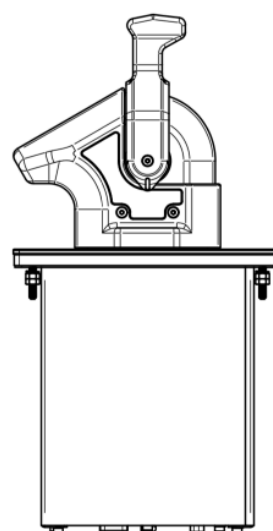
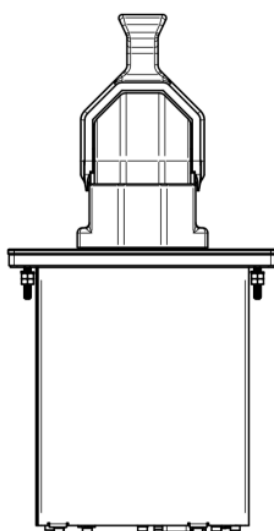
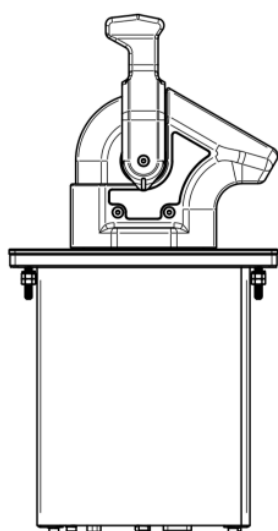




( FEELING IS BELIEVING )

## Installation and operation Manual Haptic Azimuth lever



Applicable to models:

11.00.000.XXX

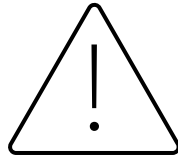
Date:

25/08/2023

Version number:

V1.1

## !!IMPORTANT!



Please read the following instructions carefully before attempting any actions with the lever.

- Install and use according to specifications stated in this document. Unintended use and/or deviating from the installation instructions of this product may result in loss of function and potential destruction of the product, with possible harmful consequences for people and equipment in the vicinity.
- Installation is to be carried out by trained personnel only.
- In case of any visual damage to the product always contact the supplier before proceeding with installation.
- Use product within specified limits only.

## Contact details

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## Version Control

<i>Version</i>	<i>Author</i>	<i>Changes</i>	<i>Released</i>	<i>Release date</i>	<i>Reviewed by</i>
V1	Jelle Tiemensma	Main document v1	Yes	7/11/2022	Brent
V1.1	Jelle Tiemensma	Updated version and TA	Yes	25/8/2023	Brent

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# 1. General

## 1.1 Scope

This document provides information regarding the safe operation and installation of Smart-Ship's Azimuth Lever product range, which can be identified by the model number range 11.00.000.XXX.

Please read this document carefully before attempting to make use of or installing such products. For any questions, please get in touch with Smart-Ship through [support@smart-ship.eu](mailto:support@smart-ship.eu).

As Smart-Ship is continuously improving its range of products, we retain the right to make changes to the products at any time. These changes may not be reflected in this version of the manual. Please get in touch with Smart-Ship for the most recent version.

## 1.2 Working Principle

Smart-Ship's Haptic Azimuth Lever is intended to be used as a control system for propulsion equipment aboard ships. It consists of one 360 degrees rotatable lever which, when operated, provides a sensor output corresponding to the lever position to adjust the angular position of the thruster, and one lever operable over a range of 90° providing a sensor output corresponding to the lever position in order to control the amount of throttle provided by the propulsion equipment. Several types of sensor outputs can be generated. For the options, see 1.4 Specifications and Options.

Furthermore, the Azimuth lever can be equipped with haptic (also known as force-feedback) functionalities. Through Smart-Ship's Haptic Algorithm, running on a separate PLC, any type of data from information systems or sensors aboard the ship, can be translated to a force or vibration to provide intuitive operational feedback to the user.

The lever is equipped with both a hardware and LED indicator for accurate depiction of the current lever position. Furthermore, it can be connected to one or more displays for adjustment of functionalities and status indication.

## 1.3 System overview

The standard Haptic Azimuth Lever consists of a lever setup with LED indicators, a glass top plate and casing with connectors as indicated in Figure 1.

Options include:

- 90° or 120° of travel for the throttle lever
- Additional tiller lever
- Various output signals, single and redundant
- Custom branding

<<See Figure 1 on the next page>>

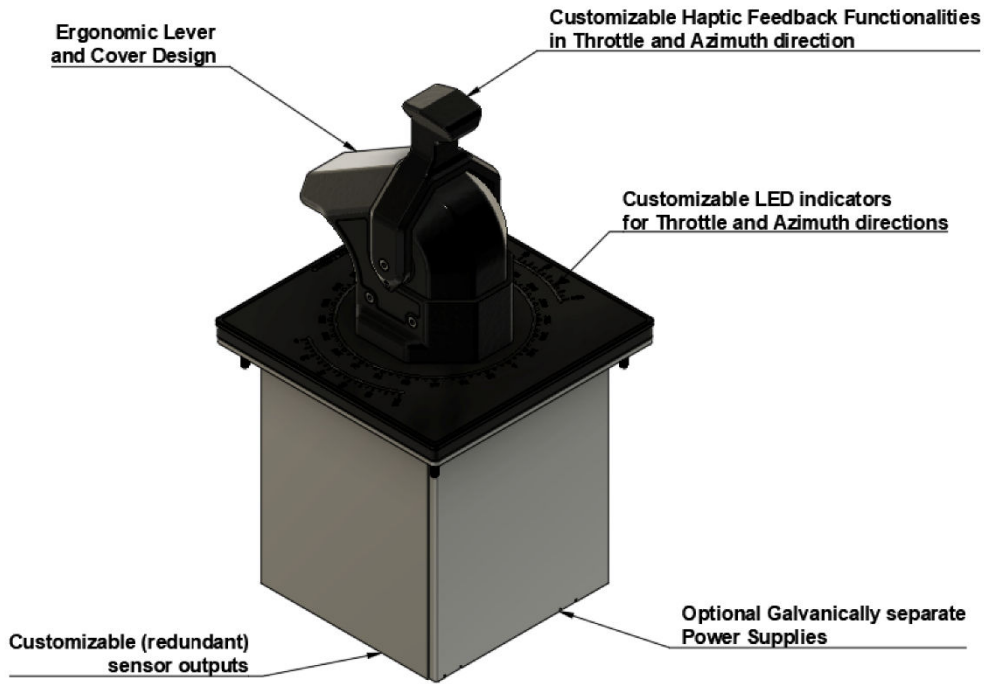


Figure 1: Azimuth System Overview

#### 1.4 Specifications and options

	<b>Mechanical Specification</b>
<b>IP Rating (TA version)</b>	IP 52
<b>Operating Temperature (TA version)</b>	-25°C ... + 70°C
<b>Rated Humidity (TA version)</b>	95% Rh at 55°C for 2 hours
<b>Weight</b>	3 kg (standard setup)
<b>Operating Range Throttle:</b>	90...120°
<b>Operating Range Azimuth:</b>	360° continuous
<b>Rated Vibration (TA version)</b>	2...13.2 Hz @ 1mm ampl. 13.2... 100Hz @ 0.7g

	<b>Electrical Specification</b>
<b>Supply Voltage</b>	24V standard
<b>Sensor output</b>	0...10 V with 5 kOhm standard See below for other options
<b>ESD (TA Version)</b>	6 kV contact 8 kV air

	<b>Options</b>
<b>Lever Layout</b>	Standard cover or Extended Rudder Lever
<b>Sensor outputs</b>	4...20 mA, CAN, Various resistance voltage outputs. All options possible with a redundant (galvanically separated) sensor
<b>Cover</b>	Customized design and glass panel upon request
<b>Signal amplifier</b>	External amplifier to provide haptic feedback over long distance cables (>5 meter)
<b>CAN Chain Controller</b>	External controller to chain CAN-signals of multiple levers

### 1.5 Certification

Type approved under Bureau Veritas (Certificate Number: 74237/A0 BV).



## 2. Installation

### 2.1 Installation of the lever in the console

The dimensions required for installation of the Haptic Azimuth Lever in a console are indicated in Figure 2.

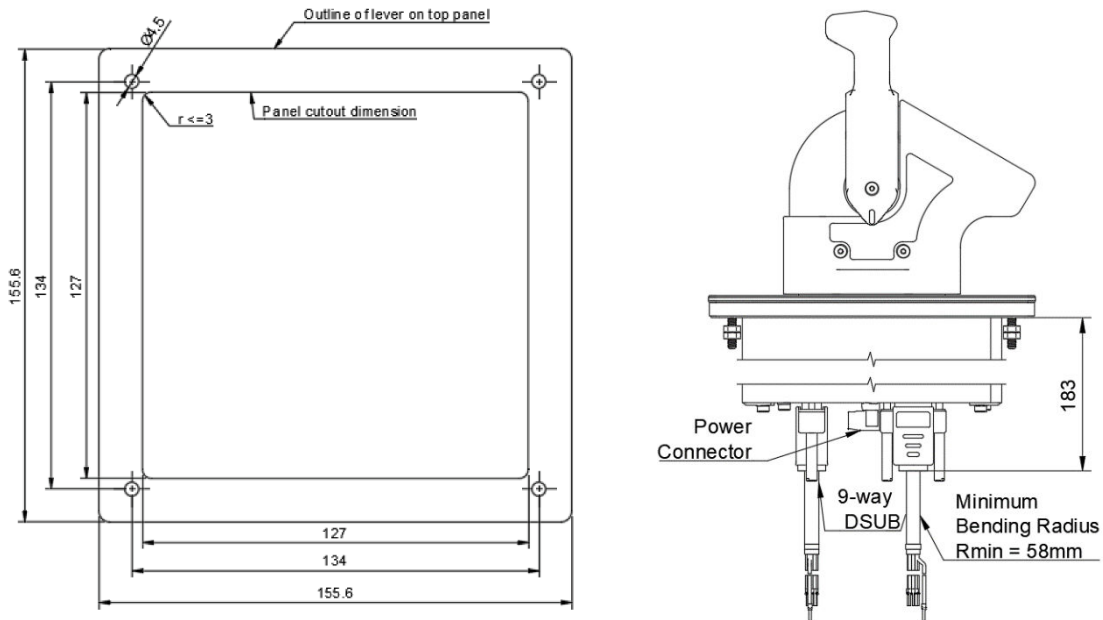


Figure 2: Panel cutout dimensions (Left), Depth below console (Right)

The following table indicates the space required by the lever below the console. Upon request, L-connectors can be provided when depth below the console is limited.

<b>Lever dimensions in console</b>	
<b>Length housing</b>	124 mm
<b>Width housing</b>	124 mm
<b>Depth (from top console) Casing excl. Cables</b>	151mm
<b>incl. cables</b>	min. 241mm
<b>Depth w/ L-connectors incl. cables (upon request)</b>	176 mm

For installation of the Haptic Azimuth Lever in the console, nuts and lock washers are supplied. Making proper use of these ensures the rated IP can be achieved. Therefore, these are to be mounted as indicated in Figure 3.

<<See Figure 3 on the next page>>

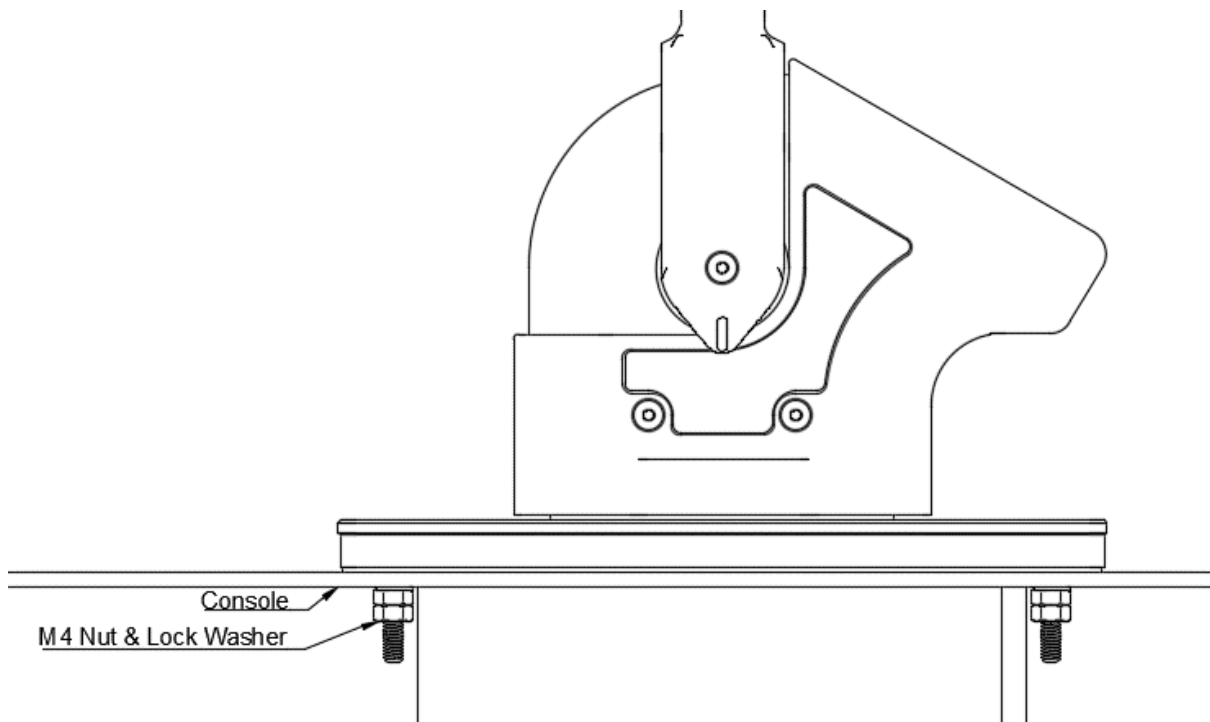
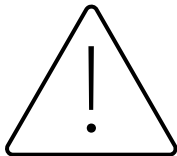


Figure 3: Mounting instructions

The cut-out and mounting points allow for the Haptic Azimuth Lever to be mounted in four different directions relative to the console. For intuitive operation of the ship and the Haptic Azimuth Lever, it is recommended to mount the product in such a way that the direction of the movement of the lever corresponds to the intended operation of the ship.



**!IMPORTANT!:** Please note that any damages resulting from improper installation, deviation from the outlined guidelines, or neglecting to follow the prescribed procedures will not be the responsibility of Smart-Ship. It is your responsibility to ensure that the installation is carried out in accordance with the instructions provided to avoid any potential issues.

We recommend reading and understanding the installation instructions thoroughly before proceeding with the installation process. If you have any uncertainties or questions about the installation, please reach out to our support team for assistance. Your cooperation in following the installation instructions will contribute to the successful implementation of the product and the prevention of any avoidable damages.

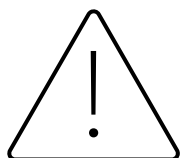
## 2.2 Connecting the levers

Smart-Ship can provide all connection equipment (cables, headers etc.) as mentioned in this section. These can be provided at various lengths, as well as tagged and numbered at your convenience. Please get in touch to discover the options.

Please note: Distinction is made between the PLC running the haptic algorithm (from here: Haptic PLC) and the PLC receiving the sensor signals to control the propulsion/-

maneuvering equipment (from here: Control PLC). In some cases, these are the same. Please refer to the provided wiring diagrams to determine your specific case.

Per installed product, the following connection points are found on the bottom of the casing (see Figure 4). The connection points at the power connector are integrated in a Male MSTB-2,5/4-STF-5,08 header. The Headers at point 5 & 6 of Figure 4 consist of 9-way Female DSUB connectors. Make sure the DSUB connectors are properly fixated with the screws at both sides of the connectors.



**!IMPORTANT!:** When the Haptic PLC is located more than 5m from the control units always make sure a shielded and twisted-pair cable is used at least for the twisted pairs specified in the table on the next page to ensure the data integrity of the RS485 signals. For all other signals, a properly shielded wire is strongly recommended.

**!WARNING!:** Follow instructions regarding polarity as stated below. Otherwise, the product might be damaged.

The following tables indicate which connection is to go in the specific positions of the connectors as indicated in Figure 4.

Power supply	
<b>4.1</b>	24V Backup
<b>4.2</b>	GND Backup
<b>4.3</b>	24V Main
<b>4.4</b>	GND Main

DSUB-9 (6)	Pairs	Main/Backup	Pairs
<b>6.1</b>	Sensor X1 Signal	Backup	
<b>6.2</b>	RS485 Data - / CAN L		3
<b>6.3</b>	RS485 Data + / CAN H		3
<b>6.4</b>	Encoder Z B/		4
<b>6.5</b>	Encoder Z B		4
<b>6.6</b>	Sensor Z1 Signal	Backup	
<b>6.7</b>	Motor Analog Z+		
<b>6.8</b>	Encoder Z A/		5
<b>6.9</b>	Encoder Z A		5

DSUB-9 (5)	Signal	Main/Backup	Pairs
<b>5.1</b>	Motor Analog X+		
<b>5.2</b>	Sensor X2 Signal	Main	
<b>5.3</b>	Motor Analog Z-		
<b>5.4</b>	Encoder X B/		1
<b>5.5</b>	Encoder X B		1
<b>5.6</b>	Motor Analog X -		
<b>5.7</b>	Sensor Z2 Signal	Main	
<b>5.8</b>	Encoder X A/		2
<b>5.9</b>	Encoder X A		2

<<See Figure 4 on the next page>>

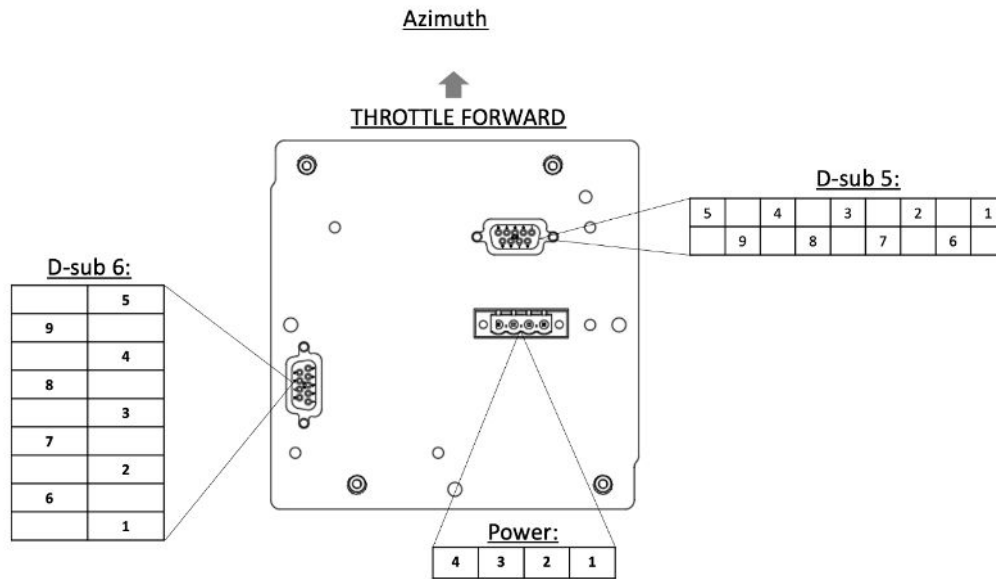


Figure 4: Azimuth pin layout

The wiring and cable routing to the Haptic PLC is specific per project and can be provided on request.

### 2.3 Redundancy

On request, the unit can be fitted with galvanically separated redundant sensors. In that case, it is important that the main and redundant power supply are also galvanically separated to create two fully separate systems.

### 2.4 Connecting Multiple Levers

When implementing multiple units into one bridge setup, a tailormade user interface can be provided.

### 2.5 CAN settings

Provided on request.

## 3. Operation

### 3.1 Start-up procedure

For standard operation, no start-up procedure is required. When powered, the lever will be operable immediately. In case the LED indicator position differs from the actual lever position refer to the user interface to reset the lever position.

Additional detents and changes in friction can be set to operator preference in the provided user interface. For information on how to access the haptic feedback functionalities and description of the specific functions, please refer to the specific add-on to this manual for your project.

### 3.2 General operation

RPM Lever:

The RPM lever is at its zero position when it is upright. Moving the lever down will result in an increase of thrust. Alternative setups (i.e., +/- 60°) can be provided upon request.

Azimuth Lever:

The direction of thrust can be changed by rotating the lever body. The lever can rotate from 0...360° continuously.

Optional detents can be set according to operator preference to signify the clutch and the steps in thrust or thruster angle.

### 3.3. Safety Precautions

Before use, make sure the unit is properly wired, the sensor signals controlling the vessel are properly received over the full range of operation by the Control PLC and the responses can be properly read out by the connected Haptic PLC

After powering the product, the following cases could indicate faulty wiring towards the lever:

- The lever is operated very lightly, i.e., no friction is felt.
- No LED function can be observed.
- No signals can be read out from the Haptic PLC or equipment receiving the sensor signals.

If any of these apply, please check the wiring before contacting your supplier.



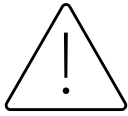
**!IMPORTANT!** Never open the unit itself without specific permission from the supplier. Opening the unit will result in the warranty being voided.

### 3.4 Adjusting Settings

For information on where to adjust the settings, please refer to the specific add-on to this manual. The user interface can be used to adjust the basic haptic settings of the unit and access the diagnostics tab. Please refer to 3.5 for more on this.

### 3.5 Self-test and diagnosis

In case the LED indicator position deviates from the actual position of the lever, a homing sequence is required. Initialise the homing sequence in the user interface provided. If this has no effect, refer to the diagnostics tab on the user interface to inspect if there are any error messages.



**!IMPORTANT!** Never initialise the homing sequence when propulsion control is enabled for this lever.

## 4. Service, Maintenance & Warranty

### 4.1 Warranty Information

Smart-Ship's products are, as standard, covered by a warranty period of 2 years starting from the moment of delivery. During this period, the costs for resolving unexpected defects and failures to the product (arisen during intended use of the product, not general wear and tear) are covered.

Maintenance, support, and other services requested outside of this period, or within this period but arisen due to abuse/usage outside of intended use, are charged at rates described below. When requesting service for the product, Smart-Ship holds the sole right to determine whether the product has been exposed to intended/unintended use and is thereby the only party deciding whether the service costs are covered by warranty. Only service requested according to the procedure below is considered and processed.

### 4.2 Warranty Void

Actions taken on/with the product deemed outside of intended use or by unauthorized personnel, such as opening covers or casing, incorrect installation, or general abuse, will void the warranty.

### 4.3 Inspection After Unpacking

Prior to installation, it is recommended to thoroughly inspect the product for any damages that might have occurred during transportation. If any such damages are detected after installation, they may not be covered under warranty.

### 4.4 Service Procedure

At times, you may require service for your product due to regular maintenance, defects, software issues, or other questions. In such cases, please follow these steps:

#### a. 4.4.1 Contact the Supplier

If you encounter any issues or have questions about your product, reach out to the company that supplied the product to you. If that company is us, you can contact us through [support@smart-ship.eu](mailto:support@smart-ship.eu) or +316-51797800 (during normal work hours).

#### b. 4.4.2. Provide Information

When requesting service, please provide relevant information about the issue you're facing, including any error messages, observations (unusual sounds or vibrations), product information (product number and type), current location, available backup systems and Service Agreement status if present.

#### c. 4.4.3. Service Rates

Additional services, costs, and travel/waiting times, which are not caused by Smart-Ship and are deemed to be outside of warranty, as well as expenses resulting from this (travel, material, and other costs) will incur charges. Details of these rates are provided below. Our goal is to provide transparent and competitive pricing for any required services beyond the warranty.

	<b>EUR</b>	<b>Notes</b>
<b>Normal hourly fee</b>	95,00	
<b>Overtime fee (+50%)</b>	142,50	>8 h/day or between 10 pm and 7 am, Saturdays
<b>Overtime fee (+100%)</b>	190,00	Sundays, holidays
<b>Travel time</b>	65,00	
<b>Kilometer allowance</b>	0,50€/km	
<b>Expenses</b>		as per receipt

Unless agreed otherwise, services will be performed during normal work hours, i.e., Monday to Friday, 08:00 to 18:00 excluding national holidays.

In the event of an issue or service call, Smart-Ship will inform the Client on the intended plan of action to solve the issue and any costs that might be incurred (if the issue is outside of warranty). Smart-Ship will only start the execution of the plan of action once it has received formal approval from the Client.

#### **4.5 Maintenance Procedure**

To ensure the longevity and optimal performance of your product, we recommend performing maintenance at yearly intervals. Unless warranty is applicable or agreed upon otherwise in your Service Agreement, the incurred rates from section 4.4.3 apply. Maintenance can be requested through the standard service procedure of 4.2.

#### **4.6 Liability Disclaimer for Damages**

Smart-Ship would like to emphasize that we cannot be held responsible for any damages that occur to third-party products or the provided product itself due to failure to adhere to the installation or operation instructions provided in this document. It is crucial to follow these instructions diligently to ensure proper installation and operation.