)**

Changes colour depending on Alert status:

- Constant green when the system is operating and no alerts are active
- Constant yellow or orange if there is an active alert (depending on alert priority)
- Flashing orange if there is an unacknowledged alert

Quick press will toggle dimming levels:

Day → Dusk → Night → Backlight Off → Day

*NOTE: The brightness setting may be operated from a central dimming source if connected to the system. Pressing the **PWR/Dimming** button will override central dimming, until a new instruction is received from the central dimming source.*

*NOTE: In Off mode, **PWR/Dimming** button are still active.*

Shut down or power up the system

- Long press (10 seconds) will power off the R6 CDU completely (soft shutdown)
- After a soft shut down, press the power button again to power up
- After a hard shut down (using power supply), the system will automatically power up

***2* - F1 - Function Key**

Provides quick access to configured view (default: ***Navigation Information***) in operative mode.

***3* - F2 - Function Key**

Provides quick access to configured view (default: ***Routes***) in operative mode.

***4* - F3 - Function Key**

Provides quick access to configured view (default: ***Plot view***) in operative mode.

***5* - F4 - Function Key**

Provides quick access to configured view (default: ***Position view***) in operative mode.

Note: Function keys can have different functions depending on the CDU's operational mode (Operative/Status/Configuration)

***6* - HOME Key**

Provides quick return to either "Position" (default) or the "Alert List" View from any other screen, including Configuration/Status views and menus.

***7* - F-key function indicators**

Indicates the current function of the corresponding physical Function Key located to the right.

Also works as touch buttons.

***8* - Alert status field**

Will indicate if any alerts are present in the system. Touch for quick access to alert list.

***9* - Main Menu button**

Provides access to lists of all available screens of the system, as well as access to the Configuration/Status views and menus. For more information on how to navigate the menu system, see Section 5.5.1.

***10* - Time and status indications field**

Colon in time stamp will blink as long as the R6 CDU is responsive.

Provides indication for RAIM level/status and GNSS Mode.

Note: The only time the R6 Navigation system does not have, UTC synchronization, is when the unit has been rebooted/power cycled and not received any GNSS/GPS signals.

5.3.1 Change Settings of a Parameter

Many views contain parameters that can be edited (colour marked). To edit a parameter, simply press it on the screen. Once the desired changes have been made press the **[Save],**  button which will appear on the view if a change has been done.

Data can be entered in the following ways:

- **Text/Numbers** through a virtual keyboard. Press characters on screen directly and press **[ENTER]** to confirm. Press **[ESC]** to undo changes.
- **Selection List:** Parameters with fixed values are displayed in a drop-down list shown when parameter is selected.
- **Checkbox:** Some parameters with only on/off or enable/disable options are displayed as a checkbox. Just Click to check/uncheck.

NOTE: REMEMBER THAT MOST CONFIGURATIONS REQUIERS TO BE SAVED WITH THE "DISKETTE BUTTON" AND THAT SYSTEM POWER IS NOT TURN OFF WITHIN 2 SECONDS AFTER THE PARAMETERS ARE SAVED.

5.4 Configurable Hardware Buttons

To configure the function of the hardware buttons F1-F4 or HOME button, press the button to be configured for 3 seconds. A popup will appear where the functionality for the pressed button is selected.

View 5-1 - Configurable hardware buttons

5.5 View Structure - Tree view

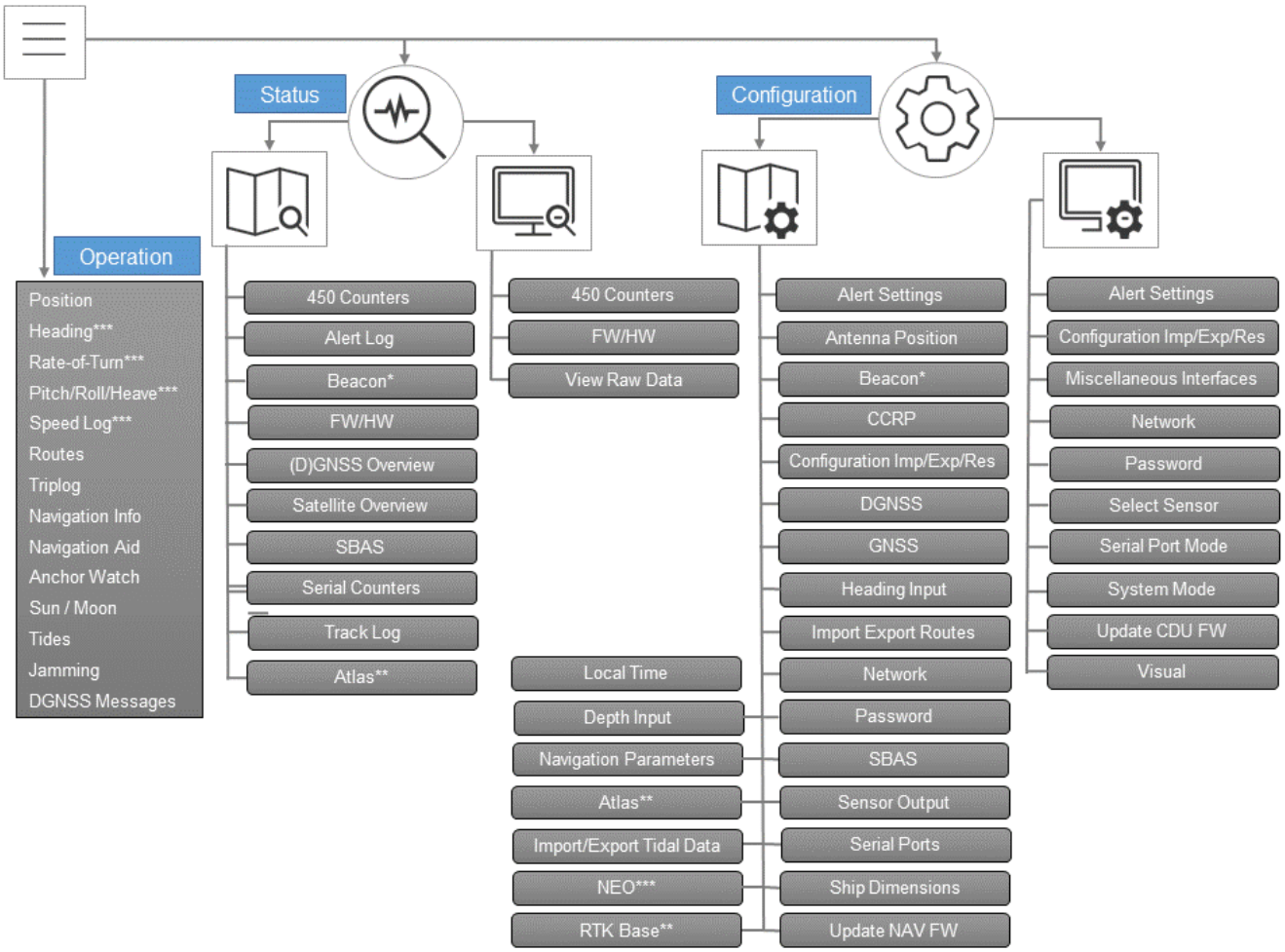


Figure 5-3 - Tree View

*NOTE: * Only for DGNSS/Beacon compatible system*
*NOTE: ** Only for PRO/RTK/Atlas compatible system*
*NOTE: *** Only for NAV PRO Compass system configurations*

5.5.1 Navigating to specific views

To fully navigate the R6 CDU, use of the touch display interface is necessary. Below is a quick guide on how to navigate to the various menus. Consult figure “Figure 5-3 - Tree View**Error! Reference source not found.**” for guidance. Press the physical **HOME** key to exit any view and bring up “Position” view.

1 - Main Menu

Press the **[Main Menu],** button in the top right corner to bring up a list of options.

2 - Operative Menu

All these options belong to the Operative view group. Select any of these options to enter.

3 - Status Menus

Press the **[Analyse magnifying glass],** to enter the Status Menus.

4 - Configuration Menus

Press the **[Gear]**, to enter the Configuration Menus.

5 - NAV/CDU view

For the Status menus/views and Configuration menus/views it is possible to toggle between the NAV and CDU menus by selecting the map or display symbols respectively. Either by the touchscreen or their related hardware buttons.

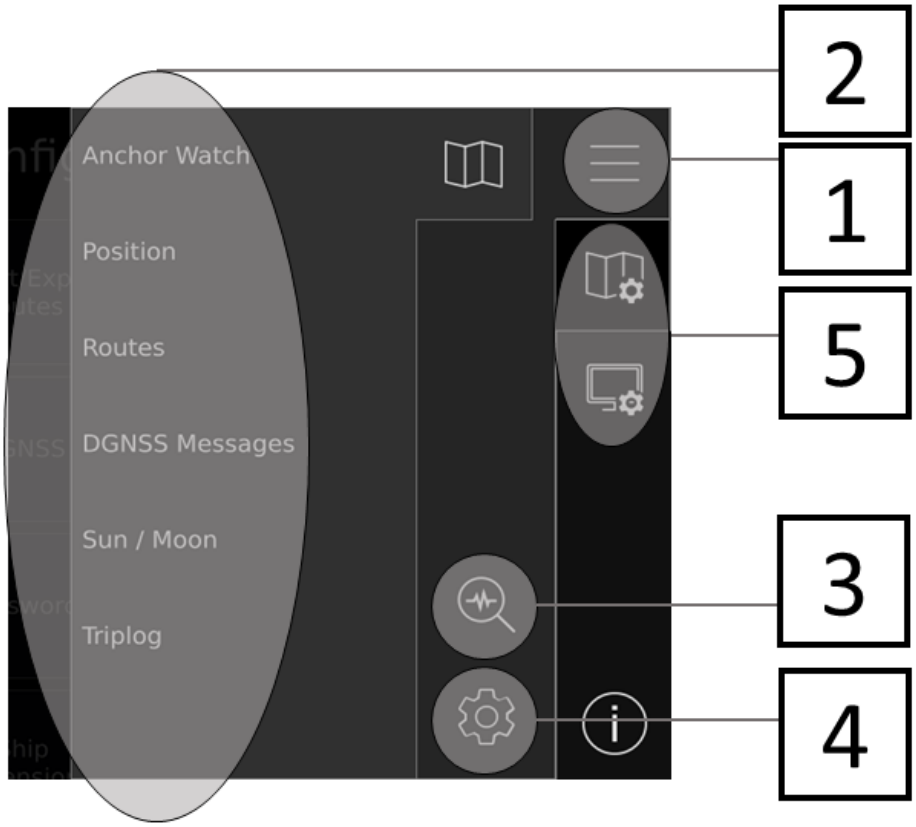


Figure 5-4 - Main Menu

5.6 Alerts

If the R6 Navigation system detects a malfunction or operational issue, an alert will be raised, indicated by an alert icon in the Alert status field (see Section 5.7.1) and possibly audible signals.

The significance of an alert is presented with their different priority levels, some requiring immediate attention and an acknowledgement.

To see alerts requiring acknowledgement or to see an overall view of all raised alerts, navigate to the “Alert List” by clicking on the **alert indication symbol** in the lower right corner. Perform necessary actions by following the instructions in section 5.13.

NOTE: Not all alerts require acknowledgement.

NOTE: For more detailed information about alert types and their effect on the system, see section 5.14.

5.7 Status Icons

5.7.1 Alert status icons


Active unacknowledged alarm (Flashing)


Active silenced alarm (Flashing)


Active acknowledged alarm


Active unacknowledged warning (flashing)


Active silenced warning (flashing)


Active acknowledged warning

Active caution


Active unacknowledged notification


Active acknowledged notification

NOTE: The list shows all alert icons in falling priority order. No alert classified as alarm will occur in a pure Navigation system. For quick access to the Alert List, press the icon.

Other status icons that can be displayed are:

RAIM (when level set to 10m)

Unread DGNSS Message

GNSS Mode Indicator

- GPS Marked when only operating with GPS
- GNSS Marked when operating with multi-GNSS
- Colour change to orange during active alerts related to position lost
- Colour change to Green when GNSS solution includes corrections (RTK/Beacon/SBAS)

5.8 RAIM Accuracy Level

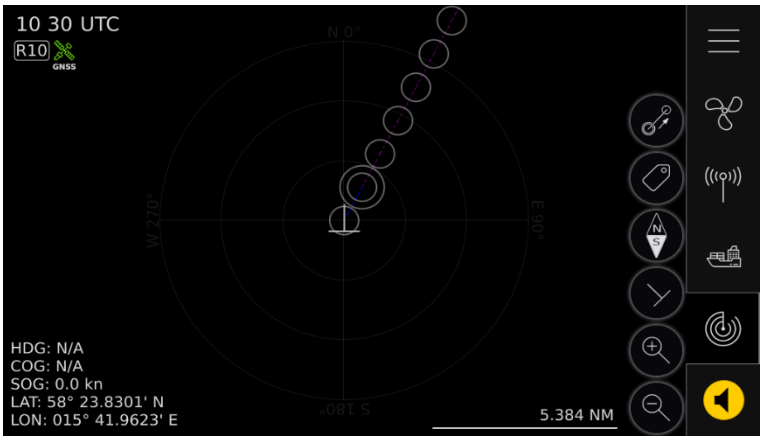
The RAIM accuracy level specifies (in meters) the desired position accuracy used to calculate current RAIM status. RAIM is an integrity monitoring scheme that evaluates the quality of position data and compares it to the specified accuracy level.

The RAIM indicator in the top left corner of the R6 CDU display will show current RAIM status. A white RAIM symbol indicates safe state; the calculated position accuracy is better than the set accuracy level. A yellow RAIM symbol indicates caution state; the system is unable to safely determine if the position accuracy is better or worse than the set accuracy level.

The set accuracy level is shown in the RAIM indicator in meters.

5.9 Plot

The Plot view displays a plot over the active route, indicating the ship's position, waypoints and legs. It also shows current navigation information such as heading, speed-over-ground and course-over-ground.



View 5-2 - Plot View

5.9.1 Navigating the Plot View

Use the touch panel interface to pan the plotted area with a drag gesture. Use pinch gesture to zoom in and out, alternatively use the plot buttons for zooming.

5.9.2 Plot Buttons

Skip waypoints

Show target tags (AIS specific)

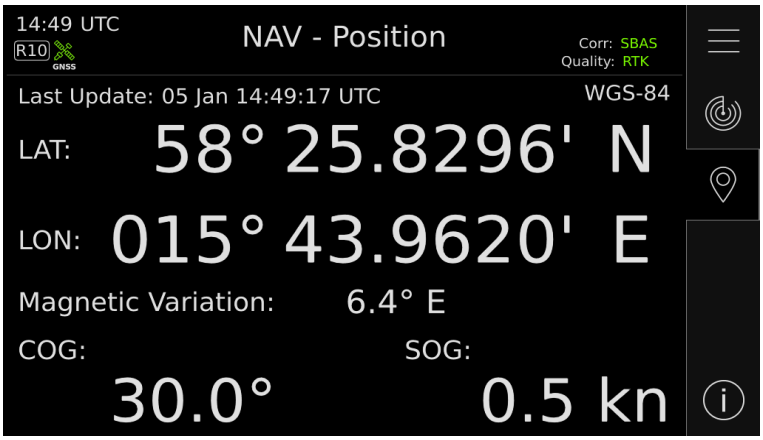
North Up / Heading up toggle

Centre on own position (reset panning)

Zoom In

Zoom Out

5.10 Show Current Position

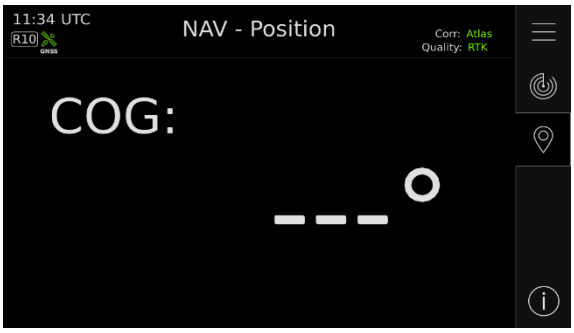


View 5-3 - Position View

The R6 Navigation System will power up in the Position view. The Position view shows current position, speed over ground (SOG) and course over ground (COG) as reported by the sensor. The position is represented by latitude and longitude. Current date and time, in UTC time, is also displayed.

If the navigation system is not able to calculate new position information, the latest valid information is shown in conjunction with the time when it was calculated.

This view also gives the user the possibility to enlarge COG/SOG/Position data, by a touch on the data, to enable greater visibility from a distance.



View 5-4 - Enlargement of data from the Positon View

Note: COG is based on track angle which requires that the ship is moving. Thus, COG data is not displayed when the SOG value is below 0.3 knots.

5.11 Heading

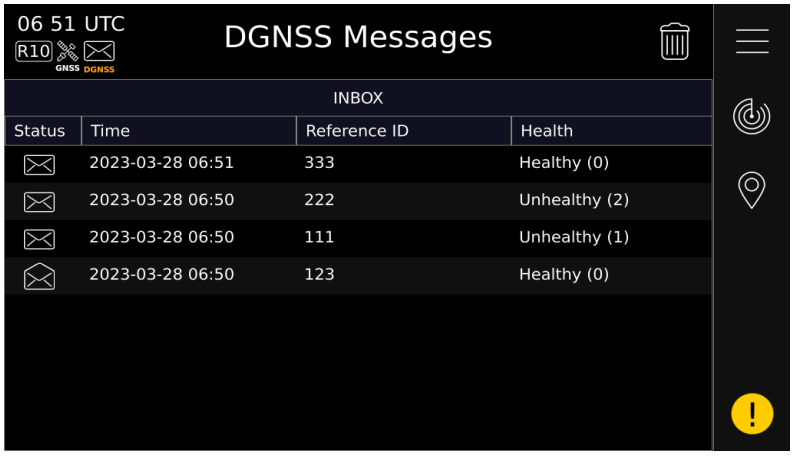
The Position view shows current heading according to the GNSS antenna's setup and the R6 NAV PRO Compass configuration of Heading BIAS.

View 5-5 - Current Heading

NOTE: This view only available in the R6 NAV PRO Compass product configuration

5.12 DGNSS Messages

It is possible to receive status messages differential stations via the beacon receiver (RTCM, Type 16 messages), which only is included in the DGNSS version of the Navigation Sensor. When a new DGNSS message received, a DGNSS **[Mail]**, ✉ will be indicating this in the upper left corner.



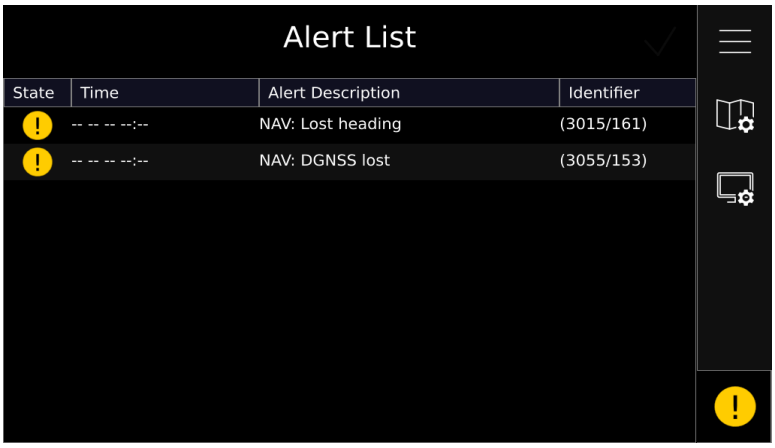
View 5-6 - DGNSS Messages Inbox

5.13 Alert List

All currently active and enabled alerts are shown in the "Alert List" view that can be accessed from or by clicking on the **alert indication symbol** in the lower right corner. For a list of all alerts, see section 5.14.5. For troubleshooting alerts see section 10.3.

If an unacknowledged/silenced alert is selected in the list an "Acknowledge" checkbox icon will become visible in the upper right corner. Press the checkbox to acknowledge the alert, the checkbox will turn grey.

NOTE: Not all alerts require acknowledgement.



View 5-7 - Alert List

5.14 Alert Status

The R6 Navigation system is a “Bridge Alert Management” and “Legacy Alert” compliant system of “Type P” according to IEC 62923-1 ed.1. Capable of handling and generating necessary information for communication with old as well as new systems.

All active alert in the R6 CDU are both presented visually and by audio signals according to BAM (IEC 62923-1 ed. 1). The visual icons used for representing the alert states in both the “Alert List”-view and the Alert Notification Area, can be seen in section 5.7.1.

5.14.1 Priority

Each alert is prioritized to one of following priorities:

- **Emergency Alarm** - Highest priority alert causing continuous audio output. Not used by any R6 Navigation system.
- **Alarm** - Next highest alert level there is, not occurring in a pure R6 Navigation system, requiring immediate attention and action. Unacknowledged alarm causes a three beeps audio signal every 7.5s.
- **Warning** - Condition requiring immediate attention, but no immediate action. Unacknowledged and escalated warning results in a two beeps audio signal. (Warnings escalates every two minutes as long as they are “Active Unacknowledged”).
- **Caution** - Lowest alert level, requiring awareness out of the ordinary, consideration of the situation, or of given information and does not cause any audio signal.
- **Notification** - Non-alert level not causing any audio signal.

5.14.2 Category

Each alert is categorized to one of following classes:

- **A** - Alert for which graphical information at the task station directly assigned to the function generating the alert is necessary, as decision support for the evaluation of the alert related condition.

- **B** - Alert where no additional information for decision support is necessary besides the information which can be presented at the central alert management interface.
- **C** - Alert that cannot be acknowledged on the bridge but for which information is required about the status and treatment of the alert.

NOTE: The R6 Navigation System only generates alerts of category B.

5.14.3 Grouping and Aggregation

The R6 Navigation system does not support these features.

5.14.4 Alert Commands

This section describes the effect of commands as applicable on alerts in the R6 Navigation system.

5.14.4.1 Acknowledgement

If an active or silenced alert is acknowledged, the alert will still be present but not able to escalate or cause more audible alert signals. If the alert is in any other state the command will have no effect on the alert.

5.14.4.2 Silence

If an active alert is silenced it will be prevented from causing audible signals for 30 seconds. However, it will still be present and regarded as unacknowledged. If the alert is in another state the command will not affect the alert.

NOTE: The CDU does not provide the functionality of this operation; it requires an external action/input by for example a CAM system.

5.14.4.3 Query

Equipment integrated with R6/R5 units may require more information, more frequently, of the system's alerts and their status, this is done via queries. Any received queries will not affect the status of alerts, but will generate an extra data output.

5.14.4.4 Responsibility transfer

The R6 Navigation System does not use this command.

5.14.5 Alert Identification List

In “Table 5-1 - Alert Identification List” all alerts that the R6 Navigation System can generate are listed with Alert identifiers, Instance identity, Priority and texts for both “Legacy Alert” and “Bridge Alert Management”.

Observe that all alerts generated by the R6 Navigation System are of “Category B” and does not support responsibility transfer functionality.

Alert ID	Instance ID	Priority	Alert Text (BAM)	Description Text (BAM)	Alert Description (Legacy Alert)
3002	155	Warning	Lost GNSS	Check GNSS data stream	GNSS Connection Lost
3008	171	Warning	GNSS Malfunction	Check GNSS, malfunctioning	Sensor Malfunction
3012	169	Warning	Doubtful DGNSS	Check DGNSS status	DGNSS Integrity Alert
3012	154	Warning	Doubtful GNSS	Check GNSS settings	GNSS Not Initialized
3013	163	Caution	Doubtful RAIM	Check GNSS, caution RAIM level	RAIM Status - Caution
3013	164	Caution	Doubtful RAIM	Check GNSS, unsafe RAIM level	RAIM Status - Unsafe
3015	152	Warning	Lost Position	Check GNSS, position data unavailable	Position Data Lost
3016	161	Warning	Lost Heading	Check GNSS, heading input	Heading Data Lost
3016	162	Caution	Lost Depth	Check GNSS, depth input	Depth Data Lost
3016	601	Caution	Lost Mag. Heading	Check GNSS, Mag. Heading Input	Mag. Heading Data Lost
3016	602	Caution	Lost Mag. Variation	Check GNSS, depth input	Mag. Variation Data Lost
3024	156	Alarm	XTD Limit	Cross-track distance too large	XTD Limit Exceeded
3032 (3031)	167	Warning (Alarm)	Anchor Watch Limit	Check Anchor	Anchor Watch Limit
3038	157	Warning	Approaching WPT	Waypoint distance exceeded	Approaching Waypoint (Distance)
3038	170	Warning	Approaching WPT	Waypoint time exceeded	Approaching Waypoint (Time)
3055	153	Warning	DGNSS Lost	No corrections available	DGNSS Position Data Lost
3055	205	Warning	L1 Signals Lost	Possibility of decreased performance	L1 Signals Lost
3056	151	Caution	HDOP Exceeded	HDOP precision exceeds limit	HDOP Limit Exceeded

Alert ID	Instance ID	Priority	Alert Text (BAM)	Description Text (BAM)	Alert Description (Legacy Alert)
10001	181	Caution	Out 1 degraded	Excessive buffering. Check data rates	Out 1 Serial Degraded
10001	182	Caution	Out 2 degraded	Excessive buffering. Check data rates	Out 2 Serial Degraded
10001	183	Caution	Out 3 degraded	Excessive buffering. Check data rates	Out 3 Serial Degraded
10001	184	Caution	Out 4 degraded	Excessive buffering. Check data rates	Out 4 Serial Degraded
10001	185	Caution	Out 5 degraded	Excessive buffering. Check data rates	Out 5 Serial Degraded
10001	186	Caution	Out 6 degraded	Excessive buffering. Check data rates	Out 6 Serial Degraded
10001	187	Caution	Out 7 degraded	Excessive buffering. Check data rates	Out 7 Serial Degraded
10001	188	Caution	Out 8 degraded	Excessive buffering. Check data rates	Out 8 Serial Degraded
10002	191	Warning	Out 1 disabled	Data overload. Check data rates	Out 1 Serial Disabled
10002	192	Warning	Out 2 disabled	Data overload. Check data rates	Out 2 Serial Disabled
10002	193	Warning	Out 3 disabled	Data overload. Check data rates	Out 3 Serial Disabled
10002	194	Warning	Out 4 disabled	Data overload. Check data rates	Out 4 Serial Disabled
10002	195	Warning	Out 5 disabled	Data overload. Check data rates	Out 5 Serial Disabled
10002	196	Warning	Out 6 disabled	Data overload. Check data rates	Out 6 Serial Disabled
10002	197	Warning	Out 7 disabled	Data overload. Check data rates	Out 7 Serial Disabled
10002	198	Warning	Out 8 disabled	Data overload. Check data rates	Out 8 Serial Disabled
10003	200	Caution	GNSS Jamming	GNSS Jamming externally reported	GNSS Jamming
10003 (10004)	201	Warning (Alarm)	GNSS Spoofing	GNSS Spoofing externally reported	GNSS Spoofing
10005	202	Caution	C6 COM Status	Check C6 COM setup	C6 COM Status
10006	203	Caution	I6 IMU Status	Check I6 IMU setup	I6 IMU Status

Table 5-1 - Alert Identification List

Maximum number of alerts possible to occur: 39

NOTE: Active alert of priority "Warning" escalates to "Warning" or "Alarm" every other minute if not acknowledged, while "Caution" cannot escalate.

NOTE: Information on when and why the alerts appear can be found in section 10.3

NOTE: When working with "Legacy alert" (ALR sentence) compatibility the Instance identifier is the same as the "Unique Alarm Identifier"

5.15 Routes

The Routes view shows routes and waypoints stored in the CDU. By this view the user has the option to designate a route as the current sailing path.

The sail route is set by selecting a route and then press the play button in the right upper corner, right next to the "Routes" title. When a route is activated, it will be visualized by its legs and waypoints in the plot view, see Plot 5.9. The plot view is accessed from the main menu.

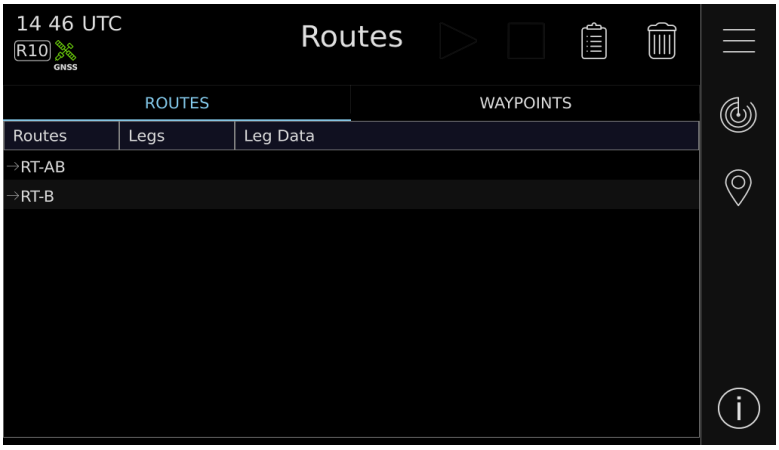
The Routes view contains two tabs. The "ROUTES" tab contains routes and leg data. The "WAYPOINTS" tab contains waypoints and the corresponding coordinates. If a route or a waypoint is being clicked on, data regarding the pressed item is presented. A waypoint will present its coordinate. A route will present its legs and their corresponding data.

5.15.1 Delete route or waypoint

To remove a route or waypoint, press **[Trash Can],**  in the upper right corner. The trash bin icon offers three options: "ALL", "SELECTED" and "CANCEL". The "SELECTED" option removes the currently selected item, which can either be a route or a waypoint. The "ALL" option removes all waypoints and routes stored in the CDU. When a waypoint is removed it gets removed from the waypoints list and from all occurrences in any routes. If a waypoint is used in a route, the entire leg where that waypoint is contained is removed as well. When a route is removed it affects the "ROUTES" tab where it disappears from the list.

5.15.2 Upload route or waypoint

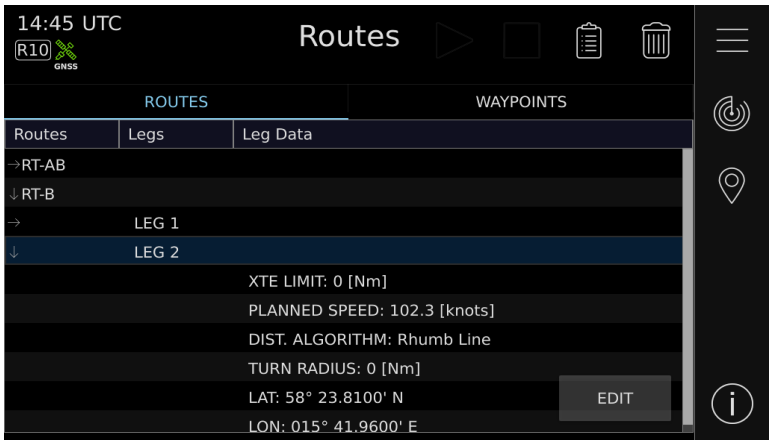
To upload a route or a waypoint, press **[Paper Plane],**  in the upper right corner. Three options are presented; "ALL", "SELECTED" and "CANCEL". The "ALL" option uploads all routes or waypoints on the configured output port(s). The "SELECTED" option uploads the selected route or waypoint on the configured output port(s). Routes and waypoints can be uploaded either on serial User Port or Light Weight Ethernet network. In order to upload routes and waypoints the user ports must be configured with correct baud rate and the sentence Upload (RTE & WPL) must be enabled, see 4.3.1 CDU - Serial Port Mode and 4.2.6 Sensor Output for more information about configuration of upload port.



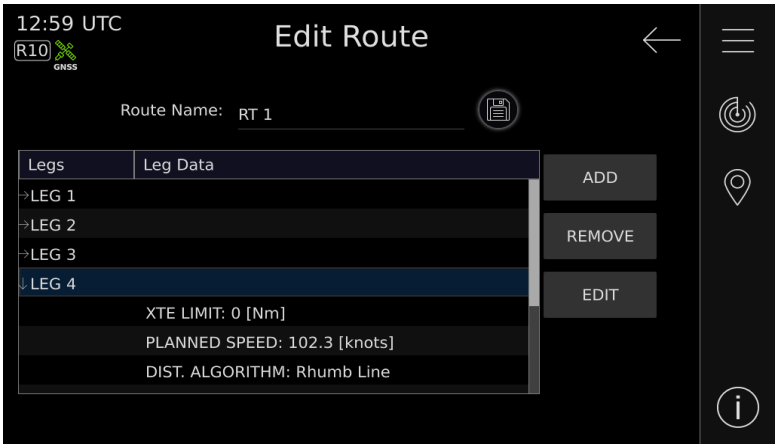
View 5-8 - Routes

5.15.3 **Create route or waypoint**

To create a new waypoint or route, press **[Assign]**,  in the upper right corner.



View 5-9 - Routes and waypoints view, presenting route data



View 5-10 - Edit Route

To edit an existing waypoint, route or leg, select the item and press **[Edit],**  in the bottom right corner.

The edit route view showcases all the legs connected to the route. In the edit route view there is functionalities for adding, editing and deleting legs in the route.

To edit or delete a leg, select the leg by clicking on it and press “REMOVE” or “EDIT”.

View 5-11 - Edit Leg

In the “Edit Leg” view the parameters regarding the leg can be modified.

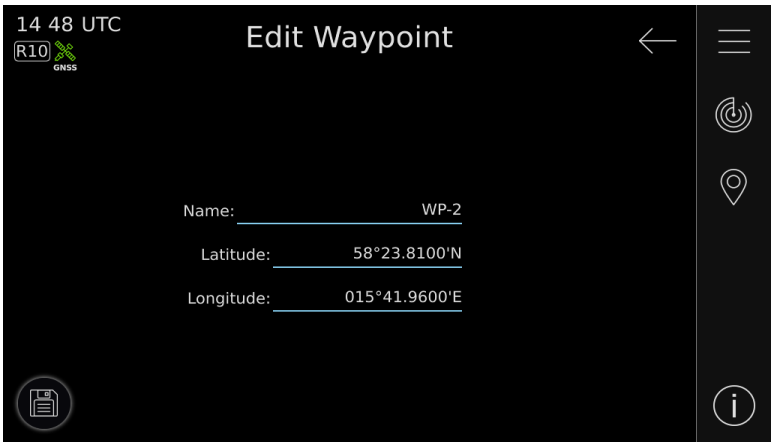
XTE limit (cross track distance), planned speed and turn radius are edited by pressing the corresponding values.

The distance algorithm and waypoint is edited by clicking the drop down menu and selecting an option.

By changing the waypoint the latitude and longitude values will change accordingly. The latitude and longitude values are not editable in the “Edit Leg” view.

To add a new waypoint, press the “NEW WP” button. To save the current leg setting, press the save button in the bottom left corner.

In the “Edit Waypoint” view the latitude and longitude values are editable. The values are changed by pressing the values. To save the current waypoint setting, press the save icon in the bottom left corner.



View 5-12 - Edit Waypoint

5.15.4 Target ETA

The Target ETA is editable when a route is active. To activate a route, press **[Play]**,  in the upper right corner in the “Routes” view. Secondly, press **[Calendar]**,  in the lower right corner. Now the “Target ETA” view shall be visible for editing.

View 5-13 - Target ETA

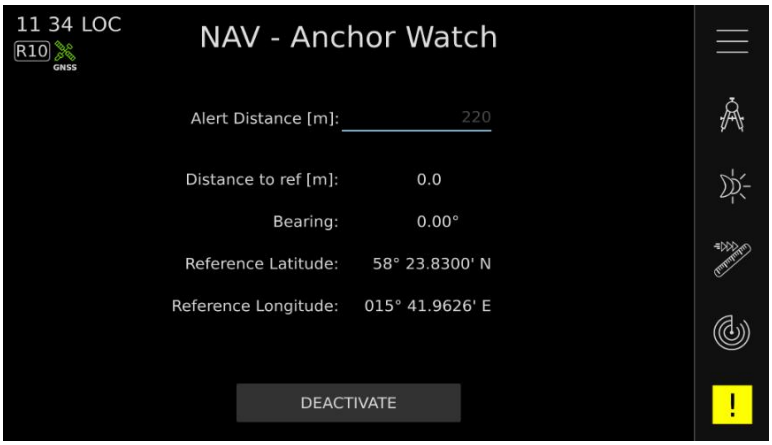
5.16 Anchor Watch

The “Anchor Watch” view offers functionality for setting up and monitoring of displacement from a reference position. The “Anchor Watch” also indicates with and alert when the defined limit is exceeded

The anchor area is defined by a circle, in the “Plot” view, with its center position located at the reference coordinate in the anchor watch view, with the alert distance specifying the radius of the anchor watch area.

The button in the lower end of the view changes its text depending on if the watch is activated or not. If the anchor watch is active the button label will change from “ACTIVATE” to “DEACTIVATE”.

As an anchor watch is being activated its reference position is set to the current position. Consequently, the reference longitude and latitude values are not editable. When no anchor watch is active, the reference latitude and longitude are set to undefined values.



View 5-14 - Anchor Watch

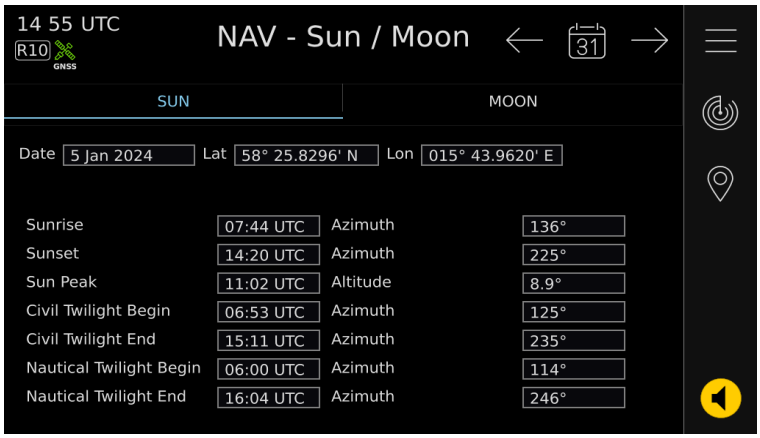
5.17 Sun / Moon

The Sun and Moon prediction features shows sun and moon states, calculated based on the current position and date.

By pressing the **[Right arrow]**, →, the presented data is changed to represent the following day's information.

By pressing the **[Right arrow]**, ←, the previous day's data is presented.

5.17.1 Sun Tab



View 5-15 - Sun / Moon - Sun

Sunrise

The estimated time of the appearance of the sun's upper circumferential edge as rises over the horizon.

Sunset

The estimated time of the disappearance of the sun's upper circumferential edge as it sets below the horizon.

Civil Twilight

Civil Twilight begins when the sun is less then 6° below the horizon in the morning and ends when reaching 6° below the horizon in the evening. This time is the approximated limit which the solar illumination suffices for the human eye to clearly distinguish terrestrial objects without aids.

Nautical Twilight

Nautical Twilight begins when the sun is less then 18° below the horizon in the morning and ends when reaching 18° below the horizon in the evening. This time is the approximated limit for which sailors can navigate via the horizon at sea.

Azimuth

Azimuth is the approximated horizontal angle, relative to north, the sun has in the certain state.

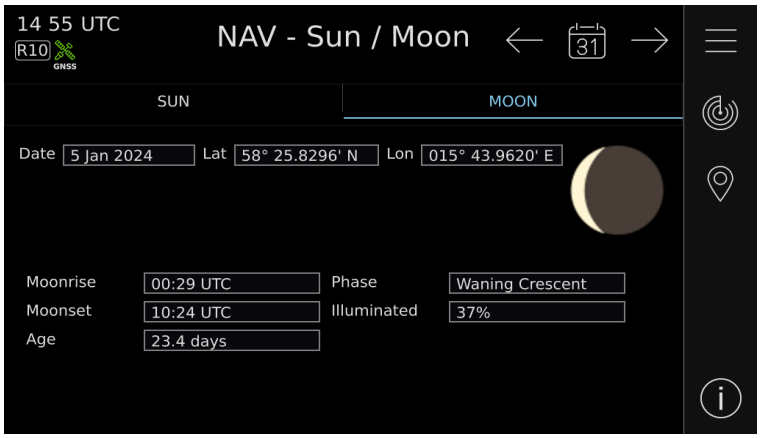
Peak Time

The estimated time when the sun is at its highest relative to the horizon.

Peak Alt.

The estimated time when the sun is at its highest relative to the horizon.

5.17.2 Moon Tab



View 5-16 - Sun / Moon - Moon

Moonrise

The estimated time of the appearance of the moon's upper circumferential edge as rises over the horizon.

Moonset

The estimated time of the disappearance of the moon's upper circumferential edge as it sets below the horizon.

Age

The estimated age since last “New Moon”.

Illuminated Part

The estimated percentage of the moon’s surface that is illuminated.

Phase

Name of the moon’s illumination phase, dependent on the moon’s expected illumination and age.

Phase	Illuminated Part

New Moon	0%
Waxing/Waning Crescent	1% - 49%
First Quarter	49% - 51%
Waxing/Waning Gibbous	51% - 99%
Full Moon	100%

5.18 Navigation Info

The Navigation Info view presents fundamental navigation data to aid the user in navigating towards a waypoint and following a route. It presents information such as bearing and range to next waypoint, the ship's current speed over ground (SOG) and current cross-track distance (if sailing a route).

View 5-17 – Navigation Information

Parameter Name	Description
BRG	Bearing to next waypoint.
RNG	Range to next waypoint.
TTW	Time To Waypoint – The estimated time left to next waypoint.
SOG	The ship's speed over ground.
XTE Limit	The cross track distance limit used for current leg. If the cross track distance value exceeds this limit, the XTE alert is activated. The xte limit, which is configurable in "Navigation Parameters" view, is used if current leg's xte limit is undefined. See 4.2.1 Navigation Parameters for more information.

XTE	Cross track distance – The distance between ship's position and the current leg of the route. "<" means the ship's position is to the left of the leg. ">" means the ship's position is to the right of the leg.
ETA	Estimated Time of Arrival to the last waypoint in the current route if the current speed over ground (SOG) is maintained.
ETA Target	Desired time when last waypoint in current route should be reached. The Target ETA setting is accessed from the "Routes" view. See 5.15.4 Target ETA for more information.
WPT REM/TOT	Number of remaining waypoints/Total number of waypoints in current route

Table 5-2 - Navigation Info Parameters - ETA

View 5-18 - Navigation Info – Sensor Information

This sub view shows information received from heading sensors, depth sensors and speed sensors. This information together with SOG and COG is also used to calculate set and drift. In order to receive information from heading and depth sensors, the input ports must be configured, see 4.2.4 Heading Input Port and 4.2.1 Depth Input for more information.

NOTE: Set and Drift calculations require speed through water and heading sensor inputs, as well as valid SOG and COG readings.

Parameter Name	Description
Set	The direction in which the ship is drifting
Drift	The speed in which the ship is drifting
HDG (T)	The ship's true heading.
HDG (M)	The ship's magnetic heading.

STW	The ship's speed through water.
Depth	The ship's depth
Target SOG	Required speed over ground in order to reach last waypoint at ETA Target.

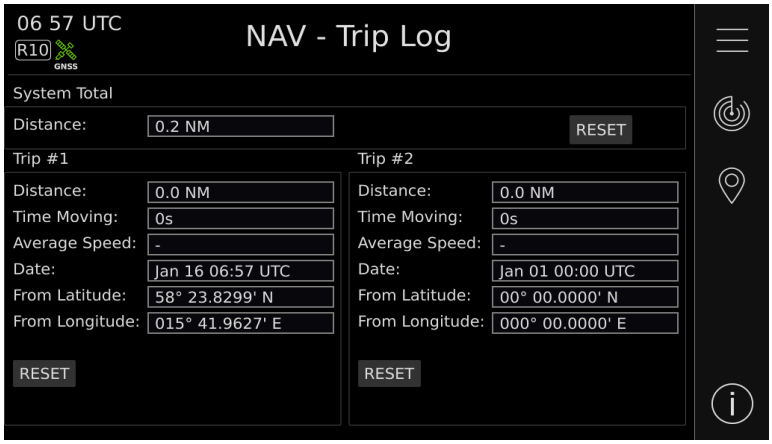
Table 5-3 - Navigation Info Parameters - Sensor Information

5.19 Trip Log

The Trip Log view shows a status summary of the three trips; Trip #1, Trip #2 and a System Total trip. The trip logs accumulate travelled distance during the time the R6 Navigation System is operating. The trip logs are resettable and the presented data is the accumulated data since the last reset with time and position reference.

The CDU password is required to reset the System Total trip, no password is required in order to reset Trip #1 and Trip #2. To reset a trip, press the "RESET" button for the trip you wish to reset.

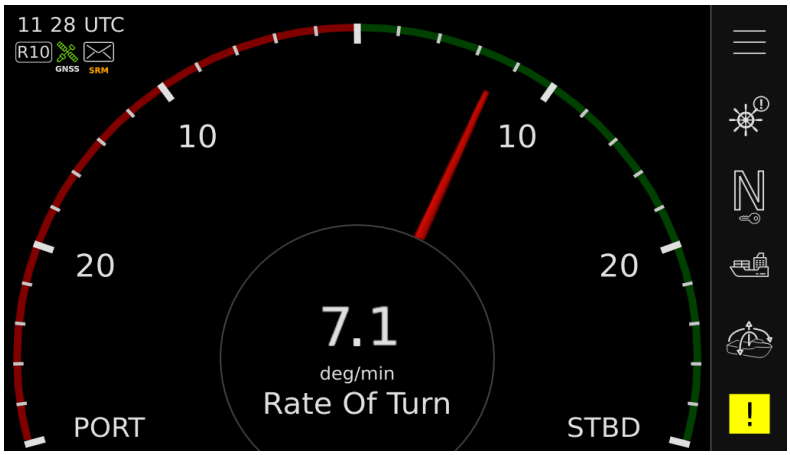
Invalid positions, due to deficient GNSS information, are not included in the accumulated trip log data.



View 5-19 - Trip Log

5.20 Rate of Turn

The Rate-of-Turn view shows the vessel's current turning rate, derived from heading changes in the R6 Compass and the I6 IMU rotation measurements.

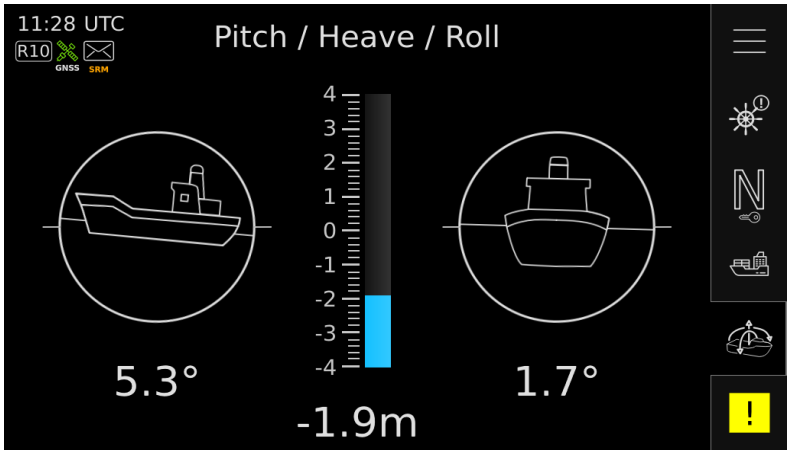


View 5-20 – Rate-Of-Turn view

NOTE: This view only present data in a R6 NAV PRO Compass+ system configuration

5.21 Pitch / Heave / Roll

This view displays the vessel's current tilt and vertical motion, based on measurements/data from the I6 IMU.

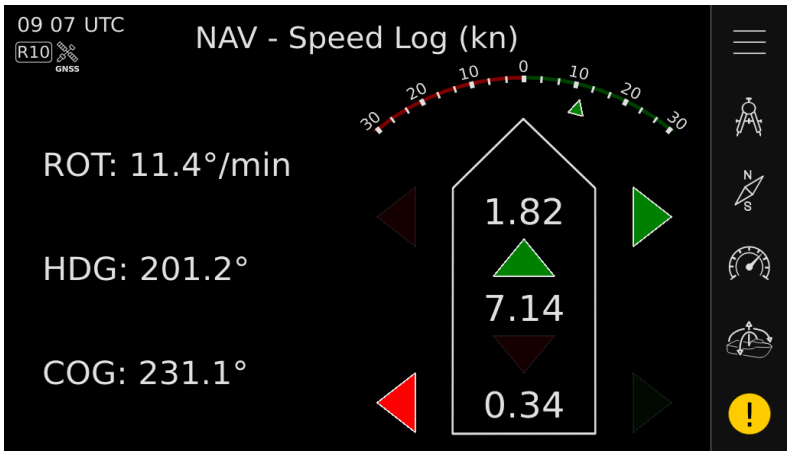


View 5-21 – Pitch / Heave / Roll view

NOTE: This view only present data in a R6 NAV PRO Compass+ system configuration and that Heave output is not output from the I6 IMU in FW 1.1.0.

5.22 Speed Log

This view displays indications of the vessel's longitudinal, fore/aft transversal ship speed over ground. Based on the heading, positional speed over ground and rate of turn.



View 5-22 – Speed Log view

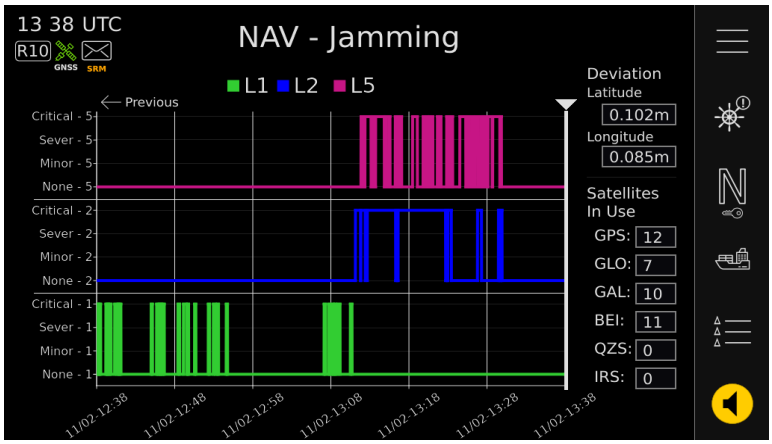
NOTE: This view only present data in a R6 NAV PRO Compass+ system configuration.

For correct indications: The R6 NAV Compass most be accurate configured with the ships dimensions (see section 4.2.9) and the placement/offset of the primary GNSS antenna (see section 4.2.2).

5.23 **Jamming**

This view shows the current jamming status for all L-band frequencies (e.g., L1, L2, L5) in use. Up to ten hours of operation can be tracked, indicating the level of jamming detected. The detection levels are defined as follows:

- *Unknown* – The graph line follows the baseline or is not shown, typically because the navigation sensor is not providing status information to the CDU.
- **None** – No jamming detected
- **Minor** – A low-level jamming indication
- **Severe** – A higher level of jamming is detected, but navigation remains possible.
- **Critical** – A high level of jamming is detected, making navigation no longer possible.



View 5-23 – Jamming Detection

NOTE: To retrieve this jamming data from the navigation sensor the FW version requires to be 1.5.2 and GNSS FW 6.1Aa03 or later.

6 STATUS

The R6 CDU menu system is divided into three categories: Operative, Status and Configuration. Views belonging to the Status Menus are described in the following sections.

6.1 NAV Status Menu

This section describes the views that can be found in the R6 Navigation System under the NAV Tab.

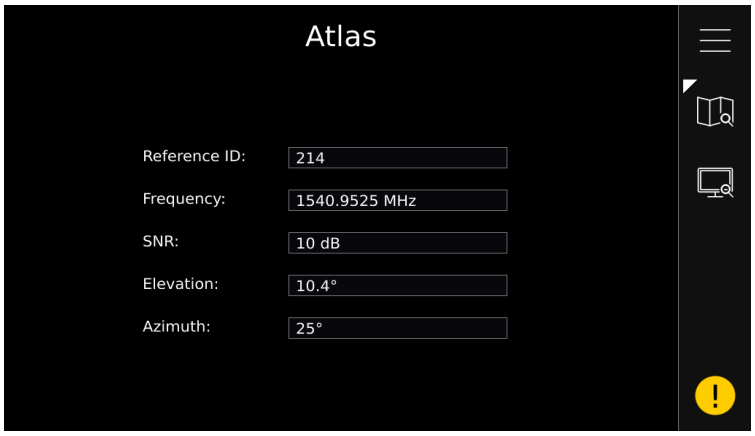
6.1.1 450 Counters

See Section 10.4.3 for more detailed information.

6.1.2 Atlas

The *Atlas status* view shows information relating to the Atlas satellite from which the Navigation Sensor is receiving a signal or is expecting one. The satellite's reference identity and its signals bit error rate are provided by the view, as well as the satellite's elevation and azimuth angle relative to the own position.

NOTE: This view is accessible, if the unit has a "PRO" license with an active "Atlas" subscription



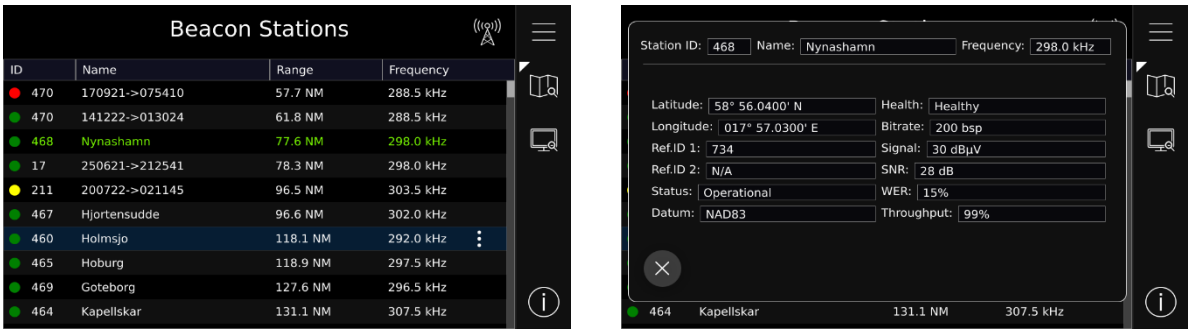
View 6-1 - Atlas Satellite Information

6.1.3 Beacon

This view provides a beacon station list, sorted on range, and with the he currently used beacon station is marked with green colour text in the list if existing in the database. In the upper right corner a **[Station]**  icon is lit if there is a station in use, which will show the extended information received from that station if clicked.

Each beacon station is also marked with an operational status icon:

- Green icon, beacon station is operational
- Yellow icon, beacon station operational status is unknown
- Red icon, beacon station is NOT operational, do not use.



View 6-2 - Beacon Database/Extended Information

6.1.4 NAV - FW/HW Information

See Section 6.3 for more detailed information.

6.1.5 (D)GNSS Overview

View 6-3 - GNSS/DGNSS Overview

The GNSS/DGNSS Overview displays information related to the current navigation solution:

Satellites In View

Number of satellites from which signal is received.

Used Satellites

Number of GNSS satellites currently used in the navigation solution.

Correction Source

The currently used correction source for differential correction which can be SBAS, External or None (-).

Station Ref. ID

The reference identity of the currently applied differential corrections (if any).

Correction Age

The time difference between navigation solution and reference time for the applied corrections (if any).

Correction Quality

The quality indicator of the currently used corrections (if any).

Available Differential Corrections

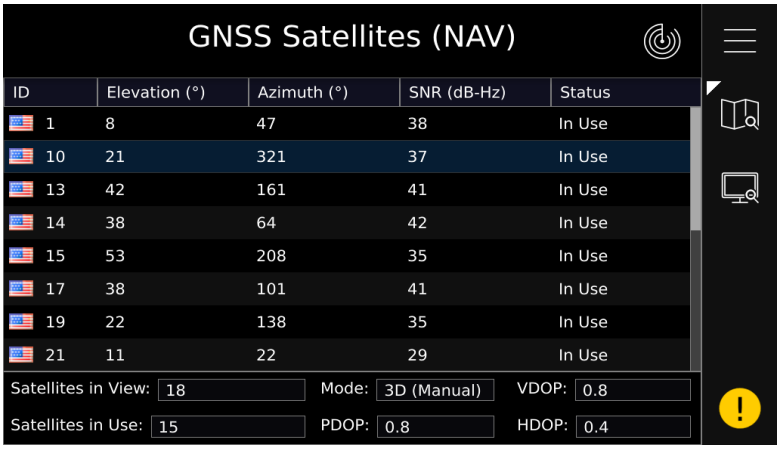
Corrections sources that currently receives valid differential corrections and are configured to be allowed/enabled.

6.1.6 Satellites Overview

Displays the satellites received by the R6 Navigation Sensor internal GNSS receiver. The list is sorted by the satellites ID (PRN number) and shows elevation, azimuth and signal to noise ratio (SNR) for each satellite.

The view also displays the total number of satellites in view, total number of satellites used in the position calculation, current operating mode and dilution of precision (DOP) values.

To view the currently used GNSS constellation, press the **Radar Symbol** in the upper right corner.



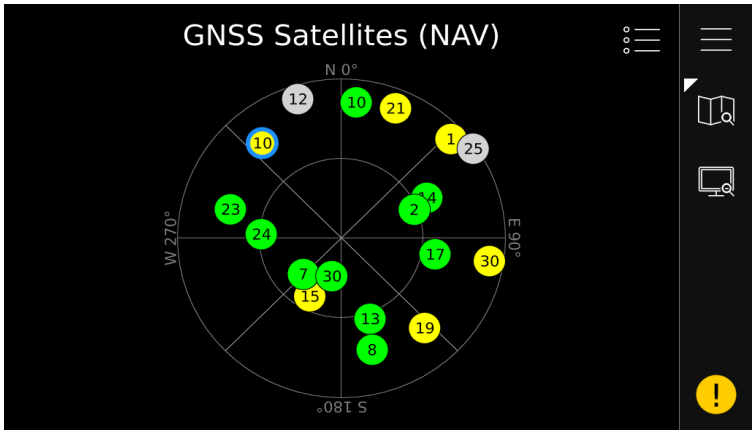
View 6-4 - GNSS Satellites Status

6.1.6.1 Sky Plot view

From the GNSS Satellites List view the “Sky Plot” view is accessible. This view shows the current GNSS constellation in a plot. Each received satellite is colour coded based on status and SNR.

Depending on SNR and status, received satellites are displayed in colours according to:

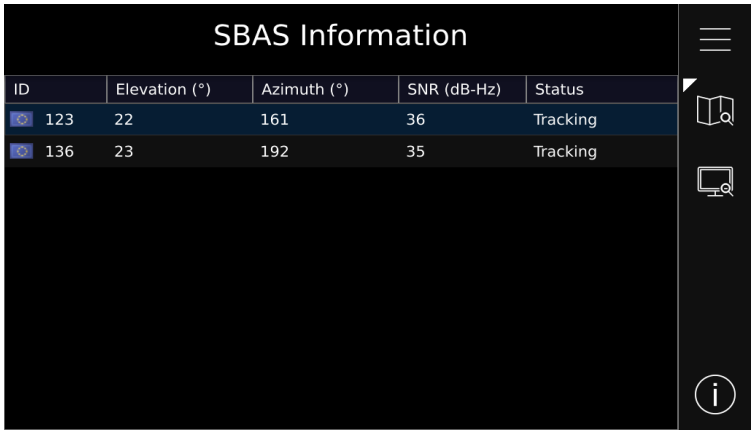
- - Status In Use and SNR over 40 dB-Hz
- - Status In Use and SNR below 40 dB-Hz
- - Status Tracking (not used in position solution)



View 6-5 - GNSS Satellites Sky Plot view

6.1.7 SBAS

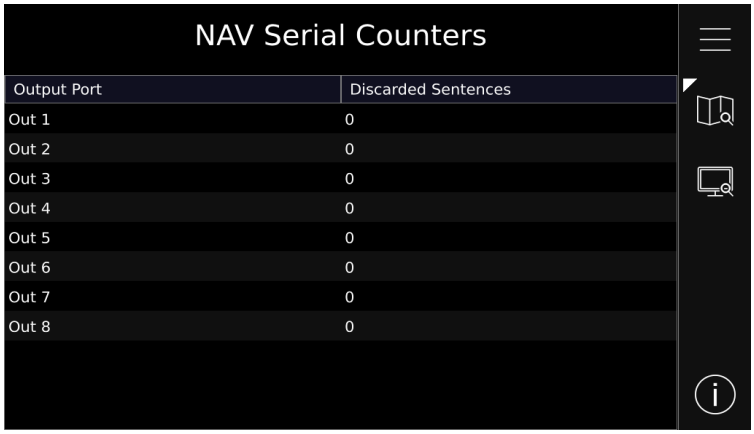
The SBAS Information view shows information relating to the one or more geostationary SBAS satellite from which the Navigation Sensor is receiving a signal or is expecting one. The view provides information about expected SBAS satellite, such as, identity (PRN number) together with its signals bit error rate, elevation and azimuth angle from the own current position to the satellites.



View 6-6 - SBAS Information

6.1.8 Serial Port Counters

In this view, a monitor feature of the R5 Navigation System is visually displayed. The system monitors the output traffic on all the serial ports and counts the amount of sentences not able to be output because of for example overflow (too much output compared to configured baud rate).



View 6-7 - Serial error counters

6.2 CDU Status Menu

This section describes the views that can be found in the R6 Navigation System under the CDU Tab. For navigation of the CDU see Section 5.4.1

6.2.1 CDU - 450 Counters

See Section 10.4.3 for more detailed information.

6.2.2 CDU - FW/HW Information

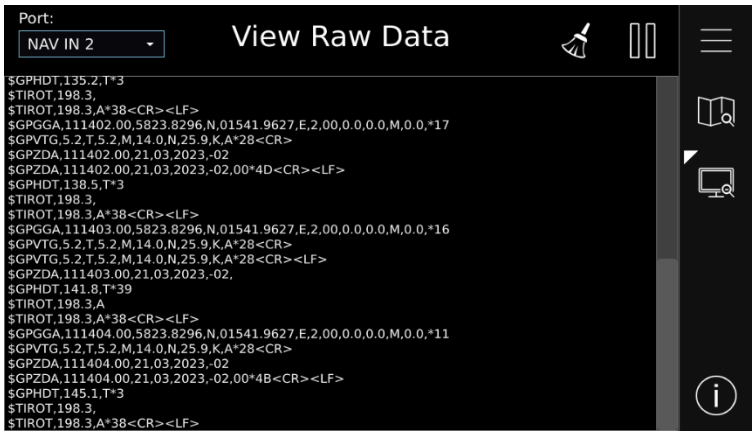
See Section 6.3 for more detailed information.

6.2.3 View Raw Data

Displays incoming data on the selected serial port. It is also possible to pause the data on the screen by pressing the **Pause** button. The “View Raw Data” view can be a helpful tool when trouble shooting the system to see what sensor input is actually received on each port.

Characters are displayed according to ISO 8859-1 (Latin-1). Non-printable characters are displayed with symbol names as “<SYMBOL>”, e.g. carriage return and line feed are displayed as “<CR><LF>”.

Use **Clear** button to clear current log data.

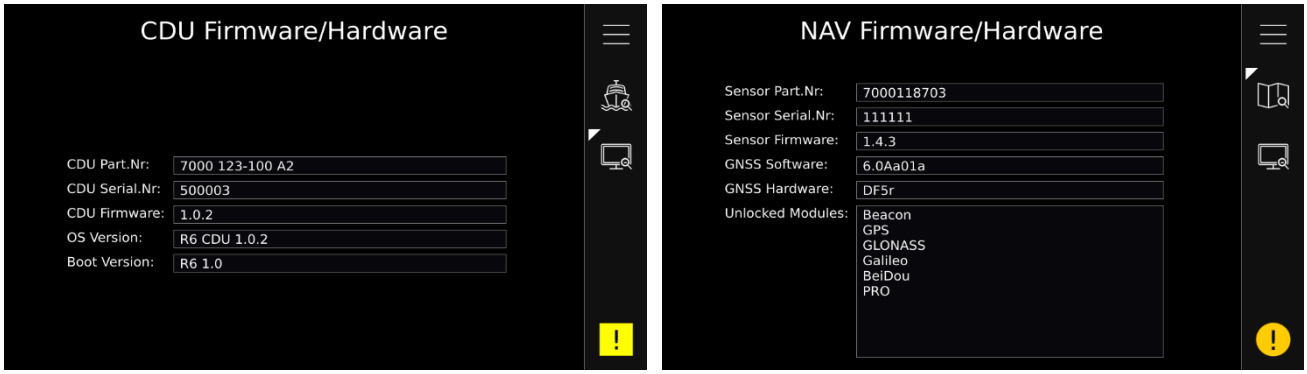


View 6-8 - View Raw Data

6.3 FW/HW Information view

This view displays the Firmware and Hardware revisions for a system component. Separate views are available for display (CDU) and sensor (NAV) Firmware/Hardware information.

This information should always be provided when contacting Saab TransponderTech support.



View 6-9 - FW/HW Information Views

7 WEB INTERFACE

The R5/R6 Navigation Sensor has a web interface, just requiring an Ethernet connection, which gives the user a possibility to operate and configure the sensor without needing the R6 CDU. The interface is accessible in the most commonly used web browsers, enter the Navigation Sensor's IP address which in default is set to 172.16.0.4 on Eth1 and 172.17.0.4 on Eth2.

7.1 Status View

In the Status view is information about how well the system preforms displayed. The view reports information about the GNSS- and Beacon receivers' performances together with alert status and satellite information.

For more information about:

- GNSS Fix see section 5.10
- Alerts Status see section 5.13 and 5.14
- Satellite Info see section 6.1.2
- Sky Plot see section 6.1.6.1
- Correction Information see section 6.1.2, 6.1.3, 6.1.5 and 6.1.7

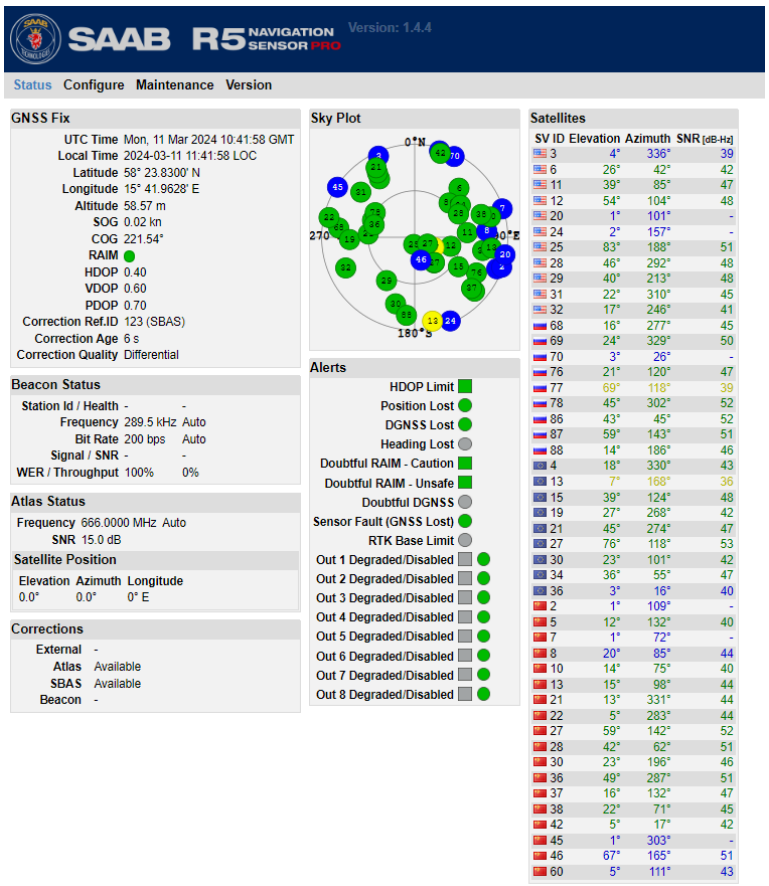


Figure 7-1 - Web Interface, Status view

7.2 Configuration View

In the Configure view the R5/R6 Navigation Sensor can be set to work as desired.

For more information about configuration parameters related to:

- GNSS, see section 4.2.1
- SBAS, see section 4.2.8
- Beacon, see section 4.2.3
- Device Position, see sections 4.2.2/4.2.5/4.2.9
- Interface, see section 4.2.3
- Alerts, see section 4.2.1
- Out/In Ports, see section 4.2.7
- Output Sentences, see section 4.2.6
- RTK Base, see section 4.2.5 (Only NAV PRO RTK)
- Heading Orientation, see section 4.2.2 (Only NAV PRO Compass)
- IMU Input/NEO Panamax Mode, see section 4.2.2 (Only NAV PRO Compass)

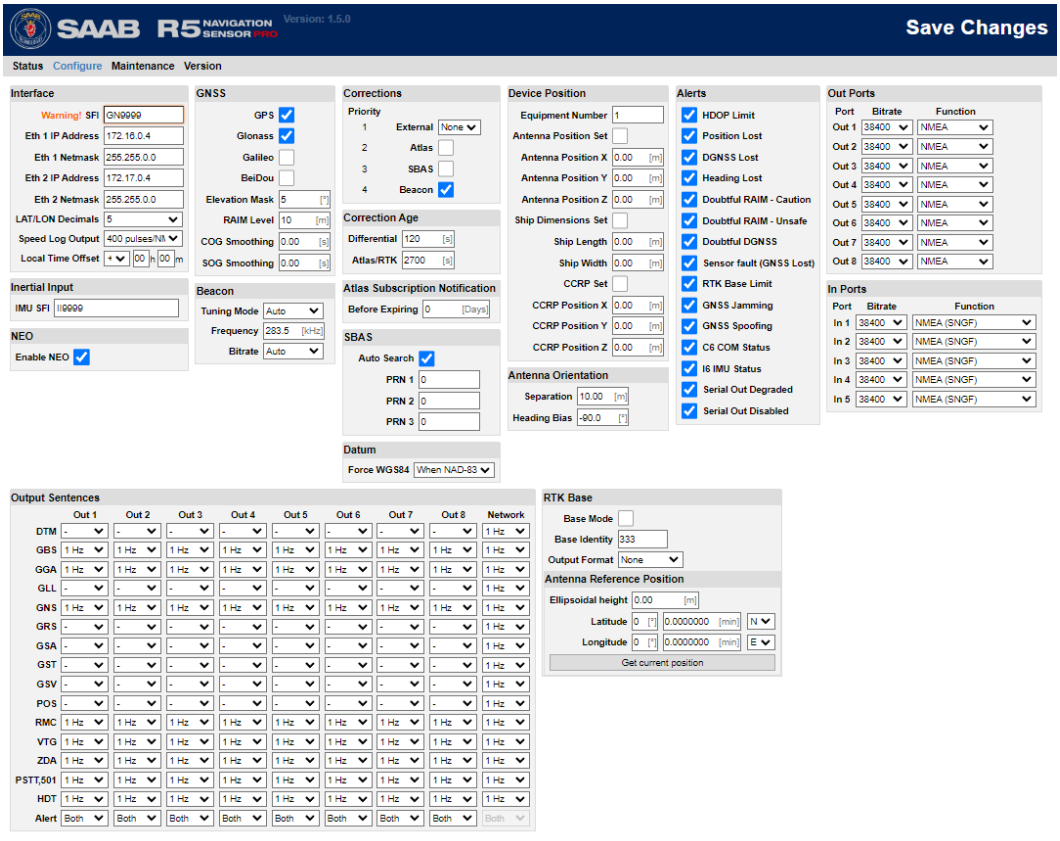


Figure 7-2 - Web Interface, Configure view

7.3 Version View

In the Version view information about the hardware and firmware, in both the main unit and the integrated receivers, is displayed. This information should always be provided when in contact with Saab TransponderTech support.

Figure 7-3 - Web Interface, Version view

7.4 Maintenance View

The “Maintenance” view’s functionalities are the uploading of Firmware, saving/loading/restoring configuration settings, license handling, alert logging and processing of password.

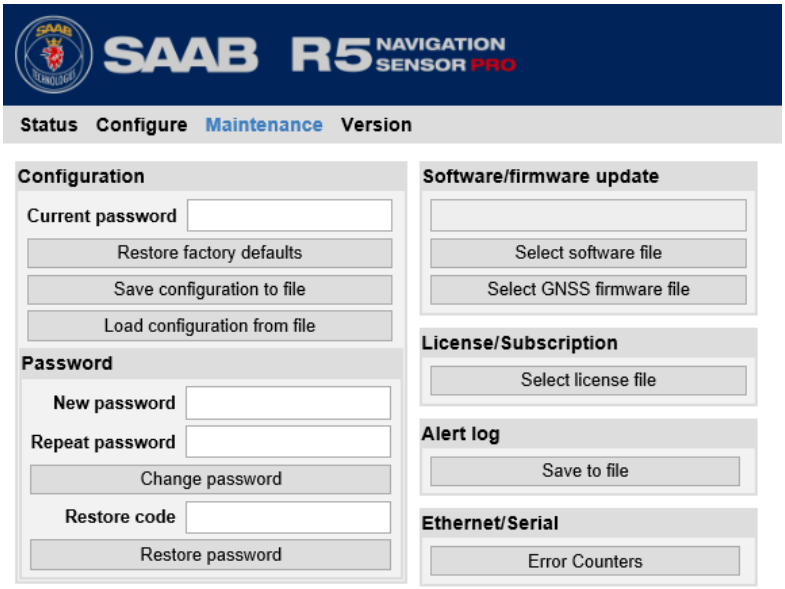


Figure 7-4 - Web Interface, Maintenance view

7.4.1 Configuration

This application in makes it possible to save the current configuration settings as a .navcfg file or load configuration settings form an already saved .navcfg file. It also provides the possibility to reset the sensor to default settings.

If a password has been set, the sensor will require that correct password is insert before proceeding with loading configurations or performing a factory reset. Refer section 4.2.4

7.4.2 Update

The update applications in the web interface makes it easy to upload new firmware versions. To perform an update through the web interface:

- Download the latest firmware package from our website (see below)
- Connect the computer to the same network/subnet as the sensor
- Enter the web interface by a preferred browser and enter the sensors current IP address (Be sure that the computer has a valid/matching IP address)
- Enter the web interface's maintenance view
- Click either on the button "Select firmware file" and select the .bin file, form the firmware package to start an upgrade process

7.4.3 License

The web-interface provides the possibility to input license keys in an easy way, just:

- Connect the computer to the same network as the sensor
- Enter the web interface by a preferred browser and enter the sensors current IP address (Be sure that the computer has a valid/matching IP address)
- Enter the web interface's maintenance view
- Click on the button "Select license file" and select the .lic file that comes with the upgrade package

7.4.4 Password

The web interface provides the opportunity to set a new password or change the current password on a R5/R6 Sensor. There is also a possibility to reset the unit's password to default (no password), but to be able to perform that operation one must contact our technical Support for receiving a restore code. Refer to section 4.2.4.

Strong passwords shall *always* be used. A strong password is characterized by the following three criteria

- Does not contain the user name or parts of the user's full name such as first name, company name, product name etc.
- Does not contain dictionary words.
- Is meaningless and random.

7.4.5 Alert Log

The R5/R6 Sensor logs the 146 latest activations and in-activations of alerts with timestamps. These logs can be exported by web interface's alert log functionality to a .txt file.

7.4.6 Ethernet/Serial Error Counters

The R5 Navigation Sensor measures the rate of datagrams, detects and counts the amount of different defects on messages over the light weight Ethernet.

These counters also show the amount of discarded messages on the output port for example caused by overflow.

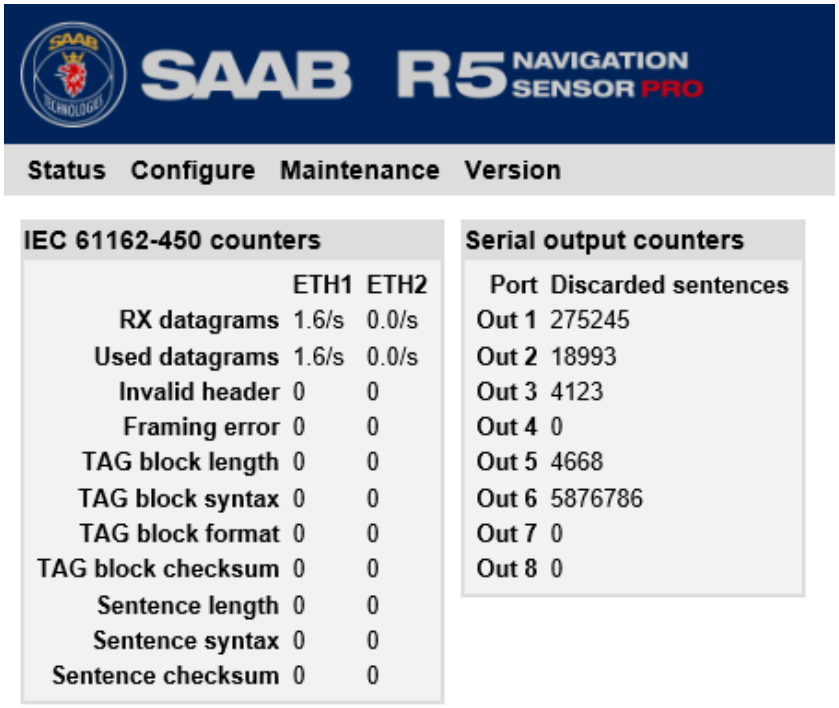


Figure 7-5 - Serial/Ethernet Error counters

8 FIRMWARE UPGRADE

After replacing a CDU or Sensor unit with a different unit, it may be necessary to make a Firmware upgrade to make sure the CDU and Sensor FW versions are fully aligned.

The Sensor can be upgraded over Ethernet via the R6 CDU using a SD card or from the R5 Navigation Sensor's web interface.

Make sure to carefully read the release notes for the Firmware upgrade package first.

For the latest manual, firmware and certificates please visit:
https://www.saab.com/transpondertechsupport

8.1 Upgrade Firmware in R5/R6 Navigation Sensor via CDU

The R5/R6 Navigation Sensor and the internal GNSS FW is upgradable through the R6 CDU SD card host interface located on the back of the R6 CDU, using the Ethernet interface. To upgrade the Firmware in the sensor, perform the following steps:

- Ensure the R5/R6 Navigation Sensor and R6 CDU is connected to a common network or directly using any of the ETH interfaces, as long as the subnet is the same.
- Unzip the R5/R6 Navigation Sensor upgrade package recommended directly on an SD card (must be FAT32 formatted). There should now be a file calleds **7000-118-709, R5_R6_NAV-*.*.*.bin, 7000 118-707, R5_NAV_GNSS-*.*Aa**.gnssfw**.and **7000 125-511, R6_NAV_GNSS -*.*Aa**.gnssfw**

  Note: the '' fields will indicate the FW version number of the package selected.*
- Insert the SD-Card in the SD-Card interface located on the back of the R6 CDU.
- Navigate to the "Update NAV FW" view that can be accessed from the "NAV Configuration Menu"
- In the browser select the upgrade file (*.bin* for Sensor update and *.gnssfw* for update of Internal GNSS receiver) on the SD card and press the upgrade symbol.
  - Loading preparation progress indication will commence in GUI.
  - If preparation succeeds, the unit will restart and start loading.
    - Should there be an issue during the firmware load, the sensor will fall-back to back-up firmware and the Status led will be lit red and DGNSS/GNSS LEDs will be flashing.
    - Back-up firmware will require a firmware load by either CDU or Web-interface before the sensor will be operational again.

In case of repeated failures to update the FW. Verify content on the SD card and possibly try with another brand of SD card if the problem persists.

8.2 Upgrade Firmware in R5/R6 Navigation Sensor via Web

To update the R5/R6 Navigation Sensor firmware or the GNSS FW, simply use the file upload tool on the Web servers "Maintenance" category page.

To perform a Firmware upgrade, perform following steps:

- Click the **Select Software file** or the **Select GNSS firmware file** button (depending on which firmware that are desired to update).
- Browse the file structure to find and select the .bin/.gnssfw - file for upload. Click on the **Upload** button (or similar in your language). The upgrade process will start.
- The file is uploaded to the R5/R6 Sensor. A progress bar displays the data transfer.
- Once the file is uploaded it will be written to the device. A progress bar is shown.
- When written the device will reboot, and the Web page will reload. The upgrade process is thereafter finished.

NOTE: This is the procedure to follow regardless of type of update. The contents of the .bin/gnssfw - files controls what is updated.

8.3 Upgrade Firmware in R6 CDU

The R6 CDU is upgradable through the SD card host interface located on the back of the R6 CDU. To upgrade the Firmware in the R6 CDU, perform the following steps:

- Unzip the R6 CDU upgrade package recommended directly on an SD card (must be FAT32 formatted). There should now be a file called **7000-123-600, R6-*.*.*.r6cdu**.

  Note: the '*' fields will indicate the FW version number of the package selected.
- Insert the SD card in the SD card interface located on the back of the R6 CDU.
- Navigate to the Update CDU FW view that can be accessed from the "CDU Configuration Menu".
- In the browser select the upgrade file on the SD card and press the upgrade symbol.
  - Loading preparation progress indication will commence in GUI.
  - If preparation succeeds, the unit will restart and start loading.
    - Initial **RED** Led indication will switch to **BLUE** within 5s
    - **BLUE** state will remain while loading. Estimated 1-2 minutes.
    - When loading is done, indication will turn **YELLOW** and the system will reboot.
    - If the upgrade process fails, The **POWER BUTTON LED** will be lit **YELLOW** and stay in this state for more than 15 s without the other buttons being lit.
    - Should this happen, perform a Hard Factory Reset (see Section).

In case of repeated failures to update the FW. Verify content on the SD card and possibly try with another brand of SD card if the problem persists.

If there is a power failure during FW loading the CDU will not be able to resume upgrade automatically, and a **factory reset of CDU FW** will be needed (see Section 8.4).

	POWER LED colour
Initial state	RED
Upgrade in progress	BLUE
Upgrade done, booting	YELLOW

Table 8-1 - CDU LED Indicators during Firmware Upgrade

8.4 Hard Factory reset of CDU FW

If the FW has been corrupted, the CDU will not complete the boot process and the **POWER BUTTON LED** will turn **RED** and then stay **YELLOW** indefinitely after power is applied. In this case the CDU FW must be factory reset. This FW may be older than the FW that was operating before the corruption. Update the FW to desired version per normal procedures after a factory reset.

To factory reset the FW:

- Disconnect power to the CDU.
- Make sure no SD card is in the SD card reader.
- Reconnect power while holding **F3** and **F4** for factory reset to commence.
- The **POWER BUTTON LED** will during the reset procedure change colours in the following sequence: **RED→BLUE→YELLOW**.
- **F3** and **F4** can be released when the **POWER BUTTON LED** turns **BLUE.** Estimated time for completion is one minute.
- The unit will automatic reboot after completion, and normal FW update procedures can be performed.

9 TECHNICAL SPECIFICATIONS

9.1 R5/R6 Navigation Sensor

9.1.1 Physical

Dimensions:	Height: 52 mm Width: 261 mm Depth: 177 mm
Weight:	1.75 kg

9.1.2 Electrical

Input Voltage:	24V DC (12 to 24 VDC)
Nominal Power:	5.3 W (GNSS Version) 5.7 W (DGNSS Version) 6.1 W (Compass Version)
Nominal Current:	0.22A @ 24 VDC input (GNSS Version) 0.24A @ 24 VDC input (DGNSS Version) 0.26A @ 24 VDC input (Compass Version)
Antenna feeding:	+6 VDC
Antenna input impedance:	50Ω

9.1.3 Environmental

Temperature:	-15˚C to +55˚C (Operational) -30˚C to +80˚C (Storage)
Vibrations:	IEC 60945 ed. 4
EMC:	IEC 60945 ed. 4
Compass Safe Distance:	60 cm (for standard magnetic compass) 30 cm (for steering magnetic compass)

9.1.4 Internal GNSS Receiver

Type: **(Single/Duel Antennas)**	GPS, GLONASS, Galileo, BeiDou, QZSS*, IRNSS*, SBAS, Atlas +800 channels / +1.100 channels

Update Rate:	10 Hz max
Horizontal Accuracy:	0.4 m, (95%), DGNSS 1.3 m, (95%), GNSS
Vertical Accuracy:	0.7m, (95%), DGNSS 2.5 m, (95%), GNSS
Positioning Accuracy: **(67% / 95%)**	GNSS: 1.2m / 2.5m SBAS: 0.3m / 0.6m RTK: 8mm + 1ppm / 15m + 1ppm
Heading Accuracy: ***(Only R6 NAV PRO Compass)***	0.16˚ @ 0.5m Baseline 0.08˚ @ 1.0m Baseline 0.04˚ @ 2.0m Baseline 0.02˚ @ 5.0m Baseline
Rate of Turn Accuracy: ***(Only R6 NAV PRO Compass+)***	0.1˚/min
Speed Accuracy: *(Only R6 NAV PRO Compass)*	3 cm/sec

Note: * Indicate function still not introduced in the system but supported

9.2 Internal Alert Relay

Max switching current:	2 A
Max switching voltage s:	24 VDC or VAC
Max switching power:	60W (DC) or 62.5 VA (AC) resistive load

9.3 R6 CDU

9.3.1 Physical

Dimensions (excluding gimbal mount):	Height: 129 mm Width: 224 mm Depth: 50 mm
Weight:	0.65 kg
Dimensions	Height: 160 mm

(incl. gimbal mount):	Width: 243 mm Depth: 86 mm
Weight (incl. gimbal mount):	0.85 kg

9.3.2 Electrical

Input Voltage:	12-24 VDC
Nominal Current:	0.32A @ 24 VDC input
Power Consumption:	7.7 W (100% Illumination)

9.3.3 Environmental

Temperature:	-15˚C to +55˚C (Operational) -30˚C to +80˚C (Storage)
Vibrations and EMC:	IEC 60945 ed. 4
Compass Safe Distance:	65 cm (for standard magnetic compass) 40 cm (for steering magnetic compass)

10 TROUBLESHOOTING

One of the basic ideas with troubleshooting is to solve a supposed problem on site instead of immediately sending the suspected part for a costly repair. Solving a supposed problem would in this aspect mean both to rectify the real problem, but it could also mean that the suspected part is confirmed to be working or not-working.

Historically, many of the parts sent to Saab TransponderTech for repair have in fact been confirmed working instead. Another common scenario is that the equipment has faulty I/O settings or other erroneous configurations, easy to fix on site. A proper troubleshooting would ideally prevent those unnecessary returns of fully functional equipment.

There are numerous ways to troubleshoot an installation, much dependant on the skill and experience level of the trouble-shooter. The preferred approach may probably also differ between different individuals, and there is no such thing as right or wrong.

This section is not intended to be a step by step troubleshooting instruction, but instead offer a toolbox with some different techniques on how to troubleshoot the R6 Navigation System.

10.1 Troubleshooting Prerequisites

A R5/R6 unit's operating environment may naturally differ widely, ranging from small high-speed vessels to very large SOLAS tankers, military aircraft carriers and even submarines. The diversity of installation environments will of course have impact on the complexity of the troubleshooting, but it is always advisable to start with minimizing all possible interference sources in order to simplify the troubleshooting.

- Disconnect other NMEA equipment from the R6 Navigation System (ECDIS, RADAR, AIS, etc.)
- Switch off other emission sources (RADAR, SATCOM, VHF, etc.)

We strongly encourage to always use the latest Firmware available for the R6 Navigation System. It may contain bug-fixes and other improvements solving already known issues. Always check existing release notes to see if your problem is to be found.

10.2 Troubleshooting with the Sensor LEDs

If the sensor's status LED is continuously lit red and the DGNSS and GNSS is flashing yellow, the sensor has failed to enter the primary firmware application and instead start up in backup mode. In backup mode will all system settings been returned to default and locked down.

10.3 Troubleshooting with Alert Messages

The R6 Navigation System constantly monitors itself for failures, abnormal conditions and other important parameters. Some of the monitoring trigger alerts and those are excellent aids in the troubleshooting process.

An active alert can have three states, silenced, unacknowledged and acknowledged. The state of an alert will affect the STATUS LED on both the R5/R6 Navigation Sensor and the R6 CDU. Refer to Section 5.

All active alerts are output on all the serial- and network interfaces of the R6 Navigation System every 30 seconds. The alert status can for example be used in interfacing ECDIS systems or centralized alert systems. The alerts can also be monitored or recorded for troubleshooting purposes by for example a terminal application.

The alerts that can occur in the R6 Navigation System are listed below:

10.3.1 HDOP Exceeded (Alert Identifier: 3056 Instance: 151)

This Caution is active when the HDOP (horizontal dilution of precision) exceeds 4.0.

10.3.2 Lost Position (Alert Identifier: 3015 Instance: 152)

This alert is active when no valid position information is available from the R5 Navigation Sensor.

10.3.3 DGNSS Lost (Alert Identifier: 3055 Instance: 153)

This alert is active when a differentially corrected position is not available.

10.3.1 L1 Signal Lost (Alert Identifier: 3055 Instance: 153)

This alert is active when there is no reception of L1 Signals from any satellite constellation, although the sensor can still provide position with degraded performance using L2/L5 Signals.

10.3.2 Anchor Watch Limit (Alert Identifier: 3032/3031 Instance: 167)

This alert is active when the anchor watch function is in operation and the range limit has been exceeded.

10.3.3 Lost Depth (Alert Identifier: 3016 Instance: 162)

This alert is active when no valid depth data is received.

10.3.4 Doubtful GNSS (Alert Identifier: 3012 Instance: 154)

The alert is active when the display is not able to configure or receive the current configuration from the R5 Navigation Sensor.

10.3.5 Lost GNSS (Alert Identifier: 3002 Instance: 155)

This alert is active if the communication between the GNSS and the R6 CDU does not work.

10.3.6 Lost Heading (Alert Identifier: 3015 Instance: 161)

This alert is active when no valid heading data is received.

10.3.7 Doubtful RAIM - Caution (Alert Identifier: 3013 Instance: 163)

This Caution is active when the RAIM status is caution.

10.3.8 Doubtful RAIM - Unsafe (Alert Identifier: 3013 Instance: 164)

This Caution is active when the RAIM status is unsafe.

10.3.9 Doubtful DGNSS (Alert Identifier: 3012 Instance: 169)

No DGNSS Signal: A correction source for GNSS other than None has been selected in the GNSS Configuration view and more than ten seconds have passed since a new set of differential corrections were applied to the navigation solution.

10.3.10 GNSS Malfunction (Alert Identifier: 3008 Instance: 171)

This alert is active if a hardware issue has occurred in the R5 Navigation Sensor.

10.3.11 Out (X) Degraded (Alert Identifier: 10001 Instance: 181-188)

These Cautions is active when the R5 Navigation Sensor's output ports have a high load causing delays or loss of less significant data (does not affect highly significant sentences, see Note 3 below)

NOTE 1: The last digit in the instance (18X) maps to which output port that the alert relates to (OUT X).

NOTE 2: Sentences considered as highly significant are:

DTM/GBS/GGA/GLL/GNS/GRS/GSA/GST/GSV/POS/RMC/VTG/ZDA

10.3.12 Out (X) Disabled (Alert Identifier: 10002 Instance: 191-198)

These Warnings are active when too much NMEA data is output on the R5 Navigation Sensor's output ports in relation to their configured baud rate.

NOTE: The last digit in the instance (18X) maps to which output port that the alert relates to (OUT X).

10.3.13 GNSS Jamming (Alert Identifier: 10003 Instance: 200)

This Caution is activated when the GNSS receiver detects stronger interferences by advanced integrated digital filters and real-time spectrum analysis.

10.3.14 GNSS Spoofing (Alert Identifier: 10003/10004 Instance: 201)

This Warning/Alarm is active when the R6 NAV PRO Compass indicates on activities in the fixed installation and signal disturbances.

NOTE: The R6 NAV systems is designed to be fixed installations and any setup/configuration changes, such as antenna baseline, may require adjustments of installation setting.

10.3.15 C6 COM Status (Alert Identifier: 10005 Instance: 202)

This Caution is activated when there are any communication issues between a R6 NAV PRO Compass and a C6 COM unit other by installation or data feeds.

10.3.16 I6 IMU Status (Alert Identifier: 10006 Instance: 203)

This Caution is activated when there are any communication issues between a R6 NAV PRO Compass and an I6 IMU unit other by installation or data feeds.

10.3.17 XTD Limit (Alert Identifier: 3024 Instance: 156)

This Warning is active when the XTD Limit is exceeded.

10.3.18 Approaching WPT (Alert Identifier: 3038 Instance: 157/170)

This Warning is active when either the waypoint distance is exceeded (Instance 157) or the waypoint time is exceeded (Instance 170).

10.4 Troubleshooting via the CDU

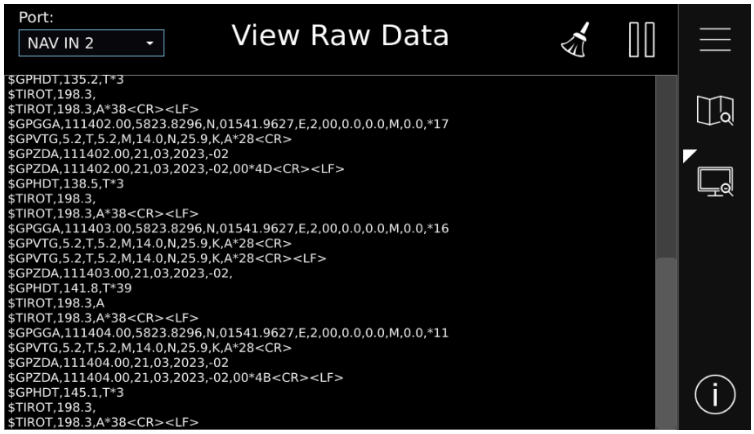
There is a lot of information and data accessible via the CDU that can be useful for troubleshooting, and that can help finding a presumed problem. The following items are just a few examples of what to look at.

10.4.1 Time in Status Bar

The time (UTC or LOC) in the upper left corner of the display is provided by the R5 Navigation Sensor. If the time is not correct, the sensor's internal GNSS does not have a position fix. This will also be indicated by the alert. This problem is normally caused by a GNSS-antenna failure or damaged antenna cables. This problem may also be caused by interference from radio equipment on-board.

10.4.2 View Raw Data

The “View Raw Data” view can be used to see received data on the ports of the R6 Navigation System. It is useful for troubleshooting to make sure that connected sensors provide correct data to the system. The **Port** parameter determines from which port the data displayed in the view are taken. It is possible to pause the view by pressing the “Pause” button. All data that is received while the view is paused will not be displayed in the view.



View 10-1 - View Raw Data

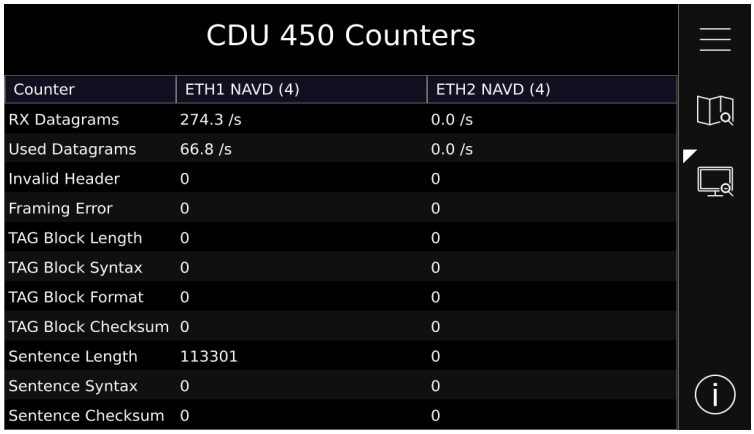
10.4.3 LWE Counters - IEC 61162-450 Counters

The IEC 61162-450 Counters view displays the rate of received and used datagrams per second and counters for the amount of different issues detected on received datagrams since start up.

Separate Views are available for the R6 CDU and the R5 Navigation Sensor (NAV).

Data available are:

- Invalid header according to the IEC 61162-450 standard
- Framing issues (missing TAG start/end etc.)
- TAG-blocks longer than 80 characters (Length)
- TAG-blocks with unexpected/invalid characters (Syntax)
- TAG-blocks with missing sources, out of range values or sequence error (Format)
- TAG-blocks with mismatching checksum
- Sentences longer than 80 characters (Length)
- Sentences with unexpected/invalid characters (Syntax)
- Sentences with mismatching checksum.



View 10-2 - IEC 61162-450 Counters

10.5 Contacting Support

The primary source for support and RMA issues for end customers should be the local dealer where the equipment was purchased in the first place. Another option is to contact one of our OEM partners or affiliate service stations and request help. An updated list with our dealers, OEM partners and service stations can be found at our website, www.saab.com/maritime, listed under the corresponding product.

It is also possible to contact Saab TransponderTechs technical support if this is preferred.

We recommend contacting us via email at support.transpondertech@saabgroup.com for most accurate and detailed help. If the situation is very urgent then it is of course also possible to call us at normal Swedish workdays and working hours. Telephone **+46-13-189420**.

Before contacting support, always check the following information and include it in the first email, or have it ready at the phone call:

- All the information provided by the “FW/HW Information” views (CDU and Sensor).
- Detailed fault description.

For the latest manual, firmware and certificates please visit https://www.saab.com/transpondertechsupport

11 COMMUNICATION INTERFACES

This section describes the characteristics of the communication interfaces in the R6 Navigation system.

The system is equipped with two Ethernet network interfaces on each unit and the R5 Sensor also provides RS-422 serial ports as well.

- Unless otherwise stated, an output sentence is transmitted on the networks as well as on all serial ports
- Unless otherwise stated, an input sentence can be received from the networks as well as from any serial port.

11.1 Serial Ports

The R5 Navigation Sensor has multiples of out- / in-put serial ports (IEC 61162-1/IEC 61162-2 Compatibles) that can be combined for bi-directional communication:

- OUT 1-8
- IN 1-5.

Port Baud rates and functionality can be individually configured for each port from the “Serial Ports” configuration view (Section 4.2.7 Serial Ports).

11.2 Ethernet Ports

NOTE: A direct connection from a R6 CDU or a R5 Navigation Sensor to an uncontrolled network is prohibited! It is the responsibility of the network installer to assert that no uncontrolled network may reach the R6 CDU or the R5 Navigation Sensor.

There are two Ethernet ports on the R5 Navigation Sensor and two on the R6 CDU. These ports handles datagrams according to the IEC 61162-450 standard.

Transmission group NAVD is used for outgoing messages. The equipment may receive data from transmission group TGTD, NAVD or SATD.

The R6 CDU and the R5 Navigation Sensor does not provide network monitoring function (per IEC 61162-460), and it may only be installed in a network where such function is provided elsewhere (if installing into a 460-Network).

To be able to identify source/destination of a datagram on the Ethernet, each datagram is tagged with System Function Identity (SFI). The SFIs for the R5 Sensor and the R6 CDU are configurable according to the table below.

Unit	Function	System Function Identity
R6 CDU	Main function	**SN**YYYY
R5 Navigation Sensor .alt **R6 NAV PRO Compass**	Main function	**GN**XXXX

Table 11-1 - System Function Identities

11.3 Load Capacity

The R6 CDU is compliant to IEEE 802.3ab (10BASE-T/100BASE-TX/1000BASE-T) and can handle following rates of received datagrams:

- 300 datagram/s intended for processing by the unit
- 6000 datagram/s not intended for processing by the unit
- 150 datagram/s intended for processing (50% of the unit max load) and 3000 datagram/s not intended for processing.

The R5 Navigation Sensor is compliant to IEEE 802.3ab and can handle following rates of received datagrams:

- 2000 datagram/s intended for processing by the unit
- 10000 datagram/s not intended for processing by the unit
- 1000 datagram/s intended for processing (50% of the unit max load) and 8000 datagram/s not intended for processing.

11.4 Serial to Network Gateway Function (SNGF)

The R5 Navigation sensor's serial ports supports IEC 61162-450 SNGF functionality. They communication on the network on the IEC 61162-450 NAVD transmission group.

Each serial output port has a 40kB buffer for output of internally generated data as well as addressed data from the network.

The sensor's input ports can forward all incoming serial data to the network depending on the unit's configuration (see 4.2.3)

There is three ways to configure how the R5 Navigation sensor's input ports should forward the received serial data:

- NMEA (No SNGF) - Received data is only used internally in the sensor, no forwarding of SNGF data onto the network
- NMEA (SNGF) - All received serial data is output on the network, including broken and incorrect NMEA sentences.
- Validated NMEA (SNGF) - All NMEA sentences with correct checksum received on the serial port will be forwarded to the network.

11.5 Input Sentences

The interfaces of the R5 Navigation System supports receiving and interpreting the input sentences described in the table below. The user can configure which port that should receive which messages for interpretation. Refer to sections 4.2.4.

Sentences receivable on the Input Ports.

Sentence	Name
ACK	Acknowledge Alert (Note1)
ACN	Alert Command

DPT	Depth
HDG	Heading, deviation and variation
HDT	Heading, true
VHW	Water speed and heading
THS	Heading, true
ROT	Rate Of Turn

Table 11-2 - Interpreted IEC 61162-1 Input Sentences

Note 1: The ACK message alert identifier must be identical to the identifier field in the ALR output message relating the acknowledgment to the alert.

11.6 Output Sentences

The serial interfaces of the R5 Navigation System support transmission of the sentences described in the tables below. All sentences are transmittable on both the network and the Output Ports.

The user can configure which sentences to output on each serial interface and the output rate, as described in the sections 4.2.7 and 4.2.6.

Sentence	Description
ACN	Alert command
ALC	Cyclic alert list
ALF	Alert sentence
ALR	Legacy Alert state
ARC	Alert command rejection
GNS	GNSS fix data
RMC	Recommended minimum specific GNSS data
VTG	Course over ground and ground speed
ZDA	UTC time and date
DTM	Datum reference
GBS	GNSS satellite fault detection
GRS	GNSS range residuals
GSA	GNSS DOP and active satellites
GST	GNSS pseudo range error statistics
GSV	GNSS satellites in view
HDT	Heading True North
RMC	Recommended minimum specific GNSS data
THS	True Heading and Status
PSTT,501	RAIM Status (proprietary message)

Sentence	Description
POS	Device position and ship dimensions report or configuration command

Table 11-3 - Supported Output Sentences

11.7 Other Network Function Ports

The R5 Navigation Sensor web server and the R6 CDU web server are both considered ONF (Other network function) ports. The ports are accessed on each device's Ethernet IP address on port 80. The web servers use the http protocol to establish a client-server communication flow.

12 IEC 61162-460 INFORMATION

This section summarizes device compliance with the IEC 61162-460 Ed.3 standard, and is oriented towards Bridge Integrators performing IEC61162-460 certification.

The R5 Navigation Sensor or R6 NAV PRO Compass and the R6 CDU are designed to be compliant with IEC 61162-460 Ed.3 as 460-Node(s).

Note: For the device to fulfil 61162-460 the password must not be disabled

12.1 Maximum Operational Output

Maximum traffic output for the R5 Navigation Sensor/R6 NAV PRO Compass is 230 kbyte/s + additional 300 kbyte/s for 5 SNGF inputs, per Ethernet interface. Traffic is averaged over a 10 min interval.

Maximum traffic output for the R6 CDU is 5 kbyte/s + additional 60 kbyte/s for 1 SNGF input, per Ethernet interface. Traffic is averaged over a 10 min interval.

12.2 Maximum Operational Input

Verified maximum traffic input for the R5 Navigation Sensor/R6 NAV PRO Compass is 375 kbyte/s. Exceeding this traffic limit may cause non-important functions to have reduced performance (i.e. slow responses from the embedded web interface). Greatly exceeding this traffic limit may cause the unit to reboot.

Verified maximum traffic input for the R6 CDU is 85 kbyte/s. Exceeding this traffic limit may cause UI to respond slowly. Additionally, non-important functions may have reduced performance (i.e slow responses from the embedded web interface). Greatly exceeding this traffic limit may cause the unit to reboot.

12.3 REDS interfaces

The R6 CDU has one REDS interface by means of an SD-Card reader. The interface is required for the Lifetime Maintenance and Operation of the device. Operational access to the interface is restricted to dedicated controls in the R6 CDU firmware for Software/Firmware maintenance and Configuration maintenance. Additionally, there are no means to install additional drivers for/from the interface (“Prevent device drivers from installing”).

If desired, physical access to the interface can be restricted by installing the device in a console using the Panel Mount Kit (7000 123-142).

12.4 Device Management Activity Events

Neither the R5 Navigation Sensor/R6 NAV PRO Compass nor the R6 CDU logs device management activity events locally. Events are instead logged by means of SysLog-messages broadcast over multicast-group 239.172.0.254:514.

12.5 Device Redundancy

The R5 Navigation Sensor/R6 NAV PRO Compass is defined ”Critical” if it is used as the main source of navigation data, and provides Interface Redundancy with two Ethernet interfaces. Additionally, multiple devices may be installed in the same network for Device Redundancy.

The R6 CDU is defined “Critical” for the operation of the R5 Navigation Sensor. It does provide Interface Redundancy with two Ethernet interfaces.

13 INTERPRETATIONS OF ALERT SENTENCES

13.1 Output/Input Sentences, Alerts

Alert sentences are always accepted/output on all interfaces (Serial/Ethernet) as long the user has actively selected to stop any outputs.

13.1.1 ACN - Alert command

$--ACN,hhmmss.ss,ccc,x.x,x.x,c,c

Field	Format	Name	Note
1	--ACN	Sentence Id	
2	hhmmss.ss	UTC time	
3	ccc	Manufacturer mnemonic code, STT = Proprietary Alert Null = Standard Alert	
4	x.x	Alert identifier	
5	x.x	Alert instance	
6	c	Alert command, A = Acknowledge Q = Request S = Silence	
7	c	Sentence status flag (C Always)	

13.1.2 ALC - Cyclic alert list

$--ALC,xx,xx,xx,x.x,ccc,x.x,x.x,x.x,…

Field	Format	Name	Note
1	--ALC	Sentence Id	
2	xx	Number of sentences	
3	xx	Sentence number	
4	xx	Sequential identifier	
5	x.x	Number of alert entries	
		Fields for one alert entry, repeats “Number of alert entries” times	
6,10,14,..	ccc	Manufacturer mnemonic code STT = Proprietary Alert Null = Standard Alert	
7,11,15,..	x.x	Alert identifier	
8,12,16,..	x.x	Alert instance	
9,13,17,..	x.x	Revision counter	

13.1.3 ALF - Alert sentence

$--ALF,x,x,x,hhmmss.ss,a,,a,a,aaa,x.x,x.x,x.x,c-c

Field	Format	Name	Comment
1	--ALF	Sentence Id	
2	x	Number of sentences	
2	x	Sentence number	
3	x	Sequential identifier	
4	hhmmss.ss	UTC time of change	
5	c	Alert category	
4	c	Alert priority W = Warning C = Caution	
5	c	Alert state N = Normal V = Active, Unacknowledged A = Active, Acknowledged S = Active, Silenced	
6	ccc	Manufacturer mnemonic code	
7	x.x	Alert identifier	
8	x.x	Alert instance	
9	x.x	Escalation Counter	
10	x	Revision Counter	
11	c-c	Alert/Description text	

13.1.4 ALR - Alert state

$--ALR,hhmmss.ss,xxx,a,a,c-c

Field	Format	Name	Comment
1	--ALR	Sentence Id	
2	hhmmss.ss	UTC time of alert condition change	
3	xxx	Unique alert identifier	
4	c	Alert condition A = Active, V = Inactive	
5	c	Acknowledgment state A = acknowledged, V = unacknowledged	
8	c-c	Alert description text	

13.1.5 ARC - Alert command rejection

$--ARC,hhmmss.ss,ccc,c,c,c

Field	Format	Name	Comment
1	--ARC	Sentence Id	
2	hhmmss.ss	UTC time of alert condition change	
3	ccc	Manufacturer mnemonic code STT = Proprietary Alert Null = Standard Alert	
4	x.x	Alert identifier	

5	x.x	Alert instance	
6	c	Alert command, A = Acknowledge Q = Request S = Silence	

13.1.6 ACK - Acknowledge alert

$--ACK,xxx

Field	Format	Name	Comment
1	--ACK	Sentence Id	Used
2	xxx	Alert identifier number	Corresponds to ALR message for alert to acknowledge

13.1.7 ACN – Alert command

$--ACN,hhmmss.ss,ccc,x.x,x.x,c,c*hh<CR><LF>

Field	Format	Name	Range
1	--ACN	Sentence formatter	--ACN always
2	hhmmss.ss	UTC time	Not used
3	ccc	Manufacturer mnemonic code	STT = Proprietary Alert Null = Standard Alert
4	x.x	Alert identifier	0 = All identifiers
5	x.x	Alert instance	0 = All instances
6	c	Alert command	A = Acknowledge Q = Request S = Silence
7	c	Sentence status flag	C Always

13.1.8 DPT – Depth

$--DPT,x.x,x.x,x.x*hh<CR><LF>

Field	Format	Name	Range
1	--DPT	Sentence formatter	--DPT always
2	x.x	Water depth relative to the transducer, in metres	
3	x.x	Offset from transducer, in metres	
4	x.x	Maximum range scale in use	

13.1.9 HBT - Heartbeat supervision sentence

Heartbeat sentence is output each 30s on the network (IEC 61162-450) and is not configurable.

NOTE: Not classed as an alert sentence but highly related

$--HBT,x.x,c,x

Field	Format	Name	Comment

1	--HBT	Sentence Id	
2	x.x	Repeat interval (Always 30s)	
3	c	Equipment in normal operation, V = no A = yes	
4	x	Sequential sentence identifier	

14 INTERPRETATIONS OF OUTPUT SENTENCES

14.1 Output Sentences, GNSS

All GNSS output sentences use the talker identifiers that can be seen in the table below. All of them starting a message with a '$'-character.

Talker identifier	System/Systems
GP	Global Position System (GPS)
GN	GPS/GLONASS/Galileo/BeiDou
GA	Galileo Position System
GB	BeiDou Position System
GL	GLONASS

14.2 Output Sentences, GNSS

14.2.1 DTM - Datum Reference

$--DTM,ccc,a,x.x,a,x.x,a,x.x,ccc

Field	Format	Name	Comment
1	--DTM	Sentence Id	
2	ccc	Local datum	Always W84
3	a	Local datum subdivision code	Null field
4	x.x	Lat offset, min	Always zero
5	a		
6	x.x	Lon offset, min	Always zero
7	a		
8	x.x	Altitude offset	Always zero
8	ccc	Reference datum	Always W84

14.2.2 GBS - GNSS Satellite Fault Detection

$--GBS,hhmmss.ss,x.x,x.x,x.x,xx,x.x,x.x,x.x,h,h

Field	Format	Name	Comment
1	--GBS	Sentence Id	
2	hhmmss.ss	UTC time of GGA or GNS	
3	x.x	Expected error in latitude	
4	x.x	Expected error in longitude	
5	x.x	Expected error in altitude	
6	xx	ID number of most likely failed satellite	

7	x.x	Probability of missed detection for most likely failed satellite	
8	x.x	Estimate of bias	
9	x.x	Standard deviation of bias estimate	
10	h	GNSS System ID	Always one (1)
11	h	GNSS Signal ID	Always one (1)

14.2.3 GGA - Global Positioning System Fix Data

$--GGA,hhmmss.ss,llll.ll,a,yyyy.yy,a,x,xx,x.x,x.x,M,x.x,M,x.x,xxxx

Field	Format	Name	Comment
1	--GGA	Sentence Id	
2	hhmmss.ss	UTC of position	
3	llll.ll	Latitude	
4	A		
5	yyyy.yy	Longitude	
6	a		
7	x	GPS quality indicator	
8	xx	Satellites in use	
9	x.x	Horizontal dilution of precision	
10	x.x	Antenna altitude	
11	M	Units of antenna altitude, meter	
12	x.x	Geodial separation	
13	M	Units of geodial sep.	
14	x.x	Age of differential GPS data	
15	xxxx	Differential reference station ID	

14.2.4 GLL - Geographic position, latitude/longitude

$--GLL,llll.ll,a,yyyy.yy,a,hhmmss.ss,A,a

Field	Format	Name	Comment
1	--GLL	Sentence Id	
2	llll.ll	Latitude	
3	a		
4	yyyy.yy	Longitude	
5	a		
6	hhmmss.ss	UTC of position	
7	A	Status	
8	a	Mode indicator	

14.2.5 GNS - GNSS fix data

$--GNS,hhmmss.ss,llll.ll,a,yyyy.yy,a,c—c,xx,x.x,x.x,x.x,x.x,x.x,x.x,a

Field	Format	Name	Comment
1	--GNS	Sentence Id	
2	hhmmss.ss	UTC of position	
3	llll.ll	Latitude	
4	a		
5	yyyy.yy	Longitude	
6	a		
7	c—c	Mode indicator	
8	xx	Total number of satellites	
9	x.x	HDOP	
10	x.x	Antenna altitude, meter	
11	x.x	Geodial separation	
12	x.x	Age of differential corrections	
13	x.x	Differential reference station ID	
14	a	Navigational Status Indicator	

14.2.6 GRS - GNSS range residuals

$--GRS,hhmmss.ss,x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x,h,h

Field	Format	Name	Comment
1	--GRS	Sentence Id	
2	hhmmss.ss	UTC time of associated GGA or GNS fix	
3	X	Mode	
4	x.x	Range residuals (1)	
5	x.x	Range residuals (2)	
…	…	…	
15	x.x	Range residuals (12)	
16	h	GNSS System ID	
17	h	GNSS Signal ID	

14.2.7 GSA - GNSS DOP and active satellites

$--GSA,a,x,x.x,x.x,…,x.x,x.x,x.x,x.x

Field	Format	Name	Comment
1	--GSA	Sentence Id	
2	A	Mode	
3	X	Mode	
4	x.x	Satellite ID (1)	
5	x.x	Satellite ID (2)	
…	…	…	
15	x.x	Satellite ID (12)	
16	x.x	PDOP	

17	x.x	HDOP	
18	x.x	VDOP	
19	h	GNSS System ID	

14.2.8 GST - GNSS pseudorange error statistics

$--GST,hhmmss.ss,x.x,x.x,x.x,x.x,x.x,x.x,x.x,x.x

Field	Format	Name	Comment
1	--GST	Sentence Id	
2	hhmmss.ss	UTC time of associated GGA or GNS fix	
3	x.x	RMS value	
4	x.x	Standard deviation of semi-major axis	
5	x.x	Standard deviation of semi-minor axis	
6	x.x	Orientation of semi-major axis	
7	x.x	Standard deviation of latitude error	
8	x.x	Standard deviation of longitude error	
9	x.x	Standard deviation of altitude error	

14.2.9 GSV - GNSS satellites in view

$--GSV,x,x,xx,xx,xx,xxx,xx.....,xx,xx,xxx,xx,h

Field	Format	Name	Comment
1	--GSV	Sentence Id	
2	x	Total number of messages	
3	x	Message number	
4	x	Total number of satellites in view	
5	xx	Satellite ID number (Satellite 1)	
6	xx	Elevation, degrees (Satellite 1)	
7	xxx	Azimuth, degrees true (Satellite 1)	
8	xx	SNR (Satellite 1)	
…	…	…	Fields for all satellites are used
21	h	Signal ID	Always one (1)

14.2.10 HDT - Heading, True

$--HDT,x.x,T

Field	Format	Name	Comment
1	--HDG	Sentence Id	Used
2	x.x	Heading, degrees true	Used

14.2.1 POS - Device position and ship dimensions report or configuration command

Note: See section 4.2.2 / 4.2.9 for coordinate references

$--POS,cc,xx,a,x.x,x.x,x.x,a,x.x,x.x,a

Field	Format	Name	Comment

1	--POS	Sentence Id	
2	cc	Equipment identification	
3	xx	Equipment number 00-99	
4	a	Position validity flag A = Valid V = Invalid	
5	x.x	Antenna Position offset X-coordinate (in meters)	
6	x.x	Antenna Position offset Y-coordinate (in meters)	
7	x.x	Antenna Position offset Z-coordinate (in meters)	
8	a	Ship's width/length A = Valid V = Invalid	
9	x.x	Ship's width (in meters)	
10	x.x	Ship's length (in meters)	
11	a	Sentence status flag R = Sentence is a status report of current settings (use for a reply to a query). C = Sentence is a configuration command to change settings. A sentence without "C" is not a command.	

14.2.2 RMC - Recommended minimum specific GNSS data

$--RMC,hhmmss.ss,A,llll.ll,a,yyyy.yy,a,x.x,x.x,xxxxxx,x.x,a,a,a

Field	Format	Name	Comment
1	--RMC	Sentence Id	
2	hhmmss.ss	UTC of position	
3	A	Status	
4	llll.ll	Latitude	
5	a		
6	yyyy.yy	Longitude	
7	a		
8	x.x	Speed over ground, knots	
9	x.x	Course over ground, degrees true	
10	xxxxxx	Date	
11	x.x	Magnetic variation	
12	a		
13	a	Mode indicator	
14	a	Navigational Status	

14.2.1 THS - True Heading and Status

$--THS,x.x,a

Field	Format	Name	Comment
1	--THS	Sentence Id	Used
2	x.x	Heading, degrees true	Used if Status is set to 'A'

3	a	Status	Used

14.2.2 VTG - Course over ground and ground speed

$--VTG,x.x,T,x.x,M,x.x,N,x.x,K,a

Field	Format	Name	Comment
1	--VTG	Sentence Id	
2	x.x	Course over ground, degrees true	
3	T		
4	x.x	Course over ground, degrees magnetic	
5	M		
6	x.x	Speed over ground, knots	
7	N		
8	x.x	Speed over ground, km/h	
9	K		
10	a	Mode indicator	

14.2.3 ZDA - Time and date

$--ZDA,hhmmss.ss,xx,xx,xxxx,xx,xx

Field	Format	Name	Comment
1	--ZDA	Sentence Id	
2	hhmmss.ss	UTC	
3	xx	Day (UTC)	
4	xx	Month (UTC)	
5	xxxx	Year (UTC)	
6	xx	Local zone hours	Used if configured
7	xx	Local zone minutes	Used if configured

15 INTERPRETATIONS OF INPUT SENTENCES

Per default, any talker identifier is accepted.

15.1 Input Sentences

15.1.1 HDG - Heading, Deviation and Variation

$--HDG,x.x,x.x,a,x.x,a

Field	Format	Name	Comment
1	--HDG	Sentence Id	Used
2	x.x	Magnetic sensor heading, degrees	Used
3	x.x	Magnetic deviation, degrees E/W	Used
4	a		
5	x.x	Magnetic variation, degrees E/W	Used
6	a		

15.1.2 HDT - Heading, True

$--HDT,x.x,T

Field	Format	Name	Comment
1	--HDG	Sentence Id	Used
2	x.x	Heading, degrees true	Used
3	T		

15.1.3 THS - True Heading and Status

$--THS,x.x,a

Field	Format	Name	Comment
1	--THS	Sentence Id	Used
2	x.x	Heading, degrees true	Used if Status is set to 'A'
3	a	Status	Used

15.1.4 VHW - Water speed and heading

$--VHW,x.x,T,x.x,M,x.x,N,x.x,K

Field	Format	Name	Comment
1	--VHW	Sentence Id	Used
2	x.x	Heading, degrees true	Used
3	T		
4	x.x	Heading, degrees magnetic	Used
5	M		
6	x.x	Speed, knots	Used
7	N		
8	x.x	Speed, km/h	Not used
9	K		

15.1.5 ROT - Rate of turn

$--ROT,x.x,a

Field	Format	Name	Comment
1	--ROT	Sentence Id	Used
2	x.x	Rate of turn, °/min, "-" = bow turns to port	Used
3	a	Status: A = data valid V = data invalid	Used

16 SYSTEM SETUPS

16.1 Combined AIS and Navigation system setup

The R6 CDU will also support AIS system approval with the R6 SUPREME Transponder series of products, through an easy update of the configuration in the CDU. It will be possible to install the R6 SUPREME transponder in combination with the R5 Navigation sensor using a common CDU as per below methods.

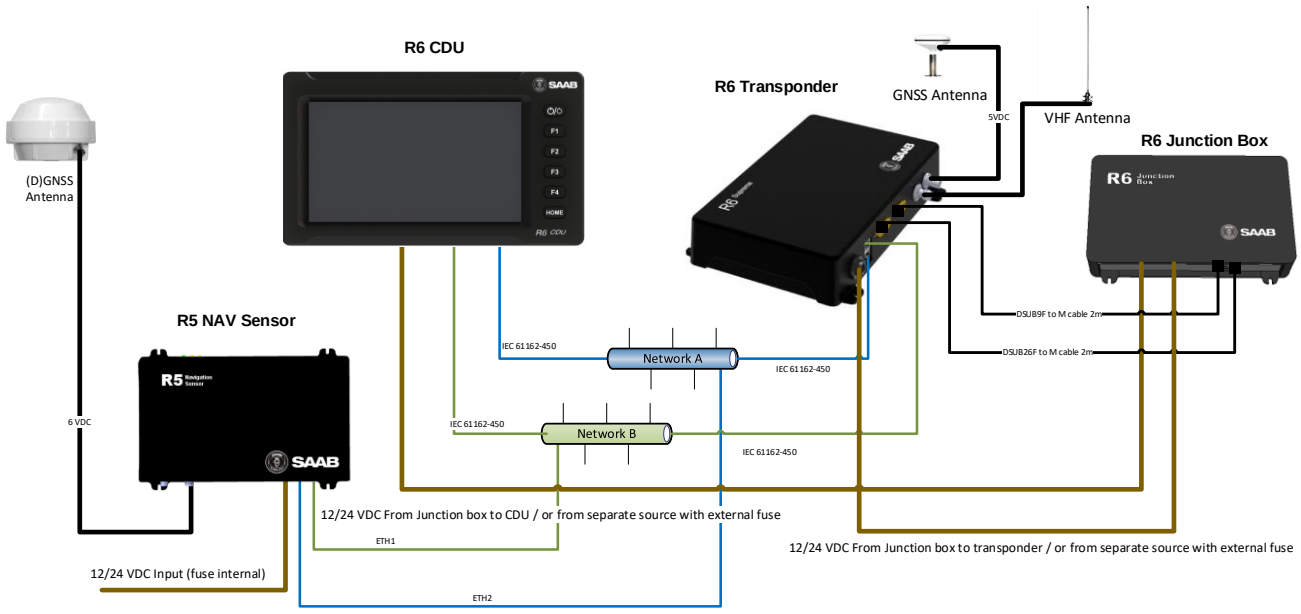


Figure 16-1 - Combined installation in redundant networks

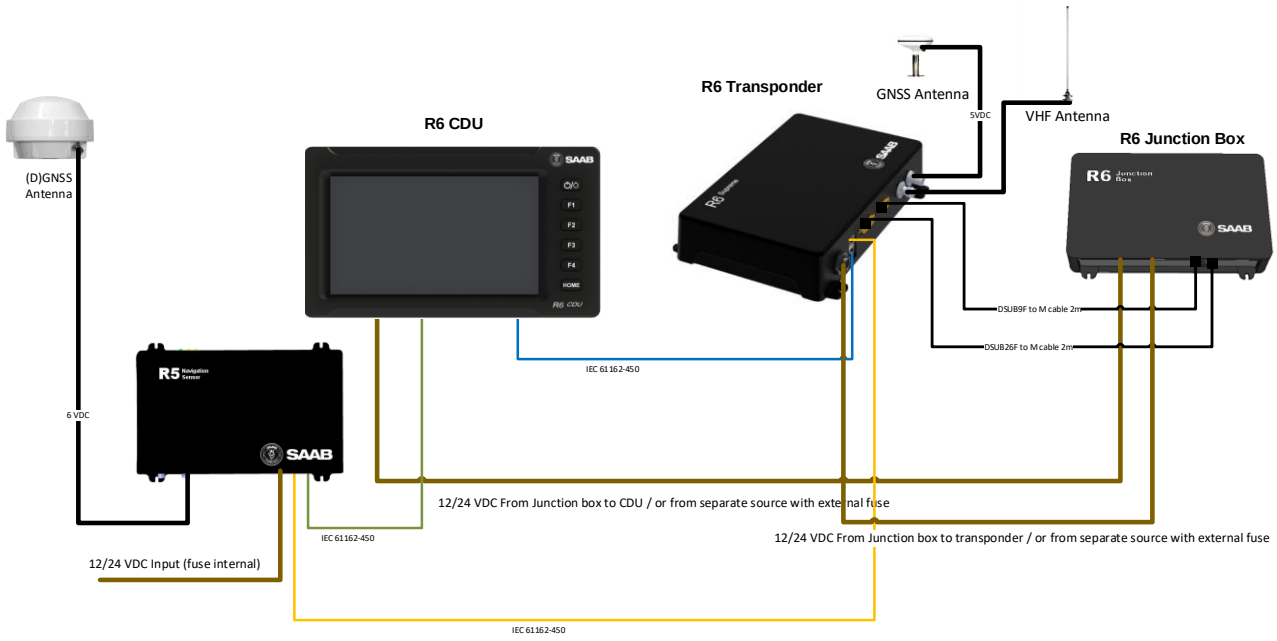


Figure 16-2 - Combined installation without network

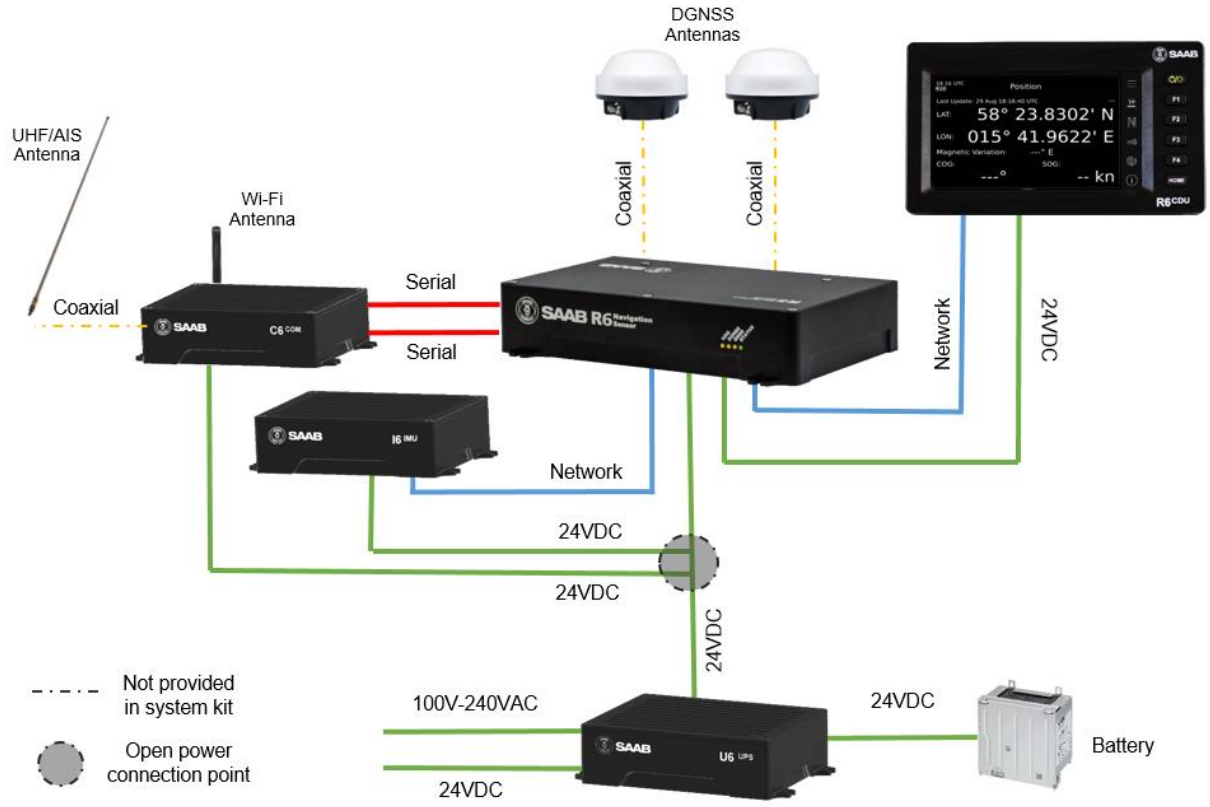


Figure 16-3 - R6 NEO NAV installation with external terminal block (power)

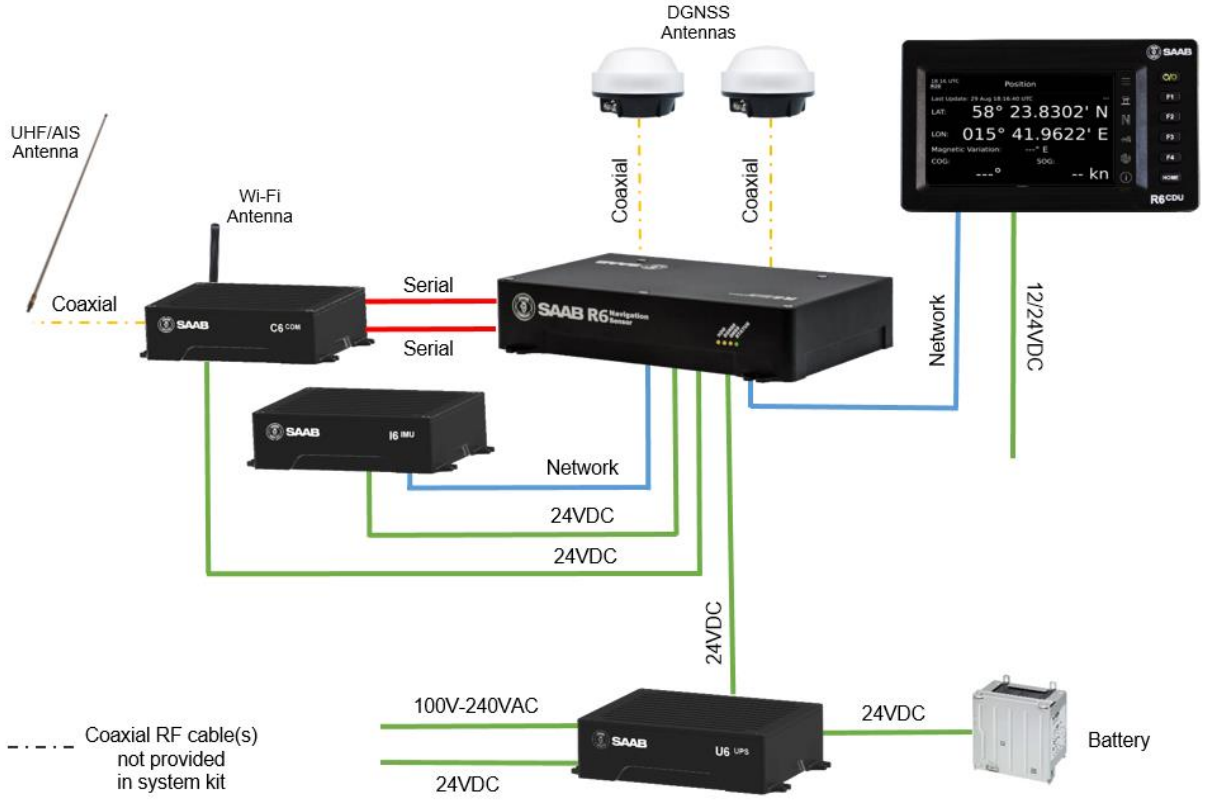


Figure 16-4 - R6 NAV NEO standard installation

17 ELECTRICAL INTERFACES

17.1.1 24 VDC interface

Type: Conxall Mini-Con-X 4-pin

Function: Power input

Pin	In/Out	Signal Name	Signal Type
1	In	PWR +	12/24 VDC
2	In	PWG GND	0 VDC
3	In	-	-
4	In	-	-

Table 17-1 - Power Cable signals

17.1.2 ETH1 and ETH2 interfaces

Compliant to IEEE 802.3ab (10BASE-T/100BASE-TX/1000BASE-T)

Supports IEC 61162-450

17.1.3 GNSS interface

Type: TNC (Female)

Function: GNSS antenna RF input - 5 VDC output

17.1.4 GND symbol interface

Type: M6 hex nuts and threaded rod

Function: Connection to ground

17.2 CDU Interfaces

All electrical interfaces of the R6 CDU are located on the rear side of the unit.

Figure 17-1 - R6 CDU rear interfaces

17.2.1 12/24 VDC interface

Type: Conxall Mini-Con-X 4-pin

Function: Power input

Pin	In/Out	Signal Name	Signal Type
1	In	PWR +	12/24 VDC
2	In	PWG GND	0 VDC
3	-	-	-
4	-	-	-

Table 17-2 - CDU 12/24 V DC

17.2.2 ETH1 and ETH2 interfaces

Compliant to IEEE 802.3ab (10BASE-T/100BASE-TX/1000BASE-T)

Supports IEC 61162-450 communication

17.2.3 R6 CDU J1 interface

Type: DB9F

Pin	In/Out	Signal Name	Signal Type
1	In	PILOT - RxA (-)	RS422
2	In	PILOT - RxB (+)	RS422
3	Out	PILOT - TxB (+)	RS422
4	Out	PILOT - TxA (-)	RS422

5	-	PILOT - GND	RS422
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-

Table 17-3 - CDU J1 Signals

17.2.4 SD interface

Full size SD Card reader slot (push-push type)

Capacity type: SD, SDHC

Speed class: Supports up to UHS-1 speeds

File system supported: FAT32, exFAT

Used for FW upgrades and Service Engineering.

17.3 R5/R6 Navigation Sensor interfaces

17.3.1 Internal circuit board layout:

For detailed description of routed signals, see R5 Navigation Sensor interface specifications.

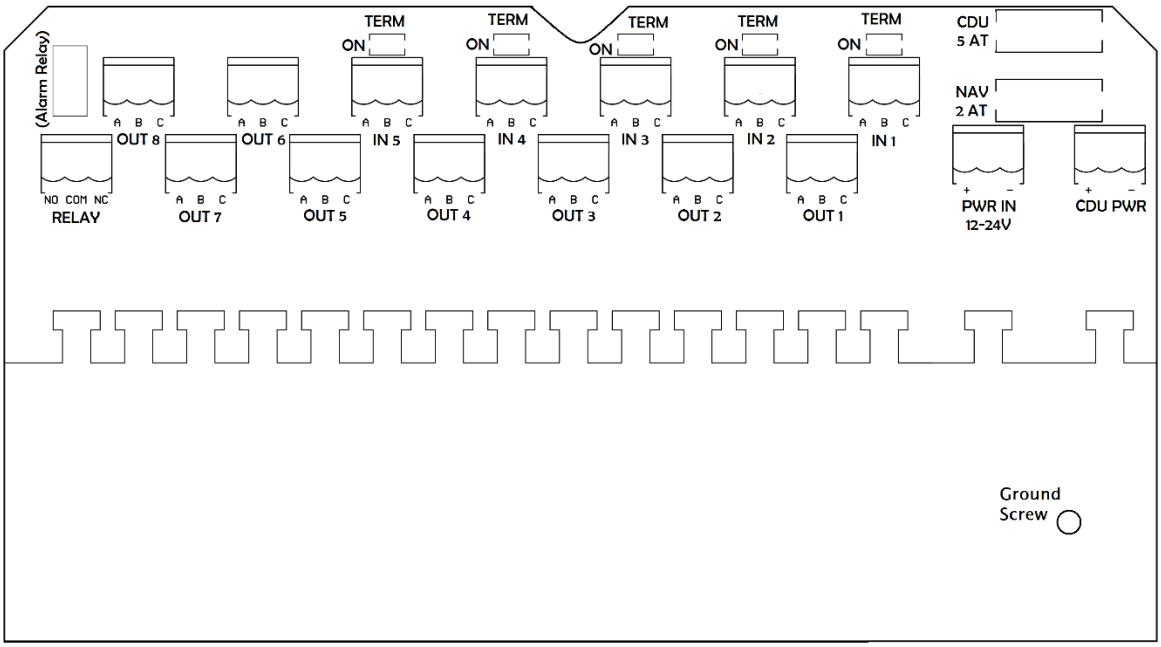


Figure 17-2 - Circuit Board Layout with additional Cover Board

Marking	Description
PWR IN	Terminal block for External 12-24VDC Isolated Input Power
CDU PWR	Terminal block for 12-24VDC Output Power, intended for the R5 Control & Display Unit
OUT 1	Terminal block for output to Sensor 1
OUT 2	Terminal block for output to Sensor 2
OUT 3	Terminal block for output to Sensor 3
OUT 4	Terminal block for output to Sensor 4
OUT 5	Terminal block for output to Sensor 5
OUT 6	Terminal block for output to Sensor 6
OUT 7	Terminal block for output to Sensor 7
OUT 8	Terminal block for output to Sensor 8
IN 1	Terminal block for input from Sensor 1 (Isolated)
IN 2	Terminal block for input from Sensor 2 (Isolated)
IN 3	Terminal block for input from Sensor 3 (Isolated)
IN 4	Terminal block for input from Sensor 4 (Isolated)
IN 5	Terminal block for input from Sensor 5 (Isolated)
RELAY	Terminal block for Alert Relay
CDU 5 AT	5A fuse for CDU PWR Terminal
NAV 2 AT	2A fuse for PWR IN Terminal
TERM	Termination Switch
Ground Screw	Connection for box grounding
1 PPS	BNC Female Connector for PPS Output
GPS/GNSS	TNC Female Connector for Primary GNSS Antenna
HDG	TNC Female Connector for Secondary GNSS Antenna Note: Only (active/available) in the R6 NAV PRO Compass product configuration
Ethernet 1	Ethernet Port 1 (Default IP-address 172.16.0.4)

Ethernet 2	Ethernet Port 2 (Default IP-address 172.17.0.4)

Table 17-4 - R5 Navigation Sensor interfaces

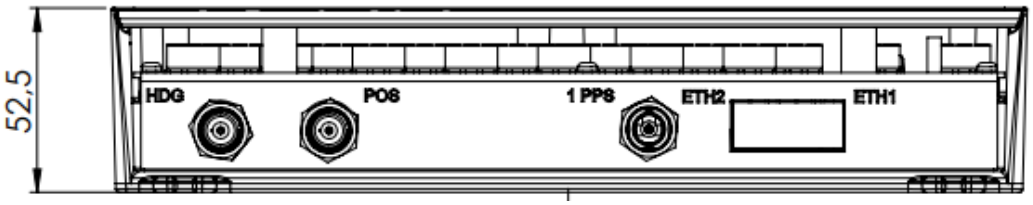


Figure 17-3 - R6 NAV PRO Compass Connectors (rear view)

17.3.2 Signal and Power port

Figure 17-2 shows the terminal blocks that are available on the R5 Navigation Sensor circuit board. Default baud rate for serial data is 38400 bps.

Terminal Marking	Terminal Pin	Signal Name
PWR IN	+	Vs+
PWR IN	-	Vs-
CDU PWR	+	Vs+
CDU PWR	-	Vs-
RELAY	NC	Normally Closed
RELAY	COM	Common
RELAY	NO	Normally Open
OUT 1	A	Tx -
OUT 1	B	Tx+
OUT 1	C	Signal GND
OUT 2	A	Tx -
OUT 2	B	Tx+
OUT 2	C	Signal GND
OUT 3	A	Tx -
OUT 3	B	Tx+

Terminal Marking	Terminal Pin	Signal Name
OUT 3	C	Signal GND
OUT 4	A	Tx -
OUT 4	B	Tx+
OUT 4	C	Signal GND
OUT 5	A	Tx -
OUT 5	B	Tx+
OUT 5	C	Signal GND
OUT 6	A	Tx -
OUT 6	B	Tx+
OUT 6	C	Signal GND
OUT 7	A	Tx -
OUT 7	B	Tx+
OUT 7	C	Signal GND
OUT 8	A	Tx -
OUT 8	B	Tx+
OUT 8	C	Signal GND
IN 1	A	Rx -
IN 1	B	Rx+
IN 1	C	Signal GND
IN 2	A	Rx -
IN 2	B	Rx+
IN 2	C	Signal GND
IN 3	A	Rx -
IN 3	B	Rx+
IN 3	C	Signal GND
IN 4	A	Rx -

Terminal Marking	Terminal Pin	Signal Name
IN 4	B	Rx+
IN 4	C	Signal GND
IN 5	A	Rx -
IN 5	B	Rx+
IN 5	C	Signal GND

Table 17-5 - Terminals/Signal Names

17.3.3 Antenna connector

Connector: TNC (Female)

Output: +6 VDC (referenced to VCC input GND)

17.3.4 Electrical Characteristics of R5 Navigation Sensor serial ports

The serial ports in the R5 Navigation Sensor are all the IN- and OUT ports.

17.3.4.1 Output Drive Capacity

Each talker output can have a maximum of 10 listeners drawing 2.0mA.

17.3.4.2 Input Load

Each listener draws less than 2mA @ 2V input voltage.

17.3.4.3 Termination

The R5 Navigation Sensor has built-in termination resistors. If needed, the termination resistors can be connected by flipping the respective termination switch (TERM to ON) on the sensors circuit board (see Figure 17-2 - Circuit Board Layout with additional Cover Board).

17.3.4.4 Schematics

Each of the RS-422 serial interfaces on the R5 Navigation Sensor fulfils the requirements as specified in IEC 61162-1. All port bit rates are configurable between 4800 bps and 115200 bps.

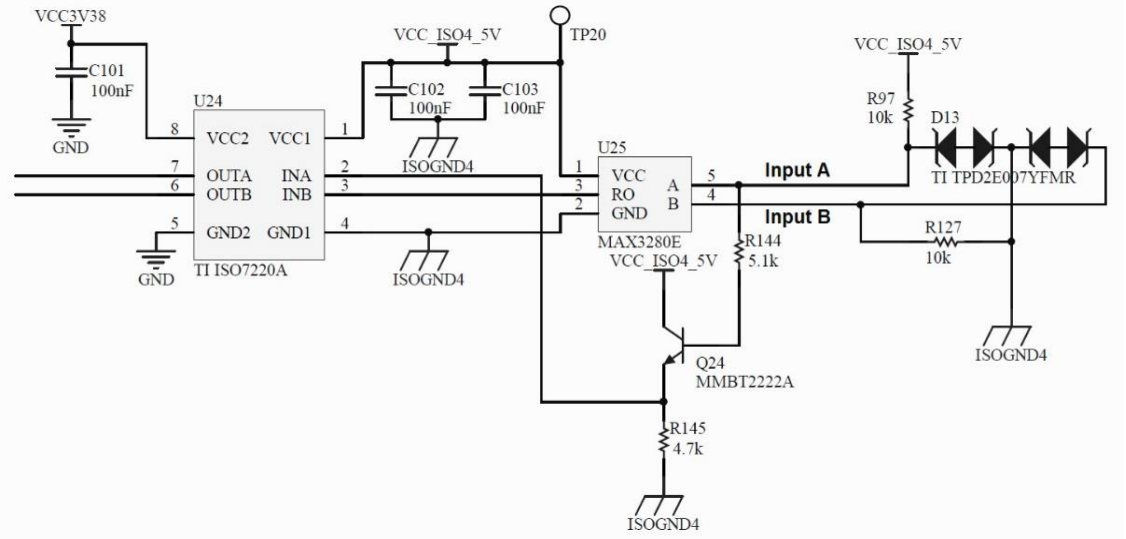


Figure 17-4 - R5 Navigation Sensor Serial Interface Input Schematics

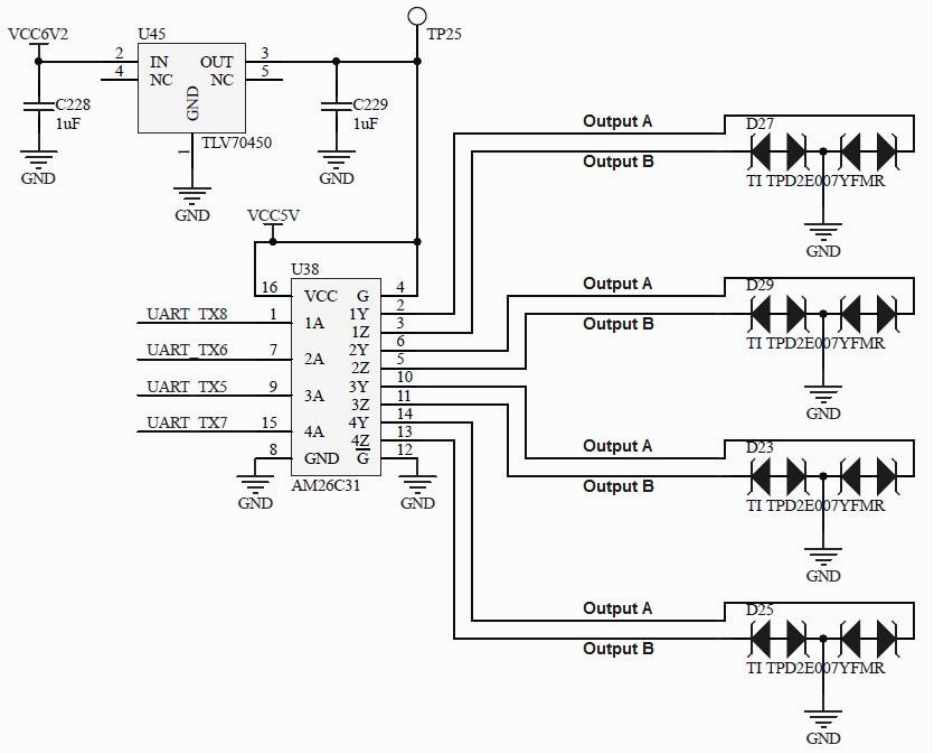


Figure 17-5 - R5 Navigation Sensor Serial Interface Output Schematics

17.3.5 Electrical Characteristics of R5 Navigation Sensor digital ports

17.3.5.1 1PPS Port

The 1PPS port send out a 5V clock pulse every second, lasting for 100ms, when the system has “GNSS Fix”, with an accuracy of 50 ns and detection on rising edge.

17.3.5.2 Alert Acknowledge Port (Configuration for Input Ports)

The Input Port’s Rx+ should be connected via an external normally open momentary switch, capable of handling a 1mA current, to the signal GND for this application. If the input port configured to have the function “Alert Ack” the system detects if the port’s Rx+ signal is drawn low, by its own isolated ground, and thereby acknowledge all active alerts.

17.3.5.3 MOB Button Port (Configuration for Input Ports)

The Input Port’s Rx+ should be connected via an external normally open momentary switch, capable of handling a 1mA current, to the signal GND for this application. If the input port configured to have the function “MOB Button” the system detects if the port’s Rx+ signal is drawn low for a second, by its own isolated ground, and thereby the sensor outputs a MOB message.

17.3.5.4 Alert relay Port

When the R5 Navigation Sensor has, unacknowledged alerts the alert relay will contact Common to Normally Open. If all alerts are acknowledged or inactive, the alert relay will instead contact Common to Normally Closed.

18 MECHANICAL DRAWINGS

18.1 CDU Physical Size and Mechanical Drawing

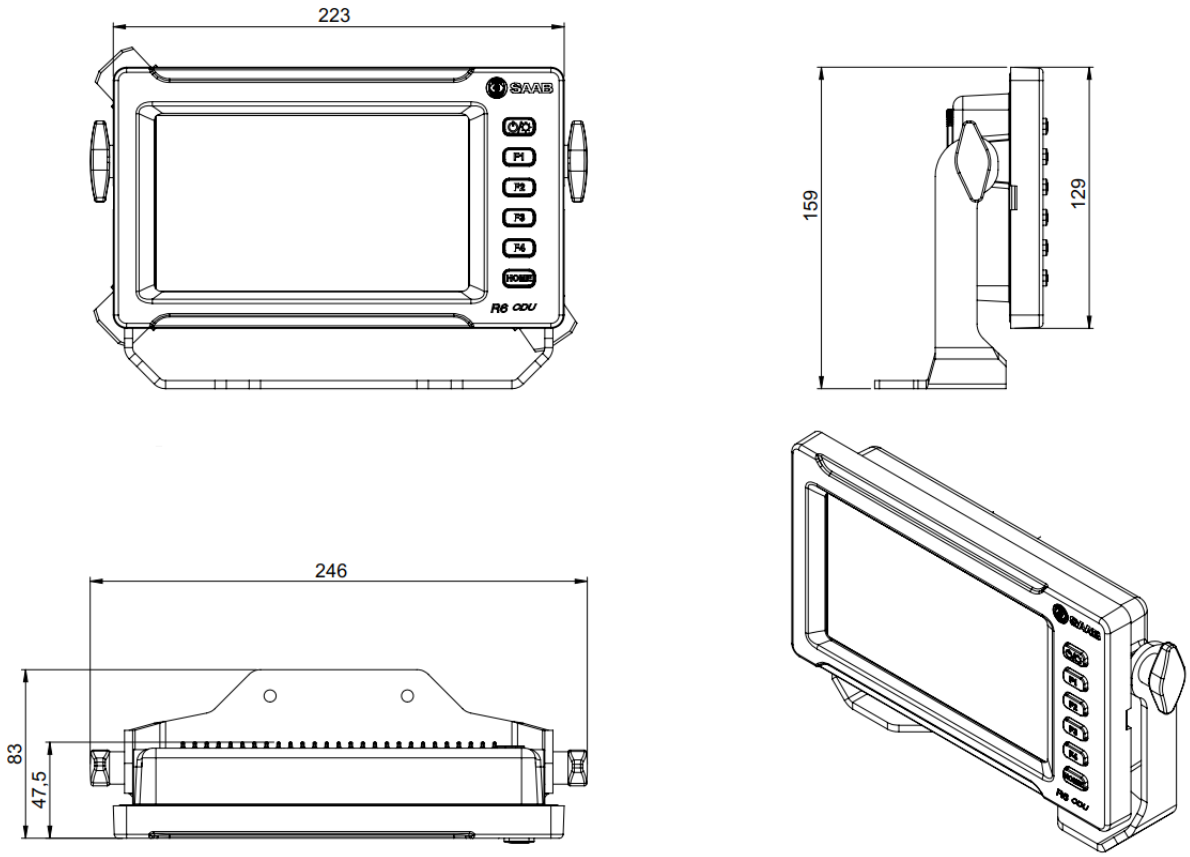


Figure 18-1 - R6 CDU Mechanical Drawing [mm]

18.2 CDU Gimbal Mount Physical Size and Mechanical Drawing

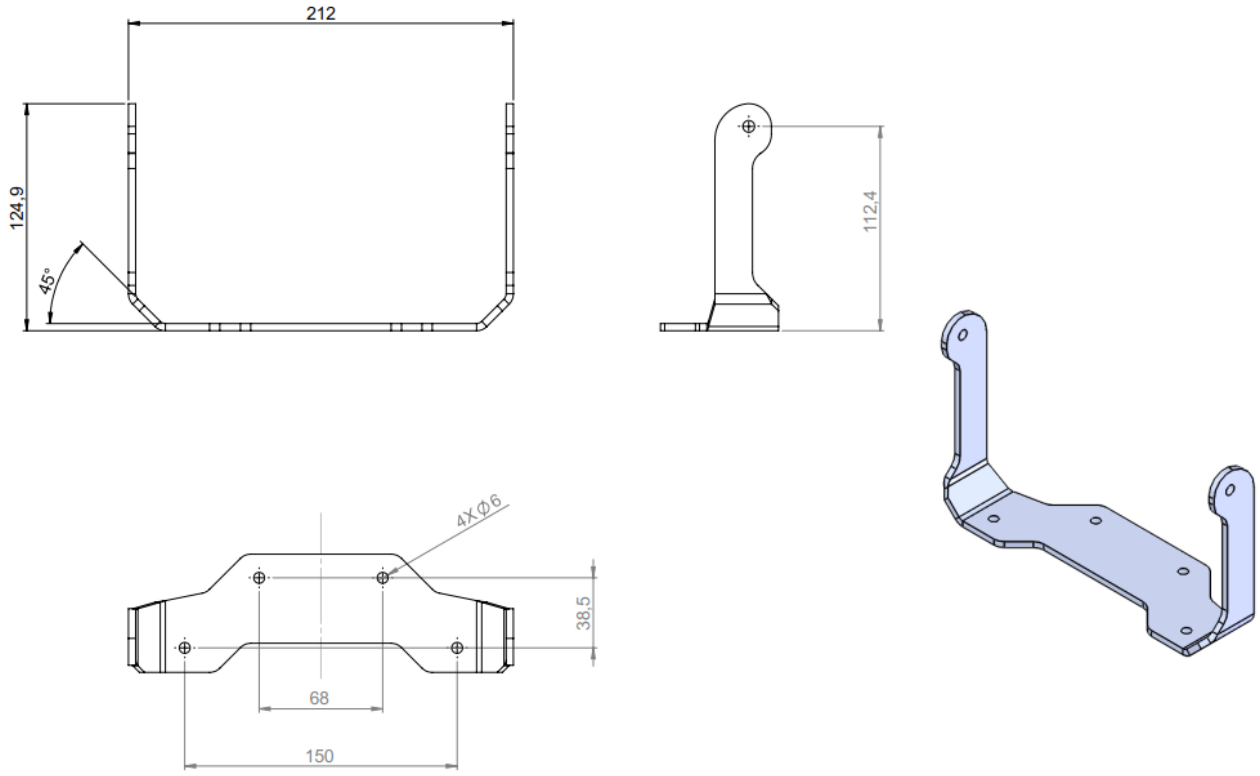


Figure 18-2 - R6 CDU, Gimbal Mount [mm]

18.3 CDU Cut-out Measurements for Panel Mount

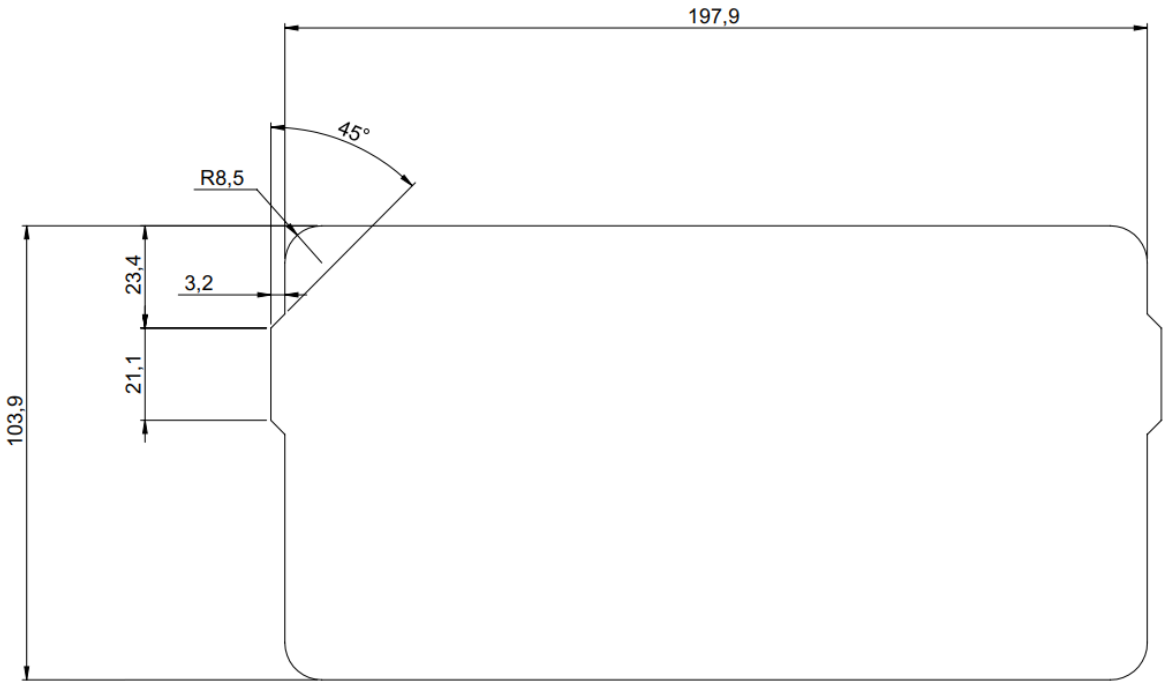


Figure 18-3 - R6 CDU, Cut-out Measurements for Panel Mount [mm]

18.4 CDU Mounting Frame Dimensions 7000 123-119

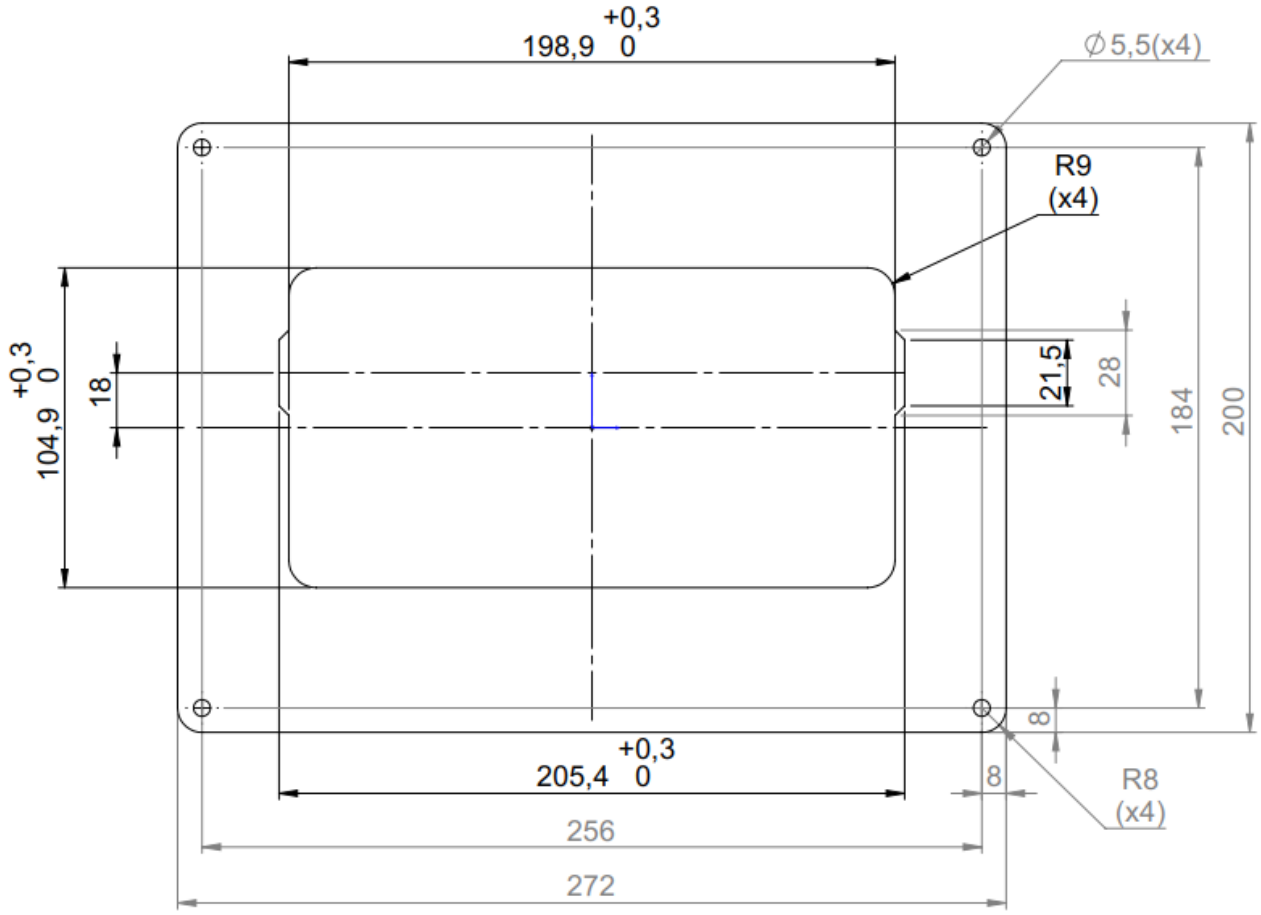


Figure 18-4 - R6 CDU, Mounting frame dimensions [mm]

18.5 CDU Mounting Frame Dimensions 7000 123-120

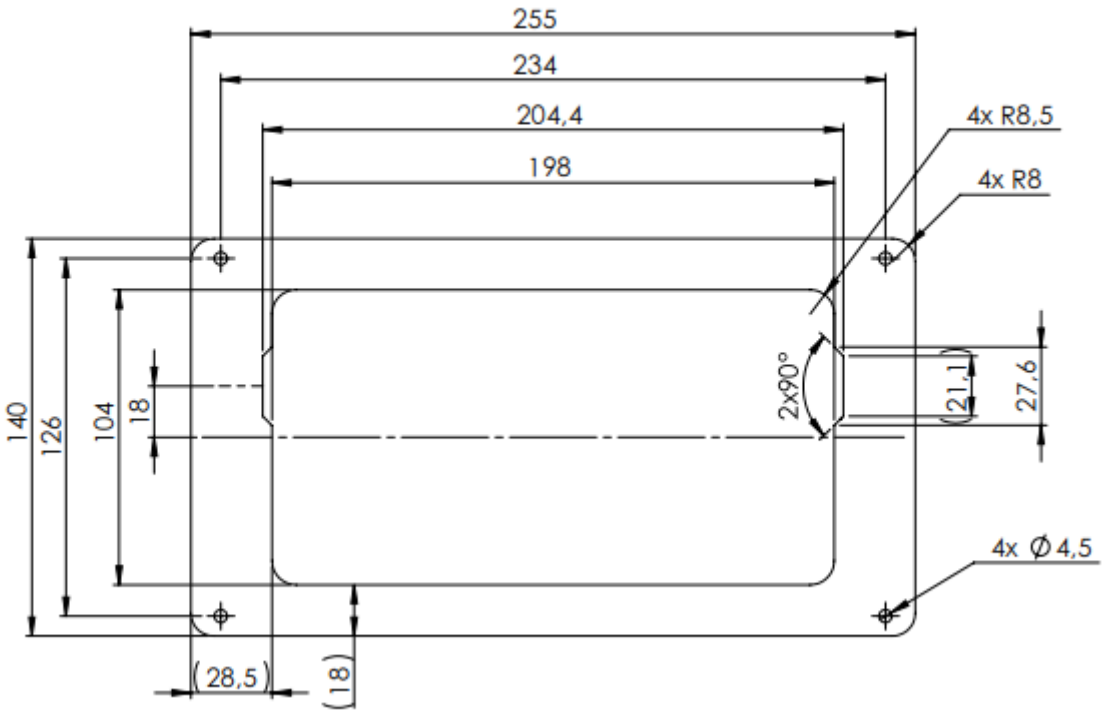


Figure 18-5 - R6 CDU, Mounting frame dimensions [mm]

18.6 R5/R6 Navigation Sensor Size and Mechanical Drawing

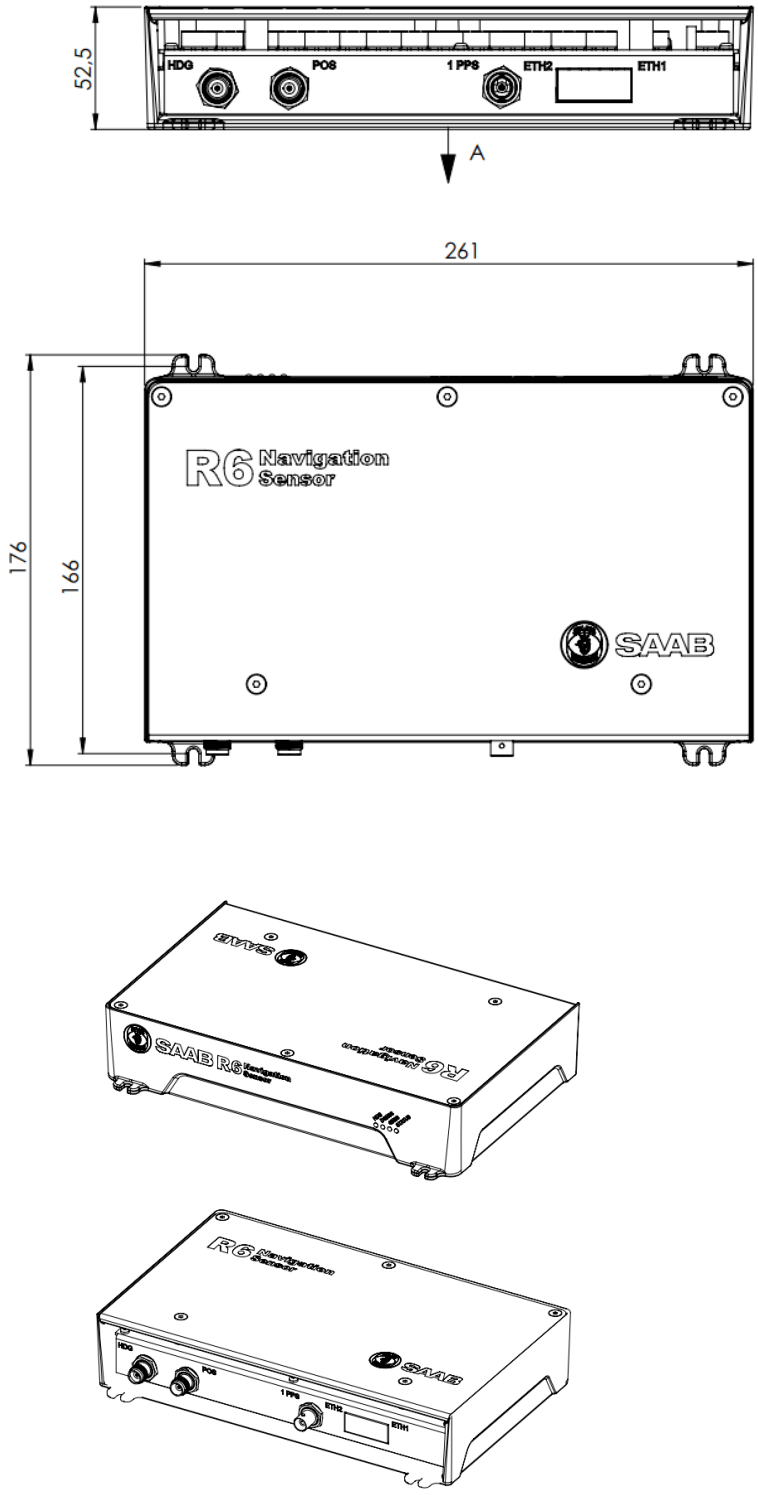


Figure 18-6 - R5/R6 Navigation Sensor Measuements [mm]

19 GLOSSARY

Term	Description
ACK	Acknowledgement
AFSK	Audio Frequency Shift Keying
AIS	Automatic Identification System
Ant	Antenna
ARPA	Automatic Radar Plotting Aid
BAM	Bridge Alert Management
BRG	Bearing
CAM	Central Alert Management
CDU	Control and Display Unit
Ch	Channel
COG	Course Over Ground
Comm	Communication
DGNSS	Differential Global Navigational Satellite System
Disp	Display
ECDIS	Electronic Chart Display and Information System
ETA	Estimated Time of Arrival
Ext	External
F/W	Firmware
GALILEO	European Union GNSS
GMSK	Gaussian Minimum Shift Keying
GNSS	Global Navigational Satellite System
GPS	Global Positioning System
HDG	Heading
HDOP	Horizontal Dilution Of Precision
H/W	Hardware
IALA	International Association of Lighthouse Authorities
ID	Identifier
IEC	International Electrotechnical Commission
IMO	International Maritime Organization
Int	Internal
IP	Internet Protocol (address)
ITU	International Telecommunications Union
LAT	Latitude
LED	Light Emitting Diode
LOC	Local
LON	Longitude

LWE	Light Weight Ethernet
MSG	Message
MKD	Minimum Keyboard and Display
NMEA	National Marine Electronics Association
N/A	Not available
N/E	North East
No	Number
NVM	Non-Volatile Memory
Pos	Position
RAIM	Receiver Autonomous Integrity Monitoring
RNG	Range
ROT	Rate Of Turn
RTA	Recommended Time of Arrival
Rx	Receive
SBAS	Satellite Based Augmentation System
SNR	Signal to Noise Ratio
SOG	Speed Over Ground
Sync	Synchronization
S/W	South West
UTC	Universal Time Coordinated
VHF	Very High Frequency

Table 19-1 - Abbreviation List

19.1 Units

bps	**Bits per second**
W	Watt
m	Meter
kHz	Kilo Hertz
dB-Hz	Decibel-Hertz
NM	Nautical Mile
km	Kilometer
kn	Knots
km/h	Kilometer per Hour
mph	Miles per Hour
mm-dd hh:mm	month-day hour:minute

Table 19-2 - Units List

20 APPENDIX A - CORRECTIONS

20.1 Real-Time Kinematic (RTK)

Real-Time Kinematic is a technic used to improve position accuracy, by the inclusion of correction data, from reference stations or a reference network, in the solutions.

A RTK reference base station (normally just mention as "*base*" in RTK terms) can be seen as a GNSS receiver that is not interested about the information included in the signal, with exception for identity. Instead, the base uses each satellite signal's carrier wave to gain insight about the current atmospheric effects and calculate the relative position- and clock error. This data is normally referred to as corrections.

Considering this, one can see that there are high demands when setting up a RTK reference base station, due to the usage of relative errors.

A mobile GNSS receiver (in RTK terms often-called "*rover*") can receive correction data in multiple ways, but most commonly over the UHF-band by an integrated/external UHF receiver or over an internet connection. The received correction data is included in the position solution by individually correcting the data received from each satellite in the GNSS systems. By minimizing each error individually, the total position error rapidly decreases and a more precise position solution is achieved.

When make use of RTK it is to prefer as local corrections as possible, to get the best result.

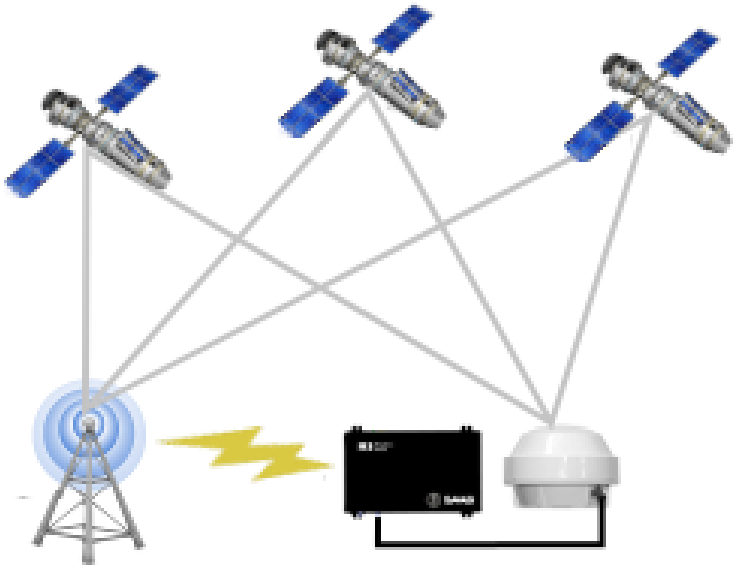


Figure 20-1 - Real-Time Kinematic

Observe that for obtaining the full resolution required for this accuracy level more decimals is needed in the output of Longitude and Latitude by NMEA sentences, this can be configured in the R5/R6 navigation sensor, but be observant this can cause violations against the 82 character limitation in NMEA 182 standard.

20.2 Atlas Correction Service

Atlas is a RTK satellite network that virtually span the entire globe; providing GNSS receivers with correction via L-Band satellite signals. It collects it data through more than a hundred RTK reference base stations uploading correction data worldwide (for more information about RTK bases/networks see Section 20.1).

With “Atlas Correction Service” the user can obtain centimetre-level positioning accuracy without being directly tied to a local reference system.

To obtain full accuracy the system may need a converging time of up to 20 minutes during the start-up process.

21 APPENDIX B - NEO PANAMAMAX MODE

The R6 NAV PRO Compass with the appropriate setup (see Figure 16-3 and configuration it can operate as a “Non-portable Piloting Unit” per A-32-2022, issued by Canal de Panamá (NEO).

In order to be sure that the NEO functionality is enabled, double check the configuration option **NEO Panamax Mode (see Section 4.2.2)** so that’s *enabled* either through web-server or the R6 CDU. Default the parameter will be activated.

When the NEO functionality is enabled, some configuration parameters will override and locked down while another set of configuration options are enforced when the Vessel is inside a pre-defined area around the Panama Canal (GeoFence) - per requirements from Canal de Panamá.

The following configurations are enforced as long the **NEO Panamax Mode** configuration is *Enabled* either always or while the Vessel remains within the GeoFenced area or:

- All **GNSS System** is forced *Enabled* (GeoFenced)
- **Elevation Mask** is forced to *5°* (GeoFenced)
- **SBAS and SBAS Auto search** is forced *Enabled* (GeoFenced)
- **Beacon** is forced *Enabled* (GeoFenced)
- **Beacon Tuning Mode** is forced to **Auto** (GeoFenced)
- **All Correction Ages** is forced to *60 sec* (GeoFenced)
- Serial Port **1 OUT** is forced to **Bitrate:** *115200* and **Function:** *C6 COM Out*
- Serial Port **1 IN** is forced to **Bitrate:** *115200* and **Function:** *RTK (***External Corrections** is forced to *NAV IN1)*
- Serial Port **2 IN** is forced to **Bitrate:** *115200* and **Function:** *C6 COM In*
- **LWE Output GNS/THS** if forced to *10Hz*
- **CCRP Enabled** is forced to be *Disabled.*

All GeoFenced settings will be restored to their previous values once the Vessel exits the specified area, or **NEO Panamax Mode** configuration.

The area of the Geo-Fenced area is outlined in the illustration in the following image.

21.1 Installation guidelines - Authority Canal de Panamá

- GNSS / VHF / UHF antennas must be installed in a location without interference from other equipment's or vessel infrastructures.
- GNSS antennas must be separated not less than 4 meters from each other. *(Install the antennas perpendicular against the vessel heading direction with the GNSS antenna at the port side and the heading antenna on the starboard side).*
- Inertial measurement unit (IMU) must be installed leveled to the vessel and free from vibrations.
- Unit must be operational when at the Panama Canal anchorage or water ways.
- Wi-Fi communication must be tested to comply with the specifications at all conning positions.
- We strongly recommend to reserve Wi-Fi channel 11 for this purpose.
- Wi-Fi SSID must not be hidden.
- A Wi-Fi configuration QR code sticker must be placed near the main pilot plug. *(One QR-Code is provided with the R6 NEO systems, more can be printed/collected by the C6 COM units web-interface)*
- The QR code must not be less than 2.5 x 2.5 centimeters.
- SSID and password must be available upon Panama Canal Personnel request
- **Antenna certificate must be requested and returned to the Panama Canal: arqueadores@pancanal.com**

For more detailed information and contacts with the Authority Canal de Panamá, visit https://pancanal.com/en/maritime-services/non-portable-piloting-unit/

21.2 R6 NAV NEO Installation Instructions

Step by step instructions for R6 NAV NEO Systems installation is described in the **7000 125-314, R6 NAV NEO Installation Instruction.**