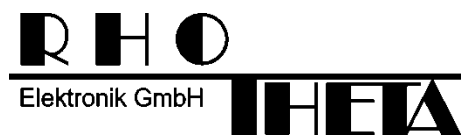


# User Manual

## RT-500-M



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- *Issue: 2019/10/22 [Rev 1.01]*
- *Document-ID: 12-9-1-0002-3-1-64*
- *Valid for RT-500-M systems with revision [Rev 4.00] or higher*

## **Note**

The manufacturer reserves the right to make modifications at any time and without previous information of the here described product.

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# 1 Legend of Signal Words

## Note

This symbol designates tips or additional notes that must be paid attention to and make work easier.

### Caution

means that ignoring the instructions may lead to property damage or loss of data.

### Warning

means that ignoring the instructions, there may be a danger to health or life.

## 2 Safety

### 2.1 General Safety Information

RHOTHETA Elektronik GmbH is constantly trying to keep the safety standard of their products up to date and to offer their customers the highest possible level of safety.

RHOTHETA products are designed and tested in accordance with the valid safety regulations. The compliance with these standards is continuously monitored by our quality assurance system.

This product is tested and left the factory in perfect technical and safety-relevant condition. To maintain this condition and to ensure safe operation, the user must pay attention to all instructions and warnings given. For any questions regarding these safety instructions, RHOTHETA Elektronik GmbH can be contacted at any time.

The observance of the safety instructions will help to prevent personal injury or damage caused by all kinds of dangers. This requires that the following safety instructions must be read carefully and understood before using the product, as well as observed while using the product. Other additional safety instructions, such as for protecting persons, appear in relevant parts of the product documentation and must also be paid attention to.

In addition, it is the responsibility of the user to use the product appropriately. The product RT-500-M, a professional VHF direction finder system, shall not be used in any way that results in personal injury or property damage.

The use of this product for other than its designated purpose or in disregard of the instructions of the manufacturer is the responsibility of the user. The manufacturer takes no responsibility for the misuse of the product.

The manufacturer is not liable beyond the scope of legal rules!

This guide is part of the product RT-500-M and must be kept with the product throughout its lifetime.

## 2.2 Basic Safety Instructions

**Caution / Warning**

**Read and observe the following instructions, warnings and safety guidelines from the manufacturer!**

- At all times, the local or national safety and accident prevention regulations must be observed.
- When installing or operating with the product, always follow the manufacturer's instructions.
- Only place the product on appropriate locations.
- Do not expose the product to environmental conditions (heat, humidity, wind load etc.) that exceed the specified conditions in the manuals.
- Use only the manufacturer's prescribed components and/or use only recommended materials and do not change them. Any other use or unauthorized modifications to the product will void the authorization to operate it.
- Connect only approved accessories kits or additional equipment.
- Ensure that the connections with information technology equipment, e.g. industrial computers, comply with the IEC 60950-1/EN 60950-1 standards that applies in each case.
- This product may only be opened by authorized personnel. The connector must always be disconnected before opening.

## 3 Legal Information

### 3.1 EU Declaration of Conformity

Hereby RHOTHETA Elektronik GmbH declares that the product RT-500-M complies with the essential requirements and other relevant provisions of:

- Directive 2014/53/EU relating to radio equipment (relevant for RT-500-M AU)
- Directive 2014/30/EU relating to electromagnetic compatibility (relevant for RT-500-M DCU)
- Directive 2014/35/EU relating to the making available on the market of electrical equipment designed for use within certain voltage limits (relevant for RT-500-M DCU)
- Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (relevant for RT-500-M AU and RT-500-M DCU)

The full text of the Declaration of Conformity can be found at:

[https://www.rhotheta.com/products/rt\\_500\\_m](https://www.rhotheta.com/products/rt_500_m)

### 3.2 FCC Information (USA)

Changes or modifications not expressly approved by the party responsible for compliance (RHOTHETA) could void the user's authority to operate the equipment.

#### Note

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

### 3.3 ISED Information (Canada)

This device contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following two conditions:

(1) This device may not cause interference.

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

A radio license must be obtained prior to possession and use of this scanner receiver.

Une licence radio doit être obtenue avant la possession et l'utilisation de ce récepteur de scanner

## 4 General Description

The RT-500-M is a wideband radio direction finder system for professional use in maritime sector. The system operates within a frequency range from 118 to 470 MHz (the whole range can be unlocked to the full extend by using the options F1 – F4 listed below).

Designed for professional use under extremely rough conditions, the SAR standard version covers the whole VHF marine band and all relevant distress frequencies, such as emergency frequencies 121.5 / 243 MHz, marine channel 16 (156.8 MHz) and all 19 frequencies of the international satellite search and rescue system COSPAS-SARSAT (406 MHz). While locating a COSPAS-SARSAT EPIRB, the direction finder can also decode and display its transmitted information (e.g. Beacon ID and GPS Position). The wide frequency range and frequency steps of 5 kHz allow using the system not only for search and rescue operations but also for detecting illegal vessels operating in a non-standard frequency grid or using PMR (446 MHz) and LPD (433 MHz) radio transmitters. Therefore the system is also widely used by police, coast guards and other maritime law enforcement organisations. The MOB (Man Over Board) surveillance for the crew safety is a standard function of the RT-500-M. The fine frequency steps (5 kHz) allow discovering hidden transmitters in the marine band and in the additional UHF band.

RT-500-M Frequency Range			
Standard Range		Optional Extended Range	
VHF emergency band	118.000 ... 124.000 MHz	F1: VHF air band	118.000 ... 136.992 MHz
VHF marine band <sup>1</sup>	154.000 ... 163.000 MHz	F2: extended VHF marine band	137.000 ... 224.995 MHz
UHF emergency band	240.000 ... 246.000 MHz	F3: UHF air band	225.000 ... 399.975 MHz
COSPAS - SARSAT	400.000 ... 406.092 MHz	-	-
UHF FM band	406.100 ... 410.000 MHz	F4: additional UHF FM band	406.100 ... 470.000 MHz

**Table 1. RT-500-M frequency ranges**

The DF-system consists of two units: the bearing device AU (antenna unit) and the operating device DCU (display control unit).

The antenna unit accommodates all the direction-finding electronics within its housing. Thus, short signal paths with low loss and insensitiveness to external disturbing fields are achieved.

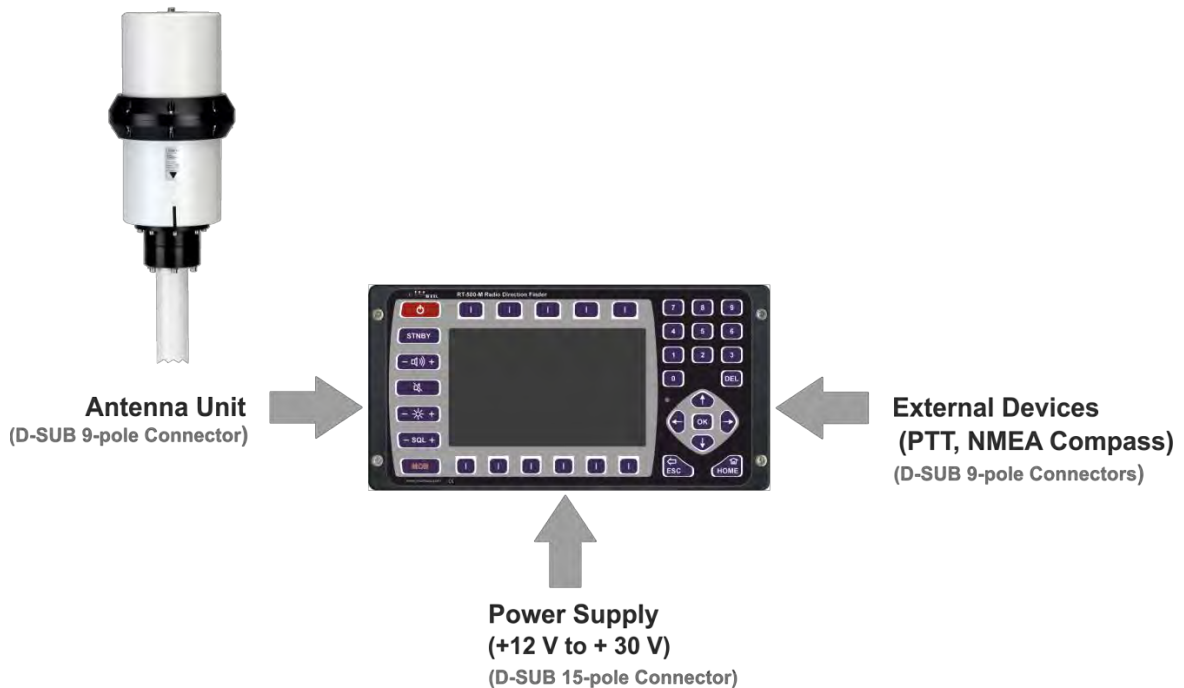
The display control unit indicates bearing signals and acts as an instrument for operating and controlling the direction-finding system. External devices can be connected to the DCU, such as an external speaker, a PTT (push-to-talk) switch, etc. It is also possible to input and read data coming from various interfaces, such as external compass data via an NMEA interface. This allows the integration of compass data into the bearing data, which can be indicated on display.

<sup>1</sup> Inclusive all maritime channels (ship / coast): channels 00 ... 88 (156,000 ... 162,025 MHz)




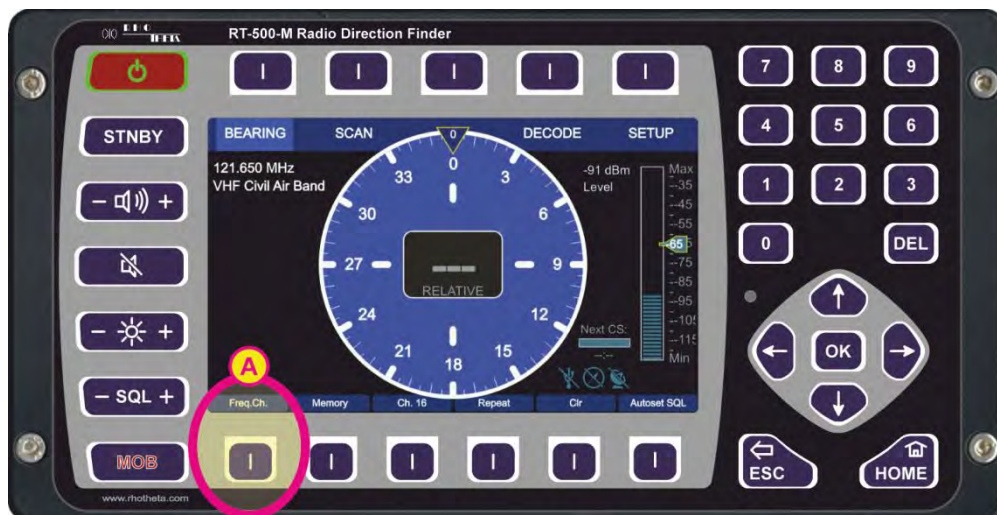
## 5 Quick Start

1. Connect the power supply to the DCU.
2. Establish the connection of the AU and the DCU.  
(Guideline for Optimal DF Antenna Position" can be found under 8.7)



**Figure 1. General connection schematic**

3. Any additional devices like external speaker, compass etc. can be also connected to the DCU. For further information about the installation of the system please refer to chapter 8.
4. Push the ON/OFF button .
5. When the DCU is turned on, the ON/OFF button lights green and after approximately 20 seconds the bearing page is loaded (s. Figure 2). To turn off the DCU hold the ON/OFF button pressed for about 2-3 seconds.

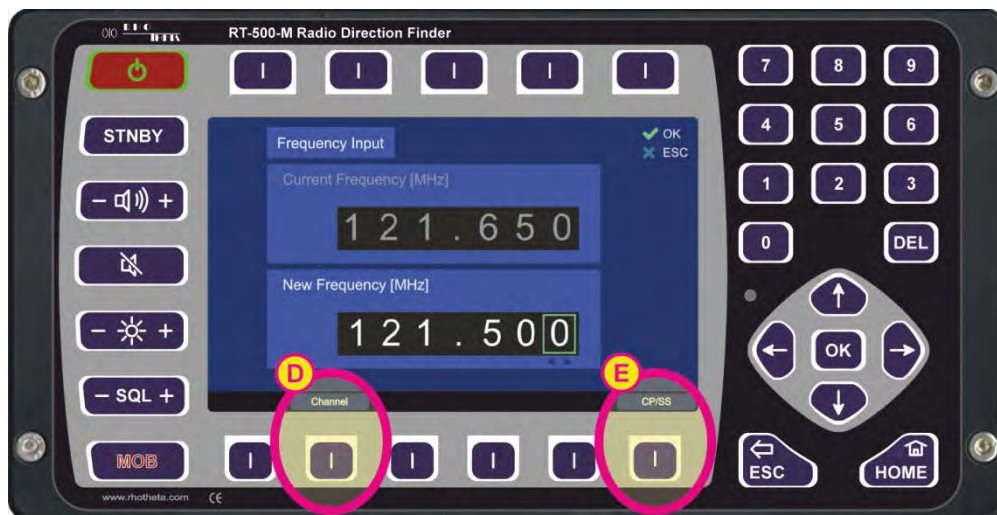


**Figure 2. Start page (bearing page)**

6. Adjust the needed main bearing frequency (the default frequency after first system start is marine channel 16):
  - Push the hotkey “Freq.Ch.” (s. field “A”, Figure 2).



**Figure 3. Frequency input dialog**

- Type the desired frequency into the lower input field “New Frequency [MHz]” by using the number-keys of the keypad (s. field “B”, Figure 3) and confirm by pressing “OK” (s. field “C”, Figure 3).  
The system will accept only inputs within the permitted frequency ranges.  
The adjusted frequency will be shown and monitored on the bearing page once the input is correctly completed.

**Figure 4. New frequency Input**

- To input a maritime channel number, push the hotkey “Channel” (s. field “D”, Figure 4) and proceed by typing the number and pressing “OK”.
- To select a desired Cospas-Sarsat frequency (channel ABC – channel RS) from a drop-down menu press the “CP/SS” hotkey (s. field “E”, Figure 4). Confirm the desired frequency with “OK”.

7. Adjust the squelch level:

- Use the arrow keys   to increase or decrease the squelch level manually (the squelch indicator will move up or down in one-percent steps and show the current value).



**Figure 5. Squelch level adjustment**

- By pressing the “Autoset SQL” hotkey the level of the squelch can be automatically adjusted to a suitable value for the current signal level.  
For more information on the setting of squelch please refer to chapter 7.5.2.

After all settings the system operates at the entered frequency.







## 6 Overview

### 6.1 Front View



Figure 6. DCU front view

Front Control Elements		
Pos.	Element	Function Description
1		Switches the system on/off. When the system is turned on, the key is highlighted in green. In the case of an error the key will blink red.
2		Provides the standby operation to save energy. By pressing this button, the standby is activated, and the button is highlighted in orange. While in standby, the brightness of the display's backlight is driven down to a defined value (configurable in the "Setup" page, s. 7.4.2.7), but the system continues monitoring the corresponding (emergency) frequency. The display will be turned on again if an event occurs (e.g. signal level rises above squelch level, alarm occurs, scan algorithm finds an active frequency). Pressing the button again will return the system from standby to normal operation mode.
3		The volume adjustment button contains two keys (+ and -). Pressing any of the two keys opens a dialog for adjusting the internal and external speakers (s. 7.5.1).
4		Switches the volume off/on (mute function). The mute-status is indicated by the orange highlight of the button. The volume can be turned on by pressing the same button again.








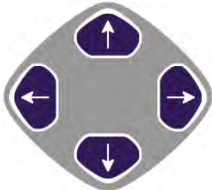


		While the mute function is activated, it is still possible to increase or decrease the volume without producing any sound (using the button for volume adjustment, s. ③).
⑤		The brightness adjustment button contains two keys (+ and -). Pressing any of the two keys opens the dialog window for brightness adjustment of the TFT-display backlight, LEDs (colored highlighting of buttons ①, ② and ④) and the white illumination of buttons / legends (s. 7.5.3).
⑥		The squelch adjustment button contains two keys (+ and -). Pressing any of the two keys opens the dialog window for adjusting of the squelch level.
⑦		Activates the “Man-Over-Board” dialog, if GPS data is available (s. 7.5.4).
⑧	5" TFT full-color display	Shows the corresponding data content of the current page or dialog.
⑨		Hotkeys for activating variable functions. The assignment of the keys differs depending on the page or dialog.
⑩	Sensor of brightness	Measures the ambient brightness to automatically adjust the brightness of the TFT display and the illumination of LEDs and buttons/legends.
⑪		Returns one step back in a menu or leaves a dialogue or an adjusting field without storing changed parameters.
⑫		Confirms an input or selection. Leaves a dialogue or an adjusting field and stores changed parameters.
⑬		By pressing this button, the system returns to the bearing page from any other page or dialog, without storing changed parameters.
⑭		The arrow keys provide the navigation and selection within the menu or selection field. Furthermore, they allow increasing or decreasing of some values (e.g. squelch level).
⑮		Numeric keys for direct numeric input.
⑯		Navigation keys for switching between the pages. Within the “Setup” page, the navigation keys have different functions due to the large number of possible settings.

Table 2. Front control elements

## 6.2 Rear View

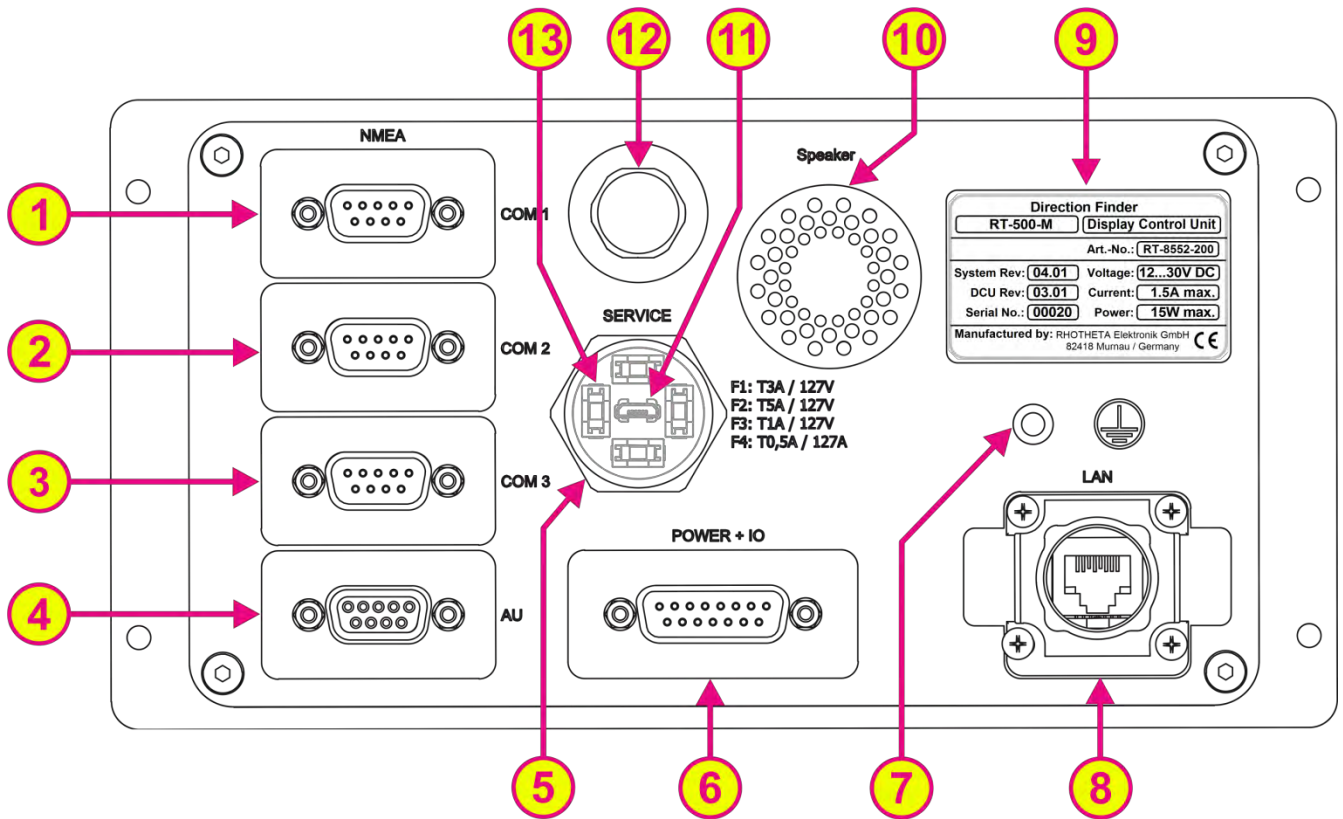


Figure 7. DCU rear view

Interfaces		
Pos.	Element	Function Description
1 2 3	Communication Ports: COM1 COM2 COM3	<p>NMEA 0183 Bus (RS422 / RS232):</p> <ul style="list-style-type: none"> <li>Connection for input of external data, such as compass, GPS, remote control, etc.</li> <li>Connection for output of bearing data, e.g. for map plotter, PC etc.</li> </ul> <p>When connecting to input use either RS232 Rx or RS422 Rx (not both)! For more information s. 8.3.</p>
4	AU	<p>Antenna connector:</p> <p>Connection between DCU and AU via cable.</p> <p>For more information s. 8.2.</p>
5	Screw Cover	<p>Waterproof protection cover for USB connector and replaceable fuses.</p> <p>Opening of the screw cover should be done in a dry room to prevent the ingress of moisture into the interior of the DCU.</p>
6	POWER + IO	<p>Source connector:</p> <p>Connection for power supply</p> <p>Connection for external speaker</p> <p>Connection for self-bearing suppression (SBS / PTT)</p> <p>Connection for audio line out</p> <p>Contacts for alarm relay</p>


		Contacts for squelch out For more information s. 8.1.
7		Ground connector: Connection of the DCU to the ground of the ship. Thread/screw M5 For more information s. 8.6.
8	LAN	LAN connector for network communication For more information s. 8.4.
9	Label	Label with identifying information about the direction finder.
10	Speaker	Waterproof internal speaker
11	USB (Only Service)	USB 2.0 port: Used only for service / manufacturing purposes. For more information s. 8.5.
12	Pressure Compensation Element	Equipped with a Gore-Tex membrane, the pressure compensation element prevents over- and underpressure in the DCU.
13	Fuses	<p>Replaceable fuses:</p> <p>F1: T3A/127V (Littelfuse 154003.T)</p> <p>F2: T5A/127V (Littelfuse 154005.T)</p> <p>F3: T1A/127V (Littelfuse 154001.T)</p> <p>F4: T0.5A/127V (Littelfuse 154.500T)</p> <p><b>Note</b> It is recommended to use an additional external fuse: T2A</p>

Table 3. Interfaces

**Warning**

The voltage supply is not galvanically isolated from the frame.  
If desired, e.g. in order to prevent current flow to the ground of the vessel, a DC/DC-converter must be adapted.



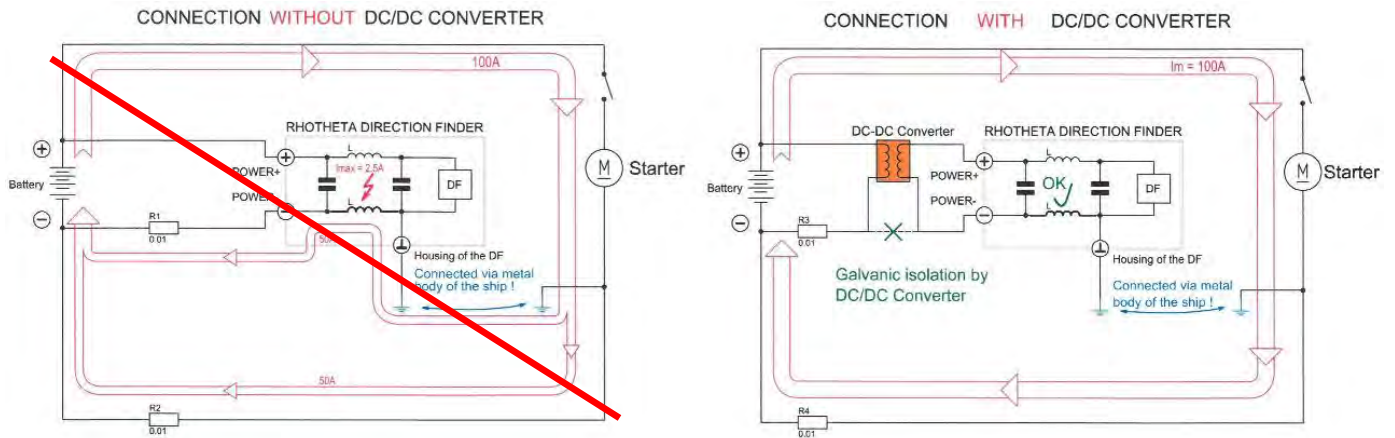


Figure 8. Necessity of DC/DC-converter

## 7 Operation

The RT-500-M is operated using the keys placed around the display.

In normal bearing mode, the keys call up common functions directly, opening the corresponding dialog window.

The basic structure of a DCU Page is as follows:

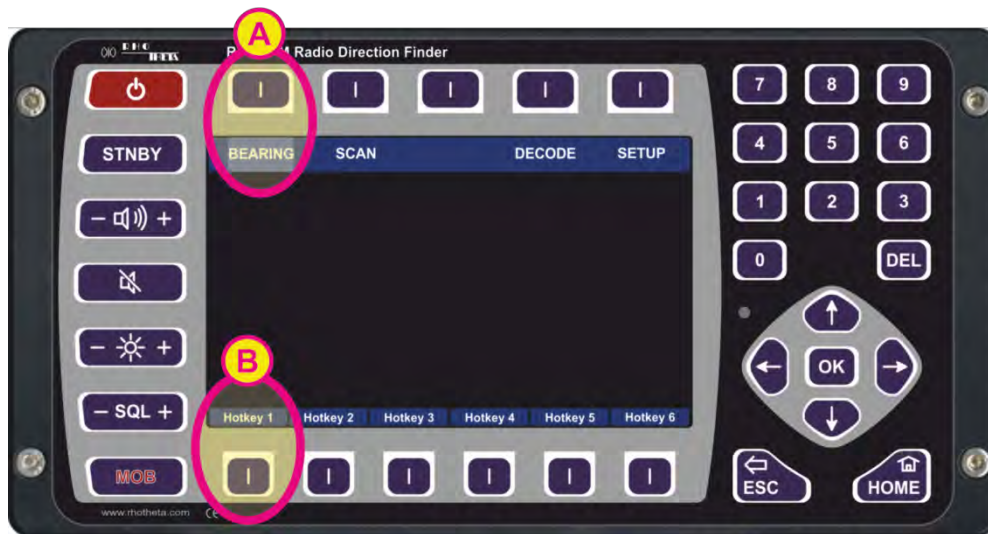


Figure 9. Basic structure of pages

The different pages are listed on the top line of the screen and the active page is highlighted in light blue. Switching between pages is done via the corresponding navigation keys, which are located directly above the page names (s. field "A", Figure 9).

The top line of the screen is the same for all pages except the "Setup" page, which contains all the necessary system setup options.

The hotkeys differ from page to page to provide page-specific functions or settings. Activate the hotkey function or setting by pressing the corresponding hotkey (s. field "B", Figure 9).



## 7.1 Bearing Page

The bearing page is the main page of the RT-500-M display unit as it provides the bearing information, settings and status reports at a glance.

This page can be opened by pressing the button “HOME” from any other page or dialog.

### 7.1.1 Bearing Indication

The “Bearing” page has the following structure (s. Figure 10).

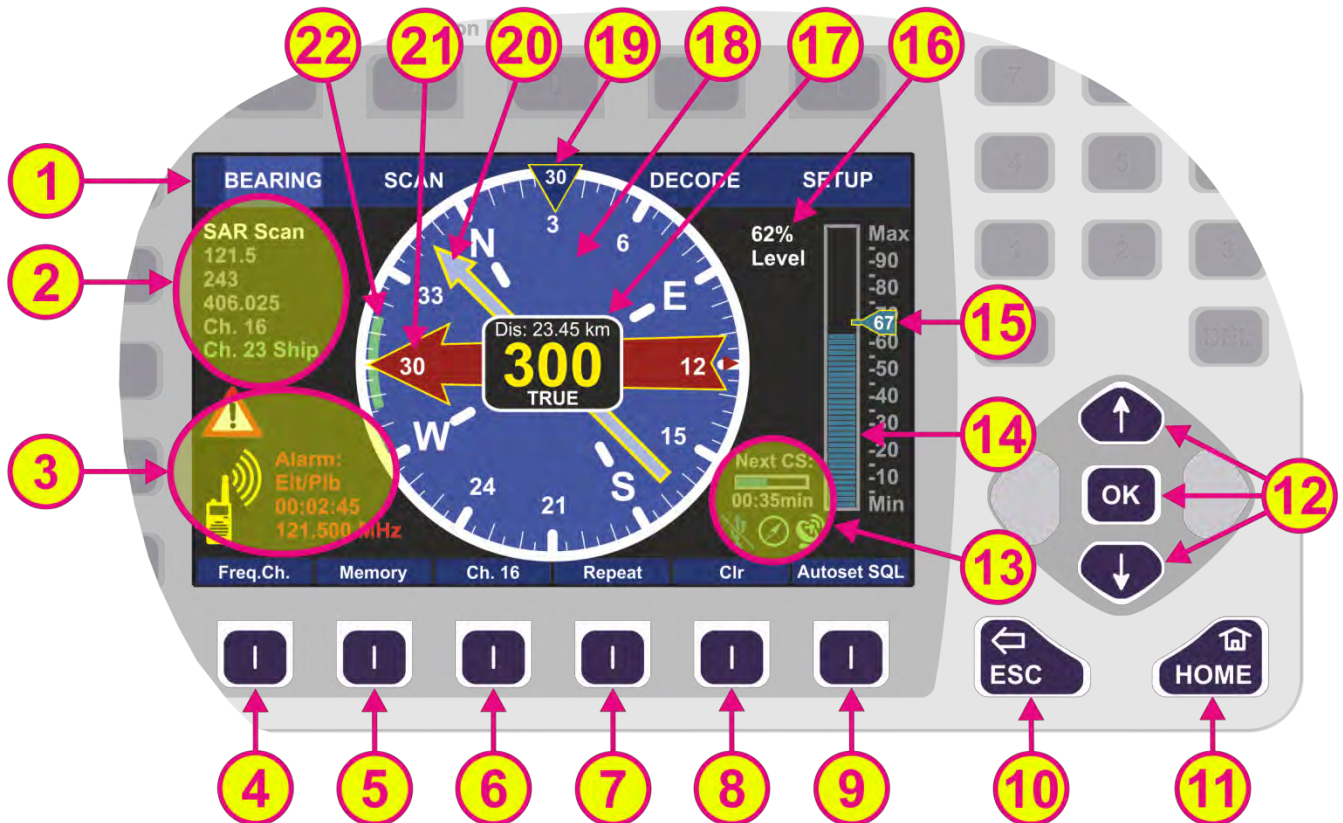
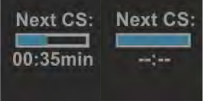



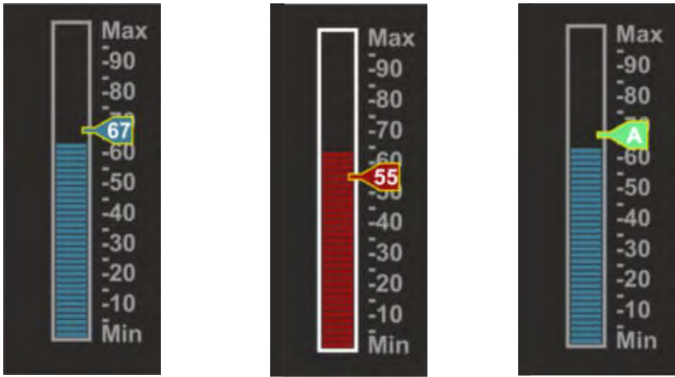











Figure 10. Bearing display

#### Indication on Bearing Page

Pos.	Element	Meaning / Description
①	Top line	Navigation line of the screen, which allows switching between pages (“Bearing”, “Scan”, “Decode” and “Setup”).
②	Frequency indication	Section for frequency/channel indication during bearing and scanning. The active frequency is displayed in white color. If the scanning function is activated, the currently active frequency (or channel) is displayed in green, and the other frequencies, monitored by the scanning algorithm, are displayed in gray.  If the “Repeat” hotkey (s. ⑦) is pressed, the old frequency value will also be shown in gray.  If there is not enough space to show all frequencies, only a subset of the frequencies around the currently active frequency will be displayed.
③	Alarms / Errors / Warnings	Section for indicating any faults in the system, alarms and/or warnings (s. 7.1.2.1).

④	Frequency / Channel hotkey	Pressing the “Freq.Ch.” hotkey will activate the frequency/channel input dialog (s. 7.1.2.2). If no input is detected for about 10 seconds, the dialog will be closed automatically. This waiting time can be changed in the “System” menu of the “Setup” page (s. 7.4.3.6).
⑤	Memory hotkey	Pressing the “Memory” hotkey will activate the memory dialog (s. 7.1.2.3). The memory dialog provides a list of saved frequencies or channels, which facilitates restoring any frequency from the list to the active bearing mode. Frequencies/channels (max. 8 frequencies) to be scanned in the mode “Fast Channel Scan” (available only with unlocked option), can be selected in the “Memory” dialog.
⑥	Channel 16	Instant access to most common maritime emergency channel (or emergency frequency 121.500 MHz).
⑦	Repeat hotkey	Calls up last valid bearing, heading and level values. The last bearing clock in the lowermost line of the digital bearing display (s. Figure 12) shows the time elapsed since the last valid bearing interruption.
⑧	Clear hotkey	Mutes the acoustic alarm (if such occurred, s. 7.1.2.1). Clears the last valid bearing.
⑨	Autoset SQL / Squelch hotkey	Activates the automatic squelch level adjustment for the active frequency (for further information s. 7.1.6).
⑩	Escape button	Pressing this button while a dialog is open, will close the dialog without saving changes. If no dialog is open, pressing this button will go back to the last activated page. The “Bearing” page is the end-point. Pressing this button on the “Bearing” page will have no effect when no dialog is open. Monitoring/scanning operation will continue onto the next frequency/channel upon pressing the “ESC” button, if e.g. currently no data is being received on present frequency.
⑪	Home button	Pressing this button always leads to the “Bearing” page (home page) from any other page or dialog. If any scan is running, a dialog for leaving the scan will be opened when the “Home” button is pressed.
⑫	Arrows “Up” and “Down” and the “OK” button	The squelch level of the main bearing frequency/channel can be adjusted manually by using the arrow buttons (this is only possible if the main frequency is active). If any scan mode is active, pressing one of these buttons will open the squelch dialog (s. 7.5.2). If no dialog is open, the “OK”- button will not have any effect on the “Bearing” page. Whereas inside a dialog this button is used to confirm an input and close the dialog.
⑬	Additional data indication	Section for indicating additional data, such as activated or deactivated additional hardware or elapsed time indication for the next awaited Cospas-Sarsat pulse.

		 <p>This symbol indicates the time left until the next Cospas-Sarsat pulse. The small bar graph gets filled every second until the next Cospas Sarsat pulse arrives. If after one minute no Cospas-Sarsat pulse arrives, the bar graph will be filled out and show “--:--” for the time.</p>  <p>This symbol indicates a USB connection. If a USB stick is connected to the DCU, the USB symbol turns green. Otherwise if there is no USB connection available, the symbol stays blue and crossed out.</p>  <p>If this symbol is green, then there is valid heading data from an external compass present. If there is no valid heading data available, the symbol stays blue and crossed out.</p>  <p>This indicator shows whether there is valid position data from an external GPS available or not. If there is no valid position data available, the symbol stays blue and crossed out. If there is valid position data, the symbol turns green.</p>
14	Indication of signal level	<p>Current signal level (bar graph):</p> <ul style="list-style-type: none"> <li>Color “blue” means that the signal level is under the squelch threshold</li> <li>Color “red” means that the signal level is above the squelch threshold</li> <li>The bar graph has a numerical scale, showing the level either in [%] or in [dBm], which can be selected in the “Setup” menu.</li> </ul> <p>See pictures below.</p>
15	Indication of squelch level	 <p>Current squelch level in [%] or [dBm]:</p> <ul style="list-style-type: none"> <li>The squelch level can be set manually. In this case the numerical value is shown inside the indicator.</li> </ul>

		<ul style="list-style-type: none"> <li>  No signal is received (squellch level &gt; signal level). By pressing “Autoset SQL” (s. ) the squellch level is set above the noise level by a defined value (only once every time this button is pressed). The indicator stays blue with the numerical value inside. </li> <li>  The signal is received (signal level &gt; squellch level). </li> <li>  The option “Automatic SQL” is selected (no signal received). </li> <li>  The option “Automatic SQL” is selected (signal is received). The squellch level will be held continuously at the best position over the noise. If set to automatic, the indicator turns green and shows an “A” instead of the numerical value. </li> </ul>
	Digital signal level indication	Signal level of active bearing frequency / channel in [%] or [dBm] (adjustable in the “Setup” page).
	Digital bearing display	<p>Indication of the bearing information:</p> <ul style="list-style-type: none"> <li>Averaged bearing value in degrees as a three-digit number in the middle of the display</li> <li>Reference of the bearing (“True”, “Magnetic” or “Relative”)</li> <li>The last bearing clock is shown in the lowermost line of the digital bearing display (s. also Figure 12), if the bearing signal has disappeared. The clock counts the time elapsed since the signal was lost. The indication is in [hh:mm:ss].</li> <li>Distance from the current GPS position to the stored GPS position is shown in the uppermost line of the digital bearing display. This information is only indicated, if GPS data is available and at least one GPS arrow is displayed (MOB or Decode mode). If there is more than one GPS arrow, only the distance to the closest coordinates will be shown. The indication is in [km] or [NM], depending on the configuration in the “Setup” menu or configuration file.</li> <li>If a PTT signal has been detected and PTT is activated for that frequency (“Setup” page), the letters “PTT” will be shown instead of the reference direction (e. g. “TRUE”) and the bearing value (e. g. “300”) will be replaced by “---“.</li> </ul>
	360° display and compass rose indication	<p>If compass information is available, the graphic display of relative bearing value within the compass rose will be shown.</p> <p>Without compass data the relative bearing will be shown in the 360°-display.</p> <p>If the antenna is mounted correctly, the 0°-value corresponds to heading / longitudinal axis of the vessel.</p>
	Heading pointer	<p>Heading direction indicator, which shows a value in [°] (here: “30”). Heading pointer is fixed in the 12 o’clock position and displays the present heading of the ship, if compass information is available.</p> <ul style="list-style-type: none"> <li>If the “Bearing Reference Direction” is set as “True bearing” (s. “Setup” page), then the heading direction is shown relatively to the true (geographic) North Pole direction.</li> </ul>

		<ul style="list-style-type: none"> <li>○ If the “Bearing Reference Direction” is set as “Magnetic bearing”, the heading direction is shown relatively to the magnetic North Pole direction.</li> <li>○ If the “Bearing Reference Direction” is set as “Relative bearing”, the heading pointer takes the zero-value (shows in the bow-of-the-vessel direction, if the antenna is installed correctly). This indication stays constant.</li> </ul>
20	GPS arrow	<p>The GPS arrow relates to the GPS position. Therefore, this indication is only possible, if GPS data is available.</p> <p>This indication can be activated for two scenarios:</p> <ul style="list-style-type: none"> <li>○ Pointing to the GPS coordinates that have been stored by pressing the MOB button (red arrow).</li> <li>○ Pointing to GPS coordinates that were decoded from Cospas-Sarsat messages on the “Decode” page (gray arrow).</li> </ul> <p>For more information s. 7.3.</p>
21	Bearing arrow	<p>The bearing arrow is the graphical indication of the bearing value on the 360° display.</p> <p>The bearing arrow additionally displays the opposite direction on the compass rose.</p> <p>The bearing value can be indicated (s. also 19):</p> <ul style="list-style-type: none"> <li>○ Relative to the heading of the vessel. This is the case, if no external compass is used.</li> <li>○ Relative to the magnetic north pole</li> <li>○ Relative to the true (geographical) north pole</li> </ul>
22	Spread of bearing	Maximum deviation of unaveraged single bearing values.

Table 4. Indication on bearing page

### 7.1.2 Bearing Operation

Once the bearing frequency and the squelch level are set, the bearing operation starts.

If a signal on the selected operating frequency/channel is received, its level will be indicated digitally in the range of 0% to 99% in the section for signal level indication besides the bar graph, which additionally represents the signal level in a graphical way (s. positions 14 and 16 in Figure 10). The squelch level will then be pictured on the scale of the signal level indication at the manually (or automatically) adjusted value (s. position 15 in Figure 10).

The bearing electronics will process data only if the signal level is above the selected **squelch level (= noise suppression)**. Even without a received signal the DF-system may display a certain signal level (= **noise**). To avoid distractions from environmental noise signals, the squelch level must be set above the noise level. For the correct setting of the squelch level, please pay attention to chapter 7.5.2.

The DF-system detects about 280 bearing values per second. These bearing values might vary significantly, depending on signal quality (signal strength and modulation). This range of spread is indicated as a green arc on the 360° display in front of the bearing arrow (s. position 22 in Figure 10). The smaller the arc, the better the signal quality. If the signal quality deteriorates, the arc becomes larger.

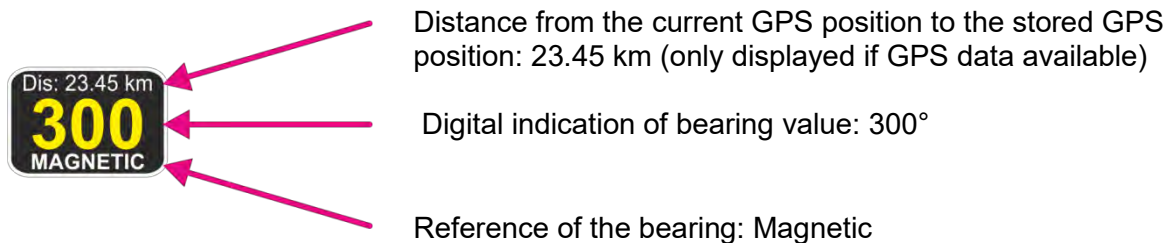
The bearing electronics process the detected bearing values over a certain time interval using a sophisticated internal algorithm, which provides a steady and reliable indication of the bearing value (e.g. the bearing arrow does not react to fast-changing reflections and noise signals). This averaging procedure produces good bearing results, even if there is a wide spread of single bearing values.

The bearing arrow represents the **relative bearing value**. This value is always relative to some fixed point, which could be either heading (the bow-of-the-vessel direction, if the antenna is installed



correctly) or one of the north pole positions (magnetic or geographic), if compass information is available (via NMEA interface).

If using the heading of the ship as the reference direction (no compass data available), the bearing will be shown on top of the 360° display. If using one of the North Pole directions, it will be shown on the 360° display with additional indication of the cardinal points.



**Figure 11. Digital bearing display  
(active signal reception)**

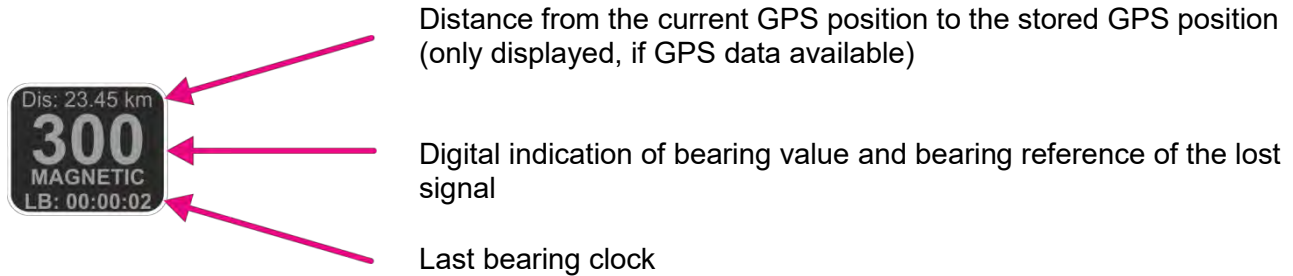
The digital bearing indication is a 3-digit number, rounded to the nearest degree.  
The reference of bearing is summarized again in the following table (s. Table 5)

Bearing reference directions		
Indication	Direction of Reference	Meaning
TRUE	True north pole	Bearing relative to true (geographic) North. This is the case, if an external compass transmits true heading data (e. g. NMEA sentence "xxHDG" with valid variation or "xxHDT" sentence).
MAGNETIC	Magnetic north pole	Bearing relative to magnetic North. This is the case, if an external compass is connected and transmits only magnetic heading (e. g. NMEA sentence "xxHDG" without valid variation).
RELATIVE	Heading of the vessel	Bearing relative to the heading of the vessel This is the case, if no external compass is used.

**Table 5. Bearing reference directions**

If the signal stops being received, the last bearing value will be displayed as a transparent arrow for two seconds (default value). This value is called "Bearing Hold Time", and can be changed in "Setup" (s. 7.4.2.1).

After 2 seconds, the arrow will disappear, and the time elapsed after the last signal reception will be shown inside the digital bearing display as "LB" (s. Figure 12).



**Figure 12. Digital bearing display (signal reception ended 2 seconds ago)**

It is possible to show the arrow of the last bearing again by pressing the "Repeat" hotkey (s. position 7 in Figure 10). The arrow will be displayed again for the time period that has been set under "Bearing Hold Time" in "Setup" (s. 7.4.2.1).

#### 7.1.2.1 Alarms, Errors, Warnings

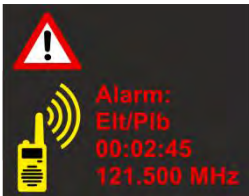
If during the operation either an emergency signal occurs, or an error is detected, or operating parameters exceed their specified limits, the system will inform the operator by activating an alarm-, error-, or warning-indication.

While a signal is being received (signal level > squelch level), it is examined in the background to determine if it is a modulated emergency signal. The emergency signals (ELT = Emergency Locator Transmitter, PLB = Personal Locator Beacon, MOB = Man Over Board) are modulated with a typical repeating and distinct sweeping tone. Once recognized as an emergency signal, the alarm will be activated.

In addition to the graphical indication, a special internal warning tone will inform the operator about the reception of the emergency signal. The acoustic alarm will remain activated (even after the signal reception has ended) until confirmed or deactivated (hotkey "Clr", s. position 8 in Figure 10). If no emergency signal is received for more than a minute, the alarm will be canceled automatically.

#### Note

The alarm relay exit will be activated as well when recognizing an emergency signal. Like the internal warning tone, the relay exit can be deactivated by pressing the hotkey "Clr". The alarm relay exit may be used for an external siren, a MOB function, or similar.

Alarms/ Errors/ Warnings		
Indication Example	Meaning	Page
	<p><b>Alarm:</b> An emergency signal has been detected. The source, the counter of the elapsed time since the last alarm, and the related frequency are shown beside the actual alarm indication.</p> <p>The hotkey "Clr" deactivates the warning signal and the alarm relay output.</p>	



	<p><b>Error:</b> An error message will be displayed if:</p> <ul style="list-style-type: none"> <li>○ one or more operating parameters are out of the admitted limits</li> <li>○ the system has recognized a malfunction (in this case the system is not working)</li> </ul> <p>The hotkey “Clr” deactivates the acoustic warning.</p>	
	<p><b>Warning:</b> The system indicates a warning, if:</p> <ul style="list-style-type: none"> <li>○ external signals are not available (anymore)</li> <li>○ operating parameters are close to the tolerable limits</li> </ul> <p>The warning means that the system’s basic functions are not affected yet, but it is recommended to check the system in order to prevent damages.</p>	

Table 6. Alarms, Errors, Warnings

### 7.1.2.2 Frequency / Channel Input Dialog

The frequency input dialog is called up either by pressing the hotkey “Freq.Ch.” (s. Figure 10, position 4) or using the numeric keys while the “Bearing” page is active.

The frequency input dialog appears in three variants with different input dialogs for:

- Frequencies
- Channels
- Frequency groups of the Cospas-Sarsat frequencies

The confirmed input of the dialog is displayed and stored, so after pressing the “Freq.Ch.” hotkey again, the dialog opens with the last activated dialog variant (e. g. channel input).


If no input is detected for about 10 seconds, the dialog will be closed automatically. This waiting time can be changed in the “System” menu of the “Setup” page.

Direct input of frequency/channel using the numeric keys works as follows:

- by pressing keys “1”, “2”, “3” or “4” in the bearing mode (during bearing of any frequency), the frequency input dialog will be opened automatically, taking the pressed number as the first digit of the frequency input.
- by pressing number keys “1”, “2”, “6”, “7” or “8” in the bearing mode (during bearing of any maritime channel), the channel/ frequency input dialog will be opened automatically, taking the pressed number as the first digit of the channel input.

#### Note

The mentioned numbers for the direct input will only work according to the unlocked frequency options of that particular RT-500-M system.

List of Elements	
Element	Function
	<p>Numeric keys for direct input.</p>





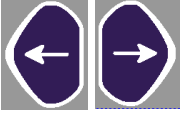



	This button deletes all digits in the input dialog for frequencies or channels.
	In the dialog for selecting Cospas-Sarsat frequencies, the “up” and “down” buttons are used to select the desired frequency group.
	In the dialog for frequency or channel input, these buttons are used to navigate inside the input dialog from one digit to another. Pressing the “left” arrow will delete the currently marked digit and skip to the next higher digit left of the deleted one. Pressing the “right” arrow will bring the cursor to the previous position, if the left arrow was pressed.
	If the input of the frequency (or channel) is complete and valid, pressing this button will adopt the values and close the dialog. In the drop-down menu for selecting Cospas-Sarsat frequencies, pressing this button will select the currently marked frequency group.
	Pressing this button will close the dialog without adopting values.
	Pressing this button will close the dialog without adopting the values and open the Bearing Page.
“Frequency”	Opens the dialog for frequency input inside the frequency input dialog.
“Channel”	Opens the dialog for channel input inside the frequency input dialog.
“Ship”	This hotkey appears only for duplex channels (s. Figure 14) in the dialog for channel input. It allows selecting the “Ship” frequency for a duplex channel.
“Coast”	This hotkey appears only for duplex channels (s. Figure 14) in the dialog for channel input. It allows the selecting the “Coast” frequency for a duplex channel.
“CP/SS”	Opens the dialog for selecting Cospas-Sarsat frequency group inside the frequency input dialog.

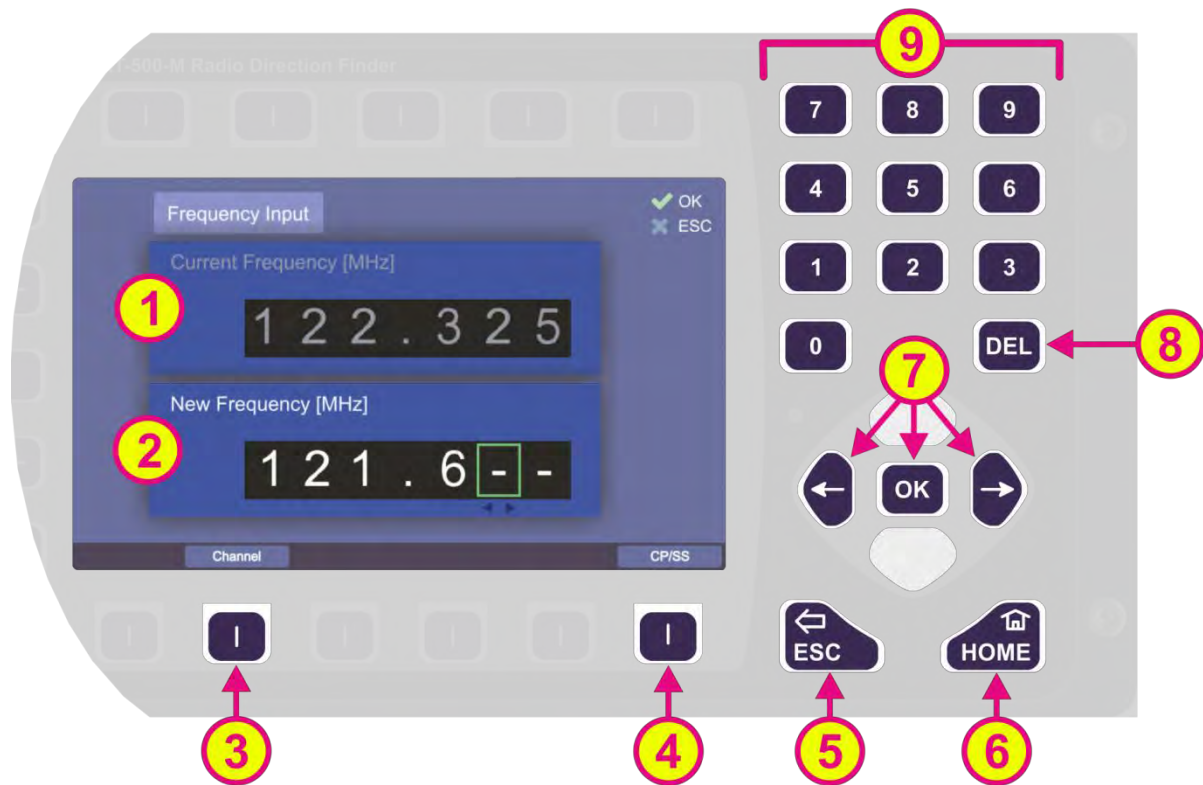
Table 7. Frequency input dialog. List of elements

**Input of Frequencies**

The “Frequency/channel input dialog” is divided into a section for the current frequency and a section for the new frequency.

Section “Current frequency [MHz]” shows the presently activated frequency (s. Figure 13, field 1).

Section “New Frequency [MHz]” allows the input of a new value (s. Figure 13, field 2).



**Figure 13. Input of a new frequency**

The input of digits is done with the numerical buttons on the front of the device (s. Figure 13, field 9).

#### Note

The input of invalid or not licensed frequency values will not be allowed.

The currently selected digit is indicated by a green-colored frame.

The following actions are possible:

- Pressing the “left” arrow deletes the currently marked digit and marks the next higher digit left of the deleted one. The “right” arrow returns to the previous digit position (s. Figure 13, position 7).
- The “DEL” button (s. Figure 13, position 8) deletes the whole input. The input field shows “---.---”.
- Pressing the “OK” button (s. Figure 13, position 7) adopts the new frequency value and closes the dialog. This is not possible until the input is complete from the first to the last digit.
- Pressing the “ESC” button (s. Figure 13, position 5) closes the dialog without changing the current frequency.
- If a marine band frequency was entered, and all digits of frequency are valid after the confirmation with “OK”, the bearing page will automatically show the number of the channel associated with that frequency (besides the indication of the corresponding frequency band).
- If a Cospas-Sarsat frequency is being entered, the value will be automatically converted to an input in the 8.333 kHz grid. That means, the inputs will be set to the following values:

406.025000 MHz = Channels: *A* (406.022 MHz), *B* (406.025 MHz), and *C* (406.028 MHz)

406.033333 MHz = Channels: *D* (406.031 MHz), *E* (406.034 MHz) and *F* (406.037 MHz)

406.041666 MHz = Channels: *G* (406.040 MHz) and *H* (406.043 MHz)

406.050000 MHz = Channels: *I* (406.046 MHz), *J* (406.049 MHz) and *K* (406.052 MHz)

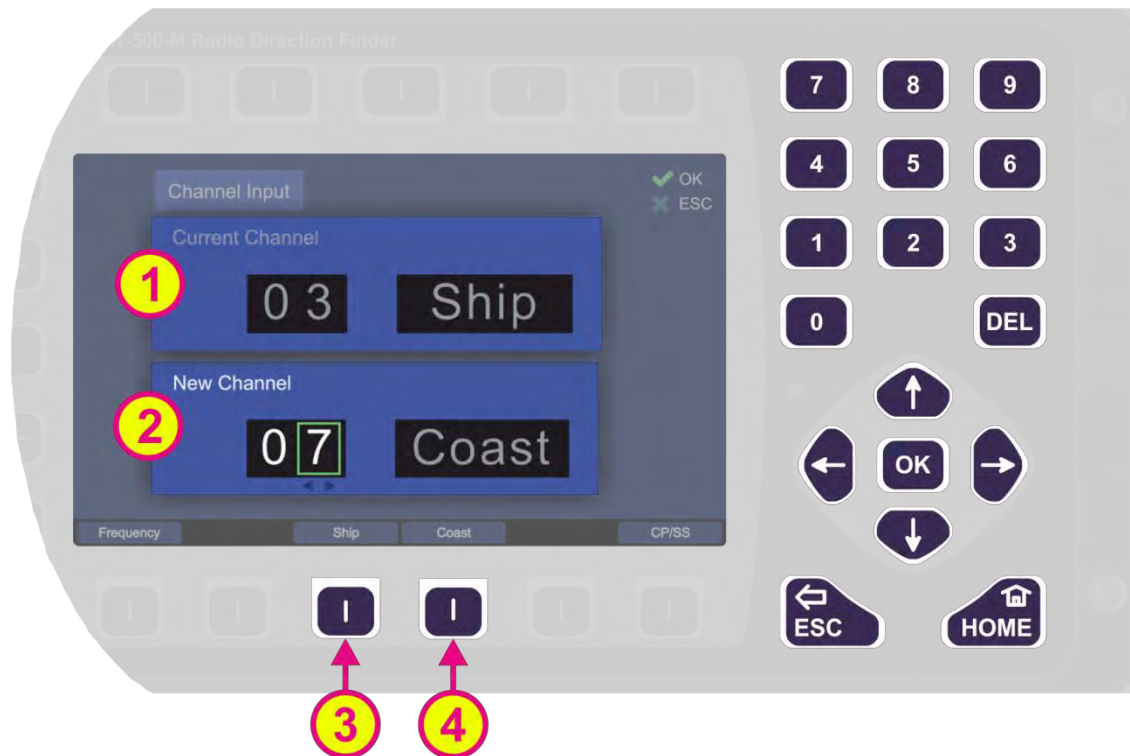
406.058333 MHz = Channels: *L* (406.055 MHz), *M* (406.058 MHz) and *N* (406.061 MHz)

406.066666 MHz = Channels: *O* (406.064 MHz), *P* (406.067 MHz) and *Q* (406.070 MHz)

406.075000 MHz = Channel: *R* (406.073 MHz) and *S* (406.076 MHz)

## Input of Channels

Generally, channel input works the same way as frequency input: the input dialog is divided into a section for the current channel and a section for the new channel (s. Figure 14, fields 1 and 2).



**Figure 14. Input of a new channel**

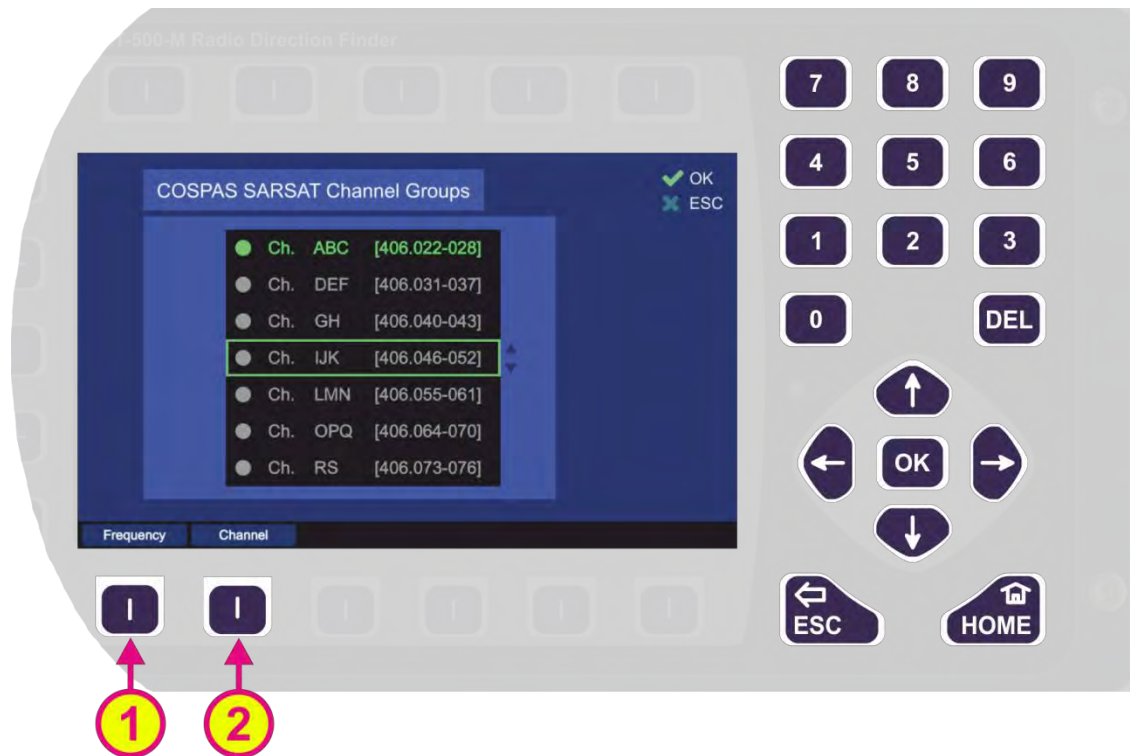
However, there are two additional hotkeys: “Coast” and “Ship” (s. Figure 14, positions 3 and 4), which allow switching between “ship”- and “coast”- frequencies in the case of a duplex channel. These hotkeys are only visible if there is a valid input for a duplex channel (e. g. the hotkeys will not be visible for an input “16”, as channel 16 is not a duplex channel). For the non-duplex channels, the new channel is entered as a number without any additional input.

Switching from channel input dialog to frequency input dialog while entering a channel number will have the following outcomes:

- If channel input is not completed, the frequency input dialog will show only the current frequency under the “Current Frequency [MHz]” field (s. Figure 13, field 1).
- If all digits of channel input are entered and the input is valid, the frequency input dialog will show the new frequency (which belongs to the channel), in the “New Frequency [MHz]”

## Selecting Cospas-Sarsat Frequency Groups

The hotkey “CP/SS” (s. Figure 13, position 4) opens a drop-down menu with selectable Cospas Sarsat frequency groups. The currently active frequency group is highlighted in green, whereas the other groups are gray. By pressing the “up” and “down” arrows, a colored frame moves and highlights the frequency group, which can then be selected by pressing “OK”. Pressing “ESC” will close the dialog without adopting the new frequency.



**Figure 15. Input of a new COSPAS-SARSAT frequency**

As a result of the 8.333 kHz grid of the AU, after selecting any channel group, the indication on the “Bearing” page will be as follows:

- “406.025 MHz” for Channel ABC
- “406.033 MHz” for Channel DEF
- “406.042 MHz” for Channel GH
- “406.050 MHz” for Channel IJK
- “406.058 MHz” for Channel LMN
- “406.067 MHz” for Channel OPQ
- “406.075 MHz” for Channel RS

### 7.1.2.3 Memory Dialog

The memory dialog (s. position 5, Figure 10) provides a list of stored frequencies (channels), which facilitates restoring any frequency from memory to the active bearing mode.

Selection of the frequencies works by using the “up” and “down” arrows. Recalling the marked frequency into the active bearing mode is accomplished by pressing the button “OK”.


Furthermore each frequency can be marked for the function “fast channel scan”, which means that by activating this function, the marked frequencies will be used for scanning. The fast scanning function itself is limited to a maximum of eight frequencies, so there is also a maximum of eight frequencies which can be marked for scanning in the “memory” dialog.

Inside the “memory” dialog, the sub-dialogs can be opened, e. g. frequency name editing dialog.





Figure 16. Memory Dialog. Top level

List of Elements		
Pos.	Element	Function
①	"New Freq."	Creates a new entry at the end of the list. By pressing this hotkey, the "Frequency input dialog" opens immediately and the new frequency can be entered into the list.
②	"Edit Freq."	Pressing this hotkey opens the "Frequency input dialog" for changing the currently marked frequency/channel.
③	"Edit Name"	Pressing this hotkey opens the virtual keyboard, which allows textual input of the name for the currently marked frequency/channel.
④	"Move Up"	By pressing this hotkey, the currently marked line will be moved one position upwards in the list.
⑤	"Move Down"	By pressing this hotkey the currently marked line will be moved one position downwards in the list.
⑥	"Scan Yes/No"	This hotkey marks the currently selected frequency for the function "Fast channel scan". That means, when "Fast channel scan" is activated, this marked frequency will be scanned as one of the eight possible frequencies for this scan function. If the frequency/channel is already marked for scan and the hotkey "Scan Yes/No" is pressed once again, the marking for "Fast channel scan" will be removed.
⑦		Pressing this button will close the dialog (or frequency / name input) without adopting the new values.





8		Pressing this button will close the dialog without adopting the values and open the “Bearing” page.
9		<p>The “up” and “down” arrows are used to select between the stored frequencies in the “memory” dialog. When editing the name of a frequency, these buttons are used to navigate on the displayed keyboard.</p> <p>The “right” and “left” arrows are used to navigate on the displayed keyboard while editing the name of a frequency.</p> <p>Button “OK”:</p> <ul style="list-style-type: none"> <li>On the top level of the “memory” dialog pressing “OK” will activate the currently marked frequency and close the dialog (previously used frequency on the “Bearing” page will be deleted).</li> <li>In the sub-dialogs “New Freq.”, “Edit Freq.” and “Edit Name”, pressing “OK” will confirm the edited values (frequency, entered letters or numbers, or the whole input).</li> </ul>
10		<p>This button deletes the currently marked frequency from the list.</p> <p><b>Note</b> Deleting the frequency from the list will follow immediately after pressing the “DEL” button, without asking for confirmation of the deleting procedure.</p> <p>Pressing the button “DEL” within the sub-dialogs “New Freq.”, “Edit Freq.” and “Edit Name” clears the input field (all digits).</p>
11		<p>The number keys can be used for inputting the frequency name (s. also 3, “Edit Name”) since the names of frequencies may contain numbers and characters.</p>
12	“Save”	<p>Pressing the “down” arrow until the green frame reaches the “Save” button and confirming with “OK” will save all previously made modifications within the “memory” dialog (editing frequencies, names etc.). Once done, the dialog can be closed by pressing “ESC”, all changes will remain saved.</p> <p>Using the “ESC” button without previously confirming the changes with “Save” will close the memory dialog without saving the changes.</p>

Table 8. Memory Dialog. List of elements

**Edit Name Sub-Dialog**



This dialog is opened from the top level of the “Memory” dialog by using the corresponding hotkey and allows inputting/editing the name for the marked frequency.

This dialog cannot be closed with the button “OK” because that button is used to confirm each individual character for the text input. The characters are selected by navigating on the virtual keypad using the arrow keys (s. position 3, Figure 17). The dialog is closed by confirming with the button “End of User Input” on the virtual keyboard.



**Figure 17. Editing the frequency name**

If the frequency name contains numbers, they can be entered using the number keys on the keypad (s. position 5, Figure 17) since the virtual keyboard itself does not contain number keys. Using the “DEL” button (s. position 4, Figure 17) the whole input will be deleted.

The arrow-keys   on the virtual keypad have the same function as “shift” and “caps” on a standard PC keyboard. The “up” arrow acts as “shift” (the next input will be interpreted as capital letter, but the following inputs are interpreted as lowercase letters unless this button is pressed again). The “down” arrow acts as “caps” (the following inputs will be interpreted as capital letters if the button is not pressed for the second time).

The “End of User Input” is used to confirm the whole text in the input field. By confirming this button with “OK”, the edit name sub-dialog will be closed, adopting the new name for the frequency which can be seen in the control field above (here: “Edit Name of Frequency” 121.650 MHz).

Pressing the “ESC” or “HOME” (s. positions 1 and 2, Figure 17) will close the dialog without adopting the values (and open the “bearing” page in case of the “HOME” button).

### 7.1.3 Function Channel 16

Pressing hotkey “Ch. 16” (s. position 6, Figure 10) enables instant access to maritime emergency channel 16.

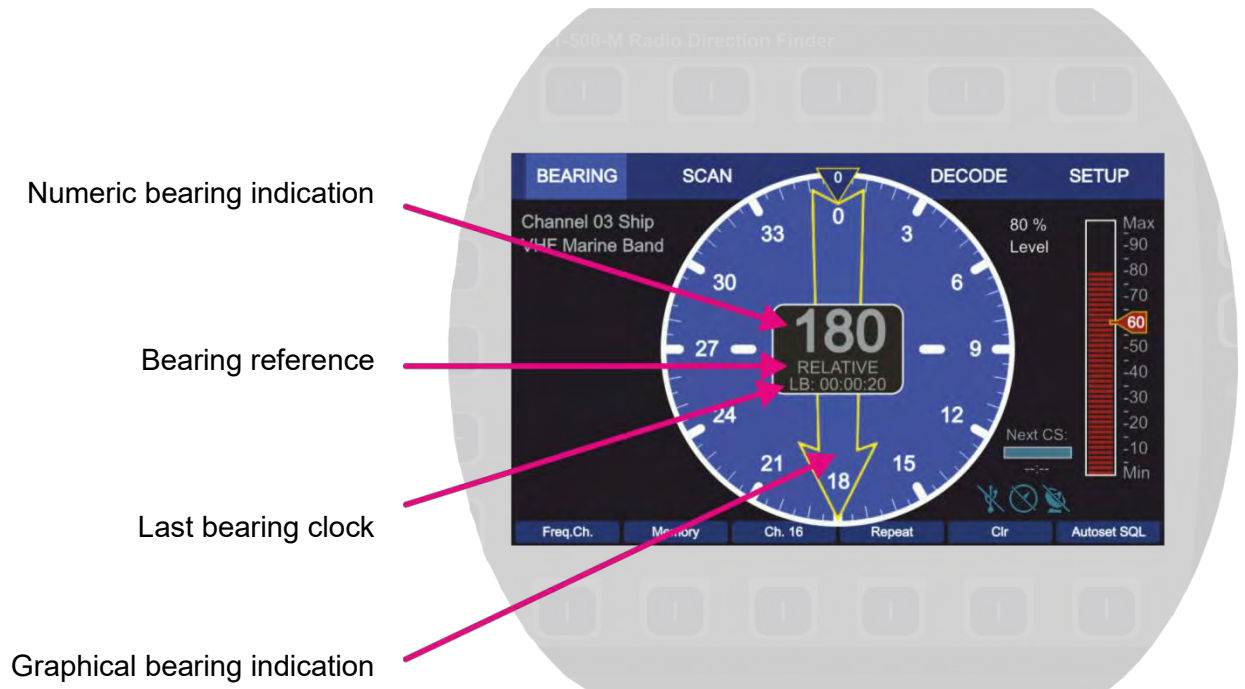
If this function is activated, the hotkey name indication adopts the value of the previously active frequency, so that it can be quickly switched back if needed.

#### Note

Please verify correct squelch adjustment. For squelch adjustment see 7.5.2.

### 7.1.4 Function Repeat

Pressing the hotkey “Repeat” (s. position 7, Figure 10) shows the last valid bearing, reference and level values.



**Figure 18. Repeat indication**

The last bearing clock in the lowermost line of the digital bearing display (s. Figure 18) shows the elapsed time since the last valid bearing was interrupted.

The last valid bearing data will be shown for 2 seconds (by default) after pressing the “Repeat” hotkey. This hold time can be changed on the “Setup” page (“Bearing Indication Hold Time”, s. 7.4.2.1). If an external compass is activated (“true” / “magnetic” bearing), a change in the heading of the ship is automatically considered for the relative bearing.

#### Note

If no external compass is activated (“relative” bearing), the indicated bearing value corresponds to the vessels heading at the time of the bearing. A change of heading in the meantime must be considered.

### 7.1.5 Function Clear

Pressing the hotkey “Clr” (s. position 8, Figure 10) will clear the last valid bearing together with all the corresponding values.

The function “Clr” clears the internal bearing value averaging memory. The averaging memory improves the bearing accuracy and provides a useful bearing indication even with poorly received signals (e.g. distant transmitter, receiving gaps).

The averaging procedure can cause a dragged error, which might affect the bearing value, if the heading changes too fast<sup>1</sup>. In this case, the indicated bearing value will slightly lag behind the actual bearing value.

Pressing the hotkey “Clr” after a distinct change of heading will correct the displayed bearing value immediately.

If an alarm was activated, this hotkey is used to mute the acoustic alarm (s. 7.1.2.1).

<sup>1</sup> Typical case is a quick pass on the transmitter, which is in the near field of the DF-antenna.



### 7.1.6 Function Autoseq SQL

In normal bearing mode (no scan active) the hotkey “Autoseq SQL / Seqelch / Automatic / Manual” hotkey is designated as “Autoseq SQL” (s. position 9, Figure 10). Pressing this hotkey will automatically set the seqelch level above the noise level by 6 dB (this is a default value and can be modified in “Setup”, s. 7.4.3.11). A manual readjustment might be necessary (s. chapter 7.5.1).

When bearing a Cospas-Sarsat frequency this hotkey is designated as “Manual”/ “Automatic”, which allows switching between these seqelch adjustment possibilities. For further information please refer to chapter 7.5.2.

If any scan algorithm is activated, this hotkey is designated with “Seqelch”, or is empty (s. “Scan” page). Pressing this hotkey will open the seqelch dialog to adjust the seqelch levels for the different frequencies.

## 7.2 Scan Page

The “Scan” page enables starting scanning modes as simply and quickly as possible. Various scan modes are shown as a list with the currently activated mode highlighted in green. If no scan is currently active, all scan modes in the list are displayed in gray, where the currently marked one is indicated by a green frame.

The scan procedures can also be configured on this page.

If a scan procedure has been activated, all relevant data of the activated mode will be displayed after switching to the “Bearing” page. Figure 19 shows the most important elements of the “Scan” page.

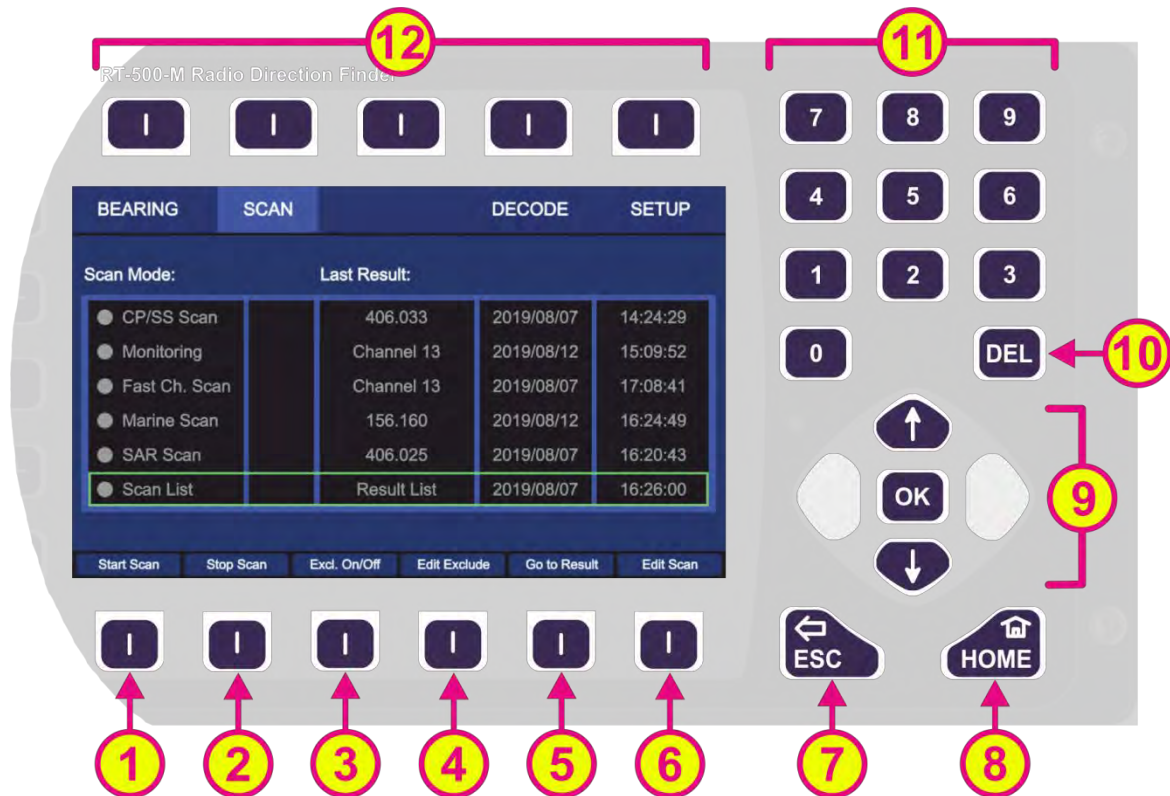







Figure 19. Scan page. General view

### Indication on Scan Page

Pos.	Element	Meaning / Description
1	„Start Scan“	Activates the currently marked scan algorithm. On the “Setup” page you can set the behavior for when this hotkey is pressed (switching to the “Bearing” page or remaining on the “Scan” page, s. 7.4.3.12)
2	“Stop Scan”	Stops the currently activated scanning algorithm, regardless of whether it is marked in the list or not.
3	“Excl. On/Off”	This hotkey appears only when the “Marine Scan” or “Scan List” is marked. By pressing this hotkey, the algorithm of the currently marked scan mode takes the “Exclude List” into account during the scan. If this setting was already activated for the currently marked scan, pressing this hotkey will deselect this option and the “Exclude List” will not be regarded during the scan.
4	“Edit Exclude”	This hotkey appears only when the “Marine Scan” or “Scan List” is marked.

		By pressing this hotkey, the dialog for editing the “Exclude List” is opened (s. 7.2.4.3).
5	“Go to Result”	Terminates the currently activated scan algorithm, acquires the frequency which was found during the last scan and switches to the “Bearing” page. If “Scan List” is marked, pressing this hotkey opens the corresponding dialog. This hotkey appears only if there is a result for the currently marked scan algorithm.
6	“Edit Scan”	Opens the dialog to edit the currently marked scan algorithm.
7		When there is a dialog opened, pressing this button will close the dialog without adopting new values. When there is no dialog opened, pressing this button will go back to the last activated page. The Bearing Page is the end-point.
8		Pressing this button while on the “Scan” page will close the “Scan” page and open the “Bearing” page (home page). Pressing this button on the “Bearing” page while any scan procedure is currently active will open a confirmation dialog for ceasing the currently running scan procedure. Confirming with “OK” terminates the scan operation and the system will change to the normal bearing mode on the previously selected frequency. By pressing the “ESC” the scan procedure will be continued. If a sub-dialog is opened, pressing this button will close it and lead to the “Bearing” page, without adopting the changed values.
9		“Up” and “Down” arrows are used to select between the general settings (move the green frame). Inside the dialogs (e.g. value editing) they are used to navigate between the characters of the virtual keypad. “Right and “left” arrows have no function on this page. If no scan mode is currently activated, pressing “OK” will activate the marked scan mode. With the “OK” button the confirming of values or opening the general settings dialogs is accomplished. If you want to use the frequency determined during the scan as the bearing frequency, press “OK”. This will quit the scan procedure and start the normal bearing mode on this frequency.
10		If any scan mode is currently activated, by pressing this button the scan mode will be stopped, regardless of whether it is marked in the list or not. Inside the settings dialogs, the “DEL” button is used to clear the whole input at once
11		Numeric keys are used to enter the numerical characters inside the dialogs. On the top level of the “Scan” page, they have no function.

12	Top line	Navigation line of the screen, which allows switching between setup menus ("General", "Display", "System", "Interface" and "Service").
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Table 9. Scan page. List of Elements

The last result, which was found during the last scan is displayed with frequency/channel, day and time besides the scan mode (s. Figure 20, field A). This allows the direct opening of a frequency for bearing, which was found in an earlier scan cycle.

● CP/SS Scan	A	406.025	2019/07/11	14:47:20
● Monitoring		—	—	—
● Fast Ch. Scan		—	—	—
● Marine Scan		—	—	—
● SAR Scan	B	406.025	Running	15:10:04
● Scan List		Result List	—	—

Figure 20. Cospas-Sarsat scan mode with the last result indication

During any scan is active, the field for the day indication shows "Running" instead of the actual day indication (s. Figure 20, field B).

● CP/SS Scan		406.033	2019/08/07	14:24:29
● Monitoring		Channel 13	2019/08/12	15:09:52
● Fast Ch. Scan	C	Channel 13	2019/08/07	17:08:41
● Marine Scan	Excl	156.145	2019/08/13	13:12:26
● SAR Scan		406.025	2019/08/07	16:20:43
● Scan List		Result List	2019/08/07	16:26:00

Figure 21. "Exclude List" use indication

Further, if the "Exclude List" is used for a scan algorithm (only for "Marine Scan" and "Scan List" available), this will be shown in the table in the second column as "Excl" (s. Figure 21, field C).

### 7.2.1 COSPAS-SARSAT Scan

In this scan mode, the direction finder keeps scanning the entire COSPAS-SARSAT range of channels (s. 7.1.2.2, section "Input of Frequencies" and "Selecting Cospas-Sarsat Frequency Groups") until a signal is detected on one of the channel groups (s. Figure 22, field A).

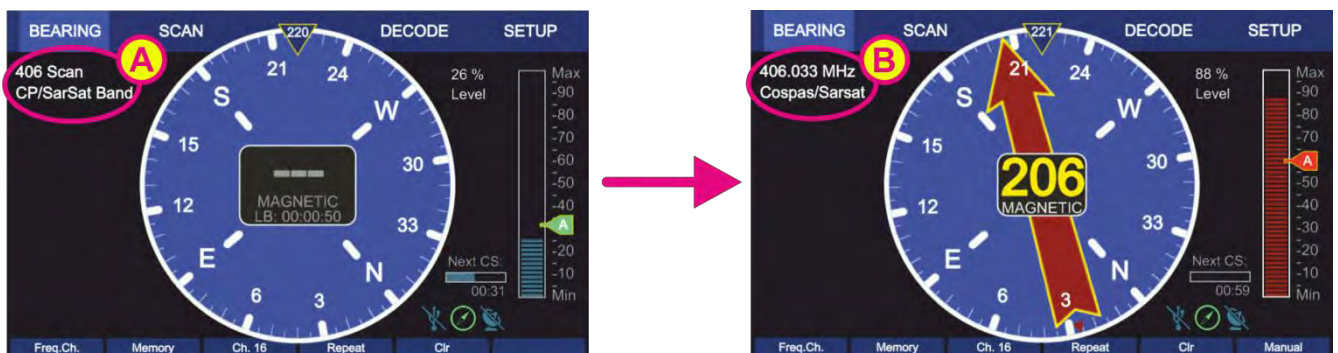


Figure 22. Cospas-Sarsat Scan indication on the "Bearing" page

After a Cospas-Sarsat frequency has been detected, the scan mode stops automatically and the direction finder changes to the normal bearing mode on this frequency (s. Figure 22, field B).

- To start the “Cospas-Sarsat Scan” mode select the corresponding line on the “Scan” page and press “OK” or the hotkey “Start Scan” (s. Figure 23, position 1)

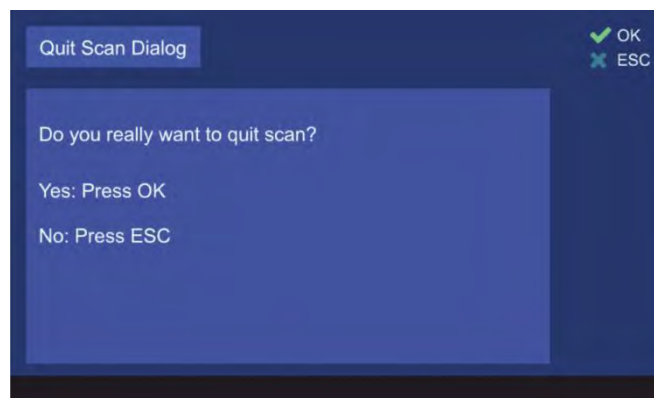


**Figure 23. "Cospas-Sarsat Scan" mode has been activated**

- Pressing the hotkey “Stop Scan” (s. Figure 23, position 2) will terminate the current scan mode and change to the bearing of the frequency, that was set before the scan mode has been activated.

#### Note

You can also stop the scan mode by pressing the “HOME” button on the “Bearing” page with activated scan. After you have confirmed the special dialog (s. Figure 24), this mode will be terminated.



**Figure 24. Confirming of leaving the scan mode**

- Pressing the hotkey “Go to Result” (s. Figure 23, position 3) during the Cospas-Sarsat scan is currently running, will terminate the scan mode, adopt the frequency which was found in this scan last time and change to the “Bearing” page. Pressing the hotkey “Go to Result” if the scan mode is not activated, will lead to the “Bearing” page with the last result as the activated frequency. This hotkey appears only if there is a result for this scan.

### 7.2.2 Monitoring

The DF-system RT-500-M can receive only one frequency at a given time. For simultaneous surveillance of the emergency frequencies (especially MOB = man over board alert) and any other frequencies/channels, this monitoring function can be used.



**Note**

The COSPAS-SARSAT frequencies cannot be set as the monitoring frequencies, but they still can be used as the main bearing frequency.

Monitoring scan has two different modes of operation that depend on the main bearing frequency:

- Monitoring (normal): the mode of operation with any main frequency that does not belong to the COSPAS-SARSAT band.
- Monitoring CP-SS: the mode of operation with a COSPAS-SARSAT frequency as the main frequency.  
This particular scan mode is convenient for a use case when the expected COSPAS-SARSAT frequency of a particular emergency beacon is not known and should be determined.  
If the exact COSPAS-SARSAT frequency is known, then using the “SAR scan” (s. 7.2.5) might be a better choice for simultaneous surveillance of several frequencies.

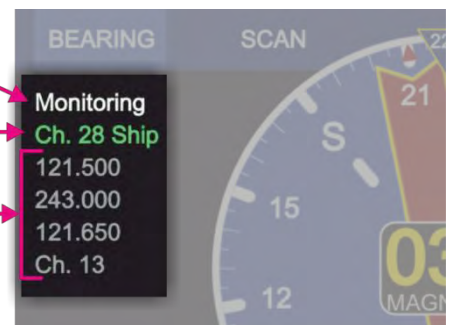
The surveillance of up to five different frequencies (within the specified frequency bands) is possible:

- One main bearing frequency
- And four monitoring frequencies:  
The emergency frequencies 121.500 MHz and 243.000 MHz are stored permanently in the “Monitoring” algorithm.  
Two more frequencies/channels can be set additionally in this scan (s. Figure 25).

Designation of the currently active scan mode

Main bearing frequency (currently active)

Monitoring frequencies



**Figure 25. “Monitoring” mode. Indication of frequencies.**

If the Monitoring (normal) function is activated, the DF system switches alternating from the main bearing frequency to the selected monitoring scanning frequencies (s. 7.2.2.1).

The currently monitored frequency is displayed highlighted in green, so you can see, which frequency is active at a given moment (s. Figure 25).

A frequency will be monitored for 3 seconds if ELT/PLB is not activated, and 10 seconds if ELT/PLB is activated.

If a signal is received during monitoring, the bearing value is indicated on the “Bearing” page for 30 seconds.

- In order to interrupt the current reception, press the “ESC” button. The system will continue with the next monitoring frequency.

Active reception will be interrupted after 30 seconds for a short moment in order to examine the other monitoring frequencies (safety function). This behavior can be changed under “Monitoring Settings” (s. 7.2.2.4, “Edit Scan” hotkey-description).

If the signal was lost during the monitoring procedure, the scanning process continues with the next frequency/channel after 30 seconds (depending on the settings of the bearing indication time and how many seconds (e.g. of 30 s - period) have already elapsed until the signal was interrupted).

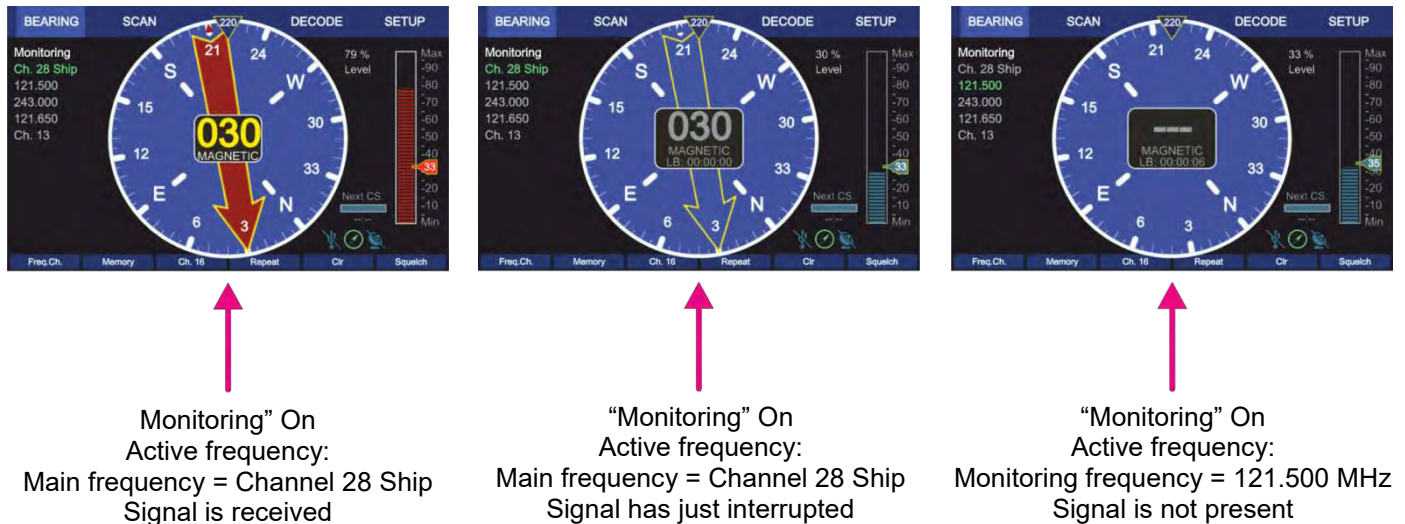


Figure 26. "Monitoring" mode. Example views of the "Bearing" page

- If at some point of scanning procedure the signal on the desired frequency is received, and monitoring of other frequencies is not desired anymore, press the "OK" button. The frequency, that receives a valid signal at the moment of pressing the "OK" button, will be adopted as the main frequency, and the system will change to a normal bearing mode.

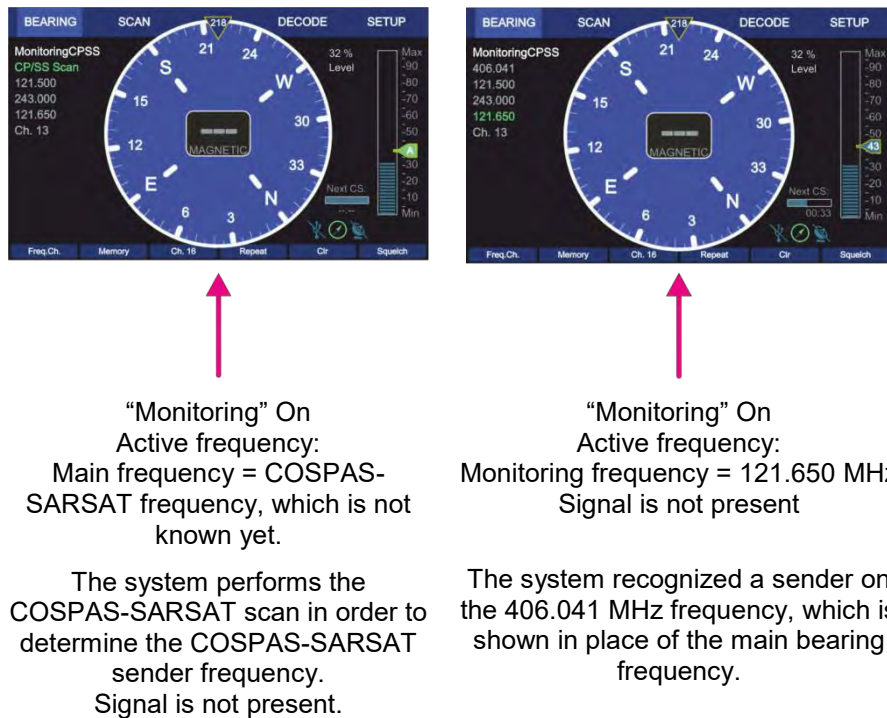


Figure 27. "Monitoring CP-SS" mode. Example views of the "Bearing" page

In the case of COSPAS-SARSAT frequency as the main bearing frequency, the Monitoring CP-SS function is activated automatically, when the "Monitoring" scan is selected. This operation mode differs from the normal monitoring mode with a non-CP-SS-frequency as the main bearing frequency (s. 7.2.2.2).

The "CP-SS" monitoring procedure will first look for the COSPAS-SARSAT signal and then, if no pulse has been detected for 60 seconds, it will search for other monitoring frequencies one after another (not alternating with the main frequency as it is in the standard case).

If a COSPAS-SARSAT signal is detected, the system releases an alarm and decodes the pulse, which can then be seen on the "Decode" page.

#### Note

If a valid COSPAS-SARSAT signal is detected during the 60-seconds-period of the monitoring procedure, the correct COSPAS-SARSAT frequency channel of the sender is determined in the first cycle (first 60 seconds period of the CP-SS scan).

Only at the second cycle of this scan algorithm the bearing and decoding information of a COSPAS-SARSAT signal is stored and shown on the corresponding pages.

#### 7.2.2.1 Timing of Normal Monitoring Operation

The main frequency (here channel 16) is monitored with the highest priority. The duration of the monitoring cycles may be extended if signals are received on the monitoring frequencies.

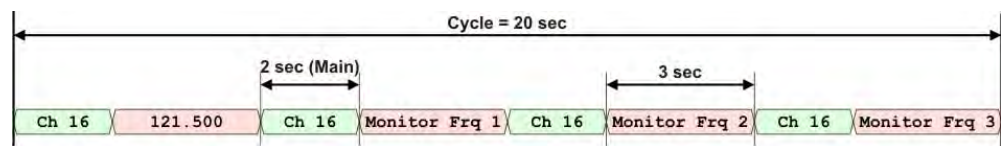


Figure 28. Example: Timing normal monitoring

#### Note

Receiving on the monitoring frequencies can be triggered by the wrong adjustment of the squelch level!

Please always prove the correctness of the squelch adjustment on the scan frequencies.

#### 7.2.2.2 Timing Monitoring with Selected Cospas-Sarsat Main Frequency

If the main frequency is adjusted to a Cospas-Sarsat frequency, the timing cycle will be changed automatically.

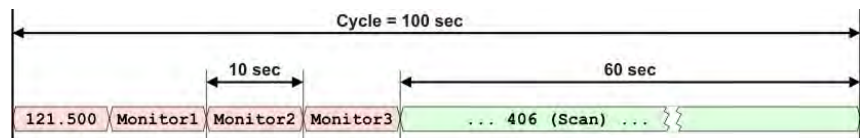


Figure 29. Example: Timing Cospas-Sarsat monitoring

Additionally, the Cospas-Sarsat-scanning is activated, in order to catch the short pulse (duration of pulse ca. 400 msec, every 50 seconds).

#### 7.2.2.3 Monitoring with Filtering of Emergency Transmitters: ID-Only

In order to activate the emergency transmitter filtering function see 7.2.2.4.

Signals transmitted by emergency transmitters (PLB/ELT/MOB) are modulated with a typical sweeping tone. In order to exclude false alarms caused by disturbing signals or by not authorized radio-communication during monitoring mode, the function "emergency transmitter filtering ID-Only" can be activated.

Once activated, the alarm for all radio signals without the prescribed sweeping tone for emergency transmitters will be suppressed. Alert will be triggered only if a modulated emergency signal is recognized.

#### Note

For very weak signals recognition of modulation may take a certain time. Releasing an alarm can be delayed in this case.



#### 7.2.2.4 Monitoring Settings

- To start the “Monitoring” mode select the corresponding line on the “Scan” page and press “OK” or the hotkey “Start Scan” (s. Figure 30, position 1)

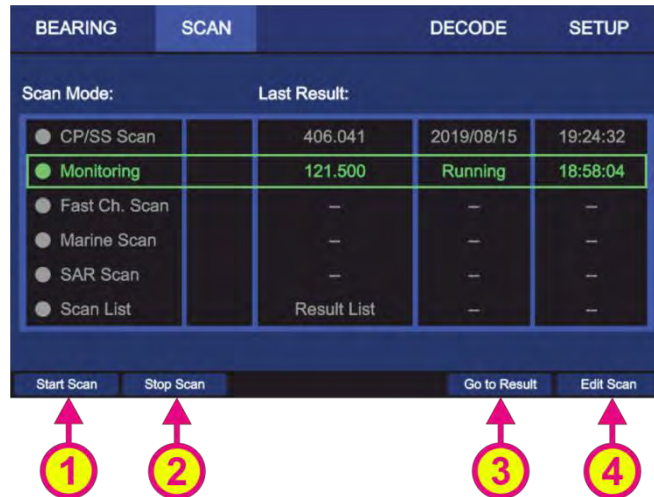


Figure 30. "Monitoring" has been activated

- Pressing the hotkey “Stop Scan” (s. Figure 30, position 2) will terminate the current scan mode and change to the bearing of the frequency that was set before the scan mode has been activated.
- You can also stop the scan mode by pressing the “HOME” button on the “Bearing” page with activated scan. After you have confirmed the special dialog (s. Figure 24), this mode will be terminated.

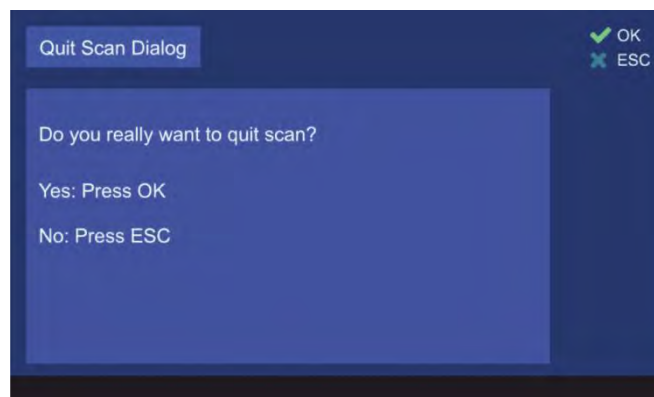
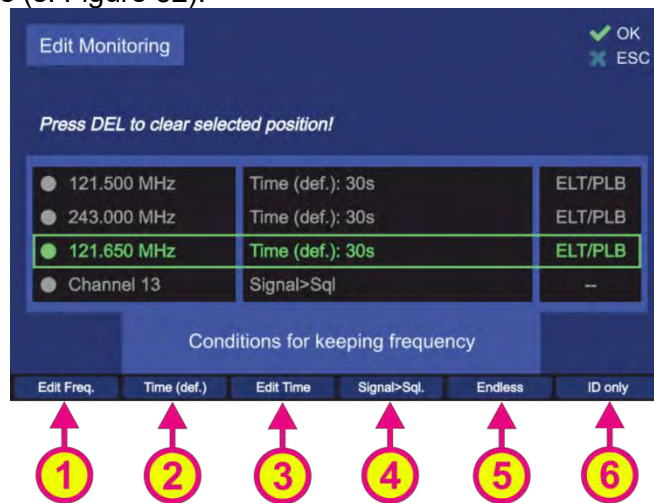


Figure 31. Confirming of leaving the scan mode

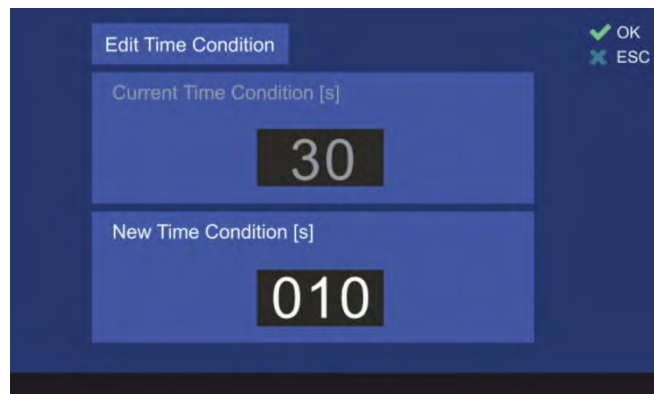
- Pressing the hotkey “Go to Result” (s. Figure 23, position 3) during the monitoring is currently running, will terminate the scan mode, adopt the frequency which was found in this scan last time and change to the “Bearing” page.
- Pressing the hotkey “Go to Result” if the scan mode is not activated, will lead to the “Bearing” page adopting the last result as the bearing frequency. This hotkey appears only if there is a result for this scan.

- Pressing the hotkey “Edit Scan” (s. Figure 23, position 4) will open the dialog for changing the monitoring settings (s. Figure 32).



**Figure 32. Monitoring mode settings**

- The hotkey “Edit Freq.” opens the “Frequency/Channel” input dialog and allows the modification of the currently marked frequency.
- Pressing the hotkey „Time (def.)“ (s. Figure 32, position 2) will set the hold time (duration of staying in the scanning on this particular frequency) to the default value of 30 seconds.
- Pressing the hotkey “Edit Time” (s. Figure 32, position 3) will open the sub-dialog for changing the hold time to the customized value (s. Figure 33). Use the number keys of the DCU keypad to type the new value in and confirm it with “OK”.



**Figure 33. Hold time setting**

- The hotkey “Signal > Sql” defines the behavior of the monitoring algorithm to “signal level > squelch level” (s. Figure 32, position 4).  
If this hotkey has been pressed, the scan algorithm will stay on the active frequency until the signal level value becomes higher than the squelch value.
- The hotkey “Endless” (s. Figure 32, position 5) defines the behavior of the monitoring algorithm when an active frequency has been found.  
If this hotkey is pressed, the monitoring algorithm will stay on an active frequency as long as the user terminates the monitoring mode or skips the actual frequency.
- Pressing the hotkey “ID only” (s. Figure 32, position 6) activates or deactivates the feature “ID Only” (s. 7.2.2.3):

1. **“ELT/PLB”:**  
Alarm is only triggered if an ELT/PLB signature has been detected.
2. **“ – “:**  
Alarm is never triggered, no matter if there is any modulation on it or not.

The hotkey “ID only” is only visible for the following frequencies:

- 121.500 MHz
- 243.000 MHz
- 121.650 MHz

### 7.2.3 Fast Channel Scan

The scan mode “fast channel scan” is only available with an unlocked option (licensed option “F5”).

#### Note

If the fast channel scan mode is not supported by the connected AU, it cannot be selected in the dialog.

#### 7.2.3.1 Fast Channel Scan Operation

In this scan mode, it is possible to scan up to eight freely selectable frequencies/channels across all the specified bands (available frequency bands are visible in the “Frequency Information” dialog, s. 7.4.1.8).

The selection of the 8 frequencies/channels which have to be scanned in the “Fast Channel Scan” mode, can also be done via “Memory” dialog, which can be opened by a hotkey on the “Bearing” page.

#### Note

If the fast channel scan is running, the hotkey “memory” does not react on pressing. Memory dialog is available after the fast channel mode is terminated.

The duration of the scan cycle for the maximal number of selectable frequencies is approximately two seconds, whereat all channels are scanned continuously one after another. If less than eight frequencies are selected, the duration of the scanning cycle decreases equivalently to their number (e.g. if four frequencies/channels are selected, one cycle of the scan procedure takes approximately one second).

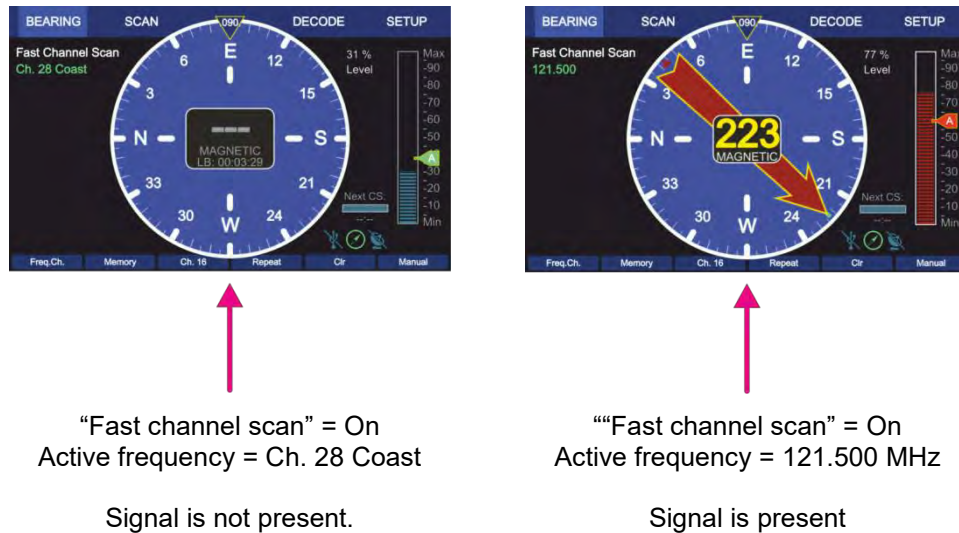
In fast channel scan mode the auto squelch is set automatically. The behavior of the auto squelch can be slightly influenced by adjusting the SNR value (Signal to Noise Ratio, s. 7.4.3.11). The SNR value indicates the number of level points above the noise level to which the auto squelch is set. For example, if the noise level on a specific channel is at 27% and the SNR value is adjusted to “7”, then the auto squelch level is set to 34%.

Since the selected frequencies in this mode can have different noise levels and originate from different bands, the SNR value for each frequency/channel can be adjusted separately.

After detection of a signal, the bearing is shown for 5 to 7 seconds for frequencies with the activated beep tone detection, additionally, the alarm will be released. For frequencies with deactivated beep tone detection, the active bearing indication time is 30 seconds.

After the elapsing of this time, the scan algorithm interrupts the bearing indication and continues with scanning of other selected frequencies.

If the signal was lost, one second after the scanning process starts again at the next frequency/channel.



**Figure 34. Fast channel scan indication on the "Bearing" page.**

In case that an unwanted signal is found, the scanning process can be proceeded immediately by pressing the “ESC” button.

If a signal is found and the direction finder should bear this signal permanently, the scanning process can be ceased either by pressing the button “OK” (the current frequency will become the new bearing frequency on the “Bearing” page), or by pressing “HOME” (in the scan dialog “Stop Scan”) and then using the “Go to result” hotkey (s. 7.2.3.3).

### Note

If there are interferences on the frequency band which are above the squelch level, scanning stops as well at these interferences (they are interpreted as signals). This may be avoided by adjusting the squelch level manually adjusting the SNR value.

Because of this, it may be possible that weak signals are not received anymore (for correct squelch adjustment read also chapter 7.5.2)

### 7.2.3.2 „Alarm Only Decoding“ / „Beep Tone“

If the mode “fast channel scan” is activated, a “Beep Tone” filter can be activated for each frequency additionally.

The alarm is only activated for signals with a distinct (preconfigured) audio frequency and activates an alarm immediately if such a signal was recognized.

This can be used to search e.g. NOVATECH radio beacons which transmit a two-second signal with an 800Hz audio tone every six seconds.

The parameters of the audio signal (upper and lower audio frequency and the minimum required duration of the signal) can be configured on the “Setup” page (s. 7.4.3.5).

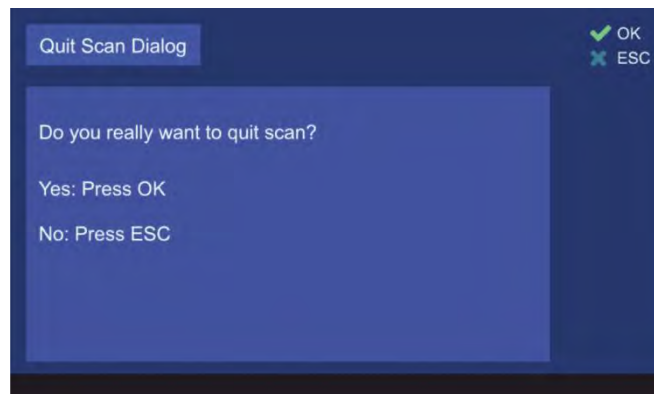
### 7.2.3.3 Fast Channel Scan Settings

- To start the “Fast Channel Scan” mode select the corresponding line on the “Scan” page and press “OK” or the hotkey “Start Scan” (s. Figure 35, position 1)



**Figure 35. Activating the “Fast Channel Scan”**

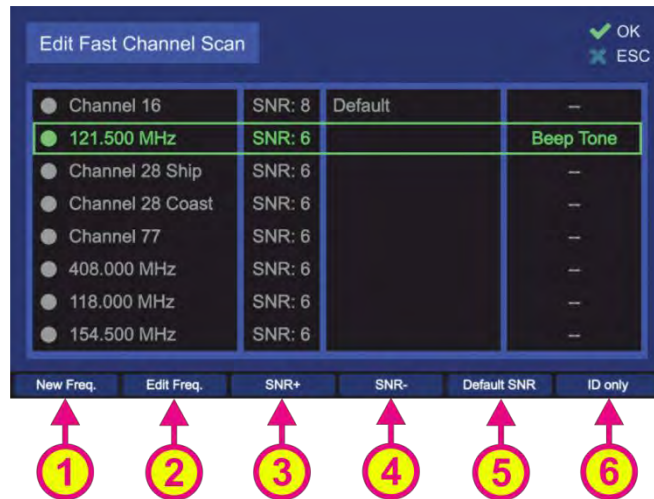
- Pressing the hotkey “Stop Scan” (s. Figure 35, position 2) will terminate the scan mode and change to the bearing of the frequency, that was set before the scan mode has been activated.
- You can also stop the scan mode by pressing the “HOME” button on the “Bearing” page with activated scan. After you have confirmed the special dialog (s. Figure 36), this mode will be terminated.



**Figure 36. Confirming of leaving the scan mode**

- Pressing the button “OK” during the time of the active reception of the signal, the scanning mode will be deactivated and the current frequency will become the new main frequency.
- Pressing the hotkey “Go to Result” (s. Figure 35, position 3) during the fast channel scan is currently running, will terminate the scan mode, adopt the frequency which was found in this scan last time and change to the “Bearing” page into normal bearing mode. Pressing the hotkey “Go to Result” if the scan mode is not activated, will lead to the “Bearing” page with the last result as the activated frequency. This hotkey appears only if there is a result for this scan.
- Pressing the hotkey “Edit Scan” (s. Figure 35, position 4) will open the dialog for changing the settings of the fast channel scan (s. Figure 37)





**Figure 37. Fast channel scan settings**

- The hotkey “New Freq.” opens the “Frequency/Channel” input dialog for adding the new frequency in the list (maximum 8 frequencies/channels).
- The hotkey “Edit Freq.” opens the “Frequency/Channel” input dialog and allows the modification of the currently marked frequency.
- Pressing the hotkey „ SNR+” (s. Figure 37, position 3) will increase the SNR value of the currently marked frequency by 1%.
- Pressing the hotkey „ SNR-” (s. Figure 37, position 4) will decrease the SNR value of the currently marked frequency by 1%.
- Pressing the hotkey “Default SNR” (s. Figure 37, position 5) will set the SNR value of the currently marked frequency to the default value, which can be defined on the “Setup” page (s. 7.4.3.11).
- Pressing the hotkey “ID only” (s. Figure 37, position 6) activates or deactivates the feature “ID Only” with two possible settings:
  - **“Beep Tone”:**  
Alarm is only triggered if an audio tone in the valid range (configured via Setup, s. 7.4.3.5) has been detected. Else the bearing is suppressed.
  - **“--”:** Alarm is never triggered no matter if there is any modulation on it or not.

**Note**

“Beep Tone” is only active in “Fast Channel Scan”.

### 7.2.4 Marine Scan

The “Marine Scan” mode provides a quick scanning of the lower marine band.

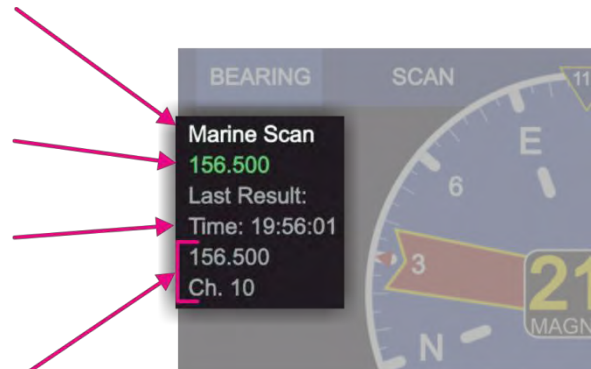
The frequency range of the “Marine Scan” is defined from 156.050 MHz (Channel 01) to 157.425 MHz (Channel 88) and is scanned with 5 kHz frequency steps without gaps. The frequency range cannot be changed. The duration of one scanning cycle is approx. 3 seconds.

Designation of the currently active scan mode

Scan frequency (changing until a signal is detected)

Time of the last signal detection

Frequency and the number of the equivalent channel of the last signal detection



**Figure 38. Marine scan. Indication of frequencies**

#### 7.2.4.1 Marine Scan Operation

If a signal is found during the scan (signal level above squelch level), the scanning is interrupted and the bearing of the signal is held for 30 seconds (default value, which can be changed in the scan settings, s. 7.2.4.2), then the algorithm continues with scanning of next frequencies.

If the button “OK” is pressed during the time of the active reception of the signal, the scanning mode will be deactivated and the current frequency will become the new main frequency.

If the signal was lost during the scan mode, the scanning process continues with the next frequency / channel after up to 30 seconds (depending on the setting of the bearing indication time, and how many seconds of the indication-time has already elapsed until the signal was interrupted).



“Marine Scan” = On  
Active frequency = 156.920 MHz

Signal is not present.

“Marine Scan” = On  
Active frequency = 156.500 MHz

Signal is present

**Figure 39. Marine scan indication on the “Bearing” page.**

In case that an unwanted signal is found, the scanning process can be proceeded immediately by pressing the “ESC” button.

### Note

If there are interferences on the frequency band which are above the squelch level, scanning stops as well at these interferences (they are interpreted as signals). This may be avoided by adjusting the squelch level manually using the “Up” and „Down“ arrow buttons.

Because of this, it might be possible that weak signals are not received anymore (for correct squelch adjustment read also chapter 7.5.2).

#### 7.2.4.2 Marine Scan Settings

- To start the “Marine Scan” mode select the corresponding line on the “Scan” page and press “OK” or the hotkey “Start Scan” (s. Figure 40, position 1).

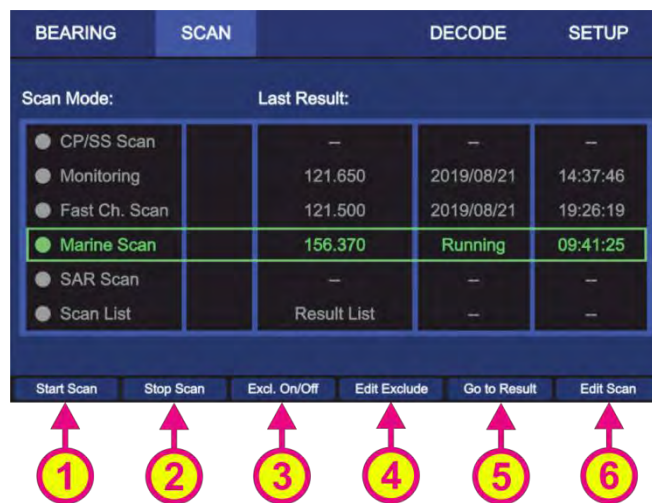


Figure 40. Marine scan is activated.

- Pressing the hotkey “Stop Scan” (s. Figure 40, position 2) will terminate the scan mode and change to the bearing of the frequency, that was set before the scan mode has been activated.
- The scanning process can be ceased also by pressing the button “HOME”. Then the direction finder changes to the bearing of the frequency, which was set before the scan mode was started.
- The hotkey “Excl. On/Off” is only visible, if “Marine scan” or “Scan List” is marked (s. Figure 40, position 3).  
By pressing this hotkey the currently marked scan mode will proceed the “Exclude List” during the scan.  
If this setting was already set for the currently marked scan mode, pressing this button will deselect this option and the “Exclude List” will be ignored during the scan procedure.
- “Edit Exclude” is only visible, if “Marine scan” or “Scan List” is marked (s. Figure 40, position 4).  
By pressing this hotkey, the dialog for editing the “Exclude List” will be opened (s. 7.2.4.3).
- Pressing the hotkey “Go to Result” (s. Figure 40, position 5) during the marine scan is currently running, will terminate the scan mode, adopt the frequency which was found in this scan last time and change to the “Bearing” page into normal bearing mode.  
Pressing the hotkey “Go to Result”, if the scan mode is not activated, will lead to the “Bearing” page with the last result as the activated frequency.  
This hotkey appears only, if there is a result for this scan.
- Pressing the hotkey “Edit Scan” (s. Figure 40, position 6) will open the dialog for changing the settings of the marine scan (s. Figure 41).



**Figure 41. Marine scan settings**

- “Time (def.)” hotkey (s. Figure 41, position 1) defines the behavior of the marine scan algorithm if the active frequency (signal level > squelch level) has been found. If this hotkey is pressed, the default time of 30 seconds will be adopted after confirming this setting with “OK”. Marine scan algorithm will stay for the default time of 30 sec on an active frequency before continuing with scanning of the lower marine band.
- Pressing the hotkey “Edit Time” (s. Figure 41, position 2) will open a dialog for editing the time of staying on the actively received frequency before continuing with the scan procedure.
- Pressing the hotkey “Signal>Sql.” hotkey (s. Figure 41, position 3) defines the time of staying on the actively received frequency before continuing with the scan procedure. If this setting is confirmed, the scanning procedure will stay on the actively received frequency as long as the signal level is higher than the squelch level.
- If the hotkey “Endless” (s. Figure 41, position 4) was pressed and confirmed with “OK”, the marine scan algorithm will stay on the actively received frequency as long as the user terminates the scan or skips the current frequency.

#### 7.2.4.3 Exclude List (for “Marine Scan” and “Scan List” modes)

The “Exclude List” (s. Figure 19, position 4) is a dialog that allows defining single frequencies or frequency ranges that are to be excluded from the scanned frequency ranges for scan modes “Scan List” and “Marine Scan”.

Due to generating the scan algorithms in the AU (that always run through all the defined frequencies of the mode without the possibility of skipping), in case of signal reception of the “Exclude List”-frequency, this frequency will not be completely suppressed but there will be a short bearing indication. After less than one second, the indication interrupts and the marine scan procedure continues immediately with the next frequencies of the defined band.

- After pressing the hotkey “Edit Exclude” on the “Scan” page (see e.g. Figure 40, position 4), the dialog for editing the “Exclude List” will be opened. In the case of first opening this dialog, all fields will be empty.



**Figure 42. „Exclude List“ configuration**

- To insert a new frequency/channel or a range of frequencies/channels, press the hotkey „New Freq.“ (s. Figure 42, position 1). The “Frequency Input Dialog” will be opened (s. 7.1.2.2), where you can input any desired frequency.  
In order to define a scope of frequencies “from ... to ...”, it is necessary to input any new frequency first. Then it is possible to proceed with editing of the start- and stop-frequencies.
- Mark any line in the list and press the hotkey “Edit Start F.” (s. Figure 42, position 3) to edit the start-frequency of the desired range to be excluded. The “Frequency Input Dialog” will be opened (s. 7.1.2.2), where you can input any desired frequency.
- Mark any line in the list and press the hotkey “Edit Stop F.” (s. Figure 42, position 4) to edit the stop-frequency of the desired range to be excluded. The “Frequency Input Dialog” will be opened (s. 7.1.2.2), where you can input any desired frequency.

#### **Note**

Start- and stop-frequencies must be in the same frequency band (s. Table 1 in chapter 4), as the AU cannot switch from one band to another while running the fast scan algorithms.

- By pressing the hotkey “Delete Freq.” (s. Figure 42, position 2) , the marked line will be deleted immediately, regardless whether it is a single frequency or a whole frequency range.  
Leaving the dialog by pressing “OK”, the deleted frequency (or range) will not be excluded from the scanning procedure anymore.



### 7.2.5 SAR Scan

The main purpose of the “SAR scan” is finding COSPAS-SARSAT beacons, which usually transmit a signal on one of the 406-MHz-frequencies and additionally a continuous signal on other emergency frequency (mostly 121.500 MHz).

A COSPAS-SARSAT signal is a strong emergency signal (approx. 5W), but its disadvantage is, that it is sent in the form of once-per-minute short pulses. They can be used to determine an activated emergency beacon over major distances. But since the direction of a pulsed signal, received from the great distance, might be influenced by reflections, noise, and distortions, it is still a rough ascertainment of the target.

The signals on other emergency frequencies are generally sent out with less power (approx. 100 mW) than the COSPAS-SARSAT pulses, but they are continuous, which allows better bearing performance compared to pulses. The bearing result becomes more precise the closer the direction finder antenna comes to the target.

The “SAR scan” procedure is organized in a way that facilitates the bearing of a COSPAS-SARSAT frequency and using breaks between the COSPAS-SARSAT pulses to observe other emergency frequencies. After a valid COSPAS-SARSAT signal was detected, it is possible either to change to the normal bearing mode on this frequency or stay in the scan mode in order to receive the continuous emergency signal on another emergency frequency after coming closer to the target.

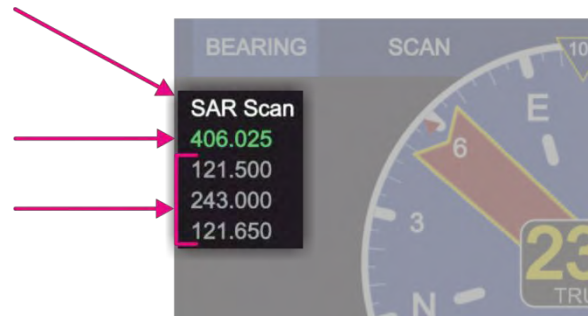
The surveillance of up to five different frequencies (within the specified frequency bands) is possible:

- The main frequency is always a COSPAS-SARSAT frequency.  
It is not possible to set other frequencies as the main frequency.  
For the case that the exact COSPAS-SARSAT frequency of the emergency beacon is not known, there is a possibility to set “All CP/SS” in place of the main frequency, which will then trigger the COSPAS-SARSAT scan as the first step of this scan algorithm. After the first COSPAS-SARSAT impulse is detected, the exact COSPAS-SARSAT frequency will be identified automatically and used for the further bearing in this scan mode.
- Two next frequencies of this algorithm are always set by default and are not changeable:
  - 1) 121.500 MHz
  - 2) 243.000 MHz
- The two remaining frequencies are free selectable.

Designation of the currently active scan mode

Main bearing frequency (currently active)

Scan frequencies



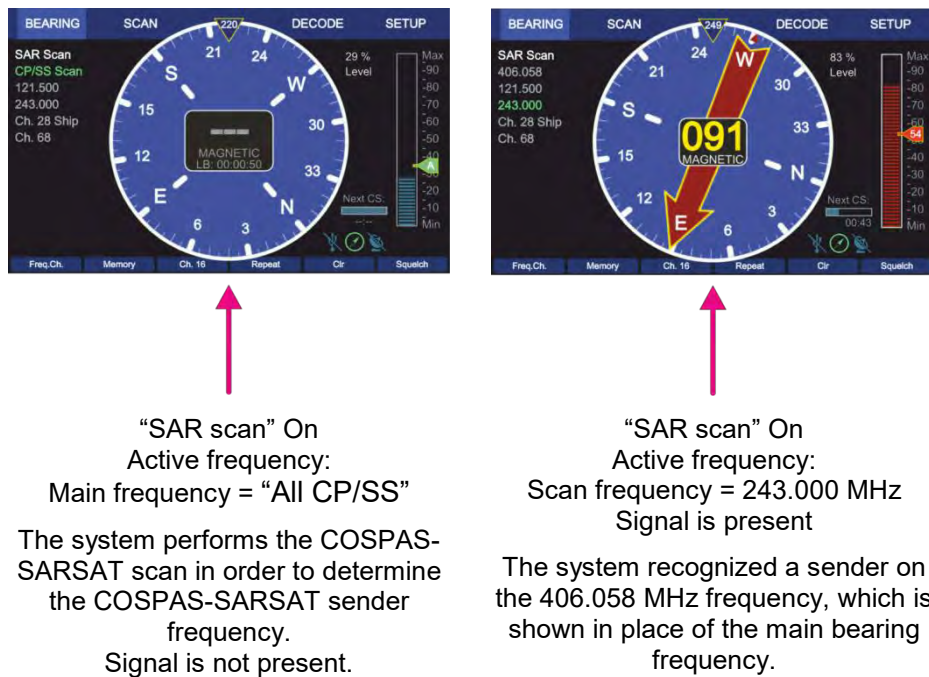
**Figure 43. SAR scan. Indication of frequencies.**

If the SAR scan function is activated, the DF system switches alternating from searching of the COSPAS-SARSAT pulse (main bearing frequency) to scanning of the other emergency frequencies using the breaks between the pulses (s. 7.2.5.1).

The currently monitored frequency is displayed highlighted in green, so you can see which frequency is active at a given moment (s. Figure 43).

If a signal is received during the scan procedure, the bearing value is indicated on the “Bearing” page.

- In order to interrupt the current reception, press the “ESC” button. The system will continue with the next scan frequency.



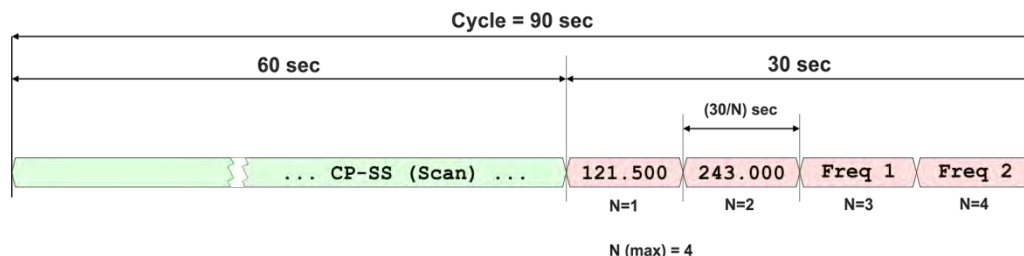
**Figure 44. “SAR scan” mode. Example views of the “Bearing” page**

- If at some point of scanning procedure the signal on the desired frequency is received, and monitoring of other frequencies is not desired anymore, press the “OK” button. The frequency, that receives a valid signal at the moment of pressing the “OK” button, will be adopted as the main frequency, and the system will change to a normal bearing mode.

#### 7.2.5.1 Timing of the SAR Scan Operation

The SAR scan procedure has slightly different timing in the cases of the unknown COSPAS-SARSAT frequency and the already determined COSPAS-SARSAT frequency after the first reception of the valid pulse.

In the case that COSPAS-SARSAT frequency is not known and the setting “All CP/SS” is set instead of an exact frequency, the system performs the COSPAS-SARSAT scan (s. 7.2.1) first. The duration of this step is always 60 seconds, if the pulse is not detected. After elapsing of 60 seconds the system proceeds with the next frequencies.



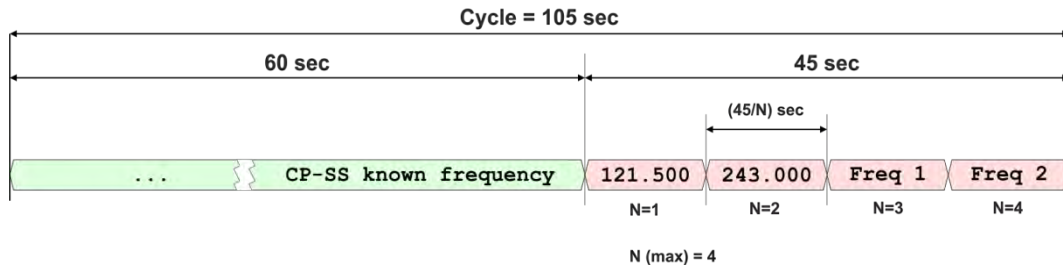
**Figure 45. Example: Timing SAR scan, if no frequency is detected.**

If during the 60 seconds-cycle a COSPAS-SARSAT pulse is detected, the scan procedure shows the bearing of the main frequency for approx. 3 seconds and then continues with the scan frequencies. So if the pulse is detected at the beginning of the 60 seconds cycle, this cycle shortens down to 3 seconds.

The scanning time for each scan frequency depends on the number of the selected frequencies ( $30 \text{ sec} / N$ ,  $N$  = number of frequencies).

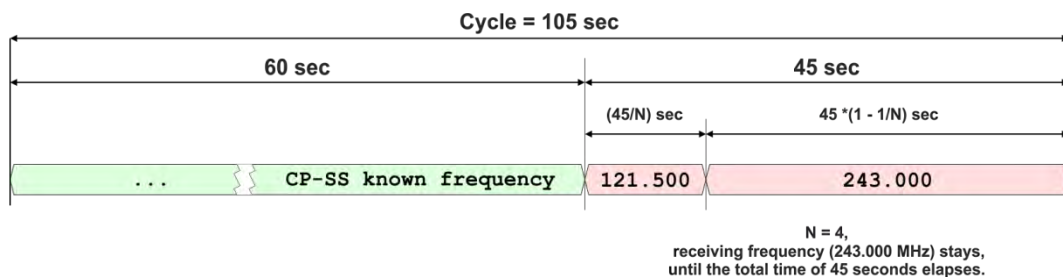
If the COSPAS-SARSAT pulse is not detected, the total time for scanning of the scan frequencies is 30 seconds, which enables the faster run-through of them.

This total time changes to 45 seconds after the first reception of the COSPAS-SARSAT pulse, which enables the efficient scanning of the selected frequencies without missing the next COSPAS-SARSAT pulses.



**Figure 46. Example: Timing SAR scan, if only COSPAS-SARSAT frequency is detected.**

If any of the selected emergency frequencies is detected, the scan algorithm will stay on this frequency (releasing the alarm, if this setting is activated under scan settings) until the 45-seconds-time elapses.



**Figure 47. Example: Timing SAR scan, if no CP-SS pulse but a signal on an emergency frequency is detected.**

The algorithm returns back to the scanning of the main COSPAS-SARSAT frequency.

### 7.2.5.2 SAR Scan Settings

- To start the “SAR scan” mode select the corresponding line on the “Scan” page and press “OK” or the hotkey “Start Scan” (s. Figure 48, position 1)



Figure 48. Selecting SAR scan

- Pressing the hotkey “Stop Scan” (s. Figure 48, position 2) will terminate the current scan mode and change to the bearing of the frequency, that was set before the scan mode has been activated.
- You can stop the scan mode by pressing the “HOME” while on the “Bearing” page with activated scan. After you confirm the dialog (s. Figure 49), this mode will be terminated.

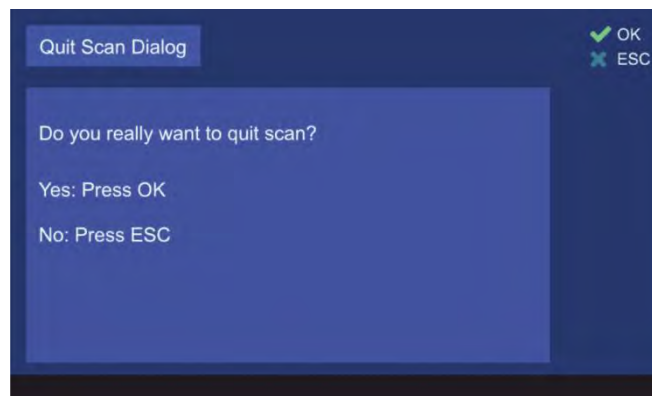
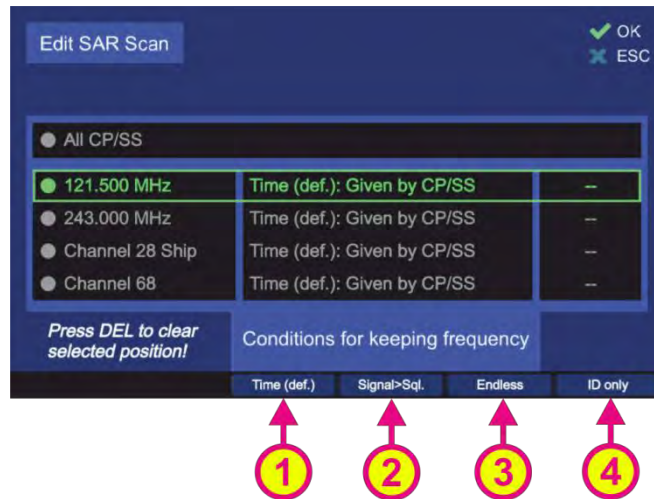


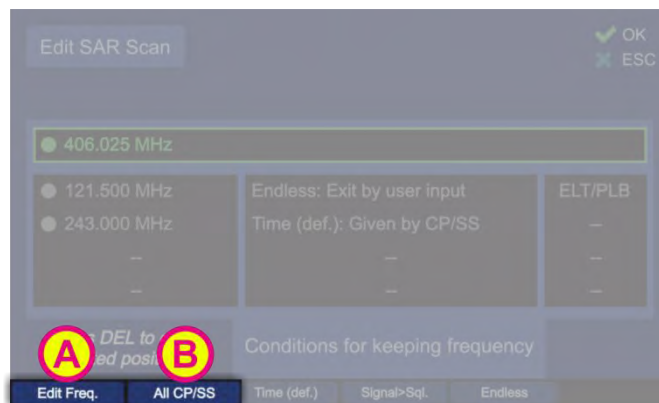
Figure 49. Confirming of leaving the scan mode

- Pressing the hotkey “Go to Result” (s. Figure 48, position 3) during the scan mode is currently running, will terminate the scan mode, adopt the frequency which was found in this scan last time and change to the “Bearing” page. Pressing the hotkey “Go to Result” if the scan mode is not activated, will lead to the “Bearing” page adopting the last result as the bearing frequency. This hotkey appears only, if there is a result for this scan.
- Pressing the hotkey “Edit Scan” (s. Figure 48, position 4) will open the dialog for changing the SAR scan settings (s. Figure 50)



**Figure 50. SAR scan. Edit scan settings.**

- The hotkey “Edit Freq.” is only visible if the COSPAS-SARSAT frequency (top frequency) or one of the free selectable frequencies is marked (s. Figure 51, position A). By pressing this hotkey the frequency input dialog will open.



**Figure 51. Alternating hotkeys**

- The hotkey “Edit Freq.” opens the “Frequency/Channel” input dialog and allows the modification of the currently marked frequency. This hotkey only appears for the frequencies that are configurable (the last two displayed frequencies: Channel 28 Ship and Channel 68, s. Figure 50).
- The hotkey “All CP/SS” is only visible if the COSPAS-SARSAT frequency is marked (s. Figure 51, position B). By pressing this hotkey a COSPAS-SARSAT scan will be started in order to find an active COSPAS-SARSAT frequency during SAR scan algorithm.
- Pressing the hotkey „Time (def)“ (s. Figure 50, position 1) will set the hold time (duration of staying in the scanning on this particular frequency) to the value that is given by the CP-SS setting (30/N or 45/N), s. 7.2.5.1.
- The hotkey “Signal>Sql” defines the behavior of the scan algorithm to “signal level > squelch level” (s. Figure 50, position 2). If this hotkey is pressed, the scan algorithm will stay on the active frequency until the signal level value becomes higher than the squelch value.
- The hotkey “Endless” (s. Figure 50, position 3) defines the behavior of the scan algorithm when an active frequency has been found.



If this hotkey is pressed, the scan algorithm will stay on an active frequency as long as the user terminates the scan mode or skips the actual frequency.

- Pressing the hotkey “ID only” (s. Figure 50, position 4) activates or deactivates the feature “ID Only” (s. 7.2.2.3):

3. **“ELT/PLB”:**

Alarm is only triggered if an ELT/PLB signature has been detected. Else the bearing is suppressed.

4. **“ – “:**

Alarm is never triggered no matter if there is any modulation on it or not.

The hotkey “ID only” is only visible for the following frequencies:

- 121.5 MHz.
- 243 MHz.

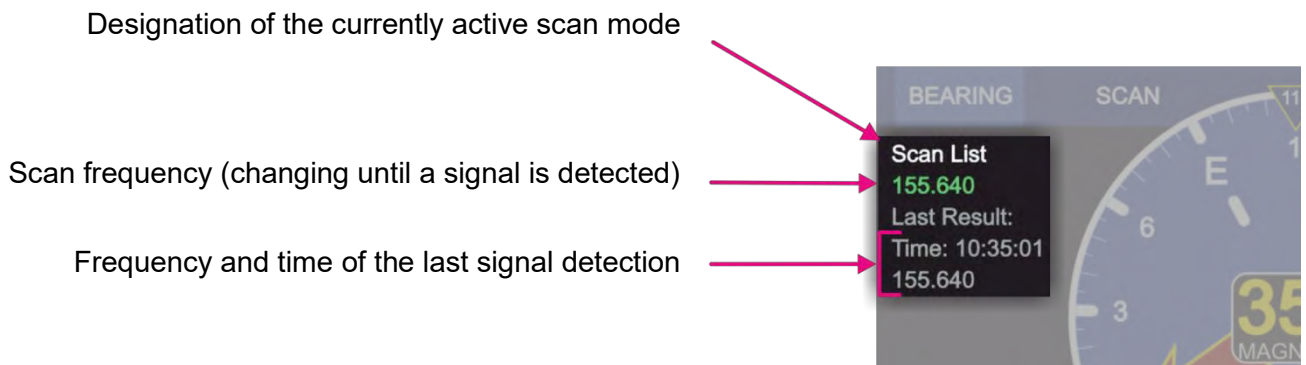
### 7.2.6 Scan List

The function “Scan List” provides a comfortable scanning feature of different frequency bands in one scan procedure.

The scan algorithm in the full scan list mode compares “Search List” (accessible over “Edit Scan”) and “Exclude List” (s. 7.2.4.3) and out of this comparison it generates an internal list of frequencies which will be scanned. All results (received signals) are saved in a “Result List”.

#### Note

The “Start” and the “Stop” frequencies of one scan section to be entered (either in the search- or in the scan-list) have to lie inside one frequency band (s. Table 1 in chapter 4).



**Figure 52. Scan List. Indication of frequencies.**

#### Note

When restarting the “Scan List” mode, there is a possibility to scan the full-range-procedure that is given by comparison of search and exclude lists, or to scan only the result list.

The scan algorithm in the “Result List” mode starts the scan procedure, which runs only around the searched frequencies (last results). If the gap between the two frequencies is too large, the scan procedure will slightly slow down.

The actual scan operation works the same way as the scanning operation of “Marine Scan” (s. 7.2.4.1).

- To start the “Scan List” mode select the corresponding line on the “Scan” page and press “OK” or the hotkey “Start Scan” (s. Figure 53, position 1).



Figure 53. "Scan List" is activated.

- Pressing the hotkey “Stop Scan” (s. Figure 53, position 2) will terminate the scan mode and change to the bearing of the frequency, that was set before the scan mode has been activated.
- The scanning process can be ceased also by pressing the button “HOME” while on “Bearing” page. Then the direction finder changes to the bearing of the frequency, which was set before the scan mode was started.
- The hotkey “Excl. On/Off” is only visible if “Marine scan” or “Scan List” is marked (s. Figure 53, position 3).  
By pressing this hotkey the currently marked scan mode will proceed the “Exclude List” during the scan.  
If this setting was already activated for the currently marked scan mode, pressing this button will deselect this option and the “Exclude List” will be ignored during the scan procedure.
- “Edit Exclude” is only visible, if “Marine scan” or “Scan List” is marked (s. Figure 53, position 4).  
By pressing this hotkey, the dialog for editing the “Exclude List” will be opened (s. 7.2.4.3).
- Pressing the hotkey “Go to Result” (s. Figure 53, position 5) during the scan list mode is currently running, will interrupt the scan mode, and open the “Result List”, where you can select the next action (s. Figure 54). This hotkey appears only if there is a result for this scan.



Figure 54. Result List Settings

- Pressing the hotkey “Go to Freq.” (s. Figure 54, position 1) adopts the currently marked frequency as main bearing frequency and switches to the normal bearing mode on the “Bearing” page.
  - Pressing the hotkey “Delete Freq.” (s. Figure 54, position 2) deletes the currently marked frequency from “Result List”. The deleted frequency will not be skipped anymore, when the results are scanned after pressing “Scan Results”.
  - Pressing “Scan Results” (s. Figure 54, position 3) starts the scan list mode, which runs only around the frequencies which had a result during the last scan (frequency span around 100 kHz).
  - Pressing “Edit Search” (s. Figure 54, position 4) will open the “Search List” dialog (s. “Edit Scan” below).
  - Pressing “Edit Exclude” (s. Figure 54, position 5) will open the “Exclude List” dialog (s. 7.2.4.3).
- Pressing the hotkey “Edit Scan” (s. Figure 53, position 6) will open the dialog for changing the settings of the “Search List” (s. Figure 55)



**Figure 55. "Search List" settings**

- Pressing the hotkey “New Freq.” (s. Figure 55, position 1) generates a new line in the “Search List” and opens the “Frequency Input Dialog” in order to input a valid start frequency. By the input of a new start frequency, the stop frequency is automatically set to the same value as the start frequency.
- Pressing the hotkey “Delete Freq.” (s. Figure 55, position 2) deletes the currently marked line from the “Search List”. After an entry has been deleted and the dialog left by pressing “OK”, the deleted frequency range will be scanned in the normal manner, when you restart the scan.
- Pressing the hotkey “Edit Start F.” (s. Figure 55, position 3) opens the “Frequency Input Dialog” (s. 7.1.2.2), which allows modifying the “Start” frequency of the currently marked frequency range.
- Pressing the hotkey “Edit Stop F.” (s. Figure 55, position 4) opens the “Frequency Input Dialog” (s. 7.1.2.2) which allows modifying the Stop Frequency of the currently marked frequency range.

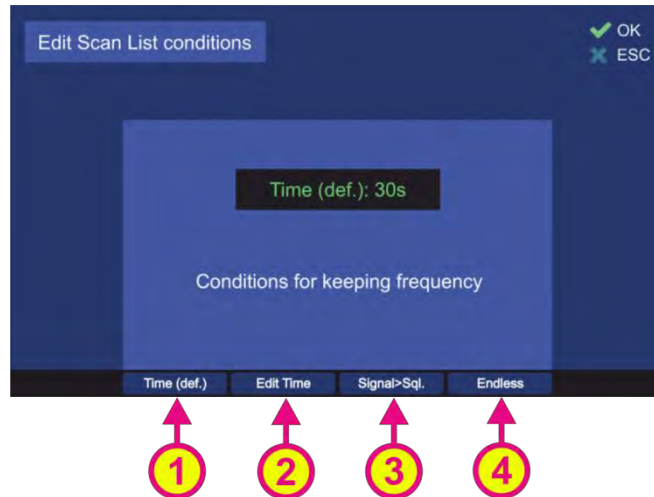
**Note**

Start- and stop-frequencies must be in the same frequency band (s. Table 1 in chapter 4), as the AU cannot switch from one band to another while running the scan algorithms.

**Note**

When choosing a COSPAS-SARSAT frequency as “Start” frequency, the AU will perform a COSPAS-SARSAT scan and scan all CP-SS frequencies. A “Stop” frequency cannot be set for this option, as always all CP-SS frequencies are scanned.

- Pressing the hotkey “Edit Cond.” (s. Figure 55, position 5) opens the “Scan List Conditions” dialog



**Figure 56. "Scan List Conditions" dialog**

- “Time (def.)” hotkey (s. Figure 56, position 1) defines the behavior of the “Scan List” algorithm if the active frequency (signal level > squelch level) has been found. If this hotkey is pressed, the default time of 30 seconds will be adopted after confirming this setting with “OK”. The scan algorithm will stay for the default time of 30 sec on an active frequency before continuing with scanning of the next frequencies.
- Pressing the hotkey “Edit Time” (s. Figure 56, position 2) will open a dialog for editing the time of staying on the actively received frequency before continuing with the scan procedure.
- Pressing the hotkey “Signal>Sql.” hotkey (s. Figure 56, position 3) defines the time of staying on the actively received frequency before continuing with the scan procedure. If this setting is confirmed, the scanning procedure will stay on the actively received frequency as long as the signal level is higher than the squelch level.
- If the hotkey “Endless” (s. Figure 56, position 4) was pressed and confirmed with “OK”, the scan algorithm will stay on the actively received frequency as long as the user terminates the scan or skips the current frequency.

### 7.3 Decode Page

The “Decode” page manages the decoded COSPAS-SARSAT data. It does not only display the decoded COSPAS-SARSAT information but also stores the messages over time and calculates the true bearing and distance to the emergency beacon if the GPS data is available in the message. Furthermore, the calculated true bearing can be exported to the “Bearing” page which is displayed as a “GPS-Arrow” in gray.

Press on “DECODE” in order to open the decode page.

When switching to “Decode” page, the active COSPAS-SARSAT frequency is determined by the following conditions:

- By switching from “Bearing” page, the COSPAS-SARSAT frequency, which was active in the “Bearing” page, will be adopted.
- If no COSPAS-SARSAT frequency was active on the “Bearing” page, the last active frequency on the “Decode” page will be used.
- If on the “Decode” page no frequency was set or used, the frequency group “406.022...028” is selected per default (s. 7.1.2.2, Selecting COSPAS-SARSAT Frequency Groups).

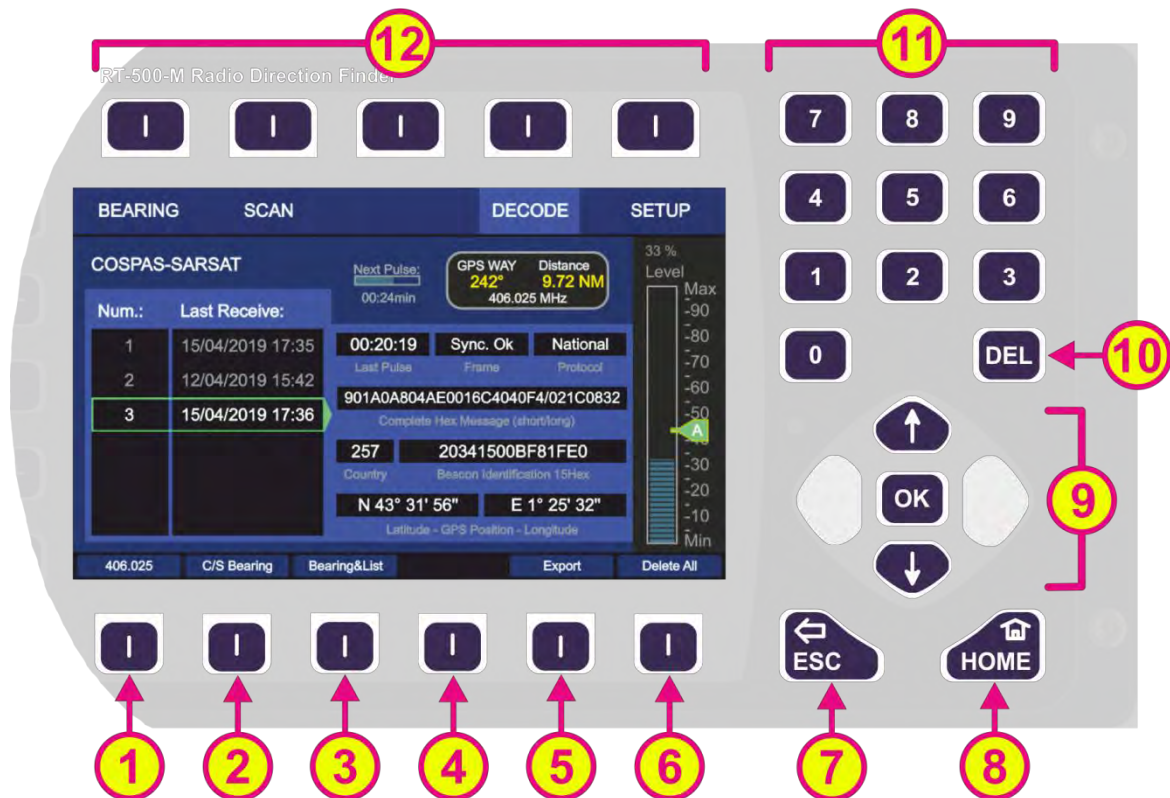


Figure 57. Decode Page. General view.








Indication on Decode Page		
Pos.	Element	Meaning / Description
①	„406.025“	Pressing this hotkey will open the “Frequency Input Dialog” with the COSPAS-SARSAT frequency groups (7.1.2.2). The hotkey label corresponds to the current operating frequency.
②	“C/S Bearing”	Pressing this hotkey will activate the view for “COSPAS-SARSAT Bearing”
③	“Bearing&List”	Pressing this hotkey will activate the view for “Bearing&List”
④	“Deselect”	Pressing this hotkey deselects the currently marked line. Deselected lines are indicated by gray text.
⑤	“Export”	Pressing this hotkey will export the selected messages to the “Bearing” page. On the “Bearing” page the GPS coordinates of these messages will be shown with “GPS arrows”.
⑥	“Delete All”	Pressing this hotkey will open a dialog for deleting all stored CP/SS messages.
⑦		If the dialog is opened, pressing this button will close the dialog without saving new values. If no dialog is opened, pressing this button will lead you back to the last activated page. The Bearing Page is the end point.
⑧		Pressing this button always leads to the “Bearing” page. Even an opened dialog will be closed. If a sub-dialog is opened, pressing this button will close it and lead to the “Bearing” page, without saving the changed values.
⑨		“Up” and “Down” arrows are used to select between the different lines from the list of received messages (move the green frame).  Using “Left” and “Right” on the selected line, switches between decoded COSPAS-SARSAT messages with the same beacon ID but different time stamp.  Pressing the “OK” button will select the currently marked line from the list of received messages.
⑩		Pressing the “DEL” button will open a dialog for deleting the currently shown COSPAS-SARSAT message of the currently marked line from the list of received messages.
⑪		Numeric keys are used to enter the numerical characters inside the dialogs. No function on the top level of the “Decode” page.
⑫	Top line	Navigation line of the screen, which allows switching between pages (BEARING, SCAN, DECODE, SETUP).

Table 10. Decode page, list of elements.

### 7.3.1 Selecting a COSPAS-SARSAT frequency

In order to receive a COSPAS-SARSAT data pulse and to decode its content, the main frequency has to be adjusted to a COSPAS-SARSAT frequency. This can be done on the “Bearing” page or directly on the “Decode” page using the hotkey „406.025“ (s. Figure 57, position 1).

### 7.3.2 COSPAS-SARSAT List View

Press the hotkey “C/S List” in order to get to the COSPAS-SARSAT list view. This view shows the list with the received COSPAS-SARSAT pulses.

When an emergency beacon is activated, it transmits a COSPAS-SARSAT pulse every 50 sec ( $\pm 5$  sec). As soon as a valid pulse is received, the hotkey “406.025” changes its label to “Confirm” and blinks in yellow (s. Figure 58). Additionally, an acoustic warning tone is emitted. Press “Confirm” in order to accept the message and to clear the alarm.

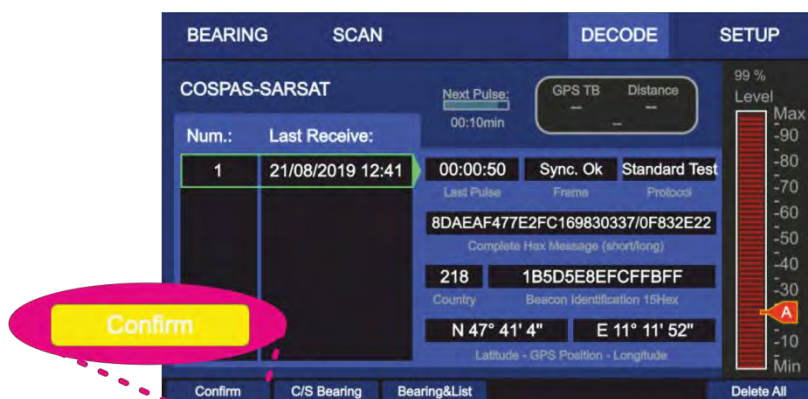


Figure 58. Confirming a new COSPAS-SARSAT message.

For each new received ID (different beacon) a new line is generated so that messages are sorted according to the beacon ID. Each line number (column “Num.:”) is related to a certain COSPAS-SARSAT beacon ID. The time entry in the line shows the receiving time of the message (s. Figure 59, “A”). The corresponding COSPAS-SARSAT message content of the selected beacon ID is displayed in the area “B” on the right side of the screen.

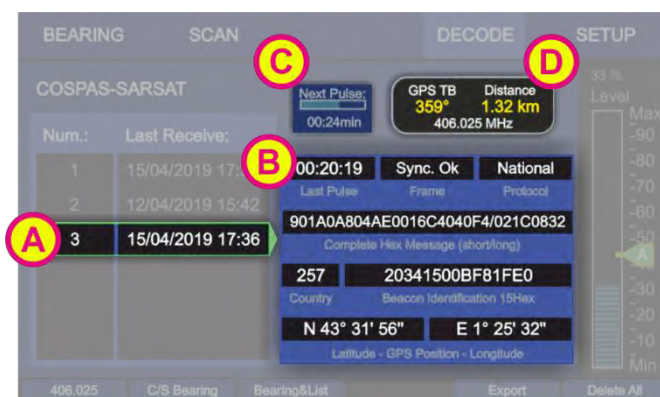


Figure 59. Decode Page. COSPAS-SARSAT List View.

Pressing the “Left” and “Right” arrow buttons of the keypad switches between the older and newer messages of the same emergency beacon.

Press “DEL” button of the keypad in order to delete a selected message. Press hotkey “Delete All” in order to delete all COSPAS-SARSAT messages. A detailed explanation of all hotkeys can be found in the next chapters.

Area C indicates the time when the next COSPAS-SARSAT pulse is expected. If after one minute no COSPAS-SARSAT pulse is received, the bar-graph-indicator is fully filled and shows the text “--:--”.

The indicator in the Area D (s. Figure 59, “D”) shows the following values:

- Direction from the current GPS position to the position of the marked COSPAS-SARSAT message (“GPS TB” = GPS True Bearing).
- Distance from the current GPS position to the position of the actually marked COSPAS-SARSAT message (the indication “km” or “NM” is adjustable in the “Setup”, s.7.4.2.4).
- Frequency:
  - By viewing an old message frequency may be other than the current frequency. In this case the frequency is displayed in gray.
  - The current frequency is displayed in white. The current frequency is also displayed in the label of the hotkey for adjusting frequency.

#### Note

GPS TB data can be shown only if compass and GPS are available.

The distance can be shown without connection of vessels compass if GPS is connected to DCU.

### 7.3.3 COSPAS-SARSAT Bearing View

This COSPAS-SARSAT bearing view allows the graphical indication of the decoded COSPAS-SARSAT information of the selected beacon ID.

Press the hotkey “C/S Bearing” (s. Figure 57, position 2) to open the “COSPAS-SARSAT Bearing” view.

#### Note

Please note that the label of the hotkey will turn to “C/S List” in order to get to the list page again.

The “C/S Bearing” page displays the following information, which corresponds to the selected beacon ID:

- The numerical bearing indication (True Bearing)
- The indication of the calculated bearing as the gray arrow (“GPS Arrow”)
- The calculated distance to the target
- The COSPAS-SARSAT frequency
- The heading of the ship indicated by the compass rose and the top triangle (here: 61°)
- Corresponding number and beacon ID and
- the time of the last received pulse

Pressing the “Left” and “Right” arrow buttons of the keypad switches between the older and newer messages of the same emergency beacon.



Figure 60. Decode Page: Bearing View.

- Change the active COSPAS-SARSAT frequency by using the hotkey “406.025” (s. Figure 60, position 1).
- Pressing the hotkey “C/S List” (s. Figure 60, position 2) will open to the “COSPAS-SARSAT List” view (s. 7.3.2).
- Pressing the hotkey “Bearing&List” (s. Figure 60, position 3) will change to the “COSPAS-SARSAT Bearing and List” view (s. 7.3.4).
- Like in the “COSPAS-SARSAT List” view, it is possible to delete all stored COSPAS-SARSAT messages by pressing the hotkey “Delete All” (s. Figure 60, position 5).

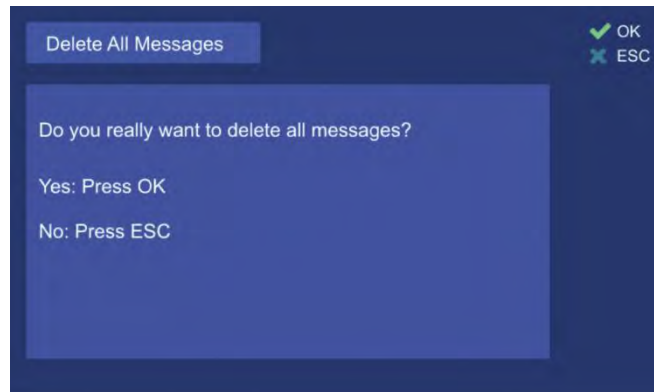


Figure 61. Dialog for confirming of deleting all CP-SS messages.

- Hotkey “Export” exports the GPS coordinates of the currently displayed COSPAS-SARSAT message to the “Bearing” page. (s. Figure 60, position 4). See also chapter 7.3.5 “Export to Bearing Page”

### 7.3.4 COSPAS-SARSAT Bearing and List

This view combines the “COSPAS-SARSAT Bearing” and “COSPAS-SARSAT List” views for the last arrived COSPAS-SARSAT messages (s. Figure 62).



Figure 62. "Decode" page. "Bearing and List" view.

- Use the hotkey “406.025” for changing the frequency (s. Figure 62, position 1).
- Pressing the hotkey “C/S Bearing” (s. Figure 62, position 2) will change to the “COSPAS-SARSAT Bearing” view (s. 7.3.3).

- Pressing the hotkey “C/S List” (s. Figure 62, position 3) will change to the “COSPAS-SARSAT List” view (s. 7.3.2).
- Hotkey “Export” exports the GPS coordinates of the currently displayed COSPAS-SARSAT message to the “Bearing” page. (s. Figure 60, position 4). See also chapter 7.3.5 “Export to Bearing Page”
- Like in the “COSPAS-SARSAT List” view, it is possible to delete all stored COSPAS-SARSAT messages by pressing the hotkey “Delete All” (s. Figure 60, position 5).

### 7.3.5 Export to Bearing Page

The calculated bearing of an emergency beacon, which is based on the decoded GPS position, can be exported to the “Bearing” page by pressing the hotkey “Export”. In this case, the RT-500-M is operating on the selected COSPAS-SARSAT frequency in the normal bearing mode. The GPS based information like:

- numerical indication of the GPS true bearing,
- indication of the GPS true bearing as the “GPS Arrow” in gray,
- the calculated distance to the emergency beacon

is displayed at the same time.



Figure 63. Indication of the GPS based bearing on the Bearing page



## 7.4 Setup Page

After the AU and power supply were connected to the DCU and the system was switched on, it is ready to work with the default settings.

All system settings, configurations etc. are made in the "Setup" page.

The screen top line of the "Setup" page contains navigation keys that include system setup menus sorted by the common concept. The settings of these menus will be explained further in this chapter.

The bearing runs in the background while changing settings on the "Setup" page. That means e. g. when bearing on 121.5 MHz and switching from "Bearing" page to the "Setup" page, an ELT signal will be detected and the alarm will be provided.

### Note

Incorrect settings may lead to considerable malfunctions of the DF system RT-500-M. Therefore, sensitive parameters concerning the bearing operation are password-protected against not authorized alterations. Any changes of settings, which require password approval, are to be made only by instructed personnel.

### 7.4.1 General

After selecting the "Setup" over the corresponding hotkey on the "Bearing" page, the following menu page opens (s. Figure 64).

The menu "General" contains uncritical settings that can be changed any time without influence on the important system parameters, therefore it is not password protected and can be used by the operator.

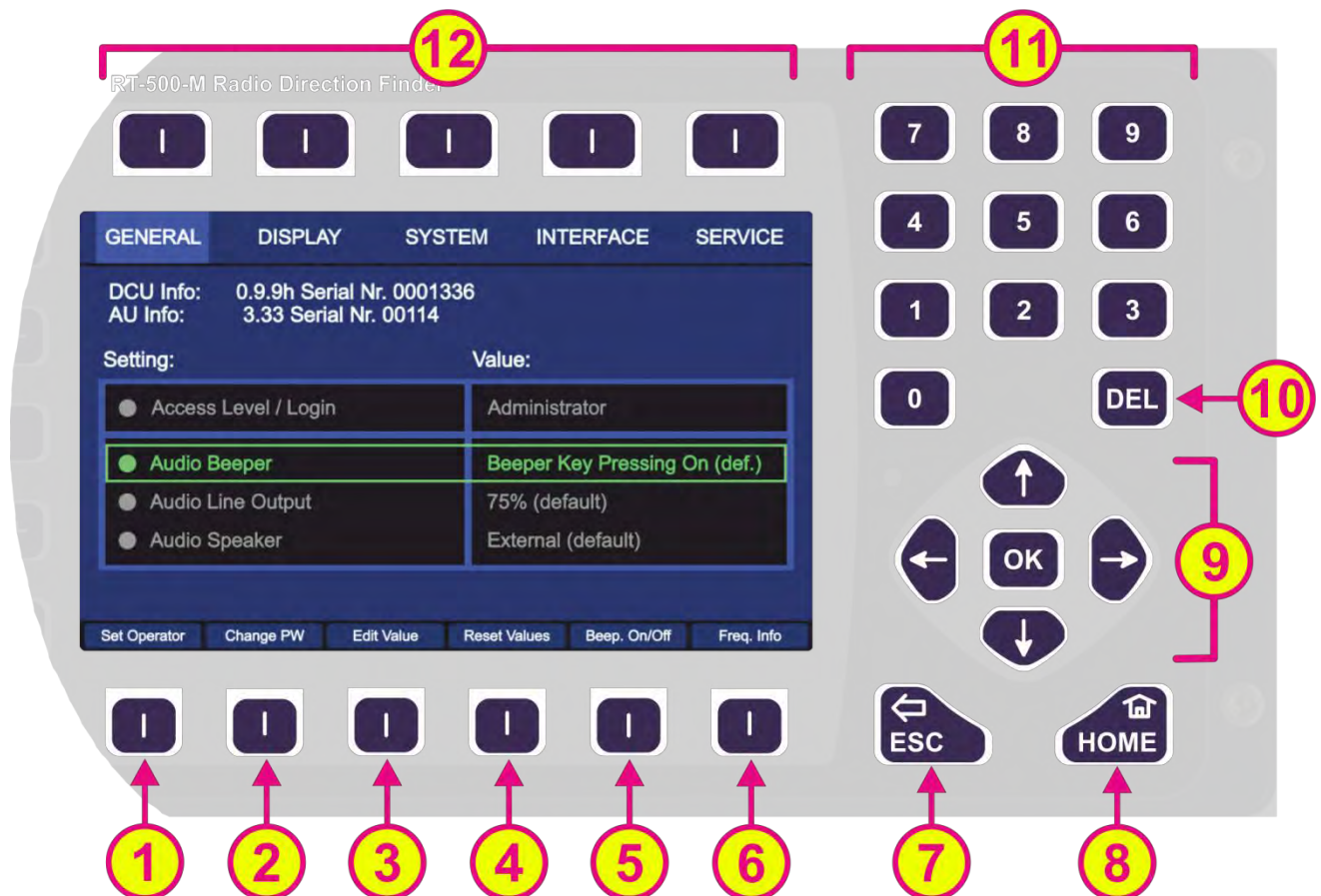


Figure 64. Setup page. General settings (administrator view)






Indication on Setup Page, General Settings		
Pos.	Element	Meaning / Description
①	„Set Operator“ / „Set Admin“	Switches between two states: <ul style="list-style-type: none"> <li>- Access level: operator</li> <li>- Access level: administrator</li> </ul>
②	“Change PW”	Pressing this hotkey will lead to the dialog for changing the password for the “Administrator” access level, where the old password has to be entered first, whereupon the new password can be defined.
③	“Edit Value”	Depending on the currently marked line, using this hotkey will open the dialog for changing the corresponding value (s. descriptions below).
④	“Reset Values”	Resets all values to the default settings. The default setting values cannot be changed by the user.
⑤	“Beep. On/Off”	Switches between two states: <ul style="list-style-type: none"> <li>- Beeper is activated by each button press</li> <li>- Beeper does not react on button presses</li> </ul>
⑥	“Freq. Info”	Opens a dialog which shows the currently available frequencies (also not available or locked frequencies will be shown) (s. 7.4.1.8).
⑦		When there is a dialog opened, pressing this button will close the dialog without adopting new values. When there is no dialog opened, pressing this button will go back to the last activated page. The Bearing Page is the end-point.
⑧		Pressing this button always leads to the Bearing Page. Even an opened dialog will be closed, without adopting the changed values.
⑨		“Up” and “Down” arrows are used to select between the general settings (move the green frame). Inside the dialogs (e.g. password or value editing) they are used to navigate between the characters of the virtual keypad. “Right and “left” arrows have a function inside the dialogs, but not on the top level of the “Setup” page. With the “OK” button the confirming of values or opening the general settings dialogs is accomplished.
⑩		Inside the general settings dialogs the “DEL” button is used to clear the whole input at once. On the top level of the “Setup” page, this button has no function.
⑪		Numeric keys are used to enter the numerical characters inside the dialogs. On the top level of the “Setup” page they have no function.
⑫	Top line	Navigation line of the screen, which allows switching between setup menus (“General”, “Display”, “System”, “Interface” and “Service”).

Table 11. Setup page, general settings. List of elements.

The “General” menu provides general information like serial numbers and software versions of DCU and AU (s. Figure 65).

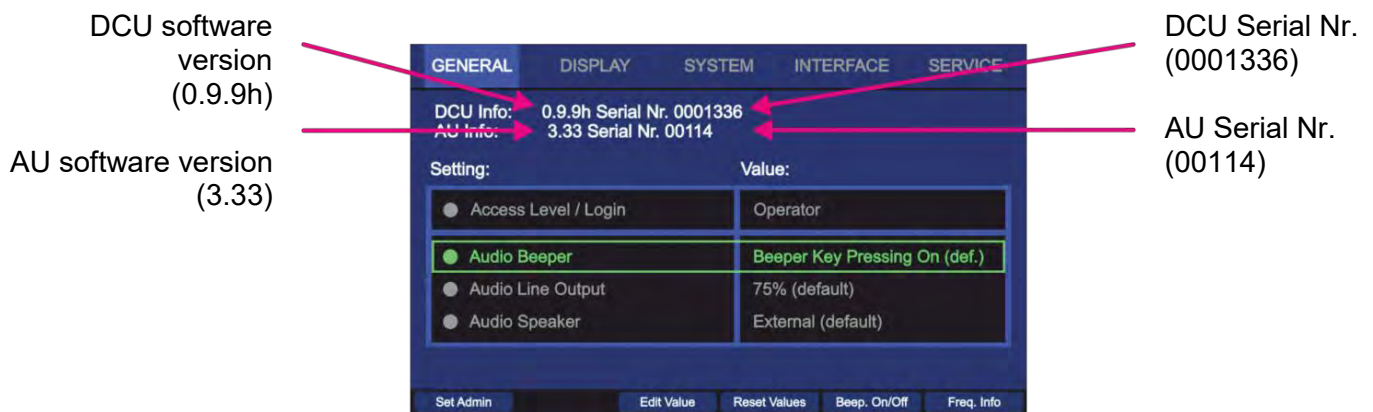
#### 7.4.1.1 Access Level / Login

Depending on the access level of the user, the scope of accessible and visible settings on the “Setup” page is different.

##### Operator:

The “Setup” page will only allow making settings in the menu “General”. This ensures that no essential system settings can be influenced or corrupted by mistake.

The access level “Operator” does not require any password as the operator has the minimum set of options for possible setup of the system.



**Figure 65. Setup page, General settings appearance for the access level “Operator”**

##### Administrator:

Has the maximum access to the possible settings (except a set of settings, which are predefined for RHOTHETA specialists for maintenance and support purposes).

After powering on of the system for the first time, the device will be started with the default access level “Administrator”. It is also possible to set the access level to “Administrator” (e.g. after the hotkey “Set Operator” was pressed) using the default password:

##### **admin**

All essential settings of the system, that have a direct influence on the bearing have to be done by authorized personnel.

##### **Note**

After the setting up of the system, it is recommended to change the password from default to a new value and set the access level to “Operator” (s. 7.4.1.7). The access level is then stored permanently on the device and remains after the restart of the device.

#### 7.4.1.2 Audio Beeper

Pressing any key of the DCU keypad produces a short beep.

This behavior is defined as the default setting for “Audio Beeper” after the first booting of the DCU. The acoustic reaction on the key pressing can be changed anytime in the setup menu “General”. Setting for the beeper can be changed by pressing “OK” or the hotkey “Edit Value”, while the line “Audio Beeper” is marked. Both actions call up the same dialog (s. 7.4.1.7, Edit value for setting “Audio Beeper”).

Pressing the hotkey “Beep On/Off” will directly switch between the “On” and “Off” settings.

### 7.4.1.3 Audio Line Output

Audio line output signal can be found at the POWER + IO connector. It can be used for connection to the audio system of the vessel.

The level of the line out signal is adjustable from 0% to 100% (s. 7.4.1.7, Edit value for setting “Audio Line Output”). Audio line exit has a determined output level and is independent of the volume adjustment.

### 7.4.1.4 Audio Speaker

The RT-500-M DCU has an internal speaker that can be used to monitor the audible signals or acoustic alarms. Alternatively, the external speaker can be used e.g. for release an alarm on the ship.

### 7.4.1.5 Set Operator / Set Admin Dialog

If the “Administrator” access mode is currently active and the hotkey “Set Operator” is pressed, it will instantly set the access level to “Operator” without asking for permission or password. The appearance of the “Setup” page will change immediately and the hotkey designation will change to “Set Administrator”

If the “Operator” access mode is active, pressing the hotkey “Set Admin” will open the “Input Password” dialog, where either the default or the own (previously changed from the default) password should be entered into the “Input Password for Administrator” field.

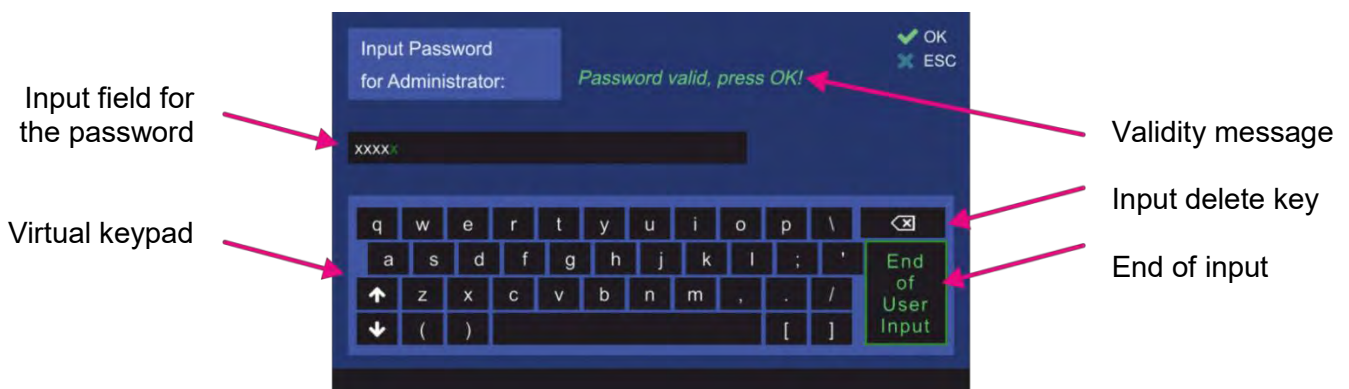


Figure 66. Accessing the administrator level

After the input of the password is complete it should be confirmed using the “End of User Input” button.

The validity message: “Password valid, press OK!” or “No valid password!” will appear.

If the password is not valid, delete the input (s. Figure 66, “Input delete key”) and proceed with the next try.

If the password is valid, by confirming with “OK” the administrator access level will be achieved.

### 7.4.1.6 Change Password Dialog

Pressing the hotkey “Change PW” (s. Figure 67) will open the dialog for changing the current (or default) administrator access level password. This hotkey is only visible in the administrator access mode.

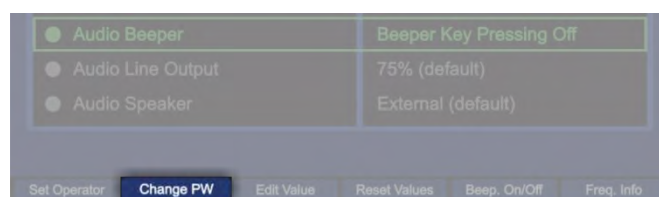


Figure 67. Changing password



Continue with the next instructions in order to change the password.



**Figure 68. Changing the administrator password**

First, the old password will be requested (“Input old Password”).

If the input is correct, the new password will be requested in the next step (“Input new Password”).

The password change dialog can be canceled by pressing "ESC" at any step, except after confirming the new password value.

If all the inputs are correct and confirmed, the message “Password successfully changed!” will appear (s. Figure 68) and the dialog can be left by pressing the “OK” button.

#### 7.4.1.7 Edit Value Dialog

Depending on the currently marked line, pressing the hotkey “Edit Value” will lead to the corresponding dialog.

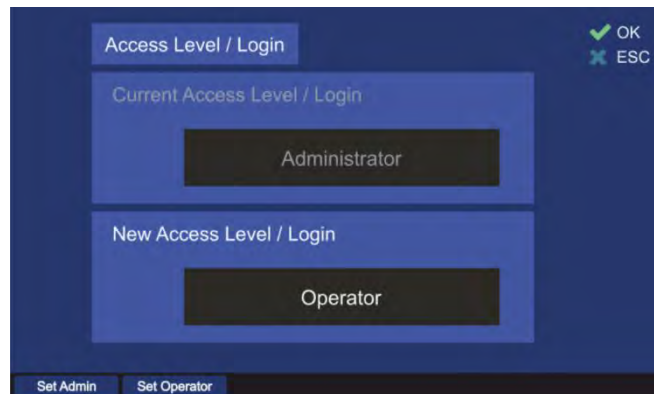
##### Edit value for setting “Access Level /Login”



**Figure 69. Edit value dialog for access level**



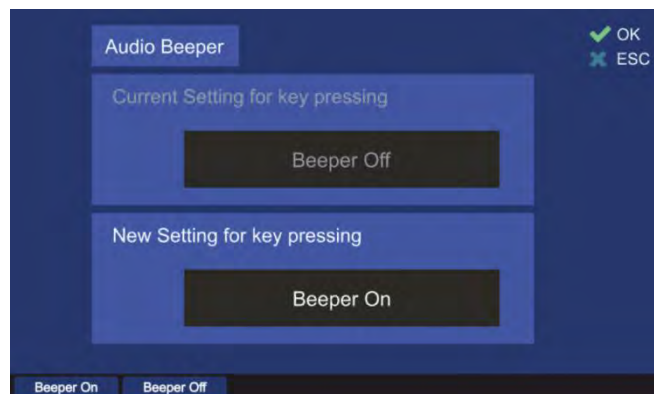
1. Pressing the hotkey “Set Admin” will lead to the “Set Admin” dialog, where the password input is required (s. 7.4.1.5).  
Pressing the hotkey “Set Operator” will change the “New Access Level /Login” field to access level “Operator” (s. Figure 70):



**Figure 70. Editing the access level to "Operator"**

2. By pressing “OK” the new access level will be accepted and pursued.  
Pressing “ESC” closes the dialog and administrator access level will be retained.

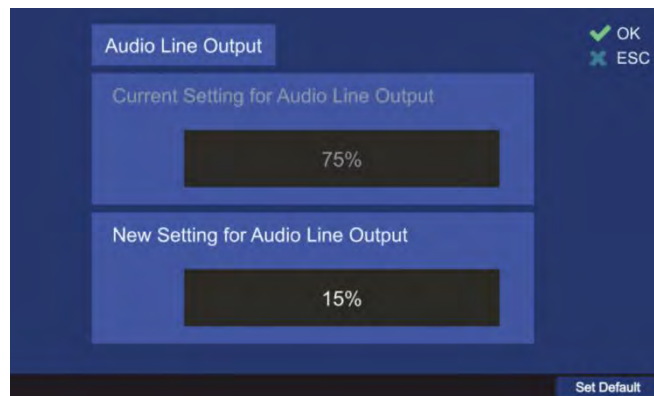
#### **Edit value for setting “Audio Beeper”**



**Figure 71. Editing the value for the audio beeper**

1. Pressing the hotkey “Beeper On” or “Beeper Off” will write the corresponding message into the “New Setting for key pressing”.
2. By confirming with “OK” the setting will be accepted and the dialog will be closed.  
For discarding the changes press “ESC” at any step and escape the dialog without saving the new value.

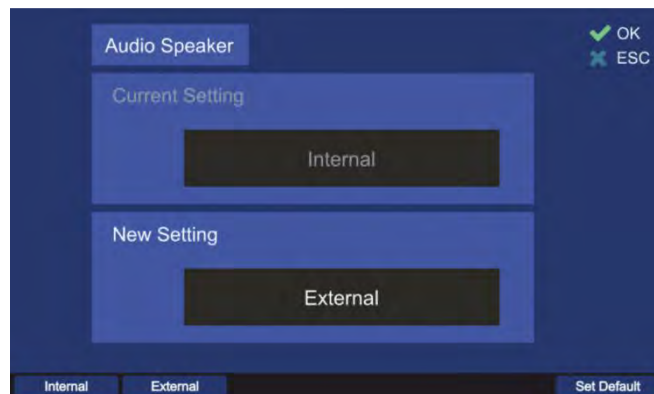
### **Edit value for setting “Audio Line Output”**



**Figure 72. Edit value of the audio line output level**

1. In the edit value dialog, the level of the audio line output in percent can be changed using the numeric keys of the DCU keypad.
2. Pressing the “Set Default” hotkey will set the line output to the default value of 75%.
3. Press “OK” to confirm the input and leave the dialog.  
For discarding the settings, press “ESC” at any step and escape the dialog without saving the new value.

### **Edit value for setting “Audio Speaker”**



**Figure 73. Edit value for the speaker**

1. Pressing the hotkey “Internal” or “External” will write the corresponding message into the “New Setting” field.
2. By confirming with “OK” the setting will be accepted and the dialog will be closed.  
For discarding the settings, press “ESC” at any step and escape the dialog without saving the new value.

#### **7.4.1.8 Frequency Information Dialog**

After pressing the hotkey “Freq. Info” (s. Figure 65) the frequency information dialog opens. The frequency information is presented in the form of a list of the available and not available frequency bands.

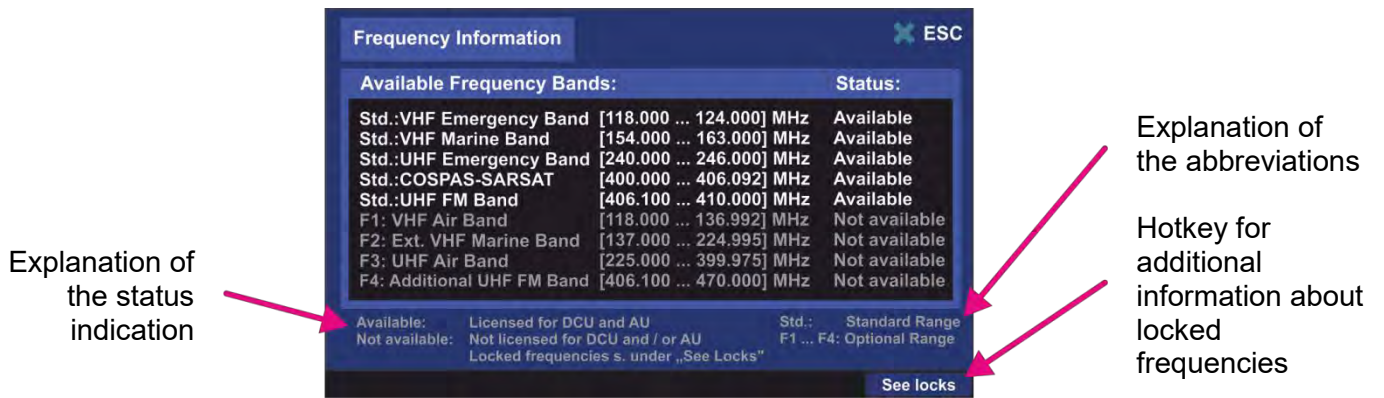


Figure 74. Frequency information dialog

- The frequency bands that are marked with „Std.“ are basic frequency ranges. These frequencies are always licensed in the standard version of RT-500-M and thus always appear as “Available”.
- The frequency ranges designated with “F1 .. F4” are optional extended ranges. In the standard version of RT-500-M, they are not licensed and thus marked as “Not available”. These optional frequency bands can be acquired separately (please contact RHOTHETA).
- However, it is possible to lock some particular frequencies as well as certain frequency bands, if these are licensed. After a frequency has been locked by the user, it will not be possible to set this frequency for the bearing operation.
- Locking of frequencies is the responsibility of the administrator.  
The operator can only view the frequencies which have been locked by the administrator.

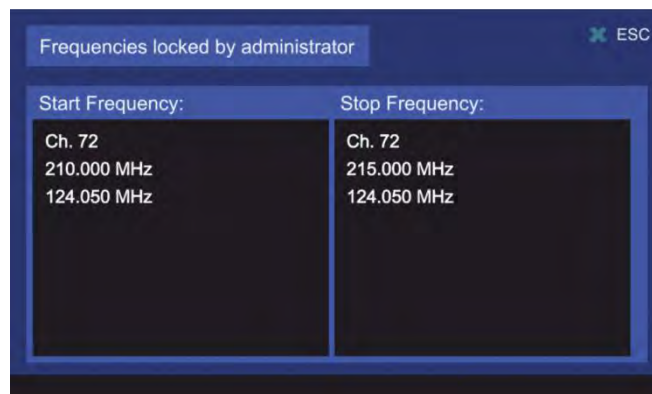


Figure 75. Locked frequencies. Operator view

Locked frequencies can be viewed in the embedded separate dialog, which is available over the hotkey “See locks” (s. Figure 74).



Figure 76. Locked frequencies. Administrator view

### **Lock / Unlock Frequencies Procedure**

Locking or unlocking of frequencies is only available over the administrator access level.  
To mark any frequency as locked/unlocked following steps are required:

- 1) Press the “See locks” hotkey in the “Freq. Info” dialog. The window, which is shown in Figure 76 appears.
- 2) To lock a single frequency, press the hotkey “Add Freq.” The “Frequency input” dialog appears (for further information s. 7.1.2.2), where a frequency, channel number or a Cospas-Sarsat frequency can be entered. After confirming with “OK” a single frequency is added. It appears then in the list of locked frequencies as “Start Frequency” as well as “Stop Frequency”.
- 3) To lock a certain frequency band proceed with step 2), adding the start frequency first. Then by pressing “Edit Stop” hotkey the last frequency of the to-be -locked band can be entered. In the same way, the start frequency can be changed using the “Edit Start” hotkey.
- 4) Unlocking (deleting) of a frequency or a frequency band is accomplished with pressing the hotkey “Delete Freq”.

#### **Note**

Pressing this hotkey will delete the marked frequency immediately without asking for confirmation!

- 5) To unlock the whole list of frequencies, use the hotkey “Delete All”.
  - a. The difference to deleting the single frequency or frequency band is that for leaving the dialog the action has to be confirmed with “OK”.

#### **Note**

If after deleting all locked frequencies the dialog will be left by pressing “ESC”, the dialog will be closed without saving any changes. That means, the list will not be deleted and is accessible again after pressing the hotkey “See locks”.

### **7.4.2 Display**

On the “Setup” page, the “Display” menu can be selected via the administrator access level only. The “Display” page enables modifying of settings that affect the graphical representation of the application.

After pressing the “Display” navigation key, following menu page opens (s. Figure 77).

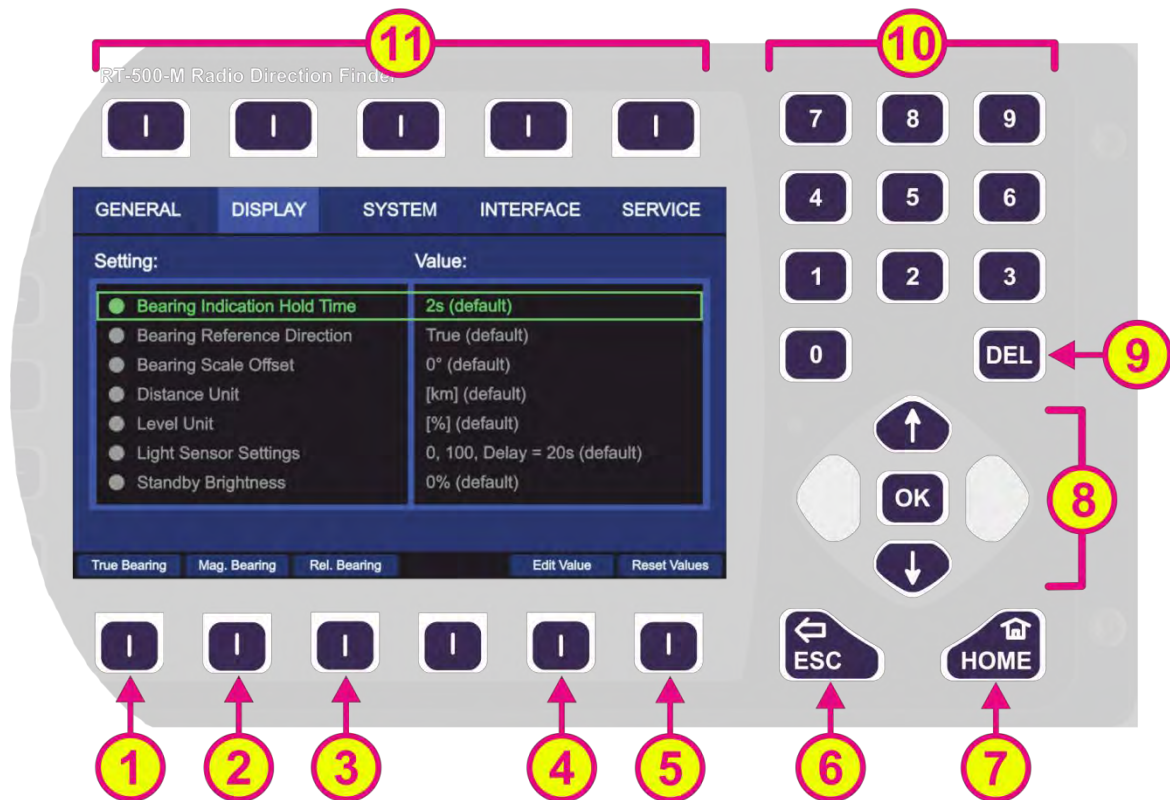


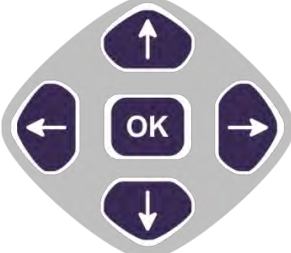




Figure 77. Setup page. Display settings

## Indication on Setup Page, Display Settings

Pos.	Element	Meaning / Description	Page
1	"True Bearing"	Sets the bearing reference direction to "TRUE" without opening the corresponding dialog (s. Table 5. Bearing reference directions").	
2	"Mag. Bearing"	Sets the bearing reference direction to "MAGNETIC" without opening the corresponding dialog (s. Table 5. Bearing reference directions").	
3	"Rel. Bearing"	Sets the bearing reference direction to "RELATIVE" without opening the corresponding dialog (s. Table 5. Bearing reference directions").	
4	"Edit Value"	Depending on currently marked line, using this hotkey will open the dialog for changing the corresponding value (s. descriptions below)	
5	"Reset Values"	Resets all values to the default settings. The default setting values cannot be changed by the user.	
6		When there is a dialog opened, pressing this button will close the dialog without adopting new values. When there is no dialog opened, pressing this button will go back to the last activated page. The "Bearing" page is the end-point.	
7		Pressing this button always leads to the Bearing Page. Even an opened dialog will be closed, without adopting the changed values.	



8		<p>“Up” and “Down” arrows are used to move between the display settings.</p> <p>“Right and “left” arrows have no function inside the display settings” page.</p> <p>With the “OK” button confirming of values or opening the display settings dialogs is accomplished.</p>	
9		<p>Inside the display settings dialogs, the “DEL” button is used to clear the whole input at once. On the top level of this page, this button has no function.</p>	
10		<p>Numeric keys are used to enter the numerical characters inside the dialogs. On the top level of the page, they have no function.</p>	
11	Top line	<p>Navigation line of the screen, which allows switching between setup menus (“General”, “Display”, “System”, “Interface” and “Service”).</p>	

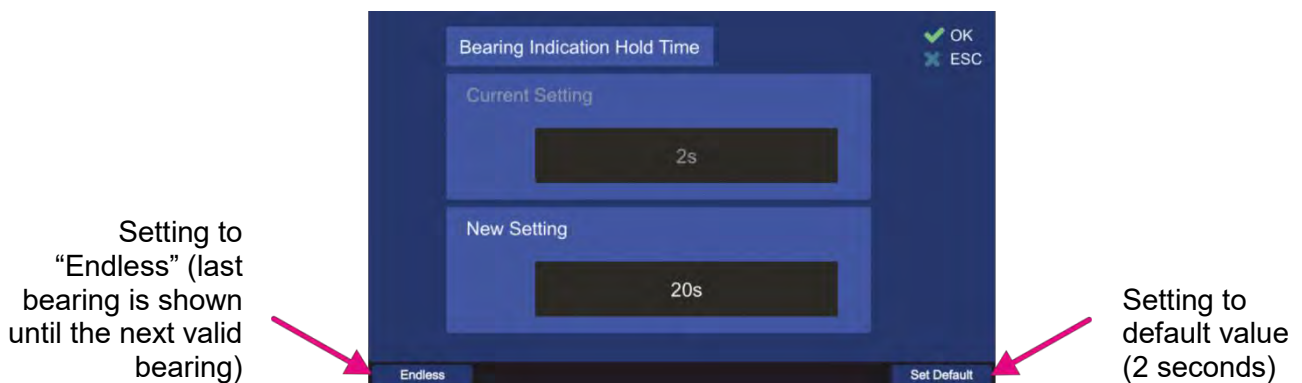
**Table 12. Setup page, display settings. List of elements**

#### 7.4.2.1 Bearing Indication Hold Time

The “bearing indication hold time” defines how long the bearing value is indicated after the signal fell under the squelch level.

If there is no more valid bearing information available, the last bearing data (bearing arrow, life values and digital bearing display) are displayed on the “Bearing” page for a defined period of time. This time is set to 2 seconds by default and configurable via this setting.

By pressing the “OK button or the hotkey “Edit Value”, the following dialog is opened.



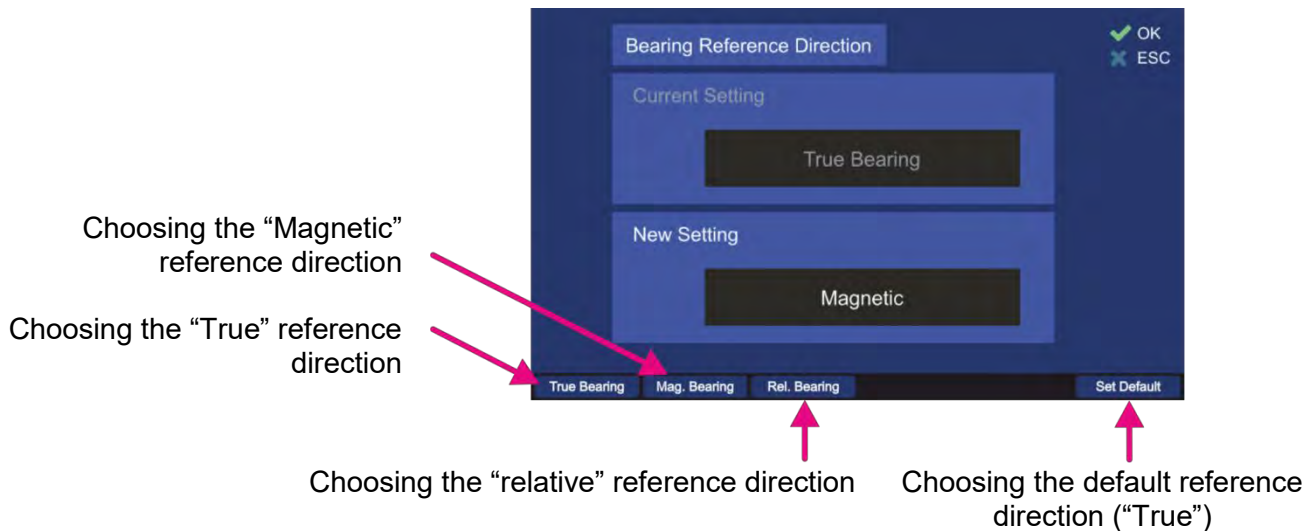
**Figure 78. Editing the bearing indication hold time**

- The new value for the bearing hold time can be entered in the input field “New Setting”, using the numeric keys of the keypad.
- Use the hotkey “Endless” to set the bearing hold time to an “endless” value, which means that (after the signal was interrupted) the last valid bearing information will be shown as long as the new valid bearing needs to arrive.
- To set the bearing hold time to the default value (2 s), press the hotkey “Set Default”.
- For the final confirmation, press “OK” or use the “ESC” button to leave the dialog without adopting the new value.

### 7.4.2.2 Bearing Reference Direction

The bearing reference direction is significant for the bearing indication. The direction of the bearing arrow in the 360° display (and compass rose indication) is always referred to a defined point in space. This reference point can be the **magnetic** north position, **true** north position and **relative** (reference is the direction to the vessels bow). For further explanation refer to chapter 7.1.2.

Pressing “OK” or “Edit Value” while the line “Bearing Reference Direction” is marked opens the corresponding dialog.



**Figure 79. Bearing reference direction dialog**

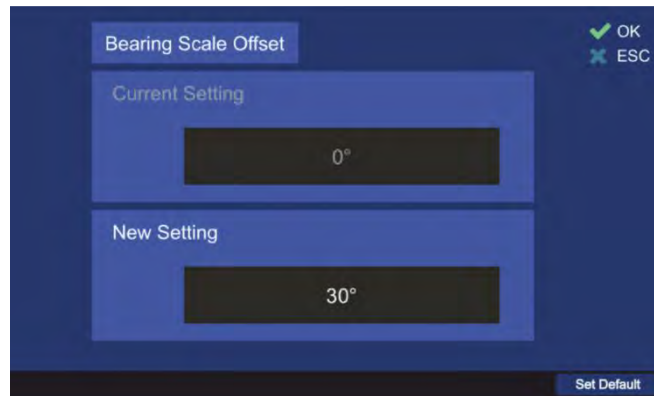
- Press the hotkey “True Bearing” to set the bearing reference direction relative to true (geographic) north (only if compass data is available). If no compass data is available, the bearing page will not adopt the “True” setting. The relative bearing and “No Compass” warning will be shown.
- Press the hotkey “Mag. Bearing” to set the bearing reference direction relative to magnetic north (only if compass data is available). If no compass data is available, the bearing page will not adopt the “Magnetic” setting. The relative bearing and “No Compass” warning will be shown.
- Press the hotkey “Rel. Bearing” to set the bearing reference direction relative to the heading of the vessel.
- Press “Set Default” to use the default value (true north direction, only if compass data is available).
- To save the changed value, press “OK”.
- Pressing the “ESC” button will leave the dialog without adopting the changed value.

### 7.4.2.3 Bearing Scale Offset

In this menu an offset for the bearing rose can be set. This is useful for e.g. better visual comprehension of the bearing direction indication. It can be used, for instance, if the window of the vessel’s control cabin shows to another direction than the bow of the ship and it is desired to take this direction as the relative direction.

After setting the bearing scale offset to a certain value that differs from 0°, the bearing rose will turn according to this value.

To set the bearing scale offset, press “OK” or “Edit Value” while the line “Bearing Scale Offset” is marked. The corresponding dialog will open.



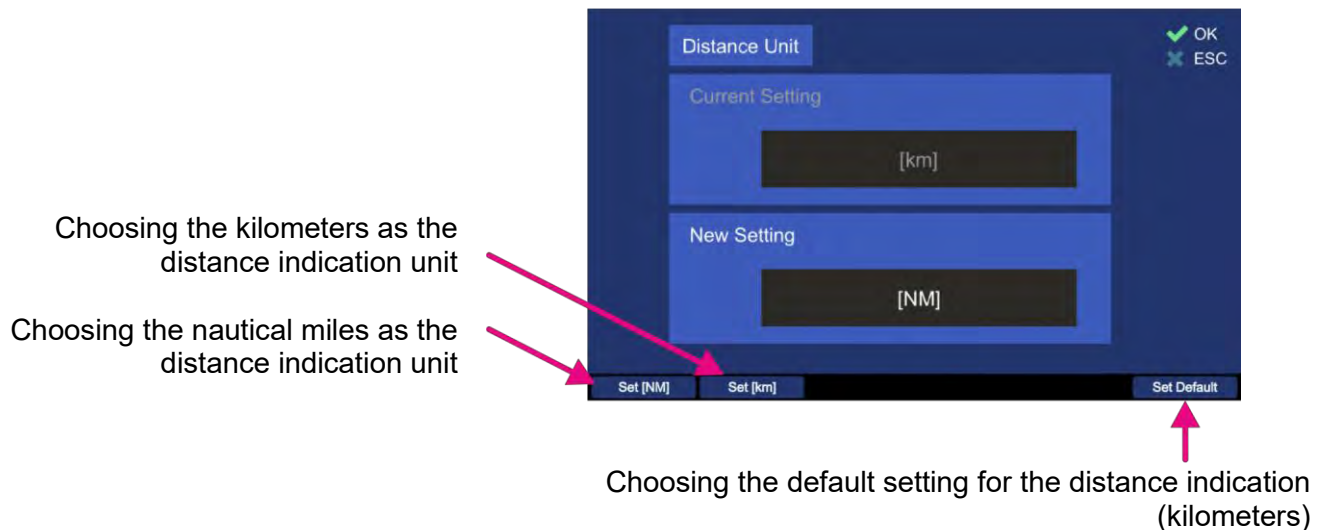
**Figure 80. Bearing scale offset editing dialog**

- Type any value in the “New Setting” input field by using the numeric keys of the keypad to set the value of the scale offset.
- Press the hotkey “Set Default” to set the default value for the bearing scale offset (0°).
- Confirm the changed value with “OK” or press “ESC” to leave the dialog without changing the previous value.

#### 7.4.2.4 Distance Unit

The indicating of distances can be either in kilometers [km] or in nautical miles [NM]. The default value is “[km]”.

To change the indication of the distance unit, press either the “OK” or “Edit value” while the setting is marked by the green frame.



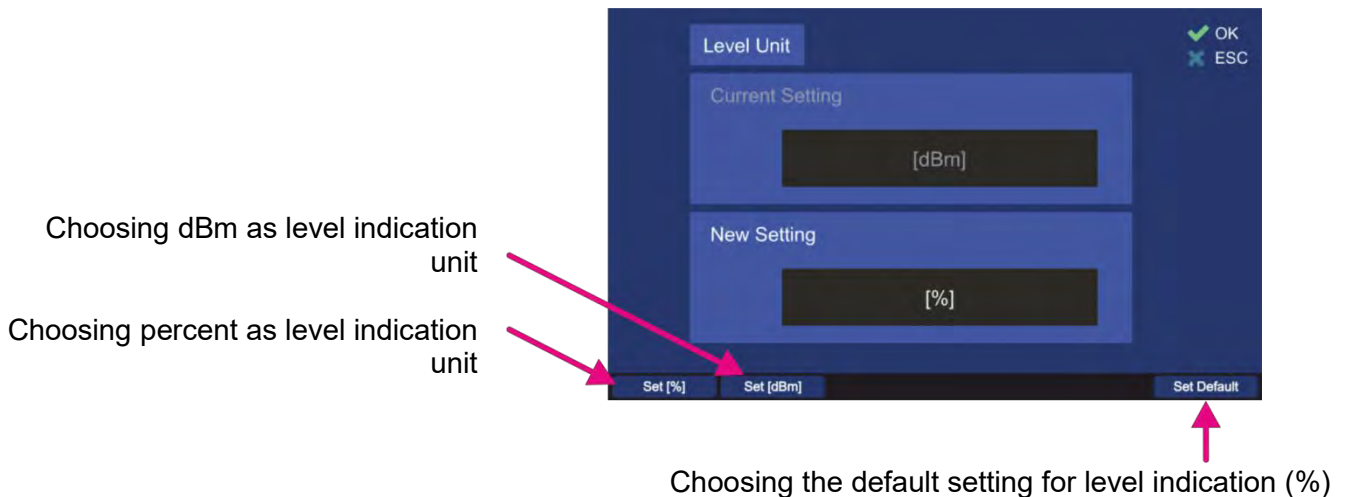
**Figure 81. Changing the distance unit**

- Press the hotkey “Set [NM]” to set the distance unit to “[NM]” (Nautical Miles). Each distance indication in the application will be indicated in nautical miles.
- Pressing the hotkey “Set [km]” will set the distance unit to “[km]” (kilometers). Each distance indication in the application will be indicated in kilometers.
- Press the hotkey “Set Default” to set the distance indication to the default value (kilometers).
- Confirm the changed value with “OK” or press “ESC” to leave the dialog without changing the previous setting.

#### 7.4.2.5 Level Unit

Indicating of levels (like signal level, or squelch level) can be either in “[%]” or in “[dB]”.

To change the currently chosen unit for the levels indication press either the button “OK” or “Edit Value”, during the setting “Level Unit” is marked.



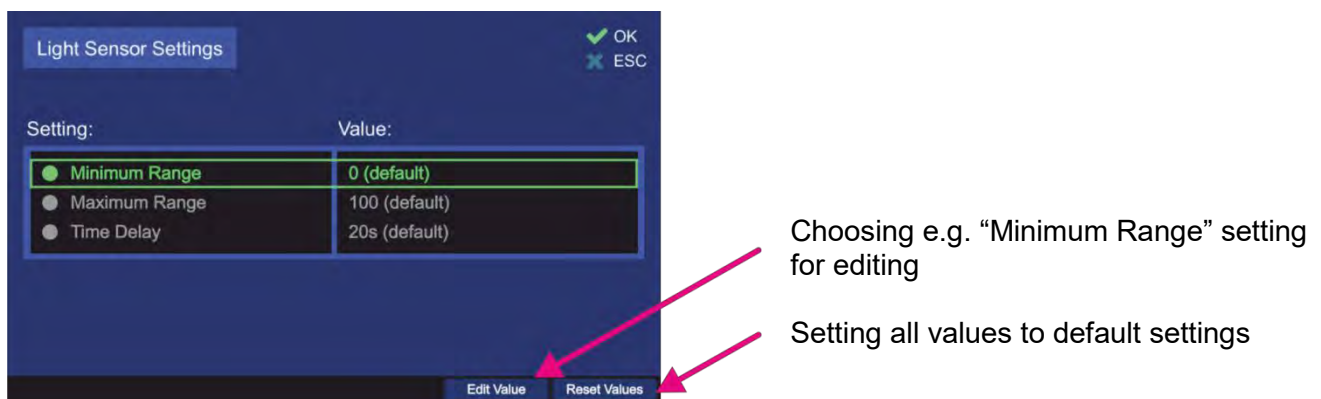
**Figure 82. Changing the level unit**

- Press the hotkey “Set [%]” to set the level unit to “[%]” (percent). Each level indication in the DCU application will be indicated in percent.
- Pressing the hotkey “Set [dBm]” will set the level unit to “[dBm]”. Each level indication in the application will be indicated in dBm.
- Press the hotkey “Set Default” to set the distance indication to the default value (%).
- Confirm the changed value with “OK” or press “ESC” to leave the dialog without changing the previous setting.

#### 7.4.2.6 Light Sensor Settings

The light sensor is used in the DCU to adjust the brightness of the display, legends and LEDs automatically according to the ambient light level.

In this menu point, which contains three settings, the characteristics of the light sensor can be defined. After pressing “OK” or “Edit Value” while the menu point “Light Sensor Settings” is marked, the following dialog will open.



**Figure 83. Light sensor settings**

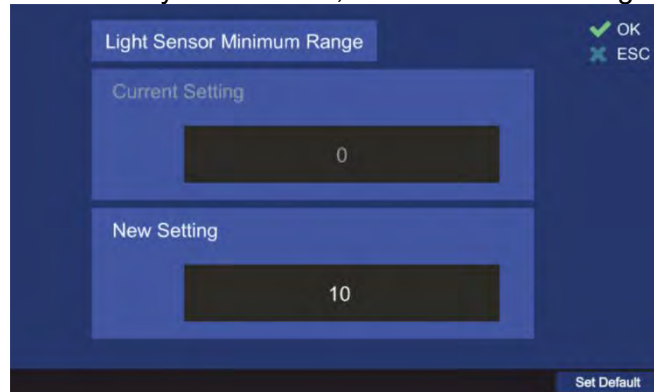
With the minimum / maximum range settings one can influence the spacing of changing the brightness of display, legends or LEDs.

- Other than with other dialogs of the “Display” menu, editing of the values is only available over the “Edit Value” hotkey (pressing “OK” is valued as accepting of the present values and will lead out of the dialog).
- Leaving the top level dialog (s. Figure 83) always press “OK” for the second time (after confirming the actual setting), otherwise, the changed settings will not be adopted.

**Minimum Range**

The minimal value of the light sensor is “0” (default value).

To change this value, press the hotkey “Edit Value”, while “Minimum Range” is marked.

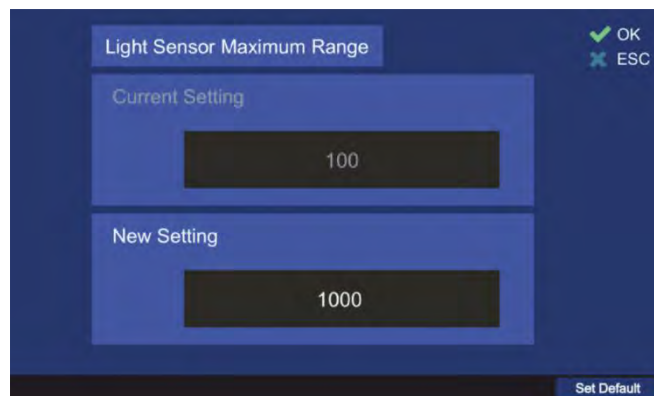


**Figure 84. Changing the minimum range value of the light sensor**

- Type the new value for the minimum range of the light sensor in the “New Setting” input field, using the numeric buttons of the DCU keypad.
- Use the “Set Default” hotkey to reset the value to the default setting.
- Confirm the changed value with “OK” or press “ESC” to leave the dialog without changing the previous setting.

**Maximum Range**

The maximal value of the light sensor is “1000”.



**Figure 85. Changing the maximum range value of the light sensor**

- Type the new value for the maximum range of the light sensor in the “New Setting” input field, using the numeric buttons of the DCU keypad.
- Use the “Set Default” hotkey to reset the value to the default setting.
- Confirm the changed value with “OK” or press “ESC” to leave the dialog without changing the previous setting.

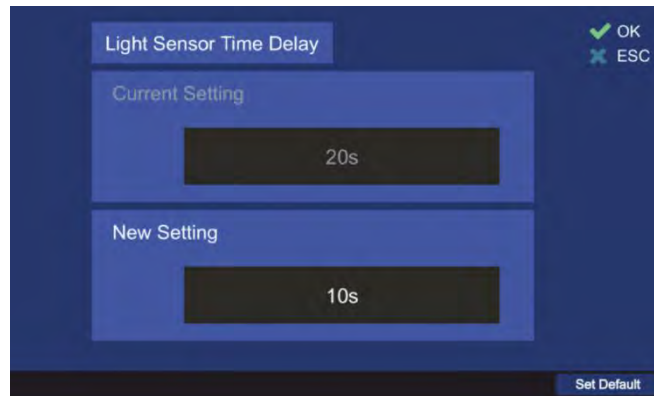
**Time Delay**

This setting determines how fast the system brightness reacts to the changing of ambient brightness. The adjustable range is between 0 s and 999 s.

Recommended value is the default value of 20 seconds, which ensures that e.g. the shadow of a person that quickly passes by, influences the brightness of the system.

To change this value, press the hotkey “Edit Value”, while “Time Delay” is marked.



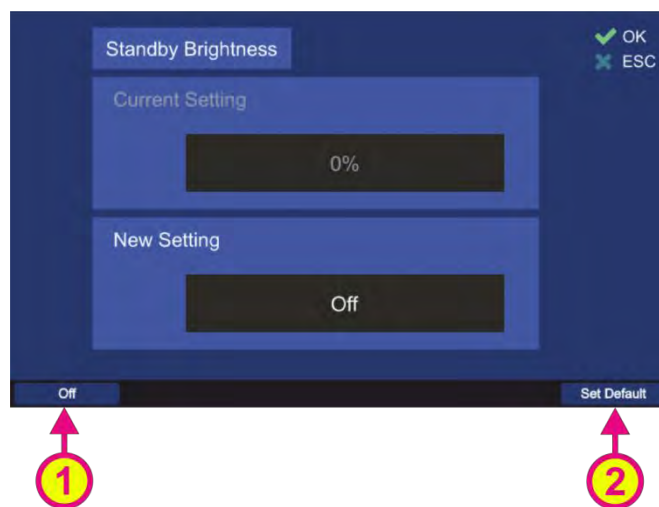


**Figure 86. Changing the time delay value for the light sensor**

- Type the new value for the delay value of the light sensor in the “New Setting” input field, using the numeric buttons of the DCU keypad.
- Use the “Set Default” hotkey to reset the value to the default setting.
- Confirm the changed value with “OK” or press “ESC” to leave the dialog without changing the previous setting.

#### 7.4.2.7 Standby Brightness

Over this setting, the general brightness during the standby mode can be defined.  
To change this value, press the hotkey “Edit Value”, while “Standby Brightness” is marked.



**Figure 87. Adjusting the standby brightness**

- Type the new value for the standby brightness value in the “New Setting” input field, using the numeric buttons of the DCU keypad or use the hotkey “Off” (s. Figure 87, position 1) in order to set the standby brightness to a “black screen”-value.  
If the setting “Off” is confirmed with “OK”, the display will be turned off after the button “Standby” is pressed.
- Use the “Set Default” hotkey (s. Figure 87, position 2) to reset the value to the default setting (0%).
- Confirm the changed value with “OK” or press “ESC” to leave the dialog without changing the previous setting.

### 7.4.3 System

The “System” settings page contains a number of the internal system settings, which are only available over the administrator access level.

All settings are organized alphabetically in order to improve the handling of the page.

#### Caution

Incorrect system settings may lead to malfunctions of the system.

The “System” settings page contains multiple settings that are represented by textual lines. Keep pressing the “Up” or “Down” arrow buttons of the DCU keypad in order to switch to the next page with the next settings (after the first set of settings of the page is over). There are currently 12 setting-lines on the “Setup” page that where appropriate include the corresponding sub-settings.

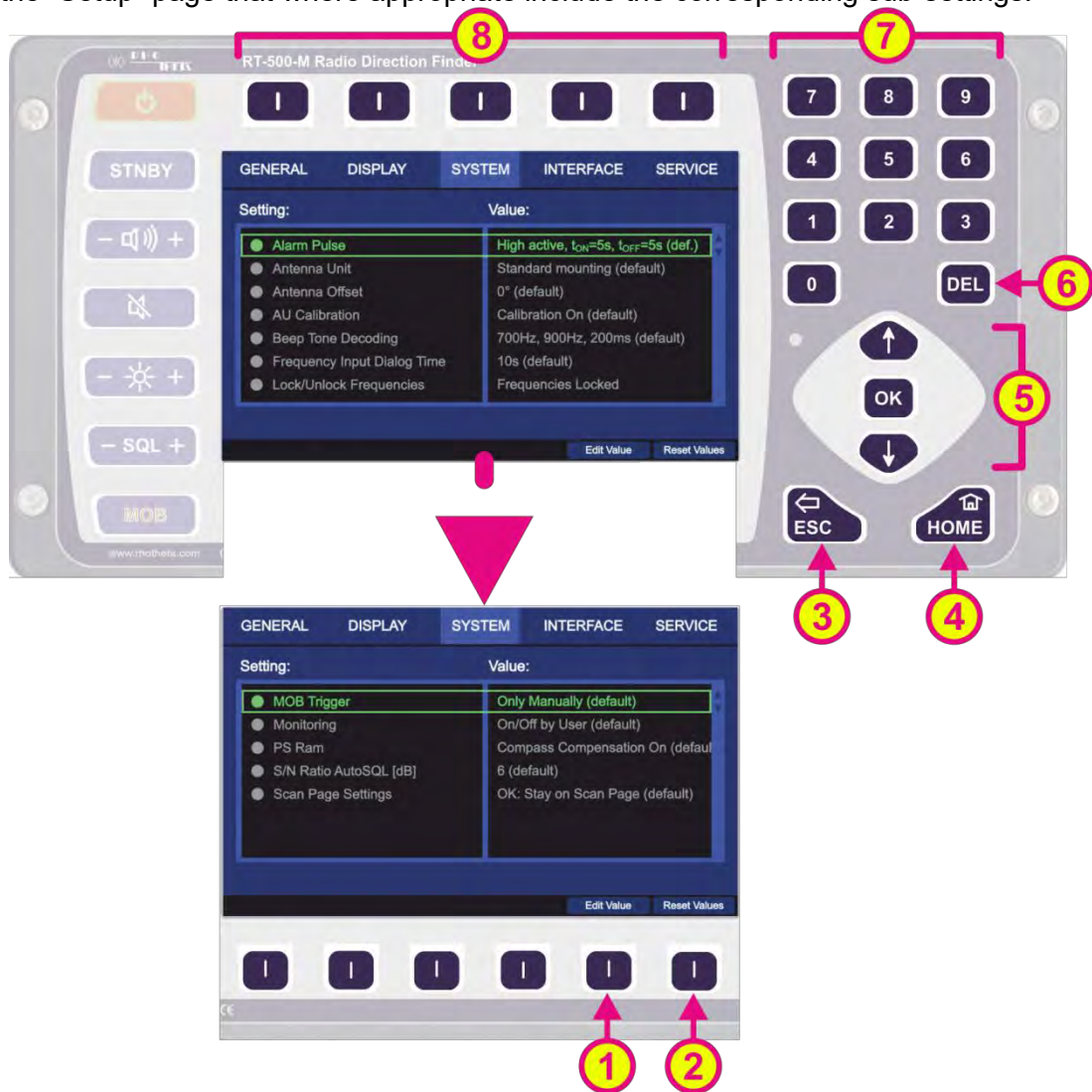


Figure 88. Setup page. System settings.

#### Indication on Setup Page, Display Settings

Pos.	Element	Meaning / Description
1	“Edit Value”	Depending on currently marked line, using this hotkey will open the dialog for changing the corresponding value (s. descriptions below)



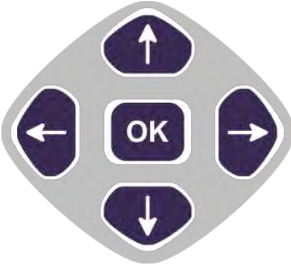


2	"Reset Values"	Resets all values to the default settings. The default setting values cannot be changed by the user.
3		When there is a dialog opened, pressing this button will close the dialog without adopting new values. When there is no dialog opened, pressing this button will go back to the last activated page. The "Bearing" page is the end point.
4		Pressing this button always leads to the "Bearing" page. Even an opened dialog will be closed, without adopting the changed values.
5		"Up" and "Down" arrows are used to move between the system settings. "Right and "left" arrows have no function inside the system settings" page. With the "OK" button confirming of values or opening the system settings dialogs is accomplished.
6		Inside the dialogs for the system settings, the "DEL" button is used to clear the whole input at once. On the top level of this page, this button has no function.
7		Numeric keys are used to enter the numerical characters inside the dialogs. On the top level of the page they have no function.
8	Top line	Navigation line of the screen, which allows switching between setup menus ("General", "Display", "System", "Interface" and "Service").

Table 13. Setup page, system settings. List of elements.

#### 7.4.3.1 Alarm Pulse

With this setting menu, the behavior of the alarm output can be defined.

The alarm output is provided by the DCU POWER+IO Connector and can be used for related alarm functions like activating a siren.

In order to facilitate the alarm function using the DCU (in combination with the alarm system that is used on the vessel), the DCU settings are changeable.

By pressing the "OK button or the hotkey "Edit Value", while the setting "Alarm Pulse" is marked by the green frame, the following dialog is opened.

#### Note

In this dialog pressing "OK" will be interpreted as confirming of the whole set of settings that are currently displayed, which will lead to closing the dialog confirming changed values.

To change the single settings only the hotkeys for modifying the related values are used (s. Figure 89).



Figure 89. Alarm pulse settings

**Active direction** setting defines which direction (low or high) will lead to an alarm indication.

This setting is changeable using the hotkeys "High active" / "Low active" or "Edit Value" (s. Figure 89, numbers ①, ② and ⑤), whereat using the first two hotkeys will change the value without opening the separate dialog.

- By pressing the hotkey "Edit Value", the dialog for changing the active direction of the alarm output will be opened. The handling of this dialog is shown in Figure 90.

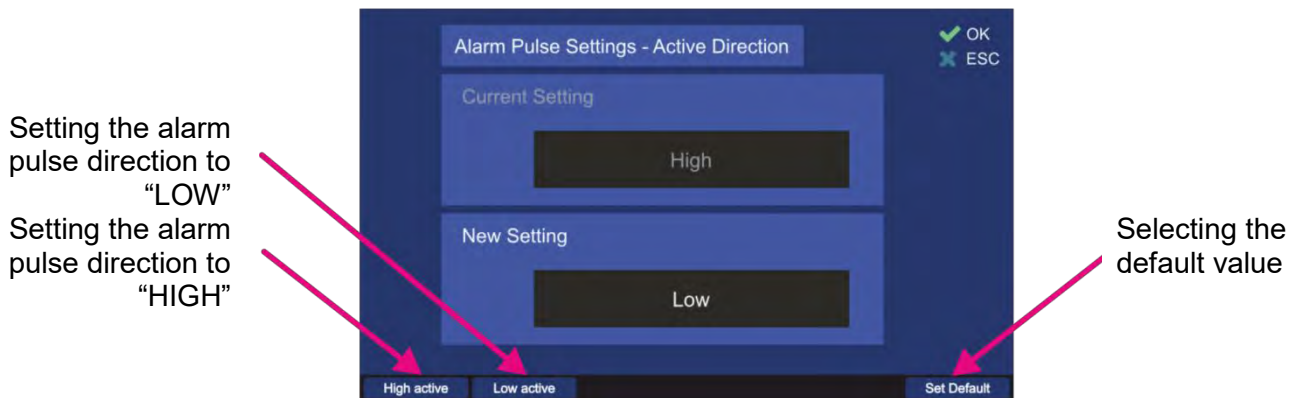


Figure 90. Active direction dialog

- Pressing the "High active" hotkey sets the active direction of the alarm pulse to "HIGH". That means, the default state of the alarm output is low and an alarm is indicated by the high state.
- Pressing the "Low active" hotkey sets the active direction of the alarm pulse to "LOW". That means, the default state of the alarm output is high and an alarm is indicated by the low state.
- Pressing the "Set Default" hotkey sets the alarm output to the default value, which is "HIGH".

**Alarm mode** setting defines, how the alarm output behaves during the alarm state (alarm mode continuous or pulsed).

This setting is changeable using the hotkeys "CONT." / "PULSE" or "Edit Value" (s. Figure 89, numbers ③, ④ and ⑤), whereat using the first two hotkeys will change the value without opening the separate dialog.

- By pressing the hotkey "Edit Value", the dialog for changing the alarm mode of the alarm output will be opened. The handling of this dialog is shown in Figure 91.

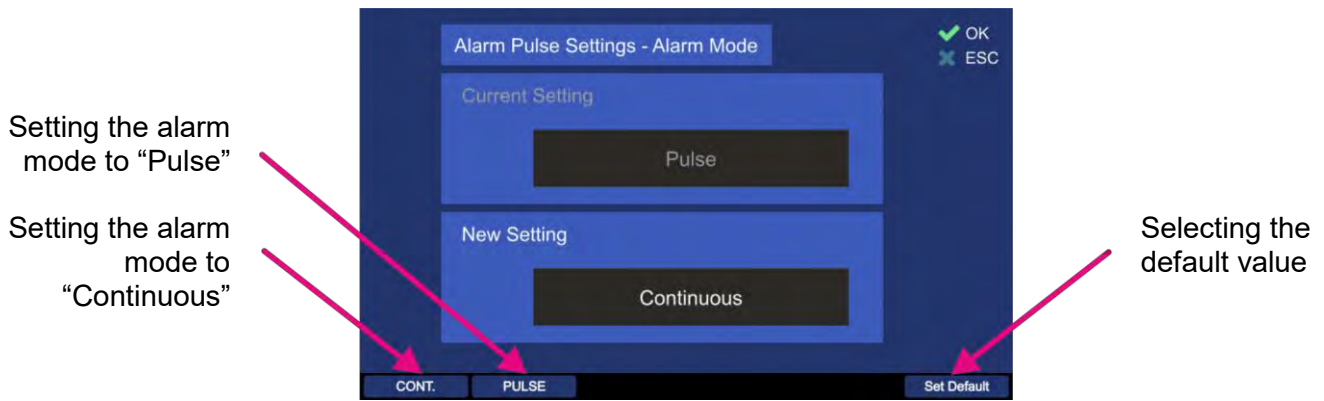


Figure 91. Alarm mode dialog

- Pressing the "CONT." hotkey sets the alarm mode of the alarm pulse to "Continuous". That means the output is high or low as long as the alarm condition exists.
- Pressing the "PULSE" hotkey sets the alarm mode to "Pulse", which means that the output is pulsed as long as the alarm condition exists. The pulsed signal is defined by the settings "Active Direction", "Time Off" and "Time On".
- Pressing the "Set Default" hotkey sets the alarm output to the default value, which is "Pulse"

### Time Off

This setting defines the time of the absence of the alarm indication (the duration of the alarm absence), e.g. using the default value of 5 seconds will stop the alarm indication for 5 seconds after period of the alarm-on time, which is adjusted in the "Time On" setting".

- To change the "Time Off"- time, press the hotkey "Edit Value" (s. Figure 89, **5**). The related dialog will open (s. Figure 92).

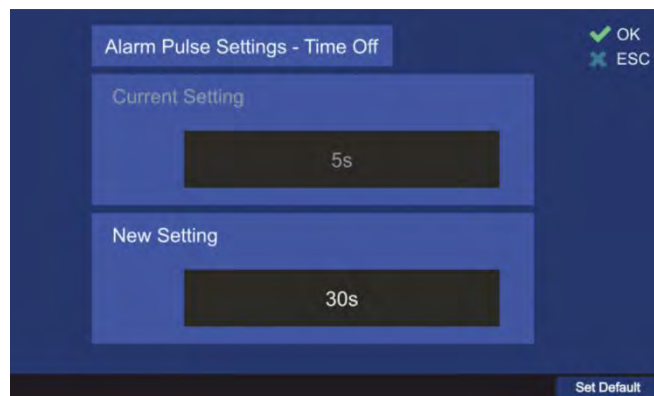


Figure 92. Time off Dialog

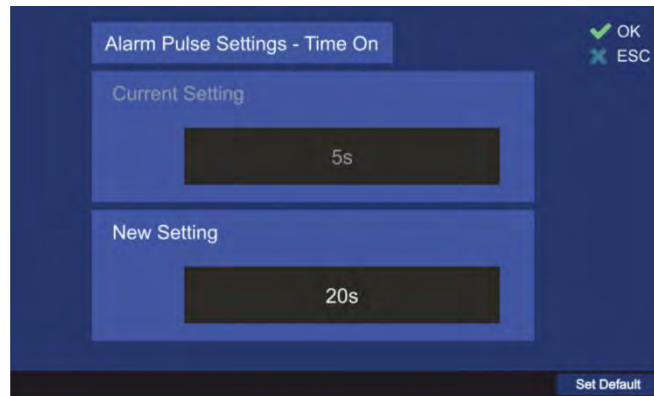
- Use the number keys of the DCU keypad to enter the new value for the "Time Off" setting.
- Press the hotkey "Set Default" to use the default value of 5 s.
- Confirm the setting with "OK" or leave the dialog without adopting the new value by pressing "ESC".

### Time On

This setting defines the time of the alarm indication (the duration of the alarm pulse), e.g. using the default value of 5 seconds will lead to an alarm indication for 5 seconds after the "Time on" was triggered.

- To change the "Time On"- time, press the hotkey "Edit Value". The related dialog will open (s. Figure 93).





**Figure 93. Time on Dialog**

- Use the number keys of the DCU keypad to enter the new value for the “Time On” setting.
- Press the hotkey “Set Default” to use the default value of 5 s.
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

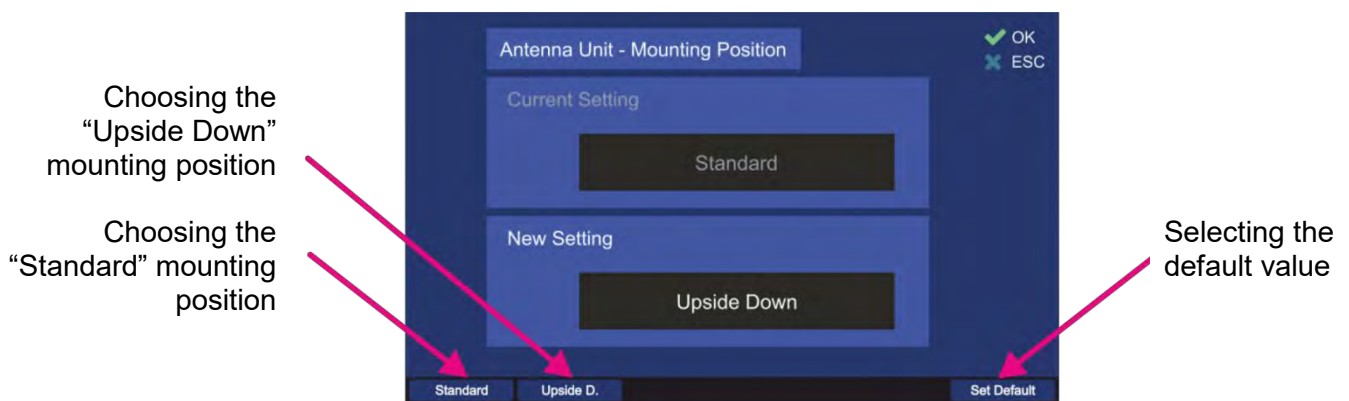
#### 7.4.3.2 Antenna Unit

The RT-500-M dipole antenna unit can only be mounted in the vertical position.

For standard mounting (which is the default setting), the mounting flange points to the bottom of the vessel.

This setting must be changed to “Upside Down”, if the antenna is mounted hanging upside down (flange on the top), in order to get the correct signal processing.

- By pressing the “OK button or the hotkey “Edit Value”, while the setting “Antenna Unit” is marked by the green frame, the following dialog is opened.



**Figure 94. Antenna unit (mounting position) dialog**

- Pressing the “Standard” hotkey sets the value for the mounting position to “Standard”.
- Pressing the “Upside D.” hotkey sets the value for the mounting position to “Upside Down”.
- Pressing the “Set Default” hotkey sets the antenna unit mounting position to the default value, which is “Standard”.
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

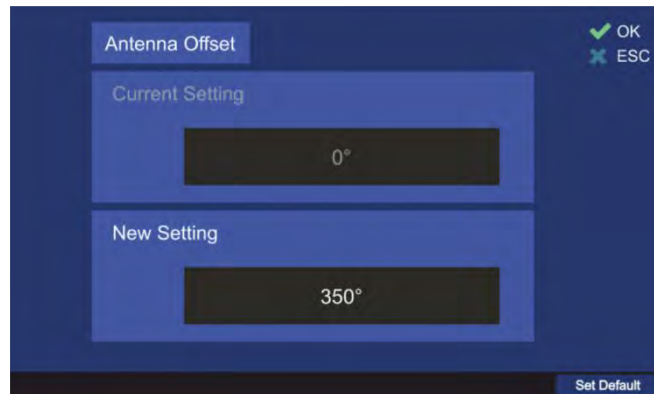
#### 7.4.3.3 Antenna Offset

The antenna is to be mounted facing “North” or “0°” direction. There is a “North” respectively “0°” marker on the antenna unit, which has to point to the vessel’s bow, parallel to the vessel’s longitudinal axis.

If for some reason the antenna cannot be mounted pointing exactly to the bow, the deviation correction should be put in, using this setting, in order to calculate bearing values correctly.

The offset is adjustable from 0° to 359° (e.g. -15° = 345°).

- By pressing the “OK button or the hotkey “Edit Value”, while the setting “Antenna Offset” is marked by the green frame, the following dialog is opened.



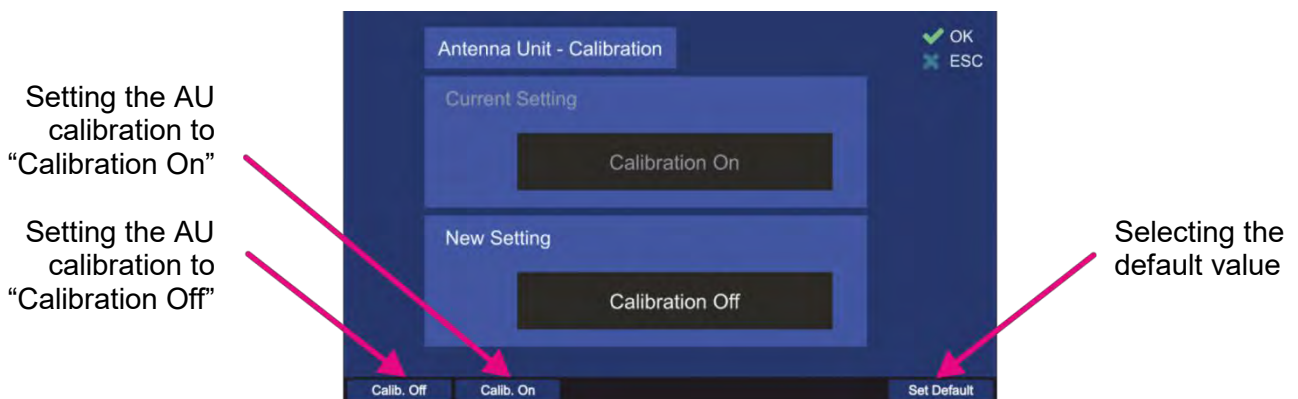
**Figure 95. Antenna offset dialog**

- Use the number keys of the DCU keypad to enter the new value for the “Antenna Offset”.
- Press the hotkey “Set Default” to use the default value of 0°.
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

#### 7.4.3.4 AU Calibration

This setting determines whether calibration values are used for the bearing calculation or not. In the default case, the internal calibration values of the AU are used, which can be disabled using this setting.

- By pressing the “OK button or hotkey “Edit Value”, while the setting “AU Calibration” is marked by the green frame, the following dialog is opened.



**Figure 96. AU calibration on/off dialog**

- Including the AU calibration values into the bearing calculation is done by pressing the hotkey “Calib. On”.
- To disable using the internal calibration values of the AU choose the hotkey “Calib. Off” (only in special cases).
- Press the hotkey “Set Default” to use the default value (calibration on).
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

### 7.4.3.5 Beep Tone Decoding

Parameters of the menu “Beep Tone Decoding” control the behavior of the function “Fast Channel Scan”, for the case that an alarm should be triggered only if an audio signal (“BeepTone”) has been decoded.

This setting is only usable, if option “Fast Channel Scan” is unlocked (for further information please see 7.2.3.2).

The user can define characteristics of beep tone decoding by pressing “OK” or the hotkey “Edit Value”, while the setting “Beep Tone Decoding” is marked by the green frame. The following dialog opens (s. Figure 97).



Figure 97. Beep tone decoding settings

All values can be set to the default values, using the hotkey “Reset Values” (s. Figure 98, position 5).

**Frequency High** defines the upper frequency for the beep tone decoding. The default value for this setting is 900 Hz. There are two ways to change this setting: either using the “Freq. High” or the “Edit Value” hotkey (s. Figure 98, positions 1 and 4), both of these hotkeys will open the same dialog.

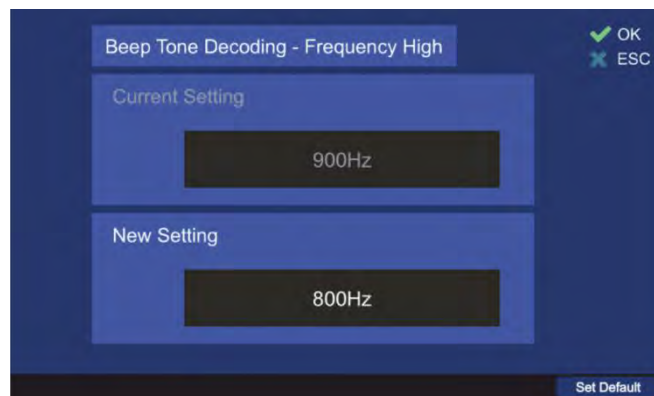
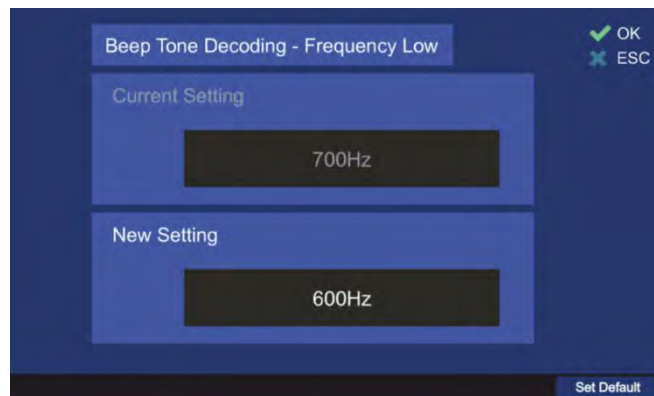


Figure 98. Dialog for the upper frequency (Beep Tone Decoding)

- Type the new value for the upper frequency into the “New Setting” field, using the DCU number keys.
- Press the hotkey “Set Default” to use the default value (900 Hz).
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

**Frequency Low** defines the upper frequency for the beep tone decoding. The default value for this setting is 700 Hz. There are two ways to change this setting: either using the “Freq. Low” or the “Edit Value” hotkey (s. Figure 98, positions 2 and 4), both of these hotkeys will open the same dialog.

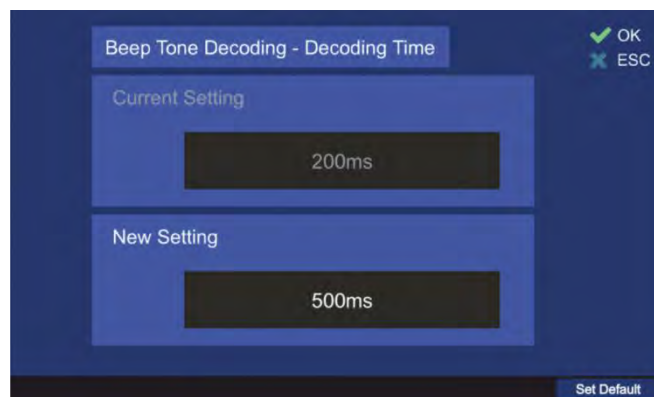


**Figure 99. Dialog for the lower frequency (Beep Tone Decoding)**

- Type the new value for the lower frequency into the “New Setting” field, using the DCU number keys.
- Press the hotkey “Set Default” to use the default value (700 Hz).
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

**Decoding Time** defines the decoding time for the beep tone decoding (minimum required duration of the signal).

The default value for this setting is 200 ms. There are two ways to change this setting: either using the “Dec. Time” or the “Edit Value” hotkey(s. Figure 98, positions 3 and 4), both of these hotkeys will open the same dialog.



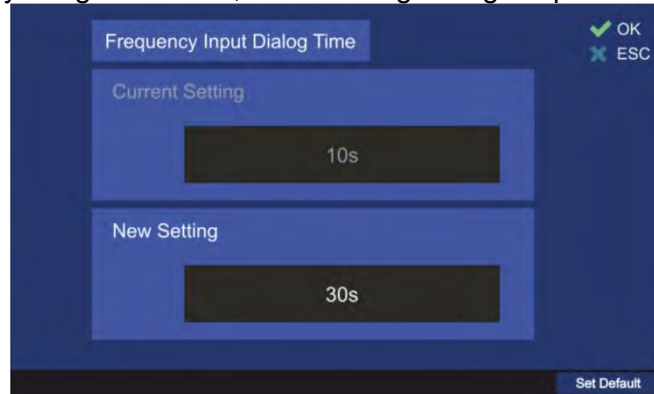
**Figure 100. Decoding time dialog**

- Type the new value for the decoding time into the “New Setting” field, using the DCU number keys.
- Press the hotkey “Set Default” to use the default value (200 ms).
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

### 7.4.3.6 Frequency Input Dialog Time

This setting defines the duration until the dialog for frequency input (s. 7.1.2.2) closes automatically if no interaction of the user happens.

- By pressing the “OK button or hotkey “Edit Value”, while the setting “Frequency Input Dialog Time” is marked by the green frame, the following dialog is opened.



**Figure 101. Frequency input hold time dialog**

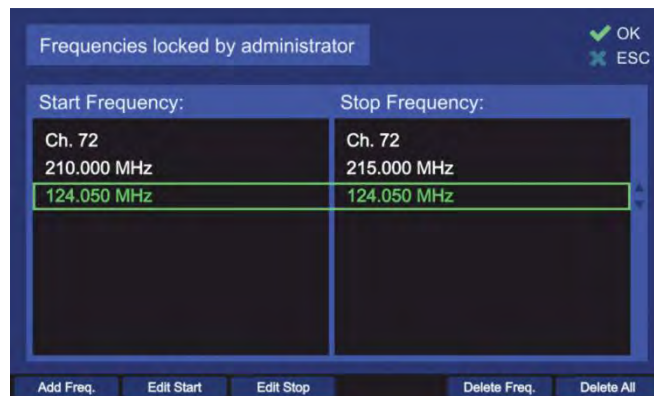
- Type the new value for the frequency input hold time into the “New Setting” field, using the DCU number keys.
- Press the hotkey “Set Default” to use the default value (10 s).
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

### 7.4.3.7 Lock/Unlock Frequencies

It is possible to lock or unlock some particular frequencies as well as entire frequency bands from the licensed frequency ranges. After a frequency has been locked, it will not be possible to set this frequency for the bearing operation on the “Bearing” page.

Locking/unlocking of frequencies is the responsibility of the administrator. The operator can only view the frequencies, which have been locked by the administrator in the dialog “Frequency Information Dialog” (s. 7.4.1.8).

- By pressing the “OK button or hotkey “Edit Value”, while the setting “Lock/Unlock Frequencies” is marked by the green frame, the following dialog is opened (s. Figure 102). This view will contain only one hotkey “Add Freq.” if entered for the first time, when no frequency is locked yet.



**Figure 102. Locked frequencies list. Administrator view**

- The use of this dialog is described in chapter 7.4.1.8, please refer to it for more information.





### 7.4.3.8 MOB Trigger

This setting defines the event for starting the MOB mode.

Basically, the MOB mode can be triggered by three situations:

1. The vessel's crew witnesses a person falling over board. The MOB mode can be activated manually by pressing the MOB button (s. Figure 6, position 7) of the DCU keypad.
2. The person, who falls over board, is wearing an ELT (emergency locator transmitter) that produces a typical modulated emergency signal. The emergency signals are recognized by RT-500-M and can activate the MOB function if the corresponding setting is activated.
3. The person, who falls over board, is wearing a personal transmitter beacon that produces an audio emergency signal ("beep tone" with distinct acoustic frequency). The emergency signals are recognized by RT-500-M and can activate the MOB function if the corresponding setting is activated.

To adjust the trigger event for starting the MOB mode, press the "OK" button or hotkey "Edit Value", while the setting "MOB Trigger" is marked. The following dialog will open (s. Figure 103).



Figure 103. MOB trigger dialog

- o Choose the new setting using one of three hotkeys (s. Figure 103, positions 1, 2 and 3), which will then appear in the "New Setting" field.

**"Only Man."** The MOB mode will be started by pressing the MOB button only.

**"Man./ELT"** The MOB mode will either be started by pressing the MOB button or by an ELT alarm.

**"Man./ELT/BT"** The MOB mode will be started by the following events:

- User presses the MOB button
- ELT alarm occurred
- Beep Tone detected

#### Note

"BT" (beep tone) is active only in "Fast Channel Scan".

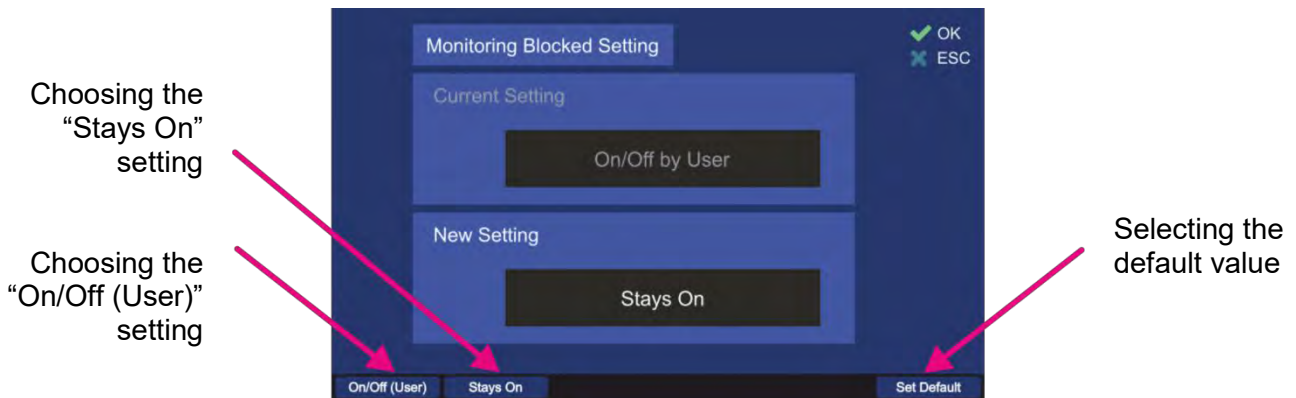
- o Press the hotkey "Set Default" (s. Figure 103, position 4), to use the default value ("Only Manually").
- o Confirm the setting with "OK" or leave the dialog without adopting the new value by pressing "ESC".

### 7.4.3.9 Monitoring

This setting determines how the "Monitoring" function will be handled.

There are two possible settings in this menu (s. Figure 104).

- To open the dialog for the “Monitoring” handling, press button “OK” or hotkey “Edit Value”, while the line “Monitoring” is marked.



**Figure 104. Monitoring handling settings**

- Choose the new setting using one of the hotkeys (s. Figure 104), which will then appear in the “New Setting” field.  
**“On/Off (User)”** The user can start and terminate the monitoring mode.  
**“Stays On”** The monitoring mode starts immediately after adopting this setting and the user cannot terminate this mode. To terminate the monitoring mode or change this setting the “Administrator” access is needed.
- Press the hotkey “Set Default” to use the default value (“On/Off by User”).
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

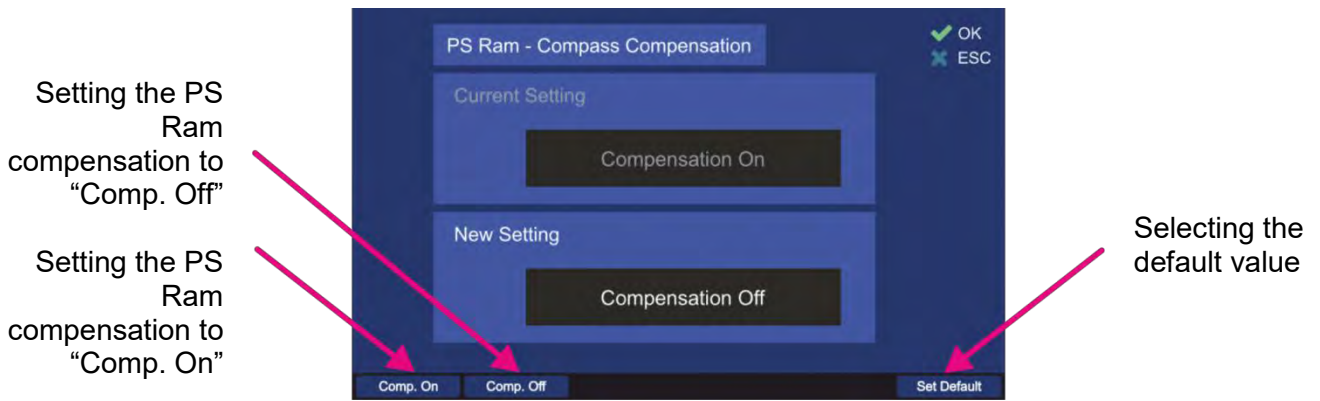
#### 7.4.3.10 PS Ram

This setting defines if compass data should be used to compensate the “Contouring Error” inside the AU.

Fast changes of the ship’s course can lead to a “Contouring Error” of the bearing indication, when the direction, shown on the bearing page, changes slowly compared to the vessel’s direction change. The reason is the averaging procedure of the phase summator inside the antenna unit.

If an external compass is connected, the bearing value determination can be done by a special, improved compensating procedure (the “PS Ram compensation”), which eliminates the contouring error. For a compass of minor quality (e.g. heavy and quick variations) it may be necessary, to switch off the “PS Ram compensation”.

- To open the dialog for the “PS Ram” handling, press button “OK” or hotkey “Edit Value”, while the line “PS Ram” is marked.



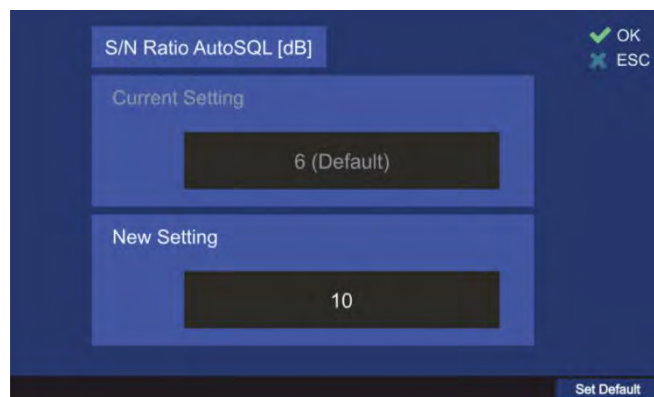
**Figure 105. PS Ram compensation dialog**

- Choose the new setting using one of the hotkeys (s. Figure 105), which will then appear in the “New Setting” field.  
**“Comp. On”**: The AU will use compass values to compensate the contouring error.  
**“Comp. Off”**: The AU will not use compass values to compensate the contouring error.
- Press the hotkey “Set Default” to use the default value (“Comp. On”).
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

#### 7.4.3.11 S/N Ratio AutoSQL [dB]

This value defines the “Signal to Noise Ratio” for the automatic squelch control inside the AU. S/N Ratio determines how many level-points the squelch marker is set above the noise level. If e.g. the value is 6, the squelch marker is always adjusted 6 level-points above the noise level, when the “AutoSQL” function is used.

- By pressing the “OK button or hotkey “Edit Value”, while the setting “S/N Ratio AutoSQL [dB]” is marked, the following dialog is opened (s. Figure 106).



**Figure 106. S/N Ratio for auto squelch function**

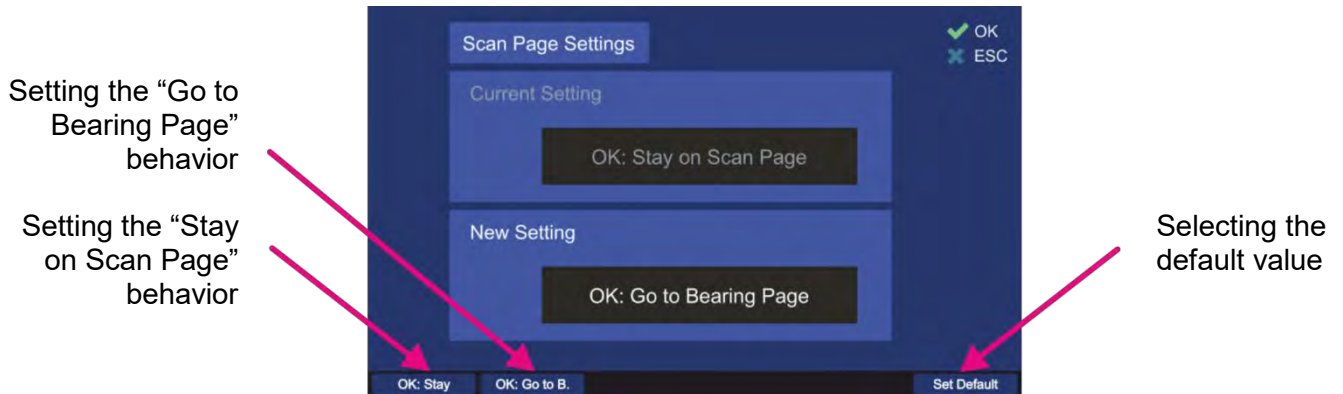
- Use the number keys of the DCU keypad to enter the new value for the “S/N Ratio”.
- Press the hotkey “Set Default” to use the default value of “6”.
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

#### 7.4.3.12 Scan Page Settings

This value defines the effect of pressing “OK” on the “Scan” page.

In every case, pressing “OK” will start a scan algorithm, if it was in a deactivated state, but with one setting the “Scan” page will stay open, and in the other case the “Bearing” page will be opened.

- By pressing the “OK button or hotkey “Edit Value”, while the setting “Scan Page Settings” is marked, the following dialog is opened (s. Figure 107).



**Figure 107. Scan page settings dialog**

- Choose the new setting using one of the hotkeys (s. Figure 107), which will then appear in the “New Setting” field.  
**“OK: Stay”**: Pressing this hotkey defines that the “Scan” page should stay opened after starting a scan algorithm by pressing “OK” (on the “Scan” page).  
**“OK: Go to B.”**: Pressing this hotkey defines that the “Bearing” page should be opened after starting a scan algorithm by pressing “OK” (on the “Scan” page).
- Press the hotkey “Set Default” to use the default value (“OK: Stay on Scan Page”).
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

#### 7.4.4 Interface

The setup menu “Interface” contains critical settings that influence important system parameters, therefore it is password protected and can be used by the administrator only.

This page enables the user to configure the interfaces to external devices.

It is possible to configure programmable IOs, LAN interface, interfaces to external compass and GPS. Furthermore, the user is able to configure the characteristics for remote control via NMEA commands.



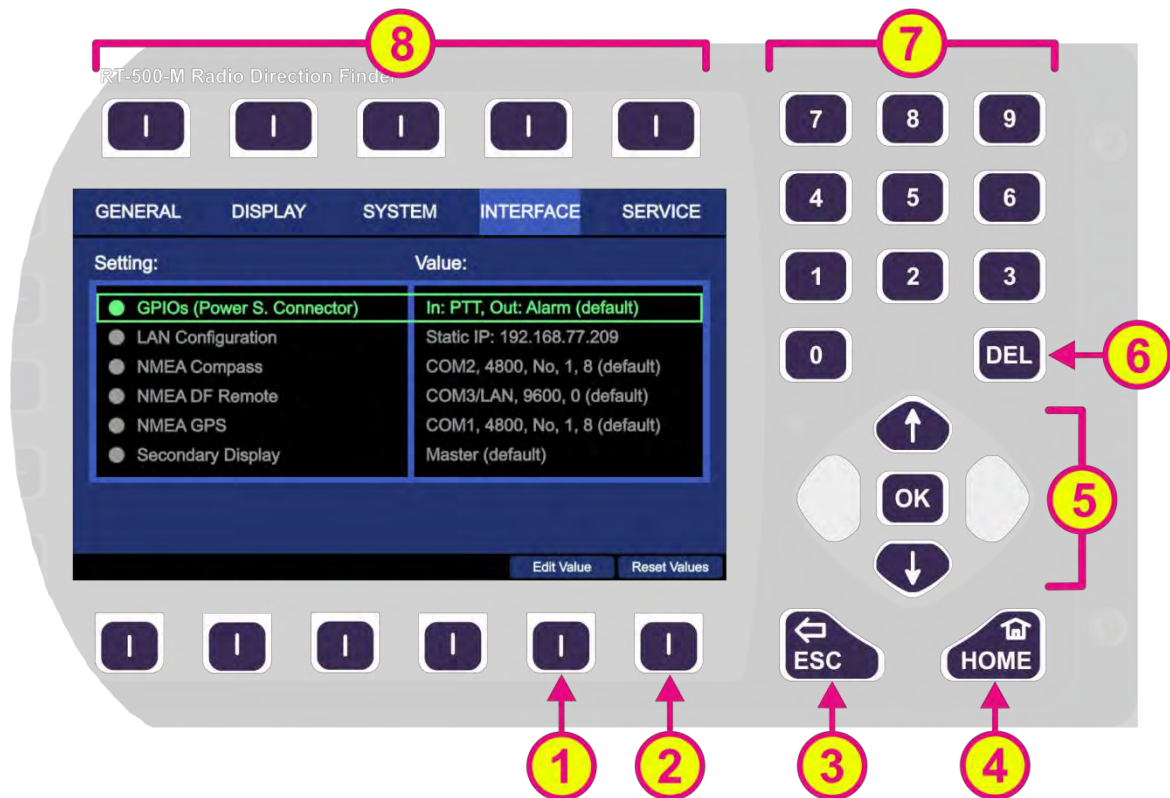






Figure 108. Setup page. Interface settings

## Indication on Setup Page, Interface Settings

Pos.	Element	Meaning / Description
1	"Edit Value"	Depending on currently marked line, using this hotkey will open the dialog for changing the corresponding value (s. descriptions below)
2	"Reset Values"	Resets all values to the default settings. The default setting values cannot be changed by the user.
3		When there is a dialog opened, pressing this button will close the dialog without adopting new values. When there is no dialog opened, pressing this button will go back to the last activated page. The "Bearing" page is the end point.
4		Pressing this button always leads to the Bearing Page. Even an opened dialog will be closed, without adopting the changed values.
5		"Up" and "Down" arrows are used to move between the display settings. "Right and "left" arrows have no function inside the interface settings" page. With the "OK" button confirming of values or opening the interface settings dialogs is accomplished.
6		Inside the interface settings dialogs the "DEL" button is used to clear the whole input at once. On the top level of this page this button has no function.


7		Numeric keys are used to enter the numerical characters inside the dialogs. On the top level of the page they have no function.
8	Top line	Navigation line of the screen, which allows switching between setup menus ("General", "Display", "System", "Interface" and "Service").

Table 14. Setup page, interface settings. List of elements.

#### 7.4.4.1 NMEA DF Remote

It is possible to operate the RT-500-M direction finder remotely using the NMEA communication protocol.

For this purpose, the control unit (e.g. ECDIS) can be connected to the NMEA interface of the DCU.

- Additionally, by choosing the combination "COMx<sup>1</sup> / LAN", the NMEA sentences will be also sent via the LAN connection (s. Figure 109, position 3).

#### Note

If communication ports other than the default port (COM3) are not used, they will appear as hotkeys in the dialogs (as possible ports to use for the NMEA remote communication). And vice versa, when they are occupied, the corresponding hotkeys are not displayed.

#### Note

By default, the "Autotalk" mode is activated, which means that NMEA sentences of the direction finder are sent out cyclically with a fixed time period of 250 ms. The "Autotalk" mode can also be deactivated per corresponding NMEA command (s. NMEA-Protocol Description (RT-500-M & RT-800))

Configure the interface settings for remote control of the direction finder in this menu item.

- Press the button "OK" or hotkey "Edit Value", while the setting "NMEA DF Remote" is marked (s. Figure 108).

Following sub-menu will appear (s. Figure 109).

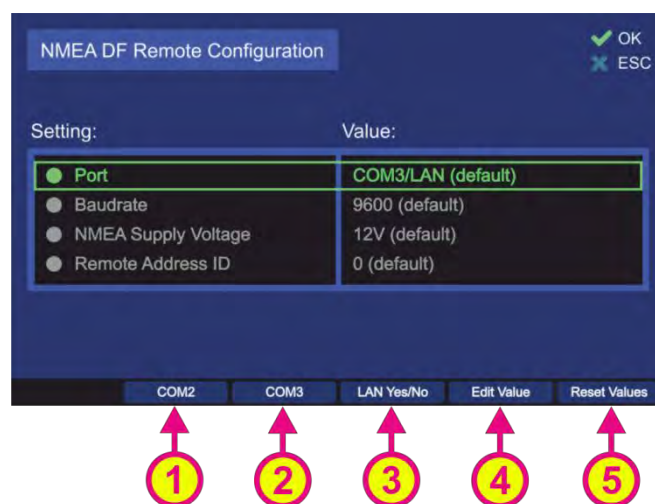


Figure 109. NMEA DF remote control configuration

<sup>1</sup> "x" stands for the number of the interface

The NMEA DF remote configuration is accomplished by the following settings:

- Port
- Baudrate
- Remote Address ID

NMEA supply voltage (12 V) is not configurable, but it is displayed there as information.

Pressing the hotkey “Reset Values” (s. Figure 109, position 5) will set all menu items to default values. To exit the dialog confirming all changes that have been made within the sub-dialogs for single settings, press “OK”.

#### **Note**

Pressing “ESC” instead of “OK” when leaving the “NMEA DF Remote Configuration” dialog will discard all entered settings.

#### **Port**

This setting defines, which communication port is connected to the remote control PC.

- For changing the communication port, press either the hotkey “COMx” (s. Figure 109, positions 1 and 2) or the hotkey “Edit Value” while the menu item “Port” is marked (s. Figure 109, position 4).

#### **Note**

that also the hotkey for COM1 can be displayed there if it is not used for other NMEA devices like e.g. compass.

- Using the hotkey for “COMx” in the top level dialog “NMEA DF Remote Configuration”, changes the value of the “Port” setting without opening the corresponding dialog.
- Pressing the hotkey “LAN Yes/No” (s. Figure 109, position 3) will turn on the additional communication over LAN (pressing this hotkey again will turn the LAN communication off, see also 7.4.4.2).

If COMx and LAN are set for remote control, the priority between both is time-based.

#### **Example:**

- ➔ Commando for squelch comes via LAN.
  - ➔ Commando for squelch comes via COM.
  - ⬅ First, the squelch level gets adjusted on the LAN command. During this time the message from the COM port is buffered.
  - ⬅ After that, the squelch level gets adjusted on the command from COM port.
- Pressing the hotkey “Edit Value” while “Baudrate” is marked, opens the following sub-dialog (s. Figure 110).



**Figure 110. Remote communication port configuration**

- Selecting “COMx” (s. Figure 110, positions 1, 2 and 3) configures the corresponding NMEA interface as the remote communication port. Choose the new setting using one of the hotkeys, which will then appear in the “New Setting” field.

**Note**

This setting will only set the corresponding communication port. Additional transmitting the NMEA sentences over LAN should be set in the top level menu (s. Figure 109, position 3).

- Press the hotkey “Set Default” to use the default value.
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

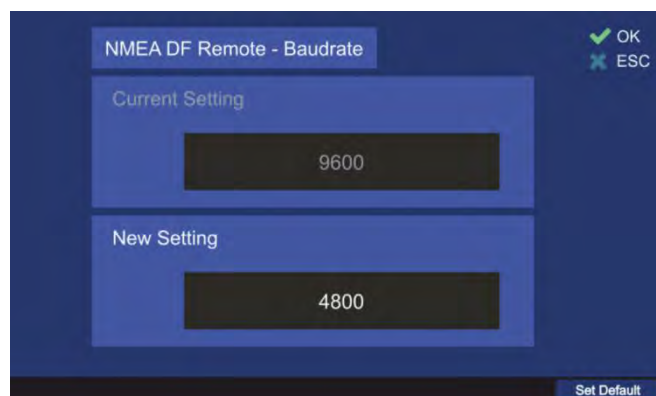
**Baudrate**

Defines the speed of NMEA interface data transfer.

The default value for the baud rate of the NMEA remote control is 9600. The baud rate can be changed using this menu item.

For further information please see the document “NMEA-Protocol Description (RT-500-M & RT-800)”.

- To change the baud rate, press the hotkey “Edit Value” while the menu item “Baudrate” is marked (s. Figure 109). The corresponding sub-dialog will be opened (s. Figure 111).



**Figure 111. Remote control baud rate configuration**

- Use the number keys of the DCU keypad to enter the new value for the “Baudrate”.
- Press the hotkey “Set Default” to use the default value of “9600”.
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

**NMEA supply voltage**

Is not configurable (12 V, default), but it is displayed under the NMEA settings as information.

**Remote Address ID**

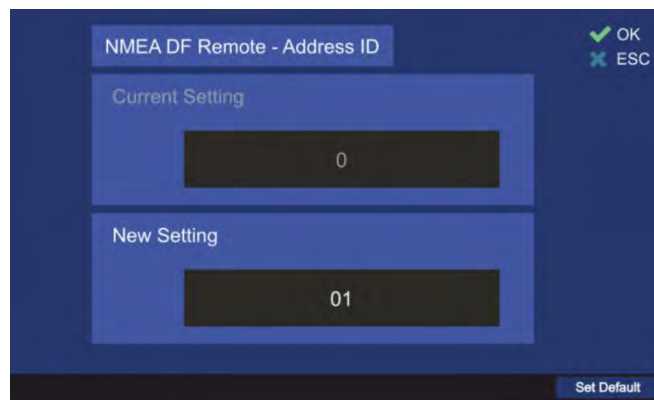
Is a setting, which is used to give the direction finder an address ID for the NMEA communication. The DF only reacts to the NMEA request sentences, if the address ID in the sentence is equal to the address, which is selected via this setting (or has the value 255, if the ID was not set).

**Note**

When using address ID = 255, then all connected DF systems are addressed, independent of their internal IDs.

For further explanation please refer to the document “NMEA-Protocol Description (RT-500-M & RT-800)”.

The address ID can take values between 0 and 99.



**Figure 112. Remote control address ID configuration**

- Use the number keys of the DCU keypad to enter the new value for the “Address ID”.
- Press the hotkey “Set Default” to use the default value of “0”.
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.



#### 7.4.4.2 LAN Configuration

The RT-500-M DCU can be connected to the Local Area Network of the vessel. To configure the LAN interface of the DCU use the menu item “LAN Configuration”.

- Press the button “OK” or hotkey “Edit Value”, while the setting “LAN Configuration” is marked (s. Figure 108).  
Following sub-menu will appear (s. Figure 113).



Figure 113. LAN configuration menu

There are two settings necessary to configure the DCU for LAN communication:

- Mode of the IP address assignment
- The IP address

Pressing the hotkey “Reset Values” (s. Figure 113, position 4) will set all menu items to the default values.

The default setting after the first booting of the system is:

Mode: **Static IP**  
IP Address: **192.168.77.208**  
TCP Port for remote control: **9999**

#### Mode

The mode of the IP address assignment can be static or dynamic.

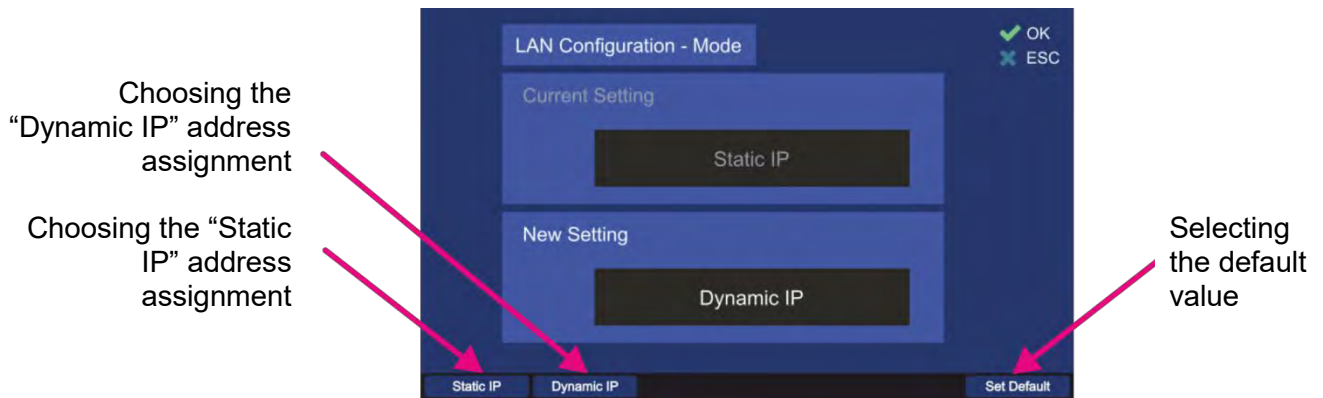
If the mode is changed to “**dynamic**”, then the IP address is assigned dynamically by the DHCP server, which means that the DCU gets a random IP address that is currently free. It also means that the IP address can change at any time.

The hotkey “Edit Value” disappears, if the setting “IP Address” is marked and “Mode” is currently set to dynamic.

The presently assigned IP address can be viewed via the “IP Address” setting.

If the mode is set to “**static**”, the IP address of the DCU must be set to a valid fixed value that is not occupied by any other user of the vessel’s LAN. Once assigned, the static IP address does not change anymore.

- IP address assignment can be changed directly using the hotkeys “Static IP” and “Dynamic IP” (positions 1 and 2, s. Figure 113), so that the value of this setting is changed without opening the dialog, or it can be set over the corresponding dialog after pressing the hotkey “Edit Value” (s. Figure 113, position 3) while this menu point is marked, the following dialog opens (s. Figure 114).



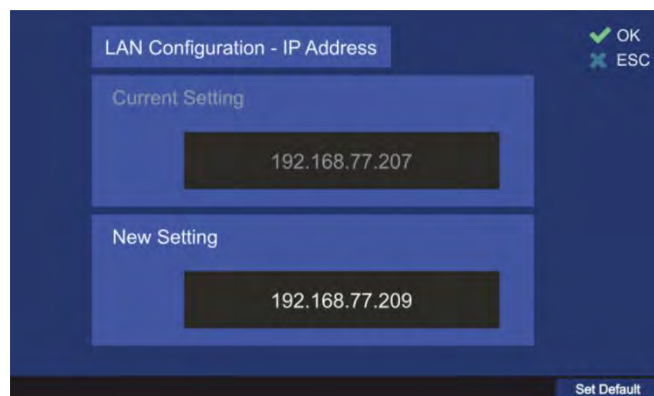
**Figure 114. Changing the mode of the IP address assignment**

- Choose the new setting using one of the hotkeys (s. Figure 114), which will then appear in the “New Setting” field.
- Press the hotkey “Set Default” to use the default value (“Static IP”).
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

### **IP Address**

The IP address can be changed only if “Mode” is set to “Static IP” (dynamic IP address is assigned by the DHCP server).

- For changing the IP address press the hotkey “Edit Value” while this menu point is marked (s. Figure 113, position 3).  
Following dialog opens (s. Figure 115).



**Figure 115. Setting the new IP address**

- Use the number keys of the DCU keypad to enter the new value for the “IP Address” setting.
- Press the hotkey “Set Default” to use the default value “192.168.77.208”.
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

### **Caution**

Always reboot the DCU after changing the mode or IP address settings!

#### 7.4.4.3 NMEA Compass

An external compass can be connected to the NMEA interface of the DCU.

Configure the interface settings for external compass in this menu item.

- Press the button “OK” or hotkey “Edit Value”, while the setting “NMEA Compass” is marked. Following sub-menu will appear (s. Figure 116).

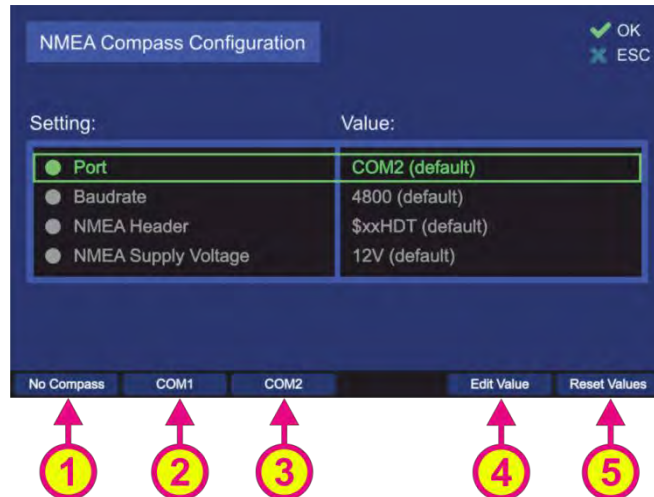


Figure 116. Compass configuration settings

There are three settings necessary to configure the NMEA compass connection:

- Port
- Baudrate
- NMEA header

NMEA supply voltage (12 V) is not configurable, but it is displayed there as information.

Pressing the hotkey “Reset Values” (s. Figure 116, position 5) will set all menu items to default values. To go out of dialog confirming all changes, which have been made within the sub-dialogs for the single settings, press “OK”.

#### Note

Pressing “ESC” instead of “OK” leaving the “NMEA Compass” dialog, all previously configured changes of single settings will not be adopted.

#### Port

This setting defines, which communication port is connected to the external compass.

- The communication port can be changed by pressing one of the three hotkeys “No Compass”, “COM1” or “COM2” (s. Figure 116, positions 1, 2 or 3) or the hotkey “Edit Value” while menu item “Port” is marked (s. Figure 116, position 4).  
Using the hotkeys 1, 2 or 3 on the top level dialog “NMEA Compass Configuration” (s. Figure 116), the value of the “Port” setting can be changed without opening the corresponding dialog.
- Pressing the hotkey “Edit Value” the following sub-dialog will be opened (s. Figure 117).



**Figure 117. Compass connector setting**

- Choose the new setting using one of the hotkeys (s. Figure 117), which will then appear in the “New Setting” field.  
Selecting “COM1” or “COM2” (s. Figure 117, positions 2 and 3) configures the corresponding communication port as the input port for the external compass data. By choosing “No compass” setting (s. Figure 117, position 1), the external compass data will be ignored. “No compass” has to be selected, if no external compass is connected, in order to avoid displaying the corresponding warning on the “Bearing” page (“No Compass” warning).
- Press the hotkey “Set Default” to use the default value (“COM2”).
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

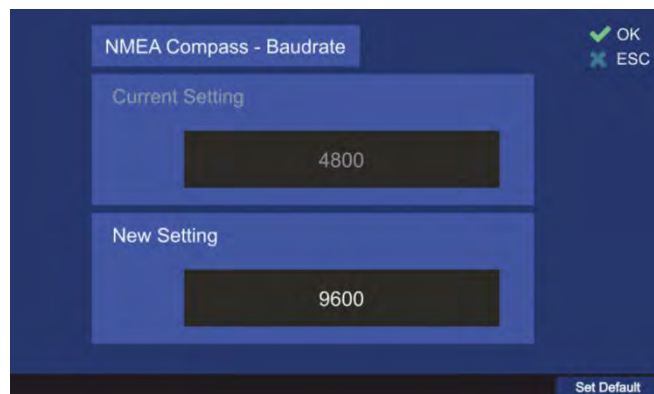
### **Baudrate**

Defines the speed of NMEA interface data transmission.

The default value for baud rate of the NMEA interface is 4800, in compliance with the standard for NMEA 0183, version 3.01. The baud rate can be changed using this menu item.

For further information please see the document “NMEA-Protocol Description (RT-500-M & RT-800)”.

- To change the baud rate, press the hotkey “Edit Value” while the menu item “Baudrate” is marked (s. Figure 116). The corresponding sub-dialog will be opened (s. Figure 118).



**Figure 118. Compass baud rate setting**

- Use the number keys of the DCU keypad to enter the new value for the “Baudrate”.

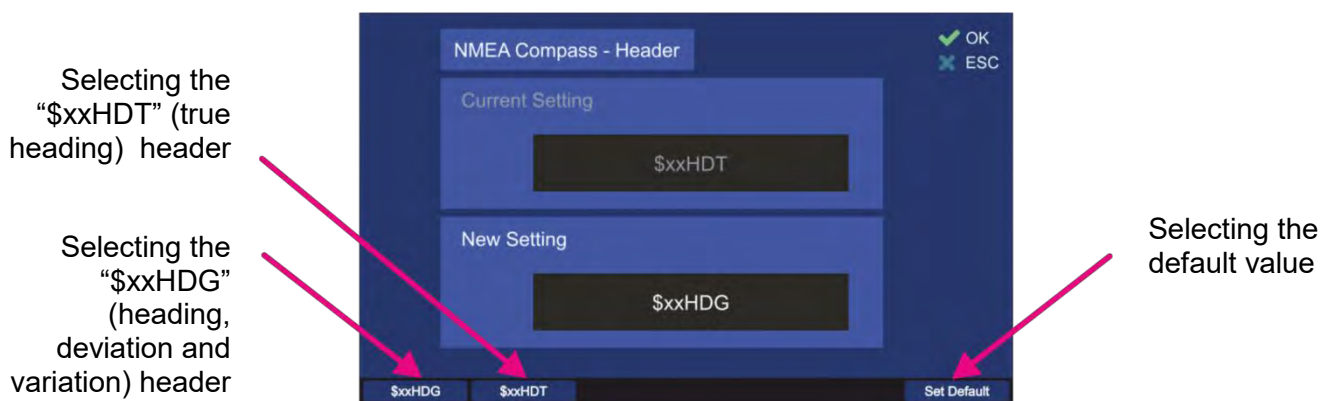
- Press the hotkey “Set Default” to use the default value of “4800”.
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

### **NMEA Header**

Defines the appropriate compass NMEA sentence provided by vessels compass. Please see the compass documentation of the vessel.

The default setting for the NMEA header is “\$xxHDT” and can be changed within this menu item.

- In order to change the NMEA header setting, press the hotkey “Edit Value” while the menu item “NMEA Header” is marked (s. Figure 116). The corresponding sub-dialog will be opened (s. Figure 119).



**Figure 119. Compass header setting**

- Choose the new setting using one of the hotkeys (s. Figure 119), which will then appear in the “New Setting” field.
- Press the hotkey “Set Default” to use the default value (“\$xxHDT”).
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

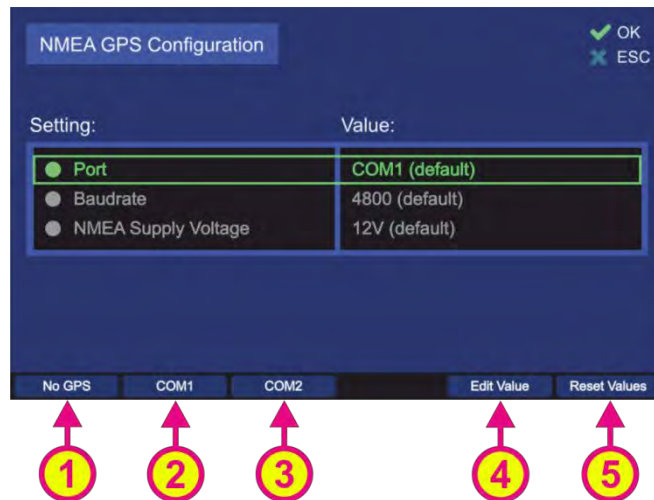
**NMEA supply voltage** (12 V, default) is not configurable, but it is displayed under the NMEA settings as information.



#### 7.4.4.4 NMEA GPS

The RT-500-M DCU is able to read external GPS data via a defined NMEA protocol. Connect the external GPS device to one of the NMEA interfaces of the DCU. The GPS data format can be configured in this menu.

- Press the button “OK” or hotkey “Edit Value”, while the setting “NMEA GPS” is marked (s. Figure 108).  
Following sub-menu will appear (s. Figure 120).



**Figure 120. NMEA GPS configuration settings**

The NMEA GPS configuration is accomplished by the following settings:

- Port
- Baudrate

NMEA supply voltage (12 V) is not configurable, but it is displayed there as information.

- Pressing the hotkey “Reset Values” (s. Figure 120, position 5) will set all menu items to default values.
- To exit the dialog confirming all changes that have been made within the sub-dialogs for single settings, press “OK”.

#### Note

Pressing “ESC” instead of “OK” when leaving the “NMEA GPS Configuration” dialog, all previously configured changes of single settings will be discarding.

**Port**

This setting defines, which communication port is connected to the external GPS device.



**Figure 121. NMEA GPS communication port settings**

- By selecting “No GPS” (s. Figure 121, position 1) the external GPS data will be ignored.
- Selecting “COM<sub>x</sub><sup>1</sup>” (s. Figure 121, positions 2 and 3) configures the corresponding NMEA interface as the GPS communication port. Choose the new setting using one of the hotkeys, which will then appear in the “New Setting” field.
- Press the hotkey “Set Default” (s. Figure 121, position 4) to use the default value.
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

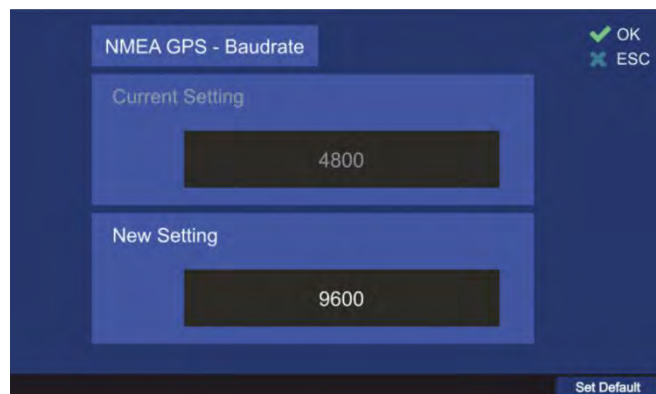
**Baudrate**

Defines the speed of NMEA GPS interface data transfer.

The default value for the baud rate of the NMEA GPS communication is 4800. The baud rate can be changed using this menu item.

For further information please see the document “NMEA-Protocol Description (RT-500-M & RT-800)”.

- To change the baud rate, press the hotkey “Edit Value” while the menu item “Baudrate” is marked (s. Figure 120). The corresponding sub-dialog will be opened (s. Figure 122).



**Figure 122. Changing the NMEA GPS baud rate setting**

<sup>1</sup> “x” stands for the number of the interface

- Use the number keys of the DCU keypad to enter the new value for the “Baudrate”.
- Press the hotkey “Set Default” to use the default value of “4800”.
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.

### **NMEA supply voltage**

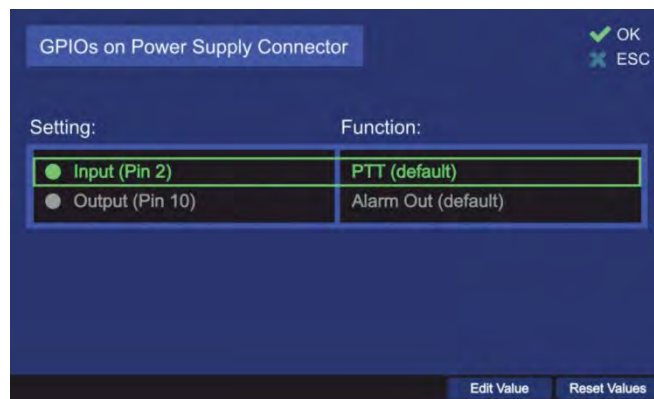
Is not configurable (12 V, default), but it is displayed under the NMEA settings as information.

#### **7.4.4.5 GPIOs (Power S. Connector)**

With this setting, the behavior of the two programmable GPIOs can be defined.

The power supply connector (POWER + IO, s. chapter 8.1) provides the “programmable IN” and the “programmable OUT” lines, where different signals can be provided.

- In order to define, which signals are to be allocated to the IOs, select the setting “GPIOs (Power S. Connector)” (s. Figure 108) and press “OK” or the hotkey “Edit Value”. The following dialog appears (s. Figure 123. Dialog for setting the GPIOs).



**Figure 123. Dialog for setting the GPIOs**

### **Input (Pin 2)**

A signal can be allocated to the “programmable IN” pin (s. chapter 8.1, POWER + IO).

There are two setting possibilities for this pin:

1. PTT: This setting defines “Pin 2” as a source for the PTT signal. The software will look for PTT signal at this pin as well as at the actual PTT input pin (s. chapter 8.1, POWER + IO). Both sources are valid as PTT source.
2. No Function: This setting means that the pin will not be related to any function.

- To configure the programmable input pin, press the hotkey “Edit Value”, while the setting “Input (Pin 2)” is marked.



**Figure 124. Assigning a function to the input pin**

- Choose the new setting using one of the hotkeys (s. Figure 124), which will then appear in the "New Setting" field.
- Press the hotkey "Set Default" to use the default value ("PTT").
- Confirm the setting with "OK" or leave the dialog without adopting the new value by pressing "ESC".

### **Output (Pin 10)**

A signal can be allocated to the "programmable pin OUT" (s. chapter 8.1, POWER + IO).

There are four setting possibilities for this pin:

1. **Alarm Out:** Choosing this setting connects the programmable output pin with the pin for the alarm relay (s. Figure 125, position 2).
  2. **Squelch Out:** Choosing this setting (s. Figure 125, position 3) connects the programmable output pin with the "Squelch Out" pin of the "POWER + IO" connector (s. chapter 8.1).
  3. **Status Out:** Choosing this setting connects the programmable output pin with the internal error status output of the device (s. Figure 125, position 4). That means, if there are no errors, the output will be active (open collector). If there is an error, the output will be not active (open collector).
  4. **No Function:** Choosing this setting allocates the state "No Function" to the programmable pin, which means that the pin is not related to any function (s. Figure 125, position 1).
- To configure the programmable output pin, press the hotkey "Edit Value", while the setting "Input (Pin 2)" is marked.



**Figure 125. Assigning a function to the output pin**

- Choose the new setting using one of the hotkeys (s. Figure 125), which will then appear in the “New Setting” field.
- Press the hotkey “Set Default” (s. Figure 125, position 5) to use the default value (“Alarm Out”).
- Confirm the setting with “OK” or leave the dialog without adopting the new value by pressing “ESC”.



### 7.4.5 Service

The “Service” menu allows the performing of the service-related functions, like e. g. updating of the DCU software, inputting the new license code if new options have been purchased, etc.

#### Note

The setup menu “Service” contains critical settings that influence important system parameters, therefore it is password protected and can be used only with the administrator access level.

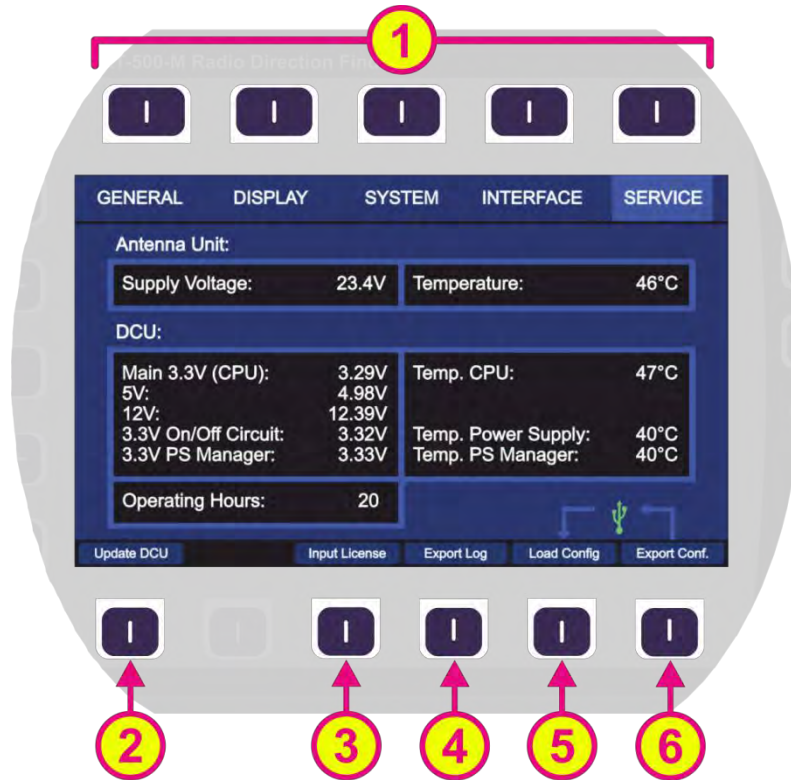


Figure 126. Setup page. Service menu

Indication on Setup Page, Service Menu		
Pos.	Element	Meaning / Description
①	Top line	Navigation line of the screen, which allows switching between setup menus (“General”, ”Display”, “System”, “Interface” and “Service”).
②	“Update DCU”	Opens a dialog to start a software update for the DCU (s. 7.4.5.1).
③	“Input License”	Opens a dialog to input a new license code (s.7.4.5.2).
④	“Export Log”	Opens a dialog to export log files to USB (s. 7.4.5.3).
⑤	“Load Config”	Opens a dialog to import configuration files from USB (s. 7.4.5.4).
⑥	“Export Conf.”	Opens a dialog to export configuration files to USB (s. 7.4.5.5).

Table 15. Service menu. List of elements.

After opening the “Service” menu by pressing the corresponding hotkey, while on the “Setup” page, an information view of the current system parameters opens.

Those are the most important working parameters of the AU and DCU, such as temperature or voltage of different functional blocks.

#### 7.4.5.1 Update DCU

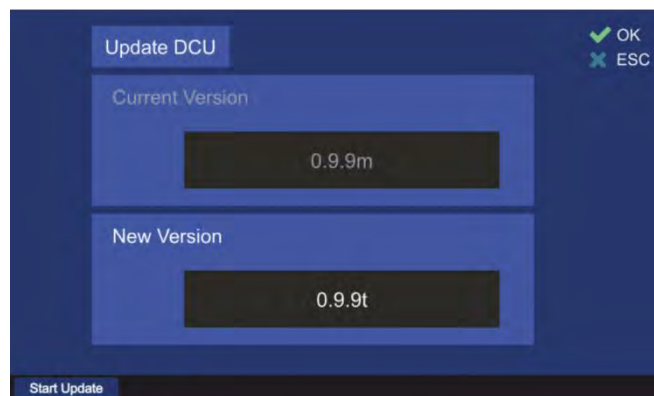
The “Update DCU” dialog is opened by pressing the corresponding hotkey when the service menu is opened (s. Figure 126, position 2). To load new software use the USB interface (s. chapter 6.2, Figure 7, position 11).

The function of this dialog is the updating of the DCU software, if a new version is available. In such a case the dialog has the following appearance (s. Figure 127).

#### Note

In the case of unavailability of the new software version, the dialog will merely show the current version without the possibility to take any action inside the dialog.

The hotkey “Start Update” appears, if a flash drive with a valid software version has been detected. The new software version is then displayed in the dialog under the label “New Version”.



**Figure 127. Update DCU dialog, new version available**

- Pressing the hotkey “Start Update” will start the update from USB. During the update, the text of the hotkey changes to “Update...” (s. Figure 128) and the warning at the top of the display appears.



**Figure 128. Update DCU in progress**

After a successful update the button name turns back to “Start Update”.



**Figure 129. Update of the DCU software finished**

- Confirm the new software version with „OK“ to leave the dialog.

### Caution

Please always restart the device after the new software version was uploaded!

After the restart of the DCU, the indication of the new software version under the menu “General” (s. Figure 130) can be checked.



**Figure 130. Update DCU control on the "General" page**

### 7.4.5.2 Input License

If a new license code has been provided to you by RHOTHETA, you can input it using this dialog. The “Input License” dialog is opened by pressing the corresponding hotkey when the service menu is opened (s. Figure 126, position 3).

- You can input the new license either manually or load it from the USB flash drive.
- Use arrow buttons of the keypad to navigate between letters of the virtual keyboard in the license input dialog (s. also description of using the virtual keyboard in 7.4.1.5).
- Use the number keys of the DCU keyboard for input of the numbers.

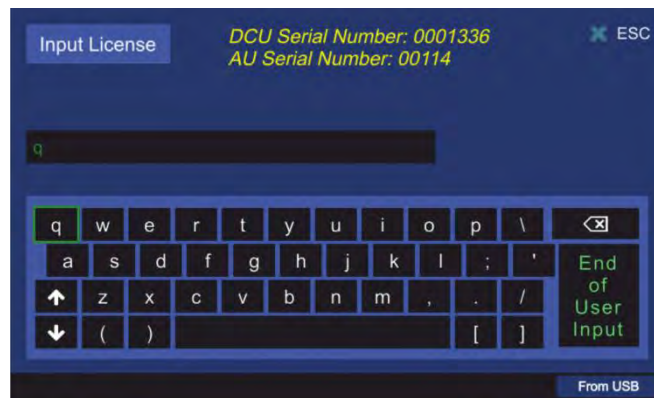


Figure 131. Input license dialog

- In order to load the license file from USB, after connecting the flash drive at the USB port (refer to chapter 6.2), press the hotkey “From USB”. The software will search for a valid license code on the flash drive. If a valid license has been found, the license text will be displayed in the license input field.
- After a valid license code was inputted, the device will show the message “Valid License!” and ask for confirming the action of adopting the new license (s. Figure 132).

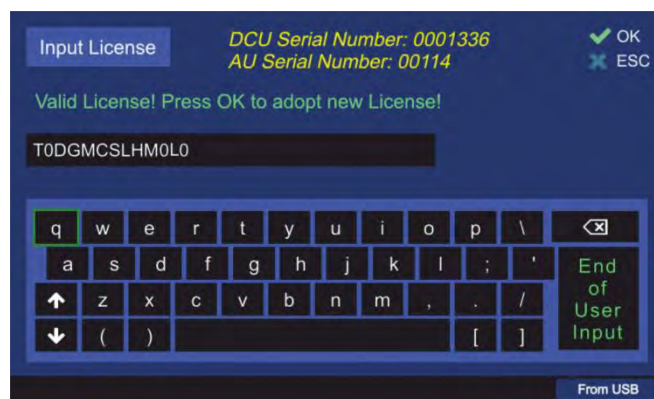


Figure 132. Input of a new license from USB

- After confirming the new valid license with “OK”, a dialog will be opened, which shows the licensed frequency bands (s. Figure 133).

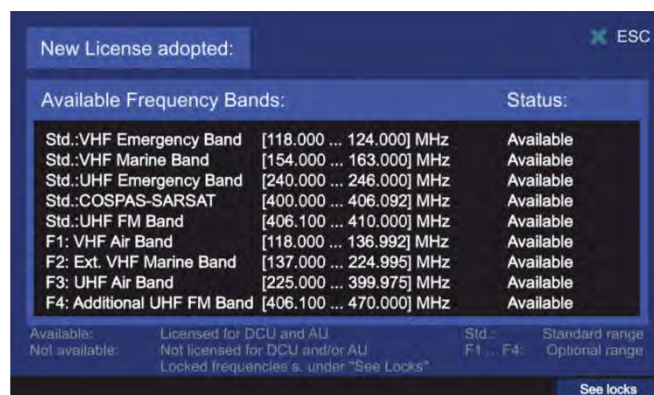


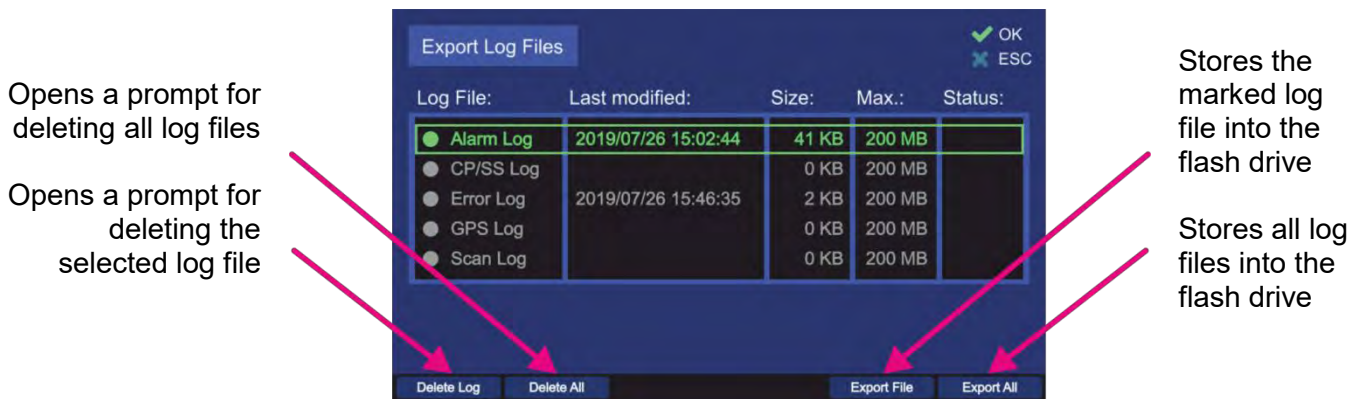
Figure 133. New license adopted

### 7.4.5.3 Export Log Files

This dialog allows the export of the log files via USB (refer to chapter 6.2). Each log file has a header with the following information:

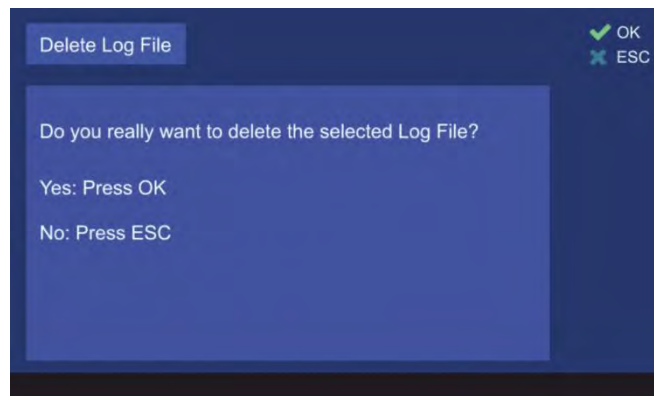
- Serial number of DCU
- Serial number of AU
- Software version of DCU
- Software version of AU
- Operating hours of DCU

The “Export Log” dialog is opened by pressing the corresponding hotkey when the service menu is opened (s. Figure 126, position 4).



**Figure 134. Export Log dialog**

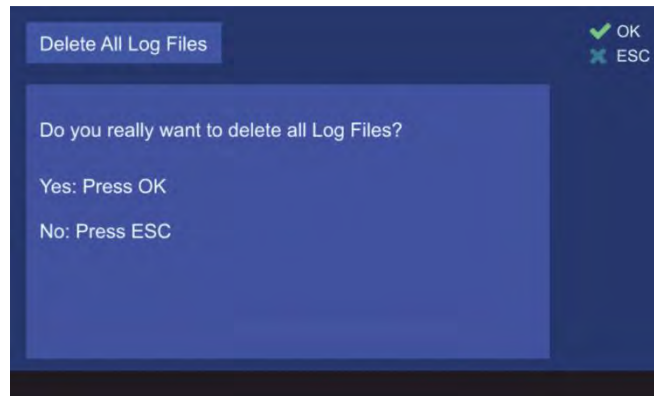
- Pressing the hotkey “Delete Log” will open the following window (s. Figure 135). Pressing “OK” will delete the currently marked file. Pressing “ESC” will close the dialog without deleting the log file.



**Figure 135. Confirming the deleting of the log file**

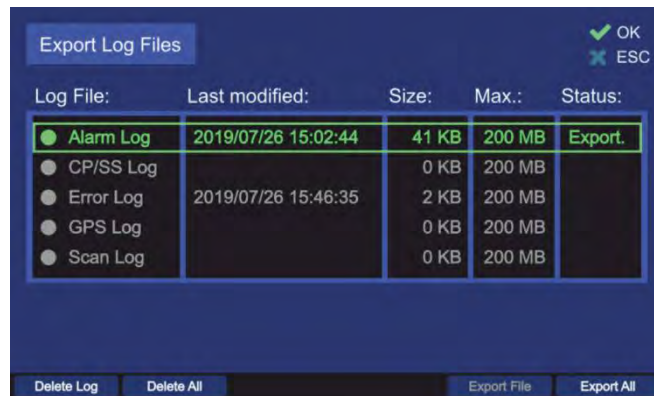
- Pressing the hotkey “Delete All” will open the prompt dialog for deleting of all log files (s. Figure 136). Pressing “OK” will delete all log files. Pressing “ESC” will close the dialog without deleting the log files.





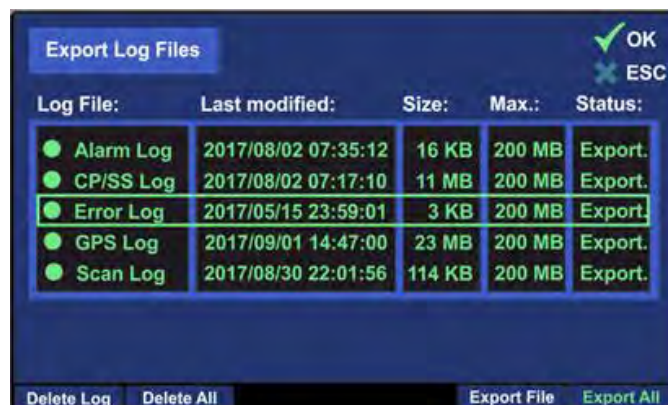
**Figure 136. Confirming of deleting of all log files**

- The hotkey “Export File” is only visible, if a valid log file is marked and the USB flash drive was detected. By pressing this hotkey, the log file will be stored in the flash drive. After a successful export of the log file, the hotkey name becomes gray. It is also gray, if a log file is marked, that has been already exported. The same export cannot be repeated without re-opening the dialog.



**Figure 137. Exporting a log file finished**

- The hotkey “Export All” is only visible, if there is at least one valid log file and the USB flash drive was detected. By pressing this hotkey, all available log files will be stored into the flash drive.



**Figure 138. Exporting of all log files is in progress**

After a successful export of log files, the hotkey name becomes gray. The same export cannot be repeated without re-opening the dialog.



#### 7.4.5.4 Load Configuration Files

This dialog allows the import of the configuration files into the RT-500-M DCU. The hotkey “Load Config” (s. Figure 126, position 5) is activated only if the USB flash drive was detected. Pressing this hotkey will open the following sub dialog (s. Figure 139).



Figure 139. Importing a log file

- The hotkey “Import File” is only visible, if a valid configuration file is marked. Pressing this hotkey will start importing the marked configuration file from the USB flash drive. After successful import of the file, the hotkey name becomes gray (s. Figure 140).

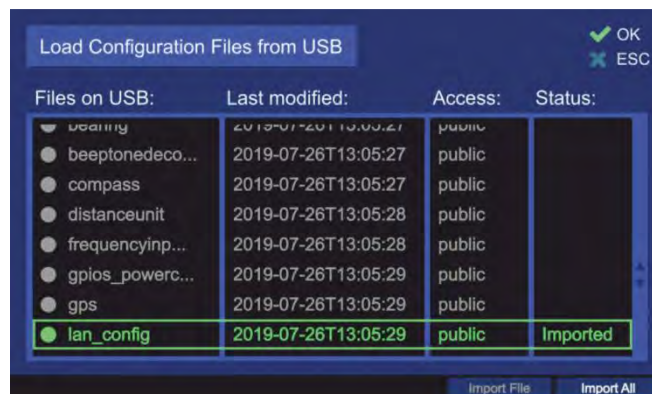


Figure 140. File imported

The import of the same configuration file cannot be repeated without re-opening the dialog.

- The hotkey “Import All” is only visible, if there is at least one valid configuration file on the connected USB flash drive. Pressing this hotkey will start importing all valid configuration files from the flash drive. After the successful import of the files, the hotkey name becomes gray.

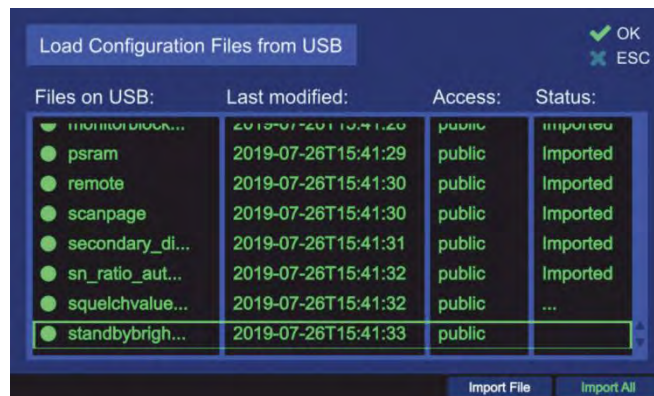


Figure 141. Importing of all files

The same import cannot be repeated without re-opening the dialog.

#### 7.4.5.5 Export Configuration Files

This dialog is used to select configuration files from the internal memory for exporting them to a USB flash drive (refer to chapter 6.2). The hotkey “Export Conf.” (s. Figure 126, position 6) is activated only if the USB flash drive was detected. Pressing this hotkey will open the following sub dialog (s. Figure 142).

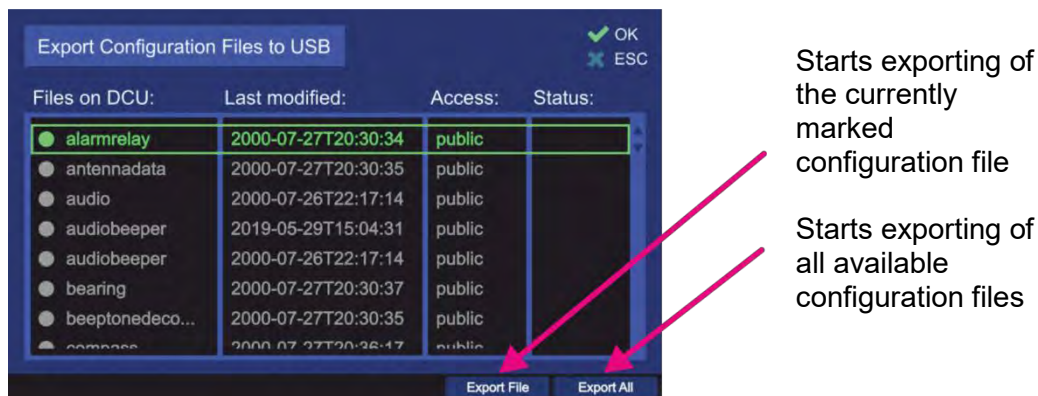
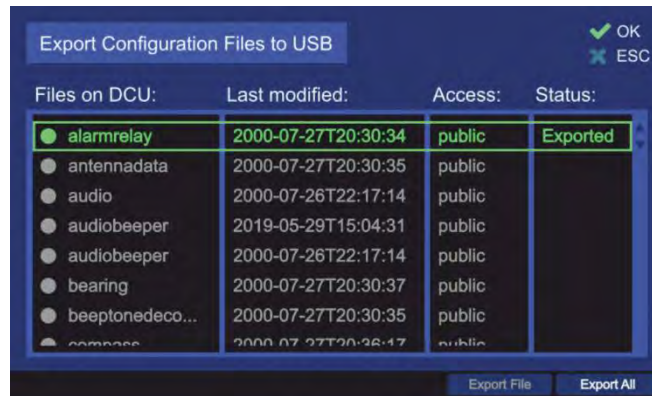


Figure 142. Export configurations dialog

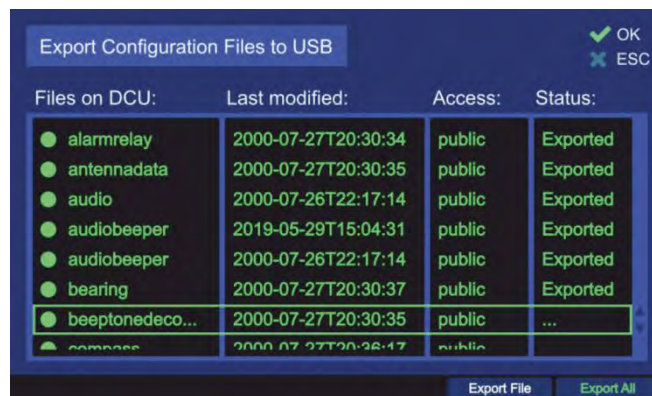
- The hotkey “Export File” is only visible, if the currently marked configuration file is labeled with “Public”. Pressing this hotkey starts exporting the configuration file to the USB flash drive.



**Figure 143. Export of a single file**

After a successful export of the file, the name of the hotkey becomes gray. The same export cannot be repeated without re-opening the dialog.

- Pressing the hotkey “Export All” will start importing all valid (“public”) configuration files to the flash drive.




**Figure 144. Export of all configuration files**

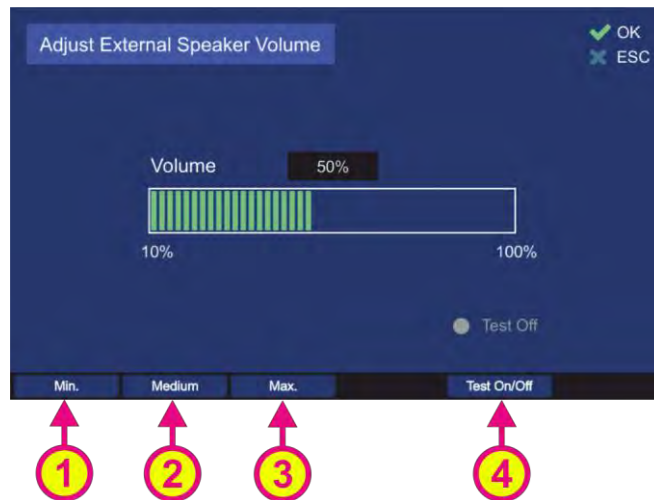
After the successful import of the files, the hotkey name becomes gray. The same export cannot be repeated without re-opening the dialog.

## 7.5 Other Operational Functions

### 7.5.1 Adjusting the Volume

The volume adjustment button  (s. Figure 6, position 3) contains two keys: “+” and “-” (twin function key).


Pressing any of the two keys opens the dialog for adjustment of internal and external speaker.



**Figure 145 "Adjust External Speaker Volume Dialog"**

Use hotkey “Min.” (s. Figure 145, position 1), “Medium” (Figure 145, position 2) and “Max.” (Figure 145, position 3) in order to set an appropriate volume.


Use hotkey “Test On/Off” (Figure 145, position 4) in order to test volume.

To switch the volume on/off quickly, use the mute-button  (s. Figure 6, position 4).

### 7.5.2 Adjusting of the Squelch

The correct adjustment of the squelch is crucial for attaining the optimal sensitivity of the signal reception. The more sensitively the system works, the greater signal range (operating distance) can be achieved. Especially weak signals are often located on the edge to the noise level or even inside the noise level.

Therefore, it is very important to continuously check the squelch level setting and adjust it to the given signal strength and environmental situation in order to use the direction finder system to the full capacity of performance.

- Pushing the button  “+” or “-” (twin function key, s. Figure 6, position 6): opens the following dialog:

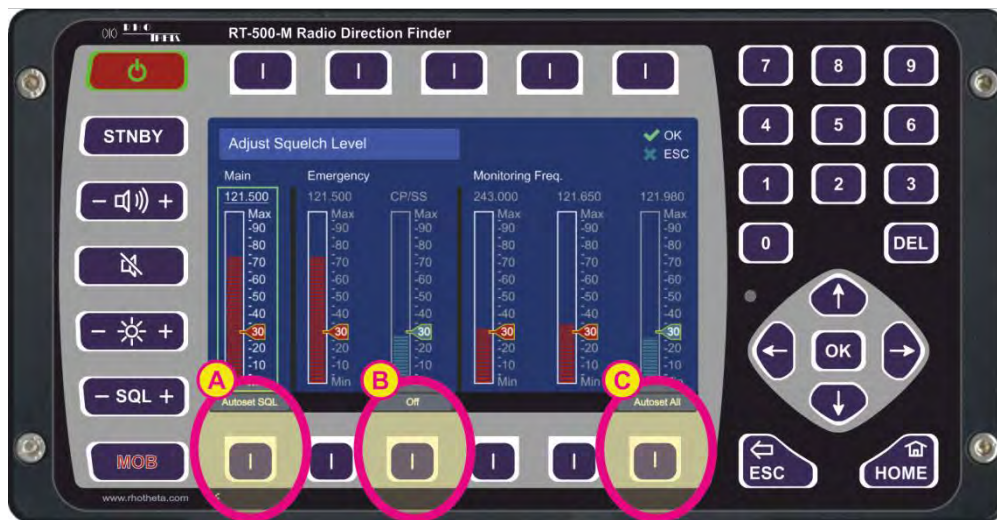






Figure 146. Squelch Dialog

- Pushing the arrow keys   allows switching between the frequencies (green frame indicates the currently chosen frequency).

With the arrow keys   the squelch can be adjusted manually to the desired level in one-percent-steps.


It is also possible to set the squelch level for the main frequency automatically, according to the received signal level. To use this function, push the hotkey “Autoset SQL” (s. field “A”). The squelch can also be turned to the zero level, e.g. for the purpose of receiving very weak signals, which are “hidden” in the noise. The turning off of the squelch is accomplished by pressing the “Off”-hotkey (s. field “B”).

To apply the function of the automatic squelch adjusting to all the stored frequencies press the hotkey “Autoset All” (s. field “C”).



### 7.5.3 Dimming

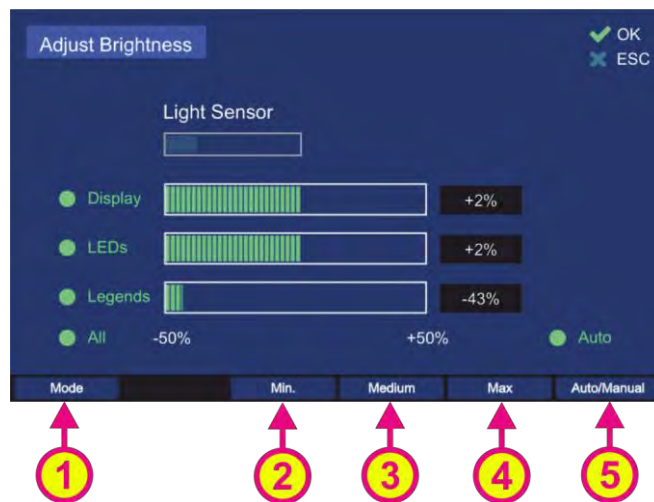
The brightness of the display and key illumination can be adapted to surrounding lighting conditions.

The button  (twin function key, s. Figure 6, position 5) has two keys (“-“, “+“) to adjust the brightness of:

- Backlight of the display
- Backlight of the keypad legends
- LEDs

Pressing one of these keys will open a dialog with a brightness indication and already decrease or increase the brightness.

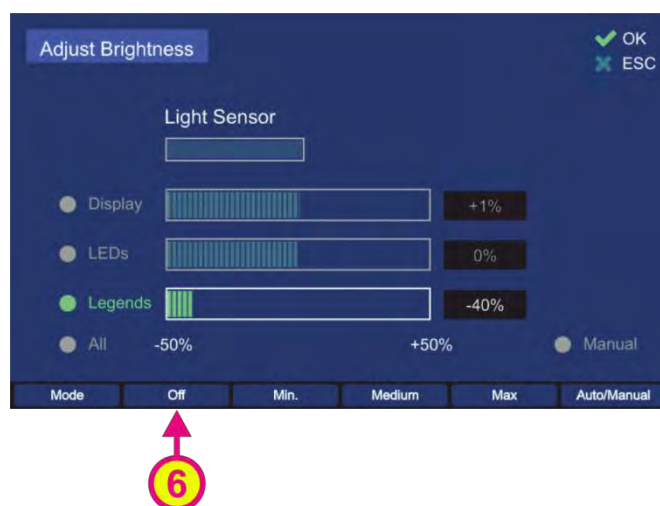
The brightness can be adjusted in the manual mode as well as in the automatic dimming mode, which is coupled with the light sensor. Further, the dialog shows the current level of the light sensor.



**Figure 147 "Adjust Brightness Dialog"**

- Use hotkey “Mode” (s. Figure 147, number 1) to select between:
  - Display
  - LEDs
  - Legends and
  - All
- Use the hotkey “Min.” (s. Figure 147, position 2), “Medium” (s. Figure 147, position 3) and “Max.” (s. Figure 147, position 4) in order to set the appropriate luminosity.
- Use the hotkey “Auto/Manual” (s. Figure 147, position 5) in order to set auto or manual luminosity adjustment mode.  
In the auto mode the luminosity of items will be adjusted automatically based on the light-sensor value.





**Figure 148. Deactivation of the illumination of legends**

- The hotkey “Off” (s. Figure 148, number 6) is only available if the “Mode” is set to “Legends”. Pressing this hotkey deactivates the illumination of the legends.

#### 7.5.4 MOB (Man Over Board) Operation

The MOB function is useful to save the current GPS position when a person goes overboard. This possibility helps to rescue a person in the water, even if the person does not have a personal locator beacon by just pressing the “MOB” button (s. Figure 6, position 7) on the keypad at the right time.

The following figure demonstrates the functionality in case of the person in the water, who has an emergency beacon operating on 121.500 MHz (121.650 as training frequency) and the MOB function has been triggered.



Figure 149 "The MOB direction overlays the bearing"

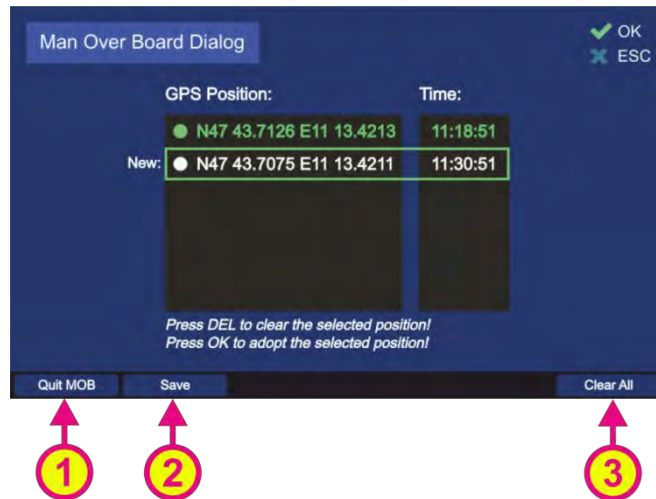
The magenta arrow (slim), which overlays the bearing arrow (the bigger red arrow) shows the direction to the GPS position which has been saved by the MOB function. Simultaneously the RT-500-M displays the Doppler based bearing of the radio signal which comes from the PLB (Personal Locator Beacon). The distance (here Dis: 0.24 km) between the saved GPS position and the current GPS position is numerically indicated in the central digital display.

The MOB function can be triggered manually or by the ELT/PLB or beep tone detection. If the MOB mode is started manually (by pressing the MOB button) the corresponding MOB dialog will be opened. If the MOB mode is started automatically (ELT/PLB or beep tone detection), the MOB dialog will not be opened, but the MOB position will be automatically adopted. All corresponding settings regarding triggering the MOB function can be found in the setup menu (see chapter 7.4.3.8).

#### Note

The basic requirement for opening “MOB” dialog is that the GPS data from an external GPS device is available.

The following figure shows the “Man Over Board” dialog.



**Figure 150. "Man Over Board" dialog**

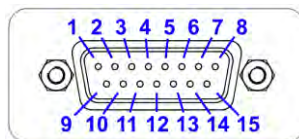
- Press "Quit MOB" (s. Figure 150, position 1) to quit the dialog. This hotkey is used to quit the MOB mode. By pressing this hotkey an extra dialog will appear for additional confirmation.
- Press "Save" (s. Figure 150, position 2) to save the current GPS position. Pressing this hotkey will save the new GPS position and move the line with the new position above the current position. Furthermore, the new position will be shown gray as it has not been adopted for MOB mode.
- Select the line with the appropriate saved GPS Position and press OK to display the corresponding GPS based calculations (distance and true bearing) on the bearing display.
- Press "Clear All" (s. s. Figure 150, position 3) to delete all saved positions.

## 8 Interfaces and Installation

### 8.1 Power & I/O

Contact  
/ Pin

Signal

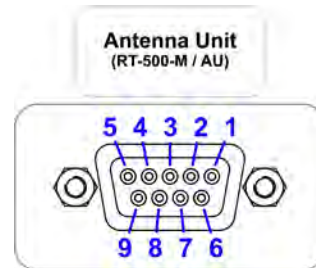


15	<b>+12 V to +30 VDC</b>	Input power supply
8	<b>GND (Ground)</b>	<b>Note</b> Ground of power supply is connected to housing with an anti-interference device.
7	<b>Permanent Operation</b>	Optional input: External power on When applying a voltage > approx. 2 V <sub>DC</sub> the device will be put into permanent operation independent of key On/Off. (Most simple activation: Connection / bridge Pin 7 ↔ Pin 15)
14	<b>PTT / SBS</b>	Optional input in order to suppress self-bearing. When connecting input PTT/SBS (Self Bearing Suppression) to Ground, self-bearing is suppressed.
6	<b>GND</b>	
12	<b>Squelch Out</b>	When receiving a signal this pin is connected to ground (active) by the means of an open collector output. Max. current 200 mA.
4	<b>Alarm Relay</b>	Optional alarm contact (mechanical relay as NOC, Normal opening contact) max. 1 A at 30 VDC resp. max. 0.3 A at 125 VAC Pin 1 = COM; Pin 4 = NC; Pin 9 = NO
1		
9		
3	<b>Speaker +</b>	Optional connection of external speaker. Impedance of speaker: 4...600 Ω, U <sub>Max</sub> : 8 V <sub>SS</sub> , Power: 1.5 W <sub>Max</sub>  <b>Note</b> The audio exit is a symmetric push-pull amplifier. This inhibits, that none of the speaker signals are to be connected to the ground.
11	<b>Speaker -</b>	
13	<b>Audio Line Out</b>	Symmetric Audio exit (adjustable in menu, from 200 mV <sub>SS</sub> at 10% to max. 2 V <sub>SS</sub> at 99%, 600 Ohm)
5	<b>Audio Line Out</b>	
2	<b>Programmable IN</b> (Electrical identical to PTT)	Optional programmable input: - PTT - No function To activate connect to GND.
10	<b>Programmable OUT</b> (Electrical identical to Squelch Out)	Optional programmable exit (open collector): - Alarm - Status (see DCU) - No function Max. current 200 mA.

Table 16. "Power &amp; I/O Connector"

## 8.2 Antenna Unit (Connecting Cable DCU ⇔ AU )

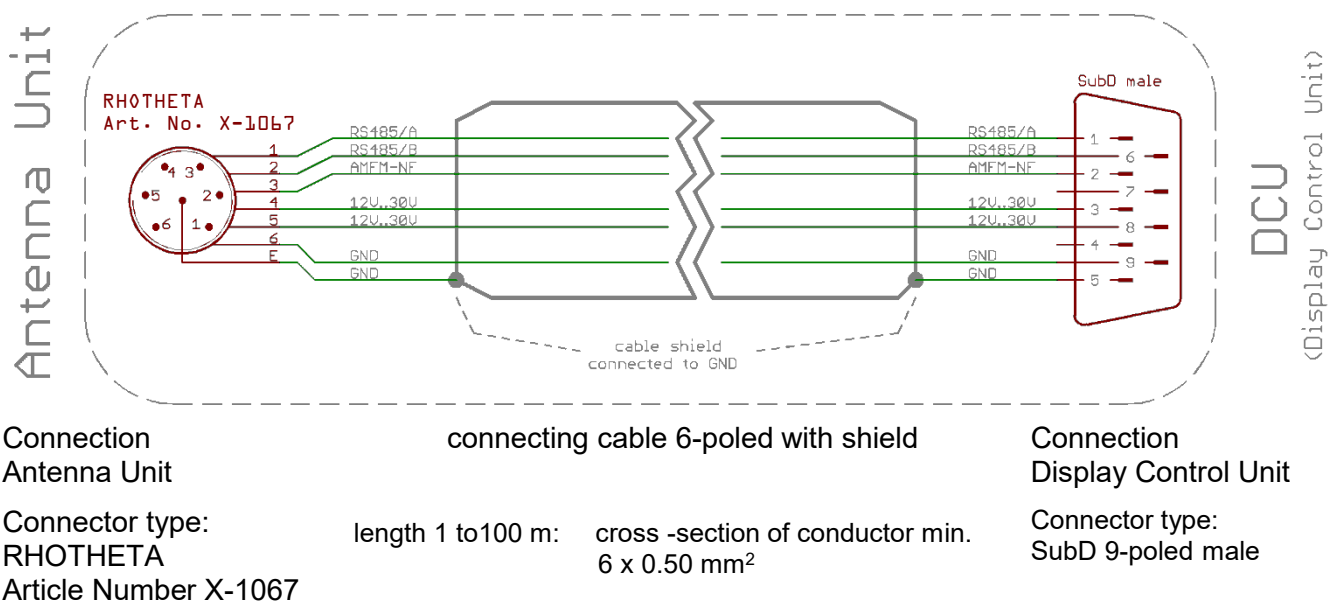
### 8.2.1 Pinning Antenna Unit Connector



Contact / Pin	Signal	
3	+12 to +30 V <sub>DC</sub>	Output - Power supply Antenna Unit
8		
5	GND	
9		
1	RS485 A	Serial data connection DCU ⇔ AU (9600 Baud / semi-duplex / receive and transmit)
6	RS485 B	
2	NF	Input audio signal resp. analog Test/Service (symmetric optional)
7	GND	Input audio symmetric (OPTIONAL)

Table 17. "Pinning of the AU Connector"

### 8.2.2 Connecting Cable DCU ⇔ AU



### 8.3 NMEA COM-Interfaces

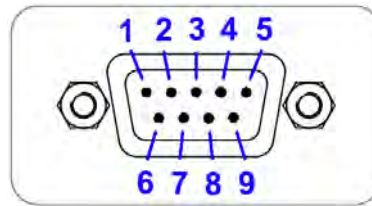
All 3 COM-Interfaces COM1, COM2, and COM3 have the same pinning.

These interfaces should be used for connection of

- COMPASS of the vessel
- GPS Receiver
- ECDIS (Remote Control)

#### Note

When connecting to input use either RS232 Rx or RS422 Rx (not both)!



Contact / Pin	Signal	
2	<b>RS232 Tx</b>	Output of serial data with RS232 level
3	<b>RS232 Rx</b>	Input of serial data with RS232 level
5	<b>GND</b>	GND level for RS232 connection
6	<b>RS422 Tx / A</b>	Output of serial data with RS422 level NMEA 0183 TX
1	<b>RS422 Tx / B</b>	
7	<b>RS422 Rx / A</b>	Input of serial data with RS422 level (isolated) NMEA 0183 RX
8	<b>RS422 Rx / B</b>	
4	<b>NC</b>	Not connected
9	<b>Power</b>	Output - Power supply for GPS / Compass (12V)

**Table 18. "Pinning of NMEA Connectors"**

#### Note

Per default the "Autotalk" mode is activated, which means that NMEA sentences of the direction finder are sent out cyclically with a fixed time period of 250 ms. The "Autotalk" mode can also be deactivated per corresponding NMEA command (s. NMEA-Protocol Description (RT-500-M & RT-800)).



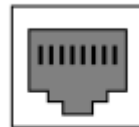
## 8.4 LAN Interface

The LAN interface can be used for connection of ECDIS or other Remote and Control Devices. The RT-500-M can be controlled via the same NMEA sentences which are available on COM Port in DF remote control configuration.

### Note

Per default the "Autotalk" mode is activated, which means that NMEA sentences of the direction finder are sent out cyclically with a fixed time period of 250 ms. The "Autotalk" mode can also be deactivated per corresponding NMEA command (s. NMEA-Protocol Description (RT-500-M & RT-800)).

1 2 3 4 5 6 7 8

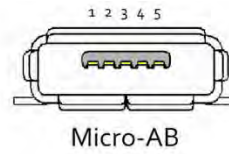
RJ-45  
Female

Contact / Pin	Signal	
1	<b>TX+_D1</b>	Transmit Data+ (10/100BaseT)
2	<b>TX-_D1</b>	Transmit Data- (10/100BaseT)
3	<b>RX+_D2</b>	Receive Data+ (10/100BaseT)
4	<b>BI+_D3</b>	Bi-directional+ (not used)
5	<b>BI-_D3</b>	Bi-directional- (not used)
6	<b>RX-_D2</b>	Receive Data- (10/100BaseT)
7	<b>BI+_D4</b>	Bi-directional+ (not used)
8	<b>BI-_D4</b>	Bi-directional- (not used)

**Table 19. "Pinning LAN Connector"**

## 8.5 USB Service Interface

The USB 2.0 connector is used only for service purposes.



Contact / Pin	Signal	
1	<b>VBUS</b>	+5V
2	<b>USB D-</b>	USB 2.0 Diferental pair
3	<b>USB D+</b>	USB 2.0 Diferental pair
4	<b>NC</b>	Not connected
5	<b>GND</b>	Ground

**Figure 151. Pinning USB**

## 8.6 Ground Connector

The ground connector (s. Figure 7, position 8) is used to connect the DCU to ground of the ship. For the connection a screw M5 is required and a cable to ground with a cross-section of 4 mm<sup>2</sup> is recommended.

## 8.7 Guideline for Optimal DF Antenna Position

The quality of the bearing results depends largely on the antenna's location. So, an antenna location has to be found where the transmitter's wavefield can reach the bearing antenna as undisturbed as possible.

If high bearing accuracy is demanded, no metallic resp. RF-conducting obstacles may be around the antenna unit (in an angle of  $\pm 45^\circ$  towards the horizontal).

Objects being in the "restricted area" will disturb the arriving wave field. Reflections will arise which might disturb bearing accuracy and so on decrease the bearing accuracy. This physical effect generally is valid for all bearing systems. In practice, often a compromise has to be found between bearing and other interests.

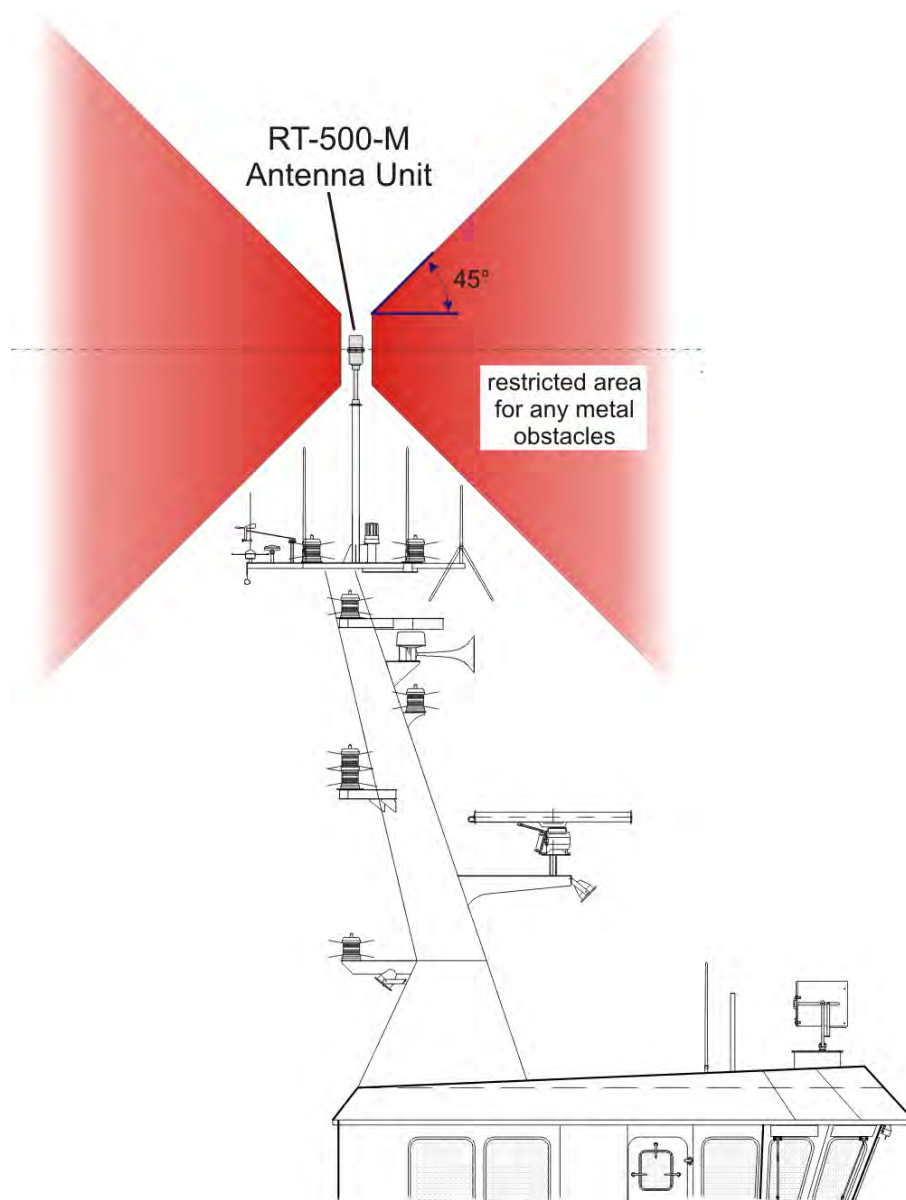


Figure 152. "Example of Optimal DF Antenna Position"

## 9 Technical Data

### 9.1 Electrical Characteristics

System Characteristics		
Parameter	Condition	Data
Method of Bearing		Doppler (3 kHz rotation frequency)
Bearing Accuracy		$\leq 5^\circ$ RMS <sup>1</sup>
Display Resolution		1°
Minimum Signal Duration		$\leq 100$ ms
Frequency Range	VHF Air Band	118.000 – 124.000 MHz 118.000 – 136.992 MHz (Option F1)
	VHF Marine Band	154.000 – 163.000 MHz 137.000 – 224.995 MHz (Option F2)
	UHF Air Band	240.000 – 246.000 MHz 225.000 – 399.975 MHz (Option F3)
	COSPAS-SARSAT	400.000 – 406.092 MHz
	UHF FM-Band	406.100 – 410.000 MHz 406.100 – 470.000 MHz (Option F4)
Receive Frequency Tuning Steps	VHF Air Band	8.33 kHz
	Marine Band	5 kHz
	UHF Air Band	25 kHz
	COSPAS-SARSAT	8.33 kHz
	UHF FM-Band	5 kHz
Bearing Sensitivity Continuous Signal  ( $\pm 5^\circ$ bearing fluctuation)	VHF Air Band	$\leq 4 \mu\text{V/m}$ / $2.5 \mu\text{V/m}$ typical
	Marine Band	$\leq 3 \mu\text{V/m}$ / $2 \mu\text{V/m}$ typical
	Extended Marine Band above 174 MHz	$\leq 5 \mu\text{V/m}$ / $3 \mu\text{V/m}$ typical
	UHF Air Band	$\leq 6 \mu\text{V/m}$ / $4 \mu\text{V/m}$ typical
	COSPAS-SARSAT	$\leq 6 \mu\text{V/m}$ / $4 \mu\text{V/m}$ typical
	UHF FM-Band	$\leq 6 \mu\text{V/m}$ / $4 \mu\text{V/m}$ typical

System Characteristics		
Parameter	Condition	Data
Bearable Types of Modulation		A3E, F3E, A3X (distress signal modulation)
Polarization		Vertical
Scanning		Multiple scanning and monitoring functions available
COSPAS-SARSAT Functionality		Decoding of COSPAS-SARSAT Message: shows beacon ID, GPS position and whole message string (short and long). Displays direction and distance to beacon <sup>2</sup> .
TFT Graphic Display		5" (127 mm), 24 bit RGB 800 x 480 x 3 dots Max. brightness 700 cd/m <sup>2</sup> Dimming: manual and automatic
Audio	Internal Speaker	1 W, 4 Ohm
	External Speaker	1 W, 4 Ohm
	Line out	Adjustable from 200 mV <sub>pp</sub> to 2 V <sub>pp</sub>
Operating Voltage		12 V to 30 V DC
Power Consumption		Max.: 15 W Typical: 8 W Stand-by: 7 W
Current Consumption		Max. 1.5 A
Interfaces		3x NMEA 0183 (RS422)   3x RS232 Ethernet LAN (NMEA over LAN) Test port (RS-232) Alarm Relay Output (2A, 30 V DC / 0,3 A, 125 V AC) PTT input for self-bearing suppression Squelch output for external audio controlling 2 x programmable I/O Ports USB 2.0 for service purposes

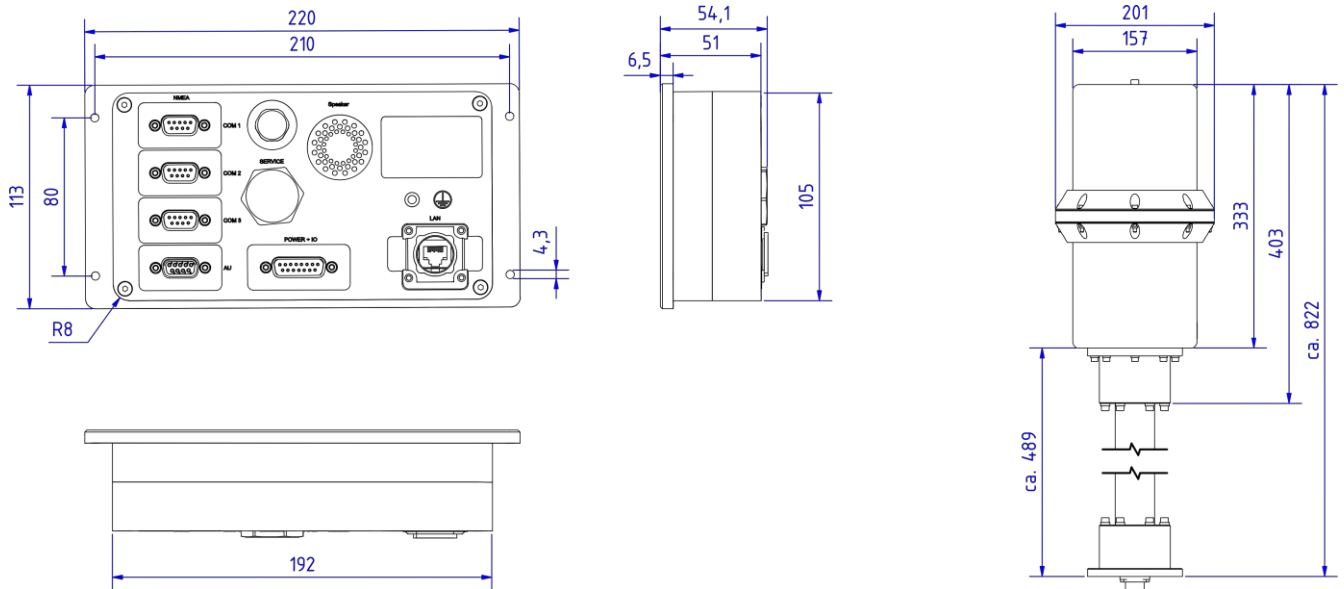
Table 20. Electrical Characteristics

<sup>1</sup> Measured with un-modulated, undisturbed wave field at field strength  $\geq 20$  dB above sensitivity level by changing the angle of incidence with the antenna rotating on a revolving table in order to eliminate environmental influences on the results.

<sup>2</sup> If GPS data is available at NMEA interface

## 9.2 Mechanical Characteristics

### 9.2.1 Mechanical Data



**Figure 153. DCU and AU mechanical dimensions**

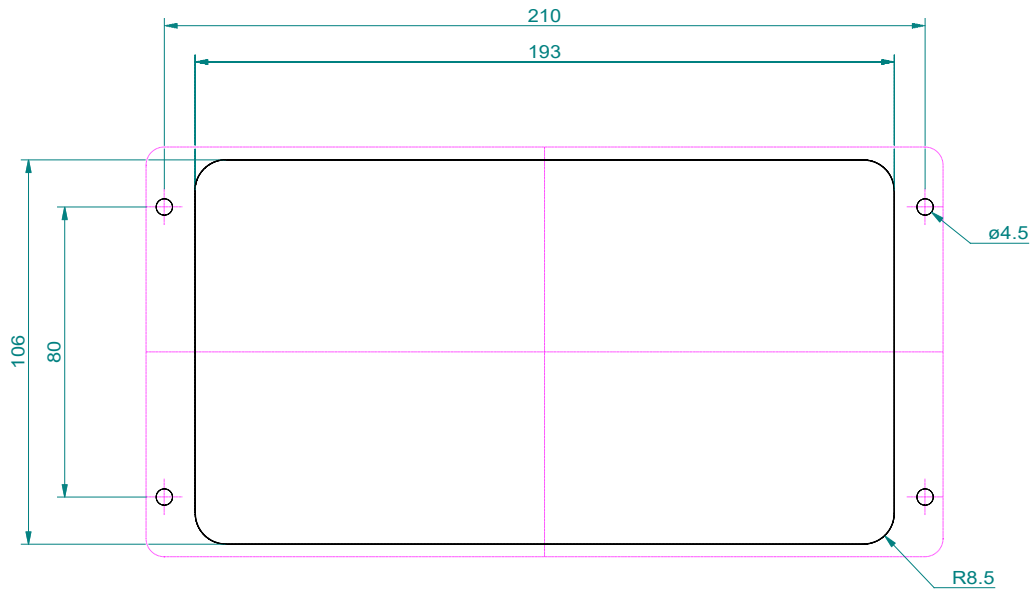
Measuring units: millimetres [mm]

Mechanical Characteristics		
Parameter	DCU	AU
Weight	1500 g (3.3 lbs)	5200 g (11.5 lbs)
Operating Temperature	-20 °C to +60 °C (-4 °F to +140 °F)	-40 °C to +60 °C (-4 °F to +140 °F)
Storage Temperature	-55 °C to +80 °C (-67 °F to +176 °F)	-55 °C to +80 °C (-67 °F to +176 °F)
Ingress Protection	IP67	IP67
Max. Wind Speed	-	270 km/h

**Table 21. Mechanical Characteristics**



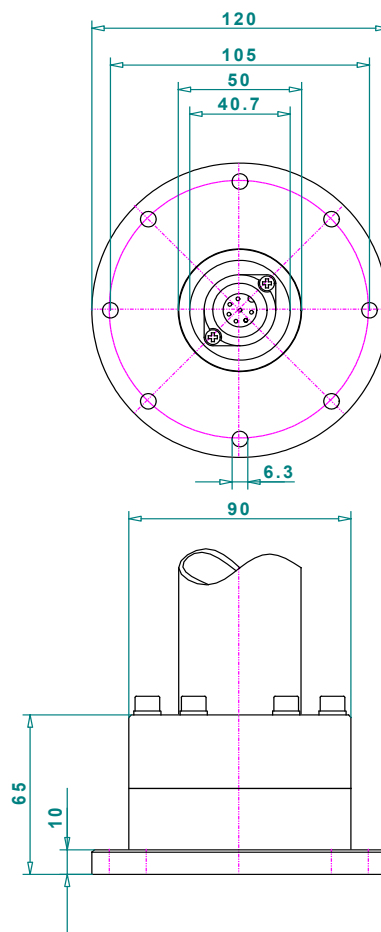
### 9.2.2 DCU Mounting Cutout



**Figure 154. DCU mounting cutout**

Measuring units: [mm] millimetres

### 9.2.3 AU Mast Flange



**Figure 155. Antenna unit mast flange. Mechanical dimensions.**

Measuring units: [mm] millimetres

## 10 Disposal within the European Union

### Product Recycling



■ Product labeling in accordance with EN 50419

At the end of the life of the product, this product may not be disposed of with normal household waste. Even disposal via the municipal collection points for electrical and electronic equipment is not allowed.

The correct disposal of this product will help to conserve resources and prevent potential negative effects on the environment and human health which may occur due to improper handling of the product.

- Therefore, carry out the inoperative device, an electronics recycling.  
or
- The RHOTHETA Elektronik GmbH takes back all its products, subject to redemption, in accordance with the requirements of the WEEE Directive (2012/19 / EC) of the European Union to deliver it to a professional disposal.

## 11 Disposal outside the European Union

For proper disposal of used electronic equipment in accordance with the respective national regulations in countries outside the European Union please check it with your dealer or the local authorities.

## **12 Maintenance and Cleaning**

### **12.1 Maintenance**

UV irradiation can age the front foil of the RT-500-M DCU with time, which can lead to brittleness of the front foil.

Depending on the operating conditions of the RT-500-M DCU, there is the possibility that moisture can penetrate through small hairline cracks in the front foil. An impairment of the functionality up to the damage of the product can result.

The exchange of the front foil may only be done by RHOTHETA Elektronik GmbH or an authorized maintenance facility; otherwise this will void the warranty.

### **12.2 Cleaning**

RHOTHETA Elektronik recommends cleaning the RT-500-M with warm water and a microfiber cloth. Persistent stains can be washed with a dishwashing detergent. Do not use any abrasives or cleaning agents containing alcohol.

## 13 Appendix

### 13.1 Error Messages

Error message	Error location	Cause
Error 01 AU No Receiver	Antenna Unit: Receiver	defective receiver circuit board in AU
Error 04 AU Rec. No PLL	Antenna	Error in receiver synthesizer oscillator in AU
Error 05 DCU>AU No Data	Connection Display → Antenna	No serial data from DCU to AU
Error 06 DCU>AU BadData	Connection Display → Antenna	Incompatible respective bad data connection between DCU and AU
Error 07 AU Low Voltage	Main voltage supply	Voltage supply below 10 V
Error 08 AU>DCU BadData	Connection Antenna → Display	Incompatible respective bad data connection between AU and DCU
Error 09 No AntennaUnit	Connection Antenna → Display	No serial data (RS485) from AU Missing or damaged cable connection between AU and DCU respective defective AU

### 13.2 Warnings

Warning message	Error location	Cause
Warning 01 AU low Voltage	Main voltage supply	Low voltage supply of AU
Warning 02 NoCompassFound	External device	Compass data not available
Warning 10 NMEA DataRange	External device	Incorrect NMEA data: Value out of allowed range
Warning 11 NMEA Bad Data	External device	Defective data recognized on NMEA interface
Warning 12 NMEA CheckSum	External device	Defective data recognized on NMEA interface: Check Sum
Warning 13 NMEA Bad Frame	External device	Defective data recognized on NMEA interface: Bad Frame
Warning 20 AU DataRange	Connection Display → Antenna	Bad data of DCU, mismatch of telegram length
Warning 21 AU Decode Err	Radio distance transmitter ↔ direction finder	Data error in Cospas-Sarsat data block, data could not be decoded.
Warning 22 Send Freq.Ofs-	Received transmitter	Frequency of transmitter too low
Warning 23 Send Freq.Ofs+	Received transmitter	Frequency of transmitter too high
Warning 30 FLASH Config	DCU Flash memory	The stored settings cannot be read (device is operating with default settings).

### 13.3 Frequencies of Channels in Marine Band

Channel No.	frequency (ship - station)	Frequency (coast - station)
0	156,000 MHz	160,600 MHz
1	156,050 MHz	160,650 MHz
2	156,100 MHz	160,700 MHz
3	156,150 MHz	160,750 MHz
4	156,200 MHz	160,800 MHz
5	156,250 MHz	160,850 MHz
6	156,300 MHz	160,900 MHz
7	156,350 MHz	160,950 MHz
8	156,400 MHz	
9	156,450 MHz	
10	156,500 MHz	
11	156,550 MHz	
12	156,600 MHz	
13	156,650 MHz	
14	156,700 MHz	
15	156,750 MHz	
16	156,800 MHz	
17	156,850 MHz	
18	156,900 MHz	161,500 MHz
19	156,950 MHz	161,550 MHz
20	157,000 MHz	161,600 MHz
21	157,050 MHz	161,650 MHz
22	157,100 MHz	161,700 MHz
23	157,150 MHz	161,750 MHz
24	157,200 MHz	161,800 MHz
25	157,250 MHz	161,850 MHz
26	157,300 MHz	161,900 MHz
27	157,350 MHz	161,950 MHz
28	157,400 MHz	162,000 MHz
60	156,025 MHz	160,625 MHz
61	156,075 MHz	160,675 MHz
62	156,125 MHz	160,725 MHz
63	156,175 MHz	160,775 MHz
64	156,225 MHz	160,825 MHz
65	156,275 MHz	160,875 MHz
66	156,325 MHz	160,925 MHz
67	156,375 MHz	
68	156,425 MHz	
69	156,475 MHz	
70	156,525 MHz	
71	156,575 MHz	
72	156,625 MHz	
73	156,675 MHz	
74	156,725 MHz	
75	156,775 MHz	
76	156,825 MHz	
77	156,875 MHz	
78	156,925 MHz	161,525 MHz
79	156,975 MHz	161,575 MHz
80	157,025 MHz	161,625 MHz
81	157,075 MHz	161,675 MHz
82	157,125 MHz	161,725 MHz
83	157,175 MHz	161,775 MHz
84	157,225 MHz	161,825 MHz
85	157,275 MHz	161,875 MHz
86	157,325 MHz	161,925 MHz
87	157,375 MHz	161,975 MHz
88	157,425 MHz	162,025 MHz

## 13.4 Abbreviations

Abbreviation	Meaning	Remarks
AU	Antenna Unit	
CP/SS	Cospas-Sarsat	
DCU	Display & Control Unit	
DF	Direction finder	
Deg	Degree (° = 60' )	
ELT	Emergency Locator Transmitter	
GND	Ground	
GPS	Global Positioning System	
ID	Identification	
IP	Ingress Protection rating	IP67
LAN	Local Area Network	
LCD	Liquid Crystal Display	
LED	Light-Emitting Diode	
MOB	Man-Over-Board	
MMSI	Maritime Mobile Service Identity	Ship's Ident. No.
NF	Audio Frequency	
NMEA (0183)	National Marine Electronics Association	Interface- and data telegram standard
PLB	Personal Locator Beacon	
PS RAM	Averaging Random Access Memory	
PTT/SBS	Push-To-Talk/ Self Bearing Suppression	
RAM	Random Access Memory	
Rx	Receiver	
S/N	Signal to Noise	
SAR	Search And Rescue	
SNR	Signal to Noise-Ratio	
SQL	Squelch	
TFT	Thin Film Transistor (see also LCD)	
Tx	Transmitter	
VDC	Volts of Direct Current	
VTs	Vessel Traffic Service	



## 14 Notes