

# AHD-TCS Trim Tabs Control System



## Operation Manual

Read this manual before beginning any work!



Dok-ID: PaB-1220 V9

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## Change History

### Change History for Operation Manual AHD-TCS

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2023-08-18	AHD-TCS_DOK_DE_V9_20230823	Initial startup of hydraulic unit added	42	Patzke, Jens (PaJ)

# 1 General Information

## 1.1 About this Operation Manual

**Read this manual carefully before beginning any work! It is part of the product and must be kept in the product's immediate vicinity, so that it is always available to the personnel.**

**Include this manual when handing the product over to third parties.**

This manual gives important product handling instructions. On the following pages, this manual describes

Trim Tabs Control System AHD-TCS.

This manual gives specific information, if further and more detailed documentation is available for particular components or functions.

Adhering to all product safety and handling instructions for the product and all connected components is a prerequisite for safe operation.

In addition, the local accident prevention and general safety regulations for the device's area of operation must be observed.

The illustrations in this manual are intended to demonstrate the contents more clearly. They are not necessarily drawn to scale and can vary from the actual product in minor details.

**This operating manual is to be understood as a single unit. It is not permitted to use excerpts from this manual as standalone documentation without referring to the entire document.**

## General Information

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### 1.2 Explanation of Symbols

#### 1.2.1 Warnings

In this manual, warnings are marked with symbols. The warnings are introduced by signal words indicating the degree of danger.

**It is important to heed these warnings and act with caution to avoid accidents, personal injury and property damage.**

**DANGER!**

... indicates an imminently hazardous situation that can result in death or severe injury, if not avoided.

**WARNING!**

... indicates a potentially hazardous situation which can result in death or severe injury, if not avoided.

**CAUTION!**

... indicates a potentially hazardous situation that can result in minor or light injury, if not avoided.

**CAUTION!**

... indicates a potentially hazardous situation that can result in equipment damage, if not avoided.

#### 1.2.2 Tips and Recommendations

**NOTICE!**

... indicates useful tips and recommendations and information for efficient and error-free operation.

### 1.3 Illustrations

Illustrations in this document may deviate slightly from actual devices, without this being pointed out separately.

In particular, illustrations of conformity markings may deviate from the current status.



### 1.4 Limitation of Liability

All information and instructions in this manual have been compiled in consideration of current norms and regulations, the state of technology, and our knowledge and experience of many years.

The manufacturer is not responsible for damages due to:

- Failure to follow the instructions in this manual
- Unintended use
- Employment of untrained personnel
- Unauthorized modifications
- Technical modifications
- Use of unauthorized spare parts
- Device and system configurations created by the user or third parties

The actual scope of delivery may vary from the explanations and illustrations in this manual in case of customized models, special ordering options or the latest technical improvements.

In addition, the agreed upon obligations in the delivery contract, the general terms and conditions, the manufacturer's delivery terms and the legal regulations current at the contract signing are in force.

We reserve the right to make changes to improve the device's performance and to further develop the product.

### 1.5 Copyright and Nondisclosure

This manual must be treated confidentially. It is intended only for those persons handling the product. It is not permitted to hand this operation manual over to third parties without the manufacturer's prior written permission.



**NOTICE!**

*The information, texts, drawings, illustrations, and other descriptions in this manual are protected by copyright laws and are subject to industrial property rights. Any misuse is subject to prosecution.*

It is not permitted to duplicate this manual in any type or form – even in excerpts – or use and/or communicate its contents without the manufacturer's written permission. Contraventions are liable to compensation. We reserve other rights.

## General Information

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### 1.6 Spare Parts



**WARNING!**

**Danger of injury due to incorrect spare parts!**

Incorrect or defective spare parts can cause damages, malfunctions or complete failure and endanger the vessel's safety.

Therefore:

- Only use the manufacturer's original spare parts.

Order spare parts from a contracted reseller or directly from the manufacturer. Refer to page 2 for the address.

### 1.7 Warranty Terms

The warranty terms can be found in the General Terms and Conditions (GTC) of the manufacturer's sales documents.

### 1.8 Customer Service

Our customer service department is available to assist you with technical information.

Information about the responsible contact person is always available via telephone, fax, e-mail, or the Internet. Refer to page 2 for the manufacturer's address.

In addition, our staff is always interested in new information and experiences resulting from the use of the product which can be used to further improve our products.

## 2 Safety

This section gives an overview of all important safety aspects for optimal protection of the personnel and safe and error-free operation.

Noncompliance with the handling and safety instructions in this manual can cause significant hazards.

### 2.1 Operator's Responsibility

This product is intended for commercial use. Therefore, its operation is subject to legal workplace safety regulations.

In addition to the workplace safety instructions in this manual, the current safety, accident prevention, and environmental protection regulations for the product's place of use must be observed. Especially:

- The operator must keep himself informed about the legal workplace safety regulations and through a risk assessment determine any additional hazards resulting from the specific working conditions at the product's place of use. He must implement these in the form of operating instructions for the product's use.
- During the product's entire period of operation, the operator must verify that his operating instructions comply with current regulations and revise them, if necessary.
- The operator must clearly regulate and define areas of responsibility for installation, operation and cleaning.
- The operator must ensure that all employees handling the product have read and understood this manual. In addition, he must train the personnel in regular intervals and inform them about any dangers.

Furthermore, the operator is responsible for always keeping the product in perfect working condition.

## Safety

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### 2.2 Personnel Requirements

#### 2.2.1 Qualifications

**WARNING!****Danger of injury due to insufficient qualification!**

Insufficient qualification can lead to significant personal injury and equipment damage.

Therefore:

- Only allow qualified personnel to do any work.

This manual lists the following qualifications for various areas of activity.

- **Trained Person**  
has been trained by the operator through an instruction for the assigned tasks and has been informed about possible hazards from improper execution.
- **Specialist**  
can execute the assigned tasks and recognize and avoid potential hazards independently, based on his professional education, knowledge, and experience as well as knowledge of the norms and regulations relevant to the situation.
- **Electrician**  
can work on electrical systems and independently identify and avoid potential hazards, based on his professional education, knowledge and experience, as well as knowledge of the norms and regulations relevant to the situation.  
The electrician has been trained for the specific workplace in which he is active and knows the relevant norms and regulations.

Only those persons who can be expected to do their work reliably are allowed as personnel. Persons, whose ability to act is reduced by for example drugs, alcohol, or medication, are not allowed.

- Observe the local age and profession specific regulations when selecting the personnel.

## 2.2.2 Unauthorized Persons



### **WARNING!**

#### **Danger for unauthorized persons!**

Unauthorized persons who do not meet the requirements described in this manual do not know the workplace dangers.

Therefore:

- Keep unauthorized persons out of the work area.
- When in doubt, approach persons and remove them from the work area.
- Interrupt all work while unauthorized persons remain in the work area.

## 2.3 Intended Use

The Trim Tabs Control System AHD-TCS has been designed and constructed exclusively for the purpose described here.

The Trim Tabs Control System AHD-TCS is used exclusively for electronically controlling the hydraulics of trim tabs on vessels.



### **WARNING!**

#### **Danger due to unintended use!**

Any use other than and/or beyond the product's intended use can lead to dangerous situations.

Therefore:

- Only use the product as intended.
- Strictly adhere to all instructions in this manual.
- In particular, avoid the following unintended use:
  - Using a supply voltage other than the one indicated in this manual

Any claims for damages resulting from unintended use are excluded.

The operator is solely responsible for any damages resulting from unintended use.

## Safety

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### **WARNING!**

#### **Danger due to improper operation of the device!**

Device failure or malfunction can lead to personal injury or equipment damage in the overall system.

Therefore:

- Although the device itself is not especially dangerous, the effects of failures or malfunctions on the overall system must be considered.
- Always discontinue using the devices when they develop smoke or abnormal heat.

## 3 Structure and Function

### 3.1 General Function

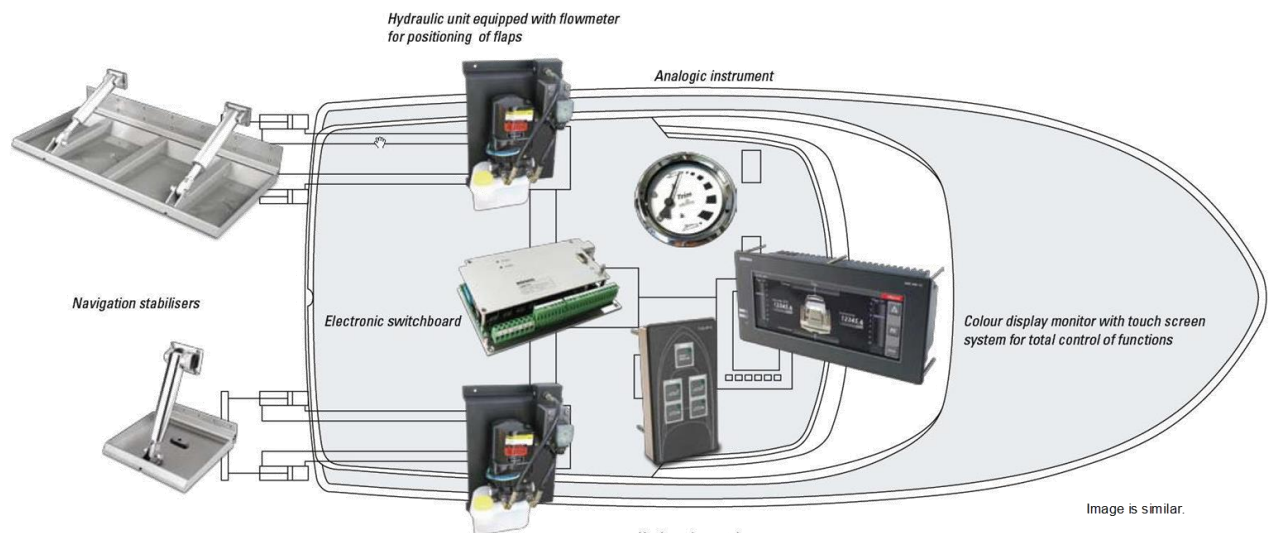
The Trim Tabs Control System AHD-TCS has been constructed for the use on fast yachts whose cruising behavior can be significantly affected by controlling the trim tabs.

As is customary for trim tabs, this is an electrohydraulic control system. Each trim tab is operated by one or several hydraulic cylinders. The directional valves required for this are controlled electrically.

Transducers are not required for the cylinders. The piston position – and thus the trim tabs position – is calculated with a flow meter and an electronics unit. The electrical wiring usually required on the ship's exterior, which is often prone to error, is thus eliminated.

A further benefit of this control system is the easy commissioning. The trim tabs are moved to one end position and then the other. The electronics unit records the number of impulses measured by the flow meter for this “full stroke.” Afterwards, the tabs are returned to the first end position, and the number of impulses thus determined is also recorded. Thus, minor differences in the impulse count that do not depend on the direction are compensated for one stroke.

If a ship alarm system with a Böning display (AHD 880 TC, AHD 1215/AHD 1219, etc.) is already installed on the yacht, this display can show the trim tab position graphically (visually).



*Illustration 1: Schema of TCS*

Moreover, the electronics provide an analog output (0 – 10 V) for each flap. Round gauges with a corresponding scale, for example, can be connected here.

## Structure and Function

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When using one of the above-mentioned displays and a GPS unit and/or when an inclination sensor is connected, the trim tabs control system can also run in automatic mode, in which several auto-modes are available. In this mode, the trim tabs are automatically moved into an optimized position based on the vessel's cruising speed (trim curve), which was determined during commissioning at the shipyard. Any customer specific assignment of trim tab positions and speed, however, can be saved as a trim curve. Of course, manual control is always available, and it overrides the automatic mode.

### 3.2 Available Auto-Modes

The following auto-modes are available for AHD-TCS controls:

#### 3.2.1 Auto-Mode "Rudder"

In this mode, the trim tab position adjustments are based on the rudder position during curving maneuvers. Here, the trim tab positions are dependent on the rudder position; this is specified by a configuration table. The trim tabs thus support the boat's curving maneuver with their optimized position. However, in this mode, there is no trimming based on inclination or speed.

#### 3.2.2 Auto-Mode "Inclination"

In this mode, the list of the boat can be corrected by the position of the trim tabs when cruising on straight stretches. Here, the tilt is determined by an inclination sensor, whose signals are analyzed and processed by the electronics unit. By adjusting the trim tabs accordingly, the control automatics ensure that the boat is always in a horizontal position. Furthermore, depending on the vessel's load distribution and the fuel levels in the tanks, an appropriate setting of the trim tabs can automatically correct the boat's list.

In this mode, the auto-mode "Rudder" is also available.

#### 3.2.3 Auto-Mode "Speed"

This automatic function is used for optimizing the speed while simultaneously decreasing the fuel consumption. When cruising in a straight line, the system attempts to increase the boat's speed without changing the engine's RPM by adjusting the trim tabs in cyclical intervals.

A base curve for defining the position to which the trim tabs are to be moved at what speed is specified during configuration. At constant speeds, the electronics attempt to increase the boat's speed by making slight corrections to the trim tab positions. If the



optimization of the speed is unsuccessful, the control process is aborted, and the trim tabs are moved to their last known position. In this mode, the auto-mode “Rudder” is also available.

### 3.3 Function

Pressing the ▲ (up) or ▼ (down) button on the Operating Panel AHD-TCS OP A moves the position of the trim tab up or down and thus pushes the vessel's bow up or down.

Here, the button for the TCS electronics causes the hydraulic aggregate to move the hydraulic cylinder forward or backward with oil pressure. Depending on the directional flow of the hydraulic oil, the flow meter sends impulses for the forward or backward movement to the TCS electronics. The position of the trim tab is calculated from the number of impulses and shown over the CAN bus on the display or analog display instruments.

Alternatively, if no display is used, the GPS receiver can be connected directly to the TCS electronics, when the trim tabs are to operate automatically.

The TCS electronics with the two flow meters and hydraulic aggregates can be constructed as a three-part system, consisting of the portside aggregate, starboard aggregate, and TCS electronics.

The operation panels and displays are cascable (e.g. for use on the fly bridge). The operation panel has back lighting and an “Automatic” LED for indicating the automatic mode. During failure of the TCS electronics, corresponding error messages are sent to the CAN bus and shown on for example the display, while it is still possible to control the trim tabs with the ▲/▼ buttons.

## Structure and Function

### 3.4 Components of the Trim Tabs Control System AHD-TCS

#### 3.4.1 AHD-TCS – Electronics Unit



Illustration 2: AHD-TCS

#### 3.4.2 AHD-TCS OP A – Operating Panel



Illustration 3: AHD-TCS OP A

## Components of the Trim Tabs Control System AHD-TCS

### 3.4.3 AHD-TCS HYD – Hydraulic Unit



Illustration 4: AHD-TCS HYD

### 3.4.4 AHD-TCS Round Gauge (optional)



Illustration 5: AHD-TCS Round Gauge

## Technical Information

# 4 Technical Information

## 4.1 AHD-TCS

### 4.1.1 Technical Data

Description	Value/Unit/Type
<b>General Data</b>	
Dimensions, W x H x D	215 mm x 120 mm x 48 mm
Weight	Appr. 0.7 kg
<b>Environmental Data</b>	
Operating Temperature	-25 °C...~+70 °C
Storage Temperature	-30 °C...~+85 °C
Protection Class	IP 10
<b>Electrical Data</b>	
Power Supply	24 V DC (+30%/-25%)
Current Consumption	Up to 150 mA
<b>Ports</b>	
	1 x CAN, 1 x RS232
Inputs	2 x Flow meters, Operation panel 2 x 4-20 mA (e.g. for inclination sensor)
Outputs	2 x Hydraulic aggregates 2 x 0-10 V (e.g. for display instruments)

### 4.1.2 Name Plate and Other Information



<b>AHD-TCS</b>	
Power supply	24 VDC ±20%
Power cons.	150 mA

The name plate of AHD-TCS (Image is similar) and other information are on the device's rear side and contain the following:

- Model designation of the device
- Power supply
- Manufacturer
- Conformity markings
- Serial number

The two first digits of the serial number indicate the year of production.

To obtain the exact date of production contact the manufacturer stating the complete serial number.

### 4.1.3 Dimensions

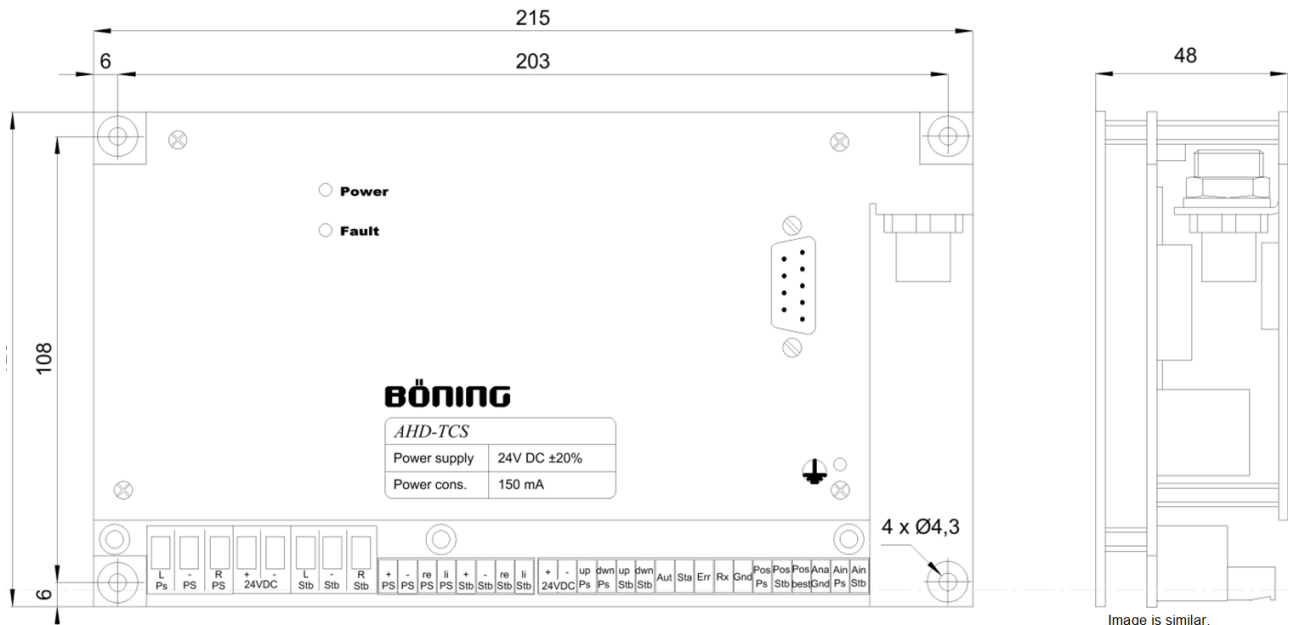


Illustration 6: AHD-TCS: Dimensions in millimeters

## Technical Information

### 4.1.4 Earthing

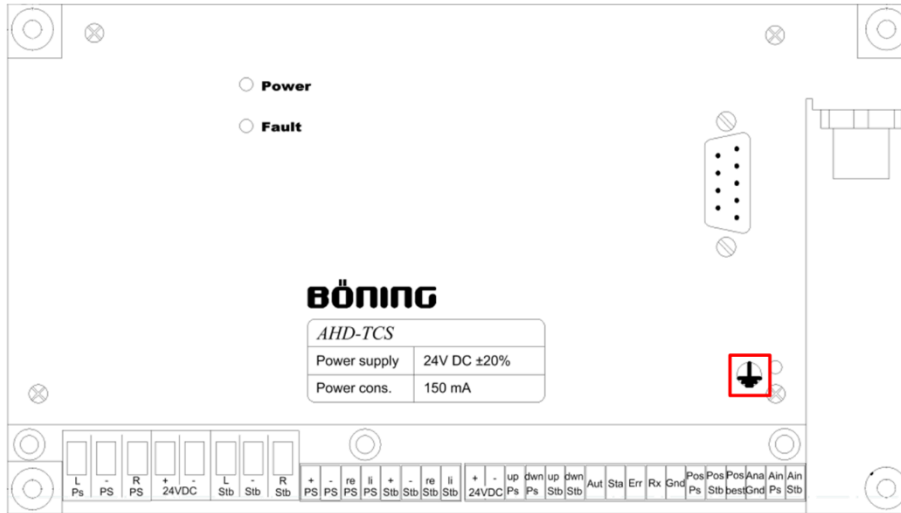


Image is similar.

*Illustration 7: Position of the grounding lug*

AHD-TCS must be earthed at the grounding lug marked red in Illustration 7 using a cable with a cross-section of 2 mm<sup>2</sup>.

## 4.2 AHD-TCS HYD

### 4.2.1 Technical Data

Description	Value/Unit/Type
<b>General Data</b>	
Dimensions, W x H x D	176 mm x 269 mm x 135 mm
Weight	Appr. 11 kg (without hydraulic oil)
Flow Rate	Type 1: 1.5 l/min Type 2: 2.0 l/min
Pressure	Appr. 70 bars
<b>Environmental Data</b>	
Operating Temperature	-25 °C...~+70 °C
Storage Temperature	-30 °C...~+85 °C
Protection Class	IP 65
<b>Electrical Data</b>	
Power Supply	24 V DC (+30%/-25%); via TCS electronics
Current Consumption	Typically 16 A
<b>Connections</b>	
Inputs	Hydraulic aggregate R/L
Outputs	Flow meter R, L, +, -

### 4.2.2 Name Plate and Other Information

The name plate for the hydraulic aggregate is installed by the manufacturer. The installation location and information on the plate can vary, depending on the production batch.

## Technical Information

### 4.2.3 Dimensions

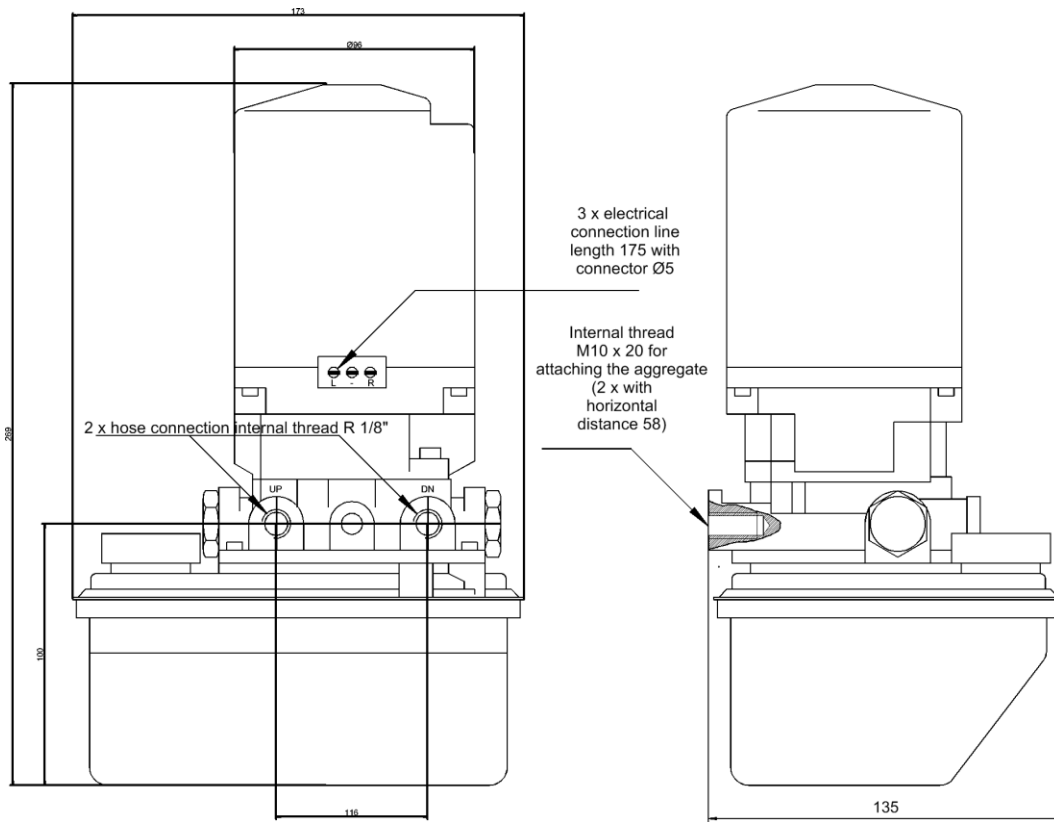


Illustration 8: AHD-TCS HYD: Dimensions in millimeters



### 4.3 AHD-TCS OP A

#### 4.3.1 Technical Data

Description	Value/Unit/Type
<b>General Data</b>	
Dimensions, W x H x D	70 mm x 130 mm x 94 mm
Weight	Appr. 0.2 kg
Panel Cutout	60 mm x 112.5 mm
<b>Environmental Data</b>	
Operating Temperature	-25 °C...~+70 °C
Storage Temperature	-30 °C...~+85 °C
Protection Class	IP 66 (frontside) IP 10 (rear)
<b>Electrical Data</b>	
Power Supply	24 V DC (+30%/-25%); via TCS electronics
Current Consumption	100 mA

#### 4.3.2 Name Plate and other Information

**BÖNING** 

<b>AHD-TCS</b>	
Power supply	24 VDC ±20%
Power cons.	150 mA

The name plate of AHD-TCS OP A (Image is similar) and other information are on the device's rear side and contain the following:

- Model designation of the device
- Power supply
- Manufacturer
- Conformity markings
- Serial number

The two first digits of the serial number indicate the year of production.

To obtain the exact date of production contact the manufacturer stating the complete serial number.

## Technical Information

### 4.3.3 Dimensions

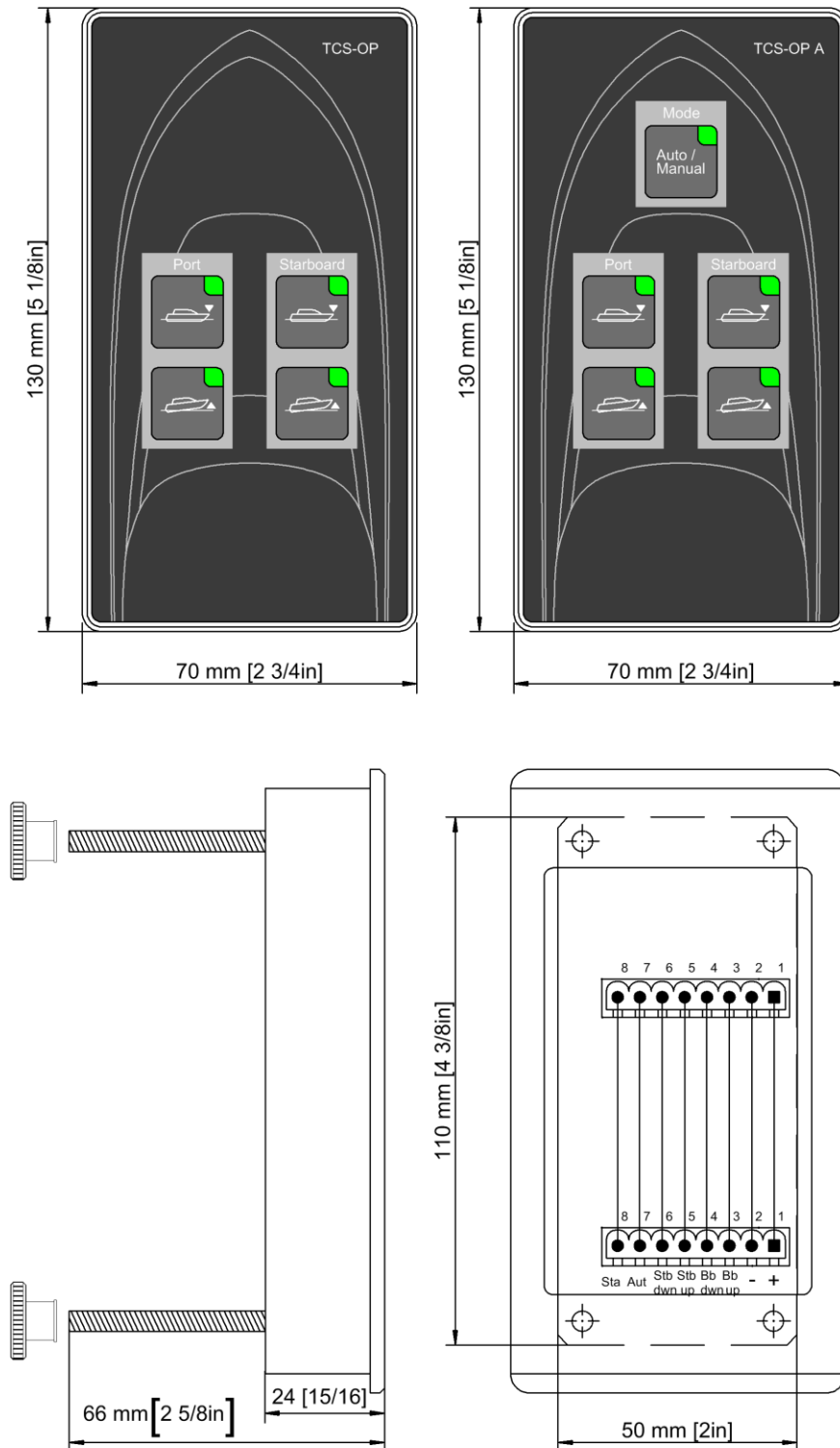


Illustration 9: AHD-TCS OP A: Dimensions in millimeters

### 4.3.4 Panel Cutout

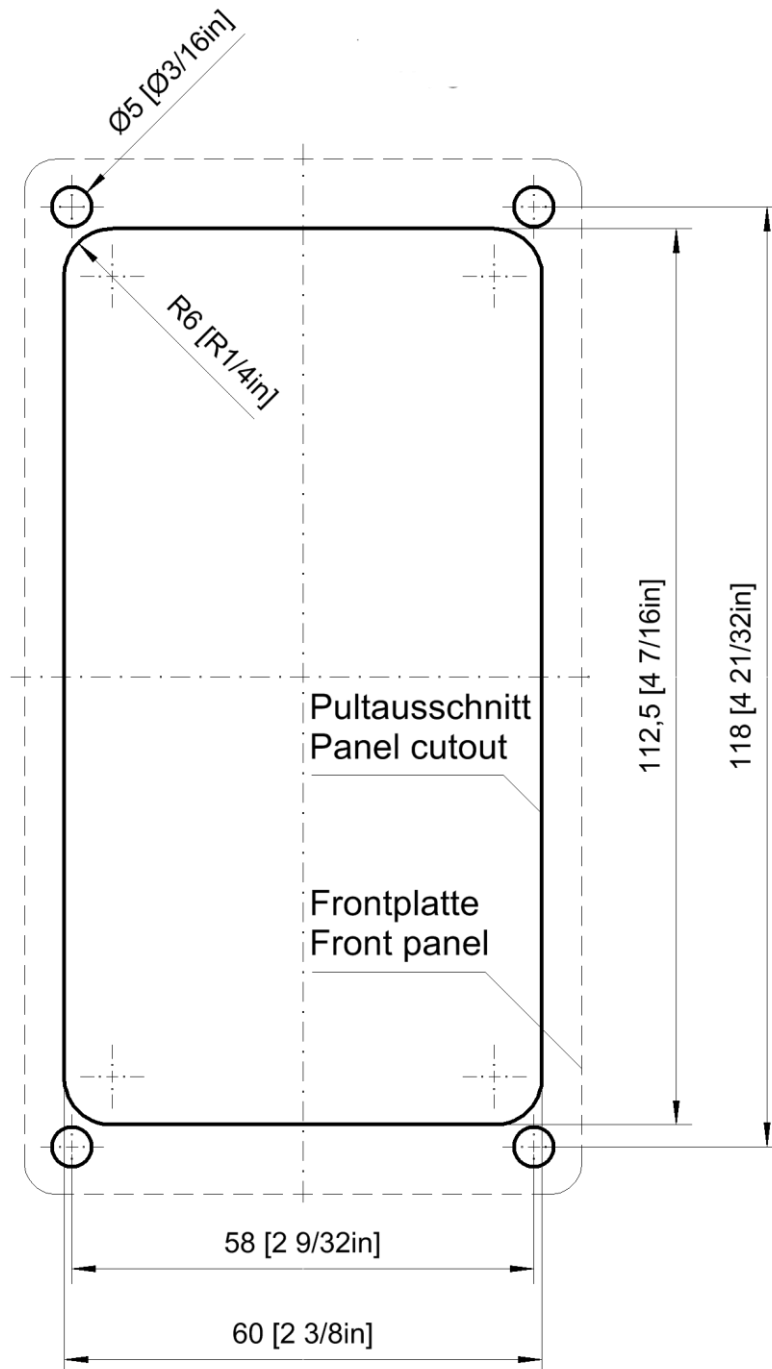


Illustration 10: AHD-TCS OP A: Panel cutout and drill holes in millimeters

## Technical Information

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### 4.4 Connection



**NOTICE!**

*The following minimum wire cross sections are required for the installation of the AHD-TCS system:*

- *supply voltage 24 V DC: 4 mm<sup>2</sup>*
- *hydraulic aggregate for AHD-TCS: 2.5 mm<sup>2</sup>*
- *flow meters for AHD-TCS: 0.75 mm<sup>2</sup>*
- *operation panel for AHD-TCS: 0.75 mm<sup>2</sup>*



## Technical Information

### 4.4.2 Terminal Assignment

Designation		Connection
<b>CAN 1</b>		CAN bus to the display
<b>RS232</b>		Serial data connection (RS232 port)
<b>PE (ground)</b>		Potential equalization
<b>Ain Stb</b>		Input analog-IN starboard (4 – 20 mA, optional)
<b>Ain Ps</b>		Input analog-IN portside (4 – 20 mA, inclination sensor)
<b>Ana Gnd</b>		Ground for analog-IN and position
<b>Pos best</b>		Output analog value (0 – 10 V, optional)
<b>Pos Stb</b>		Output analog value starboard (0 – 10 V)
<b>Pos Ps</b>		Output analog value portside (0 - 10 V)
<b>Gnd</b>		Ground for data reception
<b>Rx</b>		Data input (from optional GPS; receive data)
<b>Err</b>		Error output (error message)
<b>Sta</b>		Status output "Auto/Manual" (status message)
<b>Aut</b>		From button auto/manual (automatic/manual)
<b>dwn Stb</b>		From button starboard down
<b>up Stb</b>		From button starboard up
<b>dwn Ps</b>		From button portside down
<b>up Ps</b>		From button portside up
-	<b>24 V DC</b>	To – pole for all buttons
+		To shared + pole of all buttons
<b>le Stb</b>		(Impulse stb. left) flow meter starboard channel left
<b>ri Stb</b>		(Impulse stb. right) flow meter starboard channel right
<b>- Stb</b>		(Impulse stb. -) flow meter starboard power supply -
<b>+ Stb</b>		(Impulse stb. +) flow meter starboard power supply +
<b>le PS</b>		(Impulse ps. left) flow meter portside channel left

Designation		Connection
<b>ri PS</b>		(Impulse ps. right) flow meter portside channel right
<b>- PS</b>		(Impulse ps. -) flow meter portside power supply -
<b>+ PS</b>		(Impulse ps. +) flow meter portside power supply +
<b>R Stb</b>		(Aggregate stb. R) hydraulic aggregate starboard R
<b>- Stb</b>		(Aggregate stb. -) hydraulic aggregate starboard R
<b>L Stb</b>		(Aggregate stb. L) hydraulic aggregate starboard R
-	<b>24 V DC</b>	(Power supply -) supply voltage -
+		(Power supply +) supply voltage +24 V
<b>R PS</b>		(Aggregate ps. R) hydraulic aggregate portside R
<b>- PS</b>		(Aggregate ps. -) hydraulic aggregate portside R
<b>L PS</b>		(Aggregate ps. L) hydraulic aggregate portside R

## Transport, Packaging, and Storage

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# 5 Transport, Packaging, and Storage

## 5.1 Transport Safety Instructions

### 5.1.1 Improper Transport



#### **CAUTION!**

#### **Damages due to improper transport!**

Improper transport can cause significant equipment damage.

Therefore:

- When unloading the packages during delivery and internal transport, proceed carefully and observe the symbols and instructions on the packaging.
- Remove the packaging only shortly before installation.

## 5.2 Transport Inspection

Upon receipt, the delivery must be checked immediately for completeness and damages during transport.

Proceed as follows when noticing external transport damages:

- Do not accept delivery or accept it only with reservation.
- Note the scope of the damage on the transport documents or the deliverer's bill of delivery.
- File a claim.



#### **NOTICE!**

*Claim any fault as soon as it is noticed. Damage claims can only be filed within their respective rec-  
lamation periods.*



## 5.3 Packaging

### 5.3.1 About the Packaging

The individual parts are packaged according to the expected transport conditions. Only environmentally friendly materials are used for the packaging.

The packaging is intended to protect the individual parts against transport damages, corrosion, and other damages. Therefore, the packaging must not be destroyed, and it may only be removed shortly before installation.



#### **CAUTION!**

##### **Equipment damage due to electrostatic discharge!**

When removing the device from its packaging or when packing the device, always observe protective measures against electrostatic discharges (ESD)!

These include the use of antistatic flooring or conductive mats, antistatic clothing made of cotton instead of synthetic fibers or animal hair, control of atmospheric humidity above 50%, and the use of, for example, grounding bracelets.

### Handling the Packaging Materials

The packaging materials must be disposed of according to current legal regulations and local regulations.



#### **CAUTION!**

##### **Environmental damages due to improper disposal!**

Packaging materials are valuable raw materials and can often be reused or usefully reprocessed and recycled.

Therefore:

- Dispose of packaging materials in an environmentally safe manner.
- Observe the local disposal regulations. When necessary, contract a specialist company.

## Transport, Packaging, and Storage

---

### 5.3.2 Storage

Store the packages under the following conditions:

- Do not store them outdoors.
- Store them in a dry, dust-free environment.
- Do not expose them to aggressive media.
- Protect them against sunlight.
- Observe the storage temperature, see the section “Errors” on page 47.
- Avoid mechanical shock.
- When storing longer than 3 months, regularly inspect the general condition of all parts and the packaging.



**NOTICE!**

*In some cases, the packages contain storage instructions which extend beyond the requirements listed in this manual. These must be observed accordingly.*

## 6 Installation and Initial Startup

### 6.1 Safety

#### 6.1.1 Personnel

- Installation and initial startup may only be carried out by specially trained personnel.
- Only electricians may work on the electrical system.

#### 6.1.2 Basic Information



##### **CAUTION!**

##### **Danger of injury due to improper installation and initial startup!**

Improper installation and initial startup can cause personal injury and equipment damage.

Therefore:

- Before starting work, ensure that there is sufficient space at the installation site.
- Handle parts with exposed sharp edges carefully.
- Observe order and cleanness in the work area!
- Install the components professionally.

### 6.2 Installation

#### 6.2.1 General Information



##### **CAUTION!**

##### **Equipment damages due to electrostatic discharge!**

During all work observe protective measures against electrostatic discharges (ESD)!

These include the use of antistatic flooring or conductive mats, antistatic clothing made of cotton instead of synthetic fibers or animal hair, control of atmospheric humidity above 50%, and the use of, for example, grounding bracelets.

## Installation and Initial Startup



### CAUTION!

#### **Equipment damage due to improper handling and selection of the installation location!**

Installing the devices in locations that do not meet the requirements of the technical specifications and improper handling can lead to system failures and equipment damage.

Therefore:

- Observe the devices' technical specifications when selecting the installation location.
- Only trained personnel may carry out the installation.
- Never install the devices in areas that are not of the required protection type.
- Never install the devices in extremely high or low temperature areas.
- Never install the devices on ceilings that cannot support their weight.
- Never bump or shake the devices vigorously.
- Install the devices in such a manner that unauthorized persons cannot access the interfaces used for the configuration.
- Install the devices in such a manner that the cooling system can function properly.



### NOTICE!

*When systems or replacement devices are shipped, the devices are delivered configured according to the project specifications. This includes setting the device address which is indicated on a label. When several devices are installed into the system, it is imperative to install each device at its designated installation location.*

*Installing a device in a location where a device with a different device address must be installed will result in system malfunction!*

*The project specific configuration may be modified only by specially trained personnel.*

*If required, refer to the manufacturer or an authorized representative for further information.*



**NOTICE!**

*When installing the device, make sure that its interfaces can be accessed!*

## 6.2.2 Installation Requirements

- All required connecting cables are of the required version, led to the intended installation location with plug connectors according to technical specifications or project drawings, and properly installed and stripped. Free wires have enough installation length and are secured against short circuit and earth fault.



**NOTICE!**

*The following minimum wire cross sections are required for the installation of the AHD-TCS system:*

- *supply voltage 24 V DC: 4 mm<sup>2</sup>*
- *hydraulic aggregate for AHD-TCS: 2.5 mm<sup>2</sup>*
- *flow meters for AHD-TCS: 0.75 mm<sup>2</sup>*
- *operation panel for AHD-TCS: 0.75 mm<sup>2</sup>*



**NOTICE!**

*If the AHD-TCS electronics are connected to a display with a CAN bus cable, another device or a terminating resistor must also be connected to the T-piece.*

- The device is not connected to the power supply and wired off-circuit.

## Installation and Initial Startup

### 6.2.3 Installation

**CAUTION!**

**Danger of equipment damage and malfunction due to missing earthing!**

Earth first, then switch on!

Before powering on the device, earth it with the provided grounding lug, see Illustration 8 on page 24.

1. Install the devices properly in the intended installation locations according to technical specifications or project drawings.

**NOTICE!**

*When systems or replacement devices are shipped, the devices are delivered configured according to the project specifications. This includes setting the device address which is indicated on a label. When several devices are installed into the system, it is imperative to observe the correct selection of the installation location for the configured device.*

*Installing a device in a location where a device of the same device type with a different device address must be installed will result in system malfunction!*

*The project specific configuration may be modified only by specially trained personnel.*

*If required, refer to the manufacturer or an authorized representative for further information.*

**NOTICE!**

*If the trim tabs are also provided by Böning Automationstechnologie GmbH & Co KG, their separate mounting and installation instructions must be followed.*

2. Wire all the components' inputs and outputs according to technical drawings.



### NOTICE!

*The hydraulic aggregates must be installed in the ship so that the filler necks of the hydraulic oil reservoirs point vertically upwards. Here, the hydraulic aggregates should be close to the trim tabs to keep the length of the hydraulic hoses to the hydraulic cylinders as short as possible. Because the hydraulic system is bled at its highest point, the hoses and hydraulic cylinders should be lower than the distributors in the manifold so that it can be bled at the manifolds.*

The TCS can be operated with single-action hydraulic cylinders that have only one hydraulic oil connection as well as with dual-action cylinders with two connections. Unused hydraulic oil connections in the manifold must be sealed with end caps.

3. Connect the hydraulic aggregates and flow meters to the trim tabs' hydraulic cylinders.
4. Place the TCS electronics inside a splash-proof terminal box (for example TCS box) and connect them according to the electrical connection diagram.
5. Place the operating buttons on the bridge in such a manner that the skipper can access them while cruising.

All buttons receive a shared +24 V DC feed. Any number of buttons can be connected in parallel (for example on the fly bridge), because the TCS electronics has an internal lock and only processes the first incoming signal.

For displaying the position of the trim tabs, it makes sense to use a Böning display that also visualizes other ship data received over the CAN bus.

Here, the two-digit device address (ID) of the TCS electronics in the CAN bus must be set with rotary switches on the PCB from 01 to 99 (default ID: 03).

At the same time, the position of the trim tabs can be shown on optional display instruments with analog inputs (e.g., on the fly bridge).

When using an inclination sensor, it should be installed lengthwise and in the middle of the ship, as much as possible. Afterwards, the electrical connections to the central unit AHD-TCS (Ain Ps, Ana GND) must be established.

Furthermore, the installation and connection instructions of the sensor's manufacturer must be followed.

## Installation and Initial Startup

---



### CAUTION!

#### Equipment damage due to incorrect cable connections!

Improperly connected cables can cause system errors and equipment damage.

Therefore:

- Always verify cable and wire designations before connecting them. Check for secure seating of the connecting wires in the terminals.
- To avoid short circuits, verify that all wires are connected in the terminal.
- To not over tighten the terminals.
- When using pluggable terminal strips or plug connectors, it is imperative to ensure insertion in the correct socket and secure seating.

6. Test the system for earth/ground fault.



### CAUTION!

#### System failure or malfunction!

During earth/ground fault, incorrect data can be transmitted and lead to overall system failure or malfunctions.

Therefore:

- Immediately correct any discovered earth/ground fault.



### CAUTION!

#### Danger of equipment damage and malfunction due to missing earthing!

Earth first, then switch on!

Before powering on the device, earth it with the provided grounding lug, see Illustration 8 on page 24.



## 6.3 Initial Startup

### 6.3.1 Startup Requirements

- All system components have been properly installed and are equipped with all required connections.
  - All external devices connected to AHD-TCS have also been installed according to technical specifications or project drawings and are operational.
  - All required power supplies are available and error-free.
  - AHD-TCS and all connected external devices are not connected to the power supply or have been wired off-circuit.
1. Establish the 24 V DC power supply according to technical specifications or project drawings.
  2. Establish the power supplies for all external devices connected to AHD-TCS according to their corresponding operating instructions
  3. Test the power supplies.



#### **CAUTION!**

#### **Equipment damage due to incorrect voltage!**

Connecting an incorrect supply voltage can lead to equipment damage.

Therefore:

- Review all relevant project documents and operation manuals of the devices used and verify their correct supply voltage and polarity before connecting them.

4. Switch on the power supply of AHD-TCS and all connected external devices from the corresponding circuit breakers in the power distribution and the device internal starting devices according to the corresponding operation manuals.
5. Verify the correct startup sequence according to the following section “Operation.”
6. Log any faults or functional deviations that may occur and take appropriate measures under consideration of the errors described in the section “Errors” on page 47.
7. You may need to inspect the installed configuration and adjust it to meet the required operating conditions. Log the final configuration for the project documentation.

## Installation and Initial Startup

---

### 6.3.2 Adjusting the Inclination Sensor

After installing the inclination sensor, bring the ship into a horizontal position or place the sensor in the corresponding position prior to the fastening when the vessel is in a calm position (standing still). The sensor's correct position can be verified with the information on the display (if present).

### 6.3.3 Initial Startup of the Hydraulic Unit

1. First, fill the two reservoirs on the TCS mounting plate with hydraulic oil to the maximum fill level (MAX).
2. Afterwards, bleed the system by moving the hydraulic cylinders up and down with the operating buttons until there is no more air at the highest point of the hydraulic system. To do this, release the air at the manifold's hose connection (highest point) at the hydraulic oil flow toward the hydraulic cylinder until only hydraulic oil and no air escapes.
3. So that the TCS electronics knows how many impulses the flow meter sends between the trim tab's top and bottom end positions (dependent on the size, type, and number of hydraulic cylinders), a full calibration must be performed during commissioning.
4. **Full Calibration** (calibrate both end positions of the trim tabs and determine the stroke):  
Move the trim tab to the upper end position with the button (trim tab symbol on the display flashes 3 times). From there, move it to the lower end position, so that the TCS electronics determines the number of impulses for the entire stroke.  
Afterwards, move it to the upper end position once more (the display signals that the end positions have been reached when the white pointer indicating the position of the trim tabs flashes three times).  
We recommend performing a full calibration at least at the beginning of every season.
5. **Simple Calibration** (calibrate one end position of the trim tab):  
During each engine shutdown, the trim tabs are automatically retracted to their upper end position and calibrated there.

## 7 Operation

### 7.1 Buttons of AHD-TCS OP A

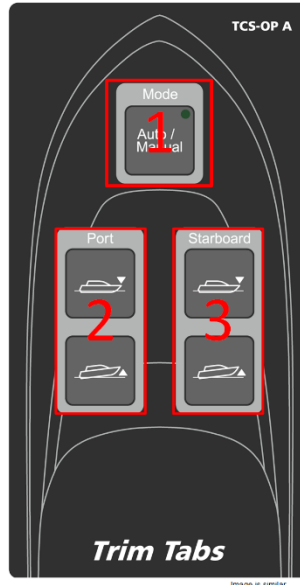


Illustration 12: Buttons of AHD-TCS OP A

1. Button “Auto/Manual” for switching between automatic mode and manual operation.  
The LED indicates the current operating mode.
2. Operating buttons ▼ (down) and ▲ (up) for operating the portside trim flaps.
3. Operating buttons ▼ (down) and ▲ (up) for operating the starbord trim flaps.

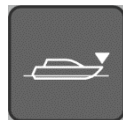


Illustration 13: Operating button ▼ (down)

Below, the operating button for lowering a trim clap is designated as ▼ (down).



Illustration 14: Operating button ▲ (up)

Below, the operating button for raising a trim clap is designated as ▲ (up).

## Operation

---

### 7.2 Operating the Trim Tabs

Pressing the starboard and portside operating buttons ▼ (down)/▲ (up) changes the position of the respective trim tab, whereby pressing the ▼ (down) button results in lowering the trim tab and bow and pressing ▲ (up) raises the trim tab and bow. If several operating buttons are connected in parallel (for example for the fly bridge), the trim tab's movement is stopped when different directions are activated by the buttons for the same trim tab, as the TCS electronics have an internal lock and only allow unambiguous entries.

When the engine is shut down, the trim tabs are moved to their upper end position.

The position of the trim tabs is shown in angular degrees on the display or on optional display instruments.

The Display AHD 880 TC (or any other Böning display) shows the positions of both trim tabs on a degree scale as trim tab symbols (white indicators).

By using GPS data for calculating the speed, it is possible to switch between manual operation of the trim tabs with the ▼ (down)/▲ (up) buttons and automatic trim tab control in the automatic version of the TCS electronics.

In auto-mode, the trim tab is automatically moved into the position for the best trim, as determined by the trim curve (pressing the "Auto/Manual" button toggles between manual and automatic modes; the LED is lit in auto-mode). Pressing one of the ▼ (down) or ▲ (up) buttons during automatic operation exits auto-mode, just as operating the "Auto/Manual" (LED goes out) does.

If the TCS electronics fail, the trim tabs can still be operated (with the ▼ (down)/▲ (up) buttons, as already described).

The TCS electronics can issue 3 different alerts for the starboard and portside trim tab (stb., ps.) each over the CAN bus:

- Trim position  
(sensor fault, no signal from flow meter)
- Trim pump overload  
(hydraulic aggregate, current consumption too high)
- Leakage trim  
(Counter receives more impulses than determined for the entire stroke)

## Recording a Trim Curve for Automatic Mode

### 7.3 Recording a Trim Curve for Automatic Mode



#### CAUTION!

#### Danger of equipment damage due to wrong trim curve!

An operating error can lead to an unintended trim curve that may impair the operation of the vessel.

However, an intact trim curve is required for the automatic mode.

For this reason, the trim curve should only be set and recorded by experienced specialists.

The manufacturer is not liable for incorrectly set trim curves and any resulting damages.

In automatic mode, the trim curve is used for automatically setting the trim tab angle based on the GPS speed (only for the automatic version AHD-TCS A).

To use a trim curve other than the standard curve, it is possible to enter a new trim curve with the aid of the Operation Panel AHD-TCS OP A. The programming mode is started in the trim tabs' manual mode by holding down the "Auto/Manual" buttons, and it is signaled by the flashing of the built-in LED.

The entry of the trim curve begins with the lowest RPM and continues in equal steps up to the highest RPM. The trim curve must consist of at least 8 values that cover a range of 1000 RPM. All in all, up to 50 values can be recorded and here, the saved trim tab angle applies to starboard and portside equally, so that it is important to make sure that both trim tabs are as much as possible at the same angle when entering the values.

When receiving a value, a constant engine speed is specified and using the "▼ (down)/▲ (up)" buttons, the trim tab setting for achieving the highest GPS speed is found. This value can then be recorded, and you can proceed with the next value.

We recommend entering the recorded values of the trim curve in the table, which can be found in the appendix of this document.

At the end of the recording process, the values determined can be saved as a new trim curve with the configuration tool.

Below the lowest recorded RPM value, the trim tab angle uses the lowest recorded RPM value (for example, a lowest recorded RPM value of 1000 RPM with a trim tab angle of  $-4^\circ$  results in a  $-4^\circ$  trim tab angle at engine speeds  $< 1000$  RPM).

Above the highest recorded RPM value, the value with the highest recorded RPM value is used (for example, a highest recorded RPM value of 2000 RPM with a trim tab angle of  $3^\circ$  results in a  $3^\circ$  trim tab angle at engine speeds  $> 2000$  RPM).

## Operation

---

### 7.4 PC Software for Uploading/Downloading the Trim Curve



#### **CAUTION!**

#### **Danger of equipment damage due to incorrect trim curve!**

Uploading a new trim curve results in overwriting the curve saved on the device.

For this reason, the trim curve should only be set and uploaded by experienced specialists.

The manufacturer is not liable for incorrectly set trim curves and any damages that may result from this.

## 8 Errors

The following table describes possible errors that may occur when operating AHD-TCS, including information about causes, error recognition, and error correction.

### 8.1 Safety

#### 8.1.1 Personnel

- Some work may only be carried out by specially trained personnel or the manufacturer. This is indicated in the description of the individual errors.
- As a rule, only electricians may work on the electrical system.

#### 8.1.2 Basic Information



##### **CAUTION!**

##### **Danger of injury due to dangerous voltages or other hazards**

Opening the covers can expose you to dangerous voltages or other hazards.

Therefore:

- Never repair devices yourself.
- Do not remove the covers.



##### **WARNING!**

##### **Danger of injury due to improper error correction!**

Improper error correction can cause severe personal injury and equipment damage.

Therefore:

- Do not repair the device yourself.
- Ensure enough installation space before beginning any work.
- Observe order and cleanliness in the work area! Parts and tools that are loosely stacked or lying about are accident sources.
- Observe correct installation procedures when parts have been uninstalled. Reinstall all mounting elements and observe torque limits.

## Errors

### 8.1.3 In Case of Error

As a rule:

1. Determine the cause of the error.
2. Immediately inform a responsible party on-site.
3. Depending on the error type, have an authorized specialist correct it, or correct it yourself.
4. Correct the error by replacing or repairing the defective parts (for example cables, plugs, etc.).
5. If the error cannot be determined with the error table, a device defect cannot be excluded. Contact the manufacturer.

### 8.2 Power/Fault LED

	Continuously ON	Continuously OFF	Flashing
<b>Power LED</b>	Device operational	Device has no power supply	-
<b>Fault LED</b>	Device has no valid configuration. Contact the manufacturer.	Device functions error-free.	CAN data communication interrupted

### 8.3 Error Correction

Error	Possible Cause	Error Recognition/Correction
No function	Power supply missing	Power LED is not lit. Check the device's power supply. If the error persists afterwards, contact the manufacturer.
System bus not processed	Connection to the system bus interrupted Port not terminated	Check the connection to the system bus Check the termination of the port
Trim tabs cannot be controlled	Connection to the operating panel and/or hydraulic unit interrupted.	Check the connection between AHD-TCS (electronics) and the operation panel as well as AHD-TCS and the hydraulic unit.



## 9 Disassembly

After the device has reached its end of life, it must be disassembled and disposed of in an environmentally safe manner.

### 9.1 Safety

#### 9.1.1 Personnel

- Only specially trained personnel may disassemble the device.
- Only electricians may work on the electrical system.

#### 9.1.2 Basic Information



#### **CAUTION!**

#### **Danger of injury due to improper disassembly!**

Stored residual energy, sharp parts, points and edges on and inside the device or required tools can cause injury.

Therefore:

- Ensure adequate space before beginning any work.
- Proceed with caution when handling parts with exposed sharp edges.
- Observe order and cleanliness in the workplace! Parts and tools that are loosely stacked or lying about are accident sources.
- Disassemble parts properly.
- When in doubt, contact the manufacturer.

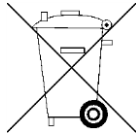
### 9.2 Disassembly

- Before beginning disassembly: disconnect the device from its power supply and secure it against reconnection
- Disconnect the cable connections and mark them, if necessary. Secure free wire ends against short circuit and earth/ground fault.
- Loosen the device mountings.
- Uninstall the device through appropriate measures.
- Clean and disassemble the device for selection according to workplace safety and environmental protection regulations.

## Disassembly

---

### 9.3 Disposal



In the absence of a return or disposal agreement, recycle the disassembled components:

- Scrap metals.
- Recycle plastic components.
- Dispose of the other components according to their material properties.



#### **CAUTION!**

#### **Environmental damages due to improper disposal!**

Electrical scraps, electronic components, lubricants, and other auxiliary materials are subject to hazardous waste regulations and may be disposed of only by licensed specialist companies!

Your local authorities or specialized disposal companies can provide you with information about environmentally safe disposal.

## 10 Appendix: Table Trim Tab Angle Settings

En- gine Speed (RPM)	Max. GPS Speed (kn)	Trim Tab Angle (°)
500		
600		
700		
800		
900		
1000		
1100		
1200		
1300		
1400		
1500		
1600		
1700		
1800		
1900		
2000		
2100		
2200		
2300		
2400		
2500		
2600		
2700		
2800		
2900		
3000		



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## List of Abbreviations

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### 13 List of Abbreviations

#### **C**

CAN – Controller Area Network

#### **G**

GPS – Global Positioning System

#### **L**

LED – Light Emitting Diode

#### **T**

TCS – Trim Tabs Control System





Devices, System Installation, Monitoring and  
Control Technology, Ship Automation

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