

# ACS A+

## Attitude Correction System

User's manual

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Mente Marine  
P.O. Box 472  
FIN-65101 Vaasa, Finland  
Email: [info@mente-marine.com](mailto:info@mente-marine.com)  
[www.mente-marine.com](http://www.mente-marine.com)

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## Introduction

Thank you for buying an attitude correction system from Mente Marine. Take a minute to read through the user's manual and you will find how this device can enhance your boating experience. Keep this User's Manual for future reference. No matter if the boat is 15' or 50', ACS will set it up to the desired attitude.

### Symbols and abbreviations

ACS Attitude Correction System

LED Light Emitting Diode

RPM Revolutions per minute

#### **POWER TRIM**

This symbol indicates that the text concerns only installations with power trim.

### Security



Switch off the main circuit breaker or put the ACS into manual mode before lifting or transporting the boat. Should the automatics engage during transport, the trim tabs or stern drive may be severely damaged.



Do not subject the box to shocks! The ACS contains precision electronics and for instance dropping it onto a hard surface may cause permanent damage.



Do not subject the device to ambient temperatures exceeding 70°C (160°F) while in operation.



The electronics is protected against moisture and water spray according to class IP66. Do not install it in a place where it may get completely wet!

## Theory of operation

The deep-V hulls of modern pleasure boats are designed to give you a smooth ride in rough water. The deeper the V, the more need for trim tabs and power trim to maintain a straight attitude. The lateral or, starboard and port balance of the boat is largely dependent on wind and passenger location. The longitudinal or, fore and aft balance depends on speed and loading. When the course is changed, winds change direction and you need to trim the boat. When passengers move, trim again. This need, to constantly adjust the trim tabs, takes the driver's attention, which can even be a security risk at high-speed operation.



The Attitude Correction System (ACS) takes care of the work for you. When changing course, winds shift, or passengers move, the attitude of the boat is automatically corrected by adjusting the trim tabs and power trim.

### Blocked while turning

While making a turn, the boat leans inwards. Thanks to the built-in yaw measurement, the system is able to detect heading changes and prevent automatic corrections while turning. Unnecessary adjusting is avoided and the boat exits the turn with optimum attitude. The AUTO indicator is blinking while making the turn to indicate that the ACS is blocked and not active at that moment. Once set up on a steady course again, the ACS continues measuring and correcting the attitude taking into account the altered conditions.

### Adaptable system

The system adapts to boats over the whole range. Thanks to the adaptive functionality, a 15 feet walkaround or a 50 feet performance yacht is set up to optimum running attitude taking into account the difference in size.

It also adapts to varying sea conditions. In calm seas, a list condition is corrected faster than in rough seas. This allows fast reaction when needed and avoids unnecessary operations that could amplify roll in high waves.

### Wireless rpm measurement

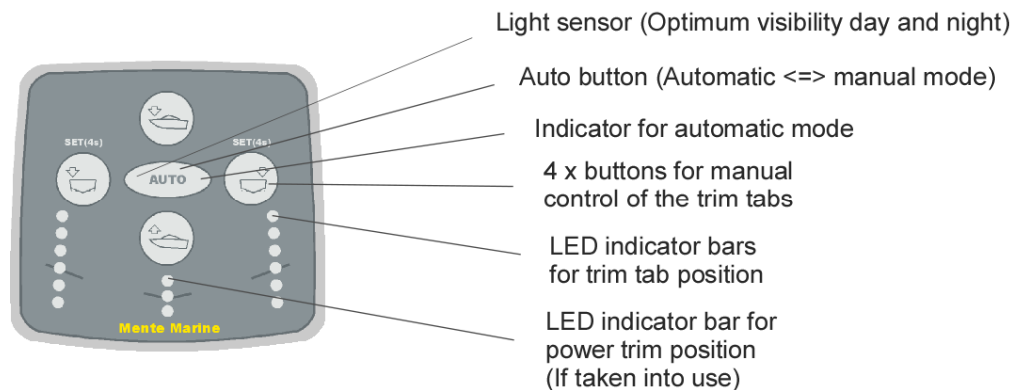


When slowing down, below the planing threshold, trim tabs lose their effect. ACS is aware of this and does not attempt to trim list conditions while off the plane. When accelerating, the ACS automatically starts up, correcting the attitude back to the desired even before the boat “breaks over” and reaches the cruising speed. This is made possible by using a technique for wireless rpm measurement, which does not require any sensor installation or maintenance.

### Position indication

ACS shows trim tab position by lighting an indicator LED for each trim tab. When a tab is extended, the lit up indicator LED moves downwards. While controlling, the indicator LED adjacent to the one lit up, is blinking, to show the control direction. No additional sensors are needed and ACS shows trim tab position for all types of trim tabs after calibration. If power trim is connected, the indicator LED row in the middle will show stern drive position. For double power trim, average position of the two stern drives is shown.

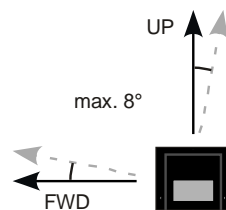
After installation, check the functionality of the light sensor by placing a finger on it to simulate darkness. The intensity of the LED indicators should be reduced.



## Installation

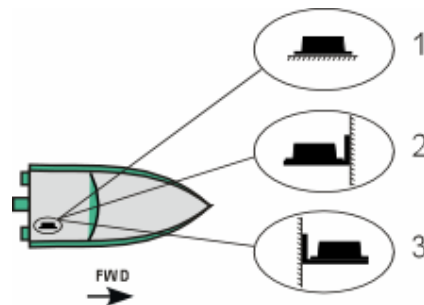
### Installing the box

The box is intended for wall mounting in an upright position. The label on the front side is marked with an UP arrow that should point upwards and a FWD arrow that should point in the forward direction. Exact mounting is not critical, however, as the desired running attitude is set after installation.



Install the box in the engine room as close to the trim tabs as possible to minimize the length of the high current cables. Avoid installing it close to noisy equipment like heaters or fans that may disturb the rpm measurement.

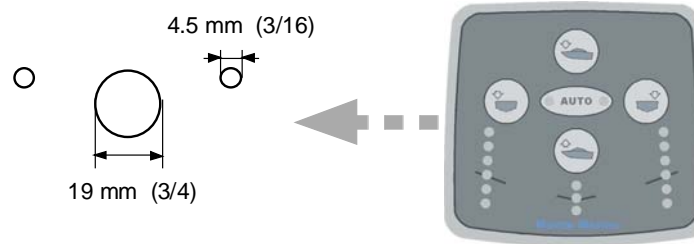
If there is no wall aligned fore to aft, on which the box can be mounted directly, use the mounting bracket. The mounting bracket has four sets of screw holes. One set for use when the bracket is floor mounted, another when roof mounted and two sets when wall mounted. Using the bracket, the ACS can be mounted on either side of a wall perpendicular to the fore-aft line of the boat.



1) Wall mounted 2)3) Wall mounted using mounting bracket

## Installing the control panel

To install the control panel, choose a location near the helm where it is convenient to access and drill two 4.5 mm holes using the enclosed drill pattern. Drill a 19 mm hole for the connector. Apply the gasket on the control panel and secure it with the nuts. If the panel is mounted on flybridge or in an open boat, make sure the installation is watertight.



## Connection

**IMPORTANT!** In retrofit installations, disconnect the old wires before connecting the ACS. Parallel connection may cause a shortcircuit even before connecting the supply voltage to the ACS.

### Hydraulic trim tabs

Hydraulic trim tabs, like Bennett, Instatrim, QL and Trimmer use a hydraulic pump unit to extend and retract the actuators. The pump unit is situated in the rear of the boat and connected to the battery's negative (-) terminal. From the pump unit, a wire harness is routed to the ACS.

Connect the wires to the ACS terminals 3, 4, 5, 6 according to the figure that follows. Terminals 5 and 6 are connected to the pump's motor and terminals 3 and 4 to the valves controlling the trim tabs.

The table below shows the colours used by the major manufacturers of hydraulic trim tabs. Corresponding ACS markings are shown in the left column.

ACS marking	Instatrim (QL)	Bennett	Trim-master	TFX Teleflex	TX Controls
3	White	Green	White	Yellow	Grey
4	Green	Red	Green	Blue	Blue
5	Yellow	Yellow	Yellow	-	Red
6	Red	Blue	Red	Red	Black

### Electromechanical trim tabs

Connect the starboard actuator to terminals 4 and 6 and the port actuator to terminals 3 and 5 according to the figure that follows. Verify the connection later on and change it if necessary.

ACS marking	Lenco	Lectrotab
3	Black (port)	White (port)
4	Black (stbd)	White (stbd)
5	White (port)	Black (port)
6	White (stbd)	Black (stbd)

## Power trim

### POWER TRIM

If the boat is equipped with an outboard engine or inboard engine with stern drive, ACS can adjust power trim for you. Power trim works with an electric motor and a hydraulic pump to raise or lower the drive and that way adjust the boat's attitude. Connect either to the switch in the handle or directly to the relays of the pump which is usually found mounted at the transom.

NB! The automatic power trim is connected in parallel with the existing manual control. Do not disconnect the power trim switch! The ACS immediately deactivates the outputs when the manual power trim is used.

### 1 x power trim

Connect terminals 11 and 12 to the relays that control the power trim motor. Terminal 12 raises the drive to lift the bow while terminal 11 lowers it.

### 2 x power trim

If the boat has two engines, terminals 9 and 10 are connected to the port engine while terminals 11 and 12 are connected to the starboard engine.

### Colour codes

The table below shows the colours used by the major manufacturers of inboard engines. Corresponding ACS markings are shown in the left column.

ACS marking	Mercruiser	Volvo Penta
11 (Dn)	Green/White	Green
12 (Up)	Blue/White	Blue
9 (Dn)	Green/White	Green
10 (Up)	Blue/White	Blue

## Control panel

Connect the control panel's yellow wire to terminal 7, green to terminal 8, brown to terminal 9 and white to terminal 10.

The red wire is connected to the ignition key run position. For Volvo Penta EVC EC and other electronically controlled engines, the red wire should be connected to the relay for external accessories.

NB! In retrofit installations, remove or disconnect the old control panel before taking the ACS into use. Parallel connection may cause a shortcircuit.

## 2 x power trim

### POWER TRIM

If the boat has two engines, the control panel's yellow cable is connected to terminal 7 and the green one to terminal 8. The brown cable is connected to (+) and the white to (-).

## Supply voltage

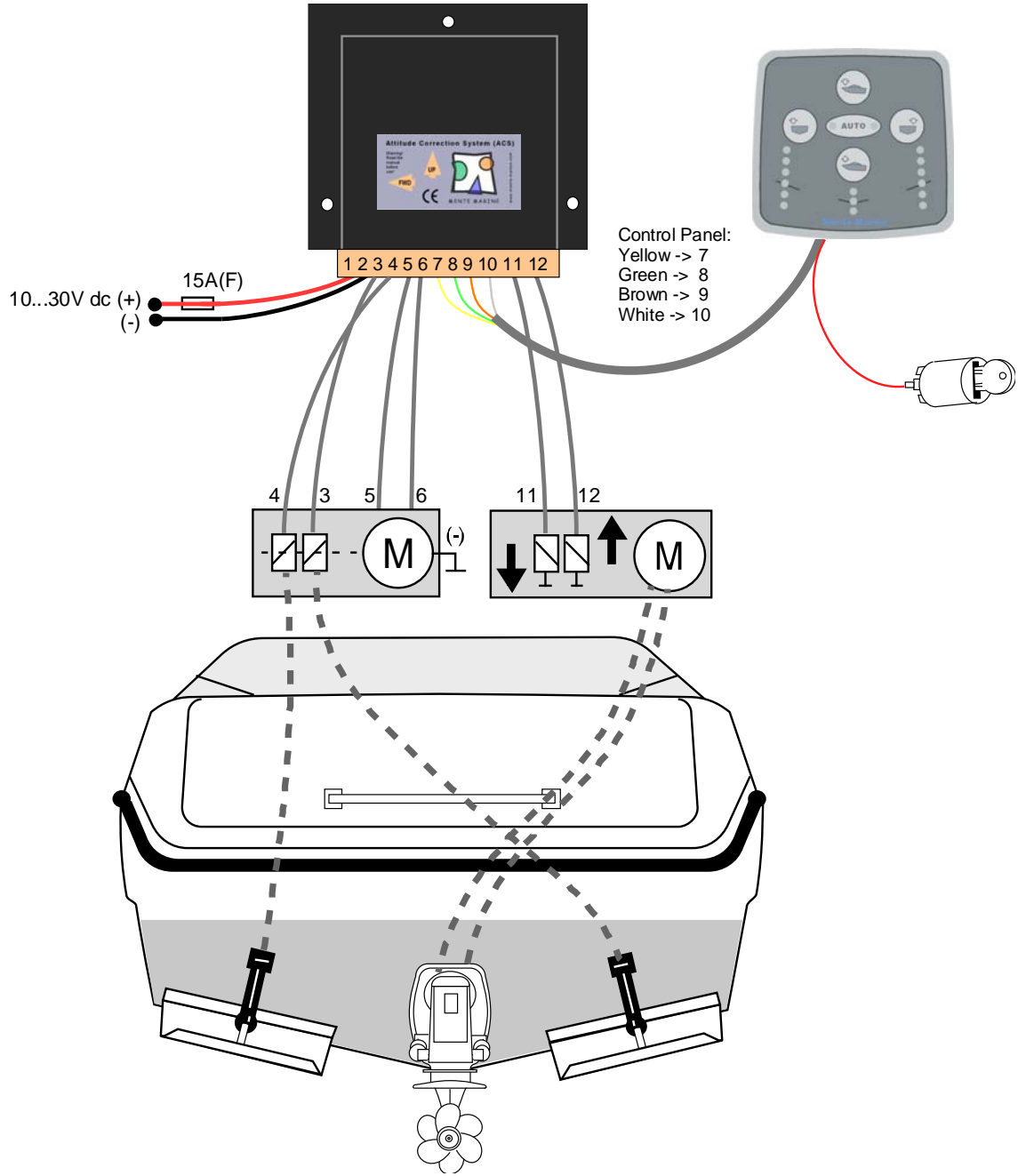
Connect the red wire to the boat's main circuit breaker through the fuseholder. Do not insert the fuse in the fuseholder until the installation is completed.

Connect the black wire to the battery's negative (-) terminal.

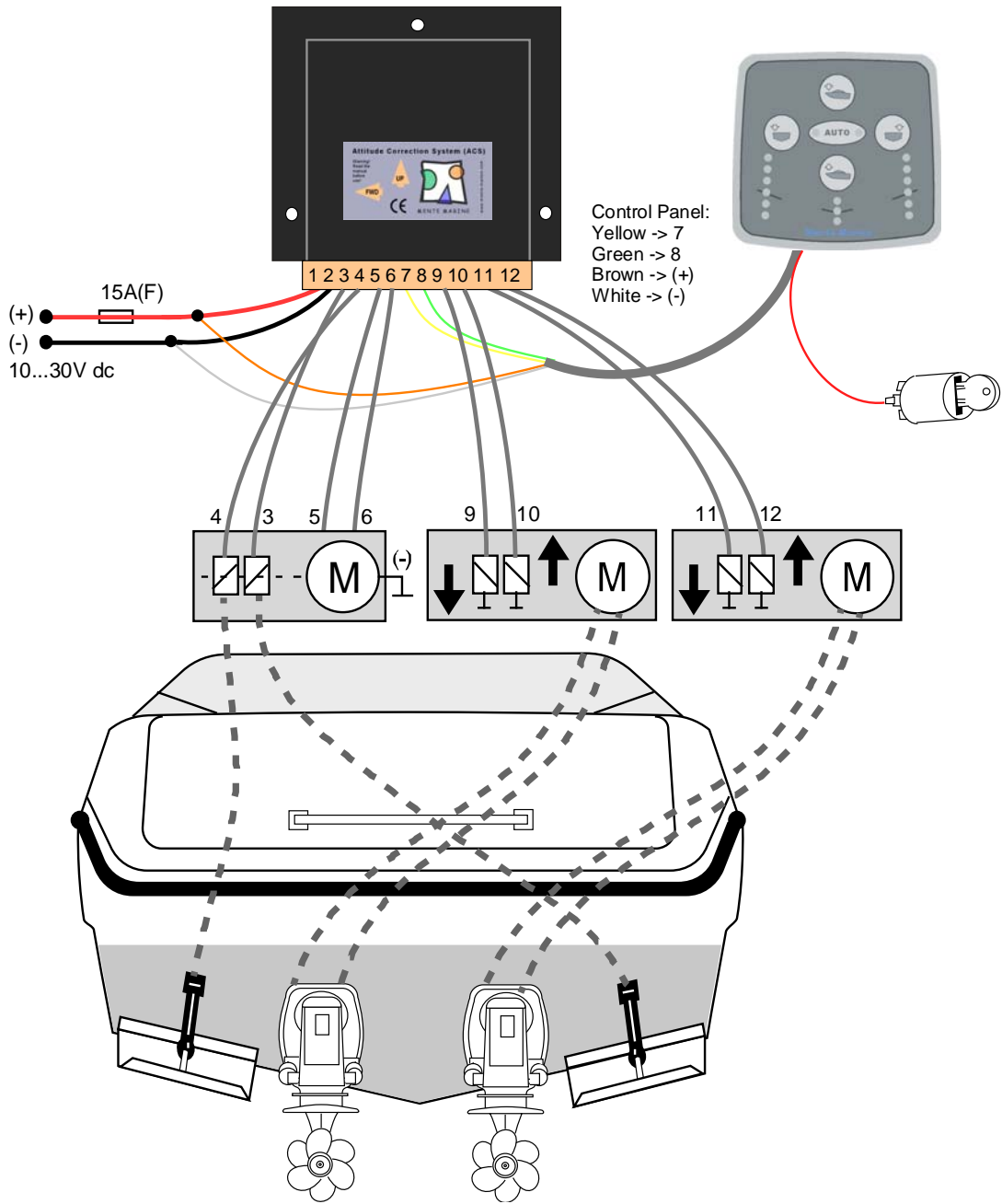
## Flybridge panel

If the boat has a flybridge, and two control panels are preferred, an extra control panel is available under product name FCP (Flybridge Control Panel). It is installed the same way as the ordinary panel and connected in parallel to the ACS terminals. Strip the wires 13 mm. Then insert the two wires of the same colour into the supplied ferrules and tighten with the screw connector. No special tools needed!

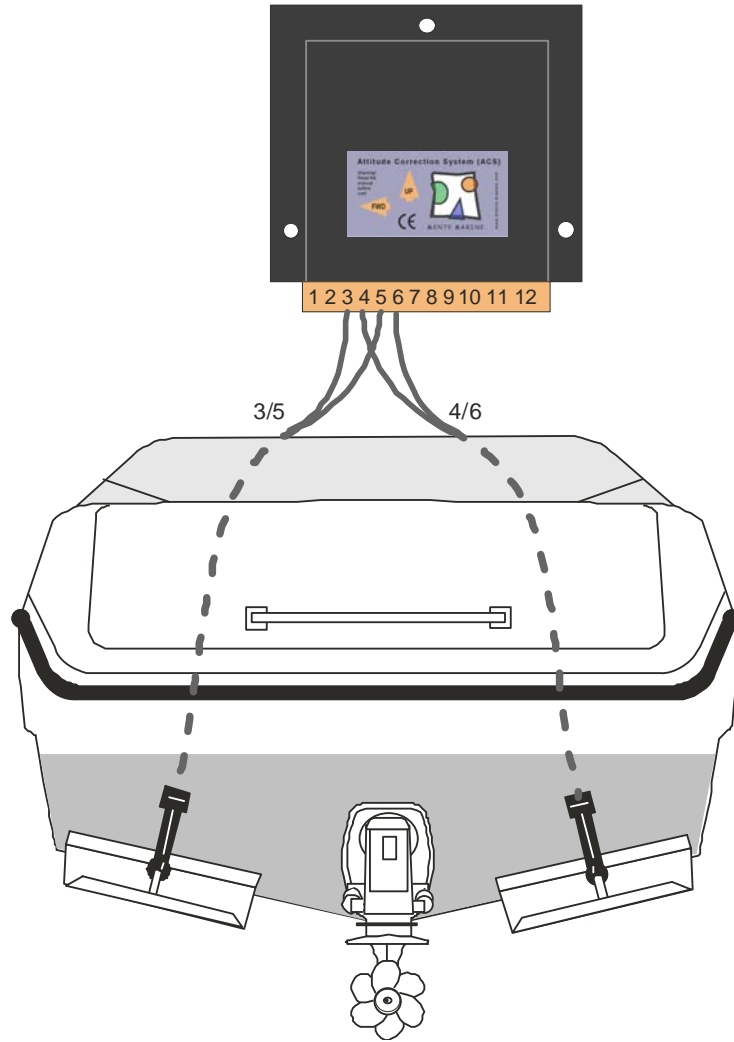
Both panels are active at the same time and the flybridge panel controls the tabs manually, engages the automatics and shows trim tab position exactly the same way as the ordinary panel.



Connection to hydraulic trim tabs and power trim looking forward



Connection to hydraulic trim tabs and double power trim looking forward



*Connection to electromechanical trim tabs looking forward*

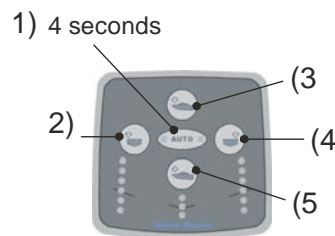
## Calibration

For the ACS to operate properly, it needs to know the trim tab type, position, electrical current consumption and the power trim function. This information is automatically acquired and stored in memory during calibration. Before you start, secure that no obstacles hinder free run of tabs and power trim. Turn the ignition key to run position to activate the ACS.

### Trim tabs only

For automatic trim tabs only, calibrate the unit as follows:

- The AUTO indicator is blinking to indicate that the device needs calibration.
- Press the AUTO button for 4 seconds until the indicator LED starts flashing.
- Press the button sequence 2 -> 3 -> 4 -> 5 for calibration. An indicator LED in the left and right bar starts to blink. For every press, the blinking indicator LED's move one step downwards.



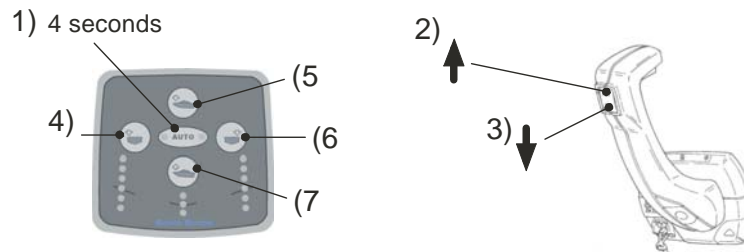
- The ACS will now run the trim tabs to their uppermost position. The starting position does not matter.
- From the uppermost position, the tabs are run downwards, and back up again. This procedure may take up to 60 seconds and should not be interrupted.
- After completion, the indicator LED's stop blinking. Port trim tab position is now shown by the left bar and starboard by the right bar.

## 1 x power trim

### POWER TRIM

If the boat has one engine, and power trim has been connected, calibrate as follows:

- After installing the ACS, and switching power on, the AUTO indicator is blinking to indicate that the device has not been calibrated yet.
- 1. Press the AUTO button for 4 seconds until the indicator LED starts flashing.
- 2. Press the power trim switch to operate the drive upwards.
- Now, the uppermost indicator LED's in the left and right bar must start blinking. If they don't, check the connection and continue calibration later.
- 3. Press the power trim switch to operate the drive downwards.
- Now, the 2<sup>nd</sup> indicator LED's should start blinking.
- Press the button sequence 4 -> 5 -> 6 -> 7 for calibration. For every press, the blinking indicator LED's move one step downwards.



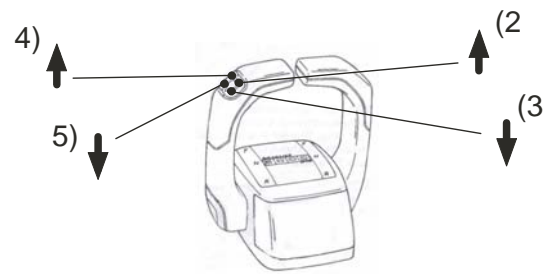
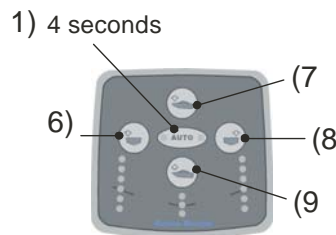
- The ACS will now run the trim tabs to their uppermost position. The starting position does not matter.
- From the uppermost position, the tabs are run downwards, and back up again. This procedure may take up to 60 seconds and should not be interrupted.
- Finally, the stern drive is operated to the lowermost position.
- After completion, the indicator LED's stop blinking. Port trim tab position is shown by the left bar and starboard by the right bar. Stern drive position is shown by the three LED's in the middle.

## 2 x power trim

### POWER TRIM

If the boat has two engines, calibrate as follows:

- After installing the ACS, and switching power on, the AUTO indicator is blinking to indicate that the device has not been calibrated yet.
1. Press the AUTO button for 4 seconds until the indicator LED starts flashing.
  2. Press the power trim switch to operate starboard drive upwards. Now, the uppermost indicator LED in the right bar must start blinking. If it does not, check the connection and continue calibration later.
  3. Press the power trim switch to operate starboard drive downwards. Now, the 2<sup>nd</sup> indicator LED in the right bar should start blinking.
  4. Then, press the power trim switch to operate port drive upwards. The uppermost indicator LED in the left bar should start blinking.
  5. Then, press the power trim switch to operate port drive downwards. Now, the 2<sup>nd</sup> indicator LED in the left bar should start blinking.
- Press the button sequence 6 -> 7 -> 8 -> 9 for calibration. For every press, the blinking indicator LED's move one step downwards.



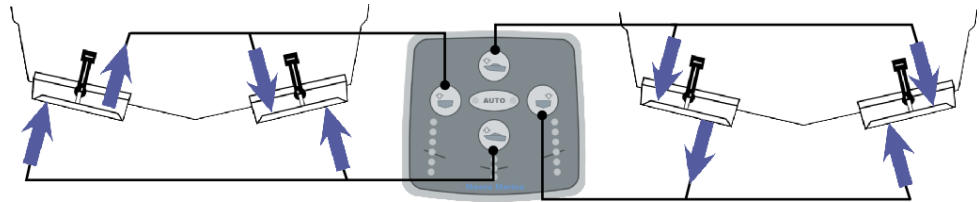
- The ACS will now run the trim tabs to their uppermost position. The starting position does not matter.
- From the uppermost position, the tabs are run downwards, and back up again. This procedure may take up to 60 seconds and should not be interrupted.
- Finally, the stern drives are operated to the lowermost position.
- After completion, the indicator LED's stop blinking. Port trim tab position is shown by the left bar and starboard by the right bar. Stern drive positions are shown by the three LED's in the middle.

## Verify connection

**IMPORTANT!** After calibration, verify the connection by pressing the buttons one by one and observing the trim tabs. Should the trim tabs move in the wrong direction when manually controlled, they will do that also in the automatic mode.

- Press the uppermost button and keep it depressed. Both trim tabs should move downwards.
- Press the lowermost button and keep it depressed. Both trim tabs should move upwards.

Should the trim tabs move in the wrong direction: For hydraulic trim tabs, exchange the 5 and 6 wires, for electromechanical trim tabs, reverse the wires of the actuator(s) that move in the wrong direction.



- Press port button and keep it depressed. Port trim tab should then move upwards first and then starboard tab downwards.
- Press starboard button and keep it depressed. Starboard trim tab should then move upwards first and then port tab downwards.

Should the trim tabs move in the wrong direction: For hydraulic trim tabs, exchange the 3 and 4 wires, for electromechanical trim tabs, exchange 4 and 6 wires with 3 and 5 wires.

### POWER TRIM

- Press power trim upwards. The lit power trim indicator LED should move upwards.
- Press power trim downwards. The lit power trim indicator LED should move downwards.

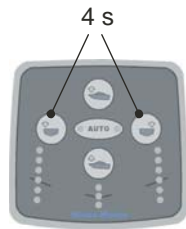
Should the lit indicator LED move in the wrong direction: For single power trim, exchange the 11 and 12 wires, for double power trim, exchange also the 9 and 10 wires.

The ACS is now ready for operation. Verify the installation by disconnecting and connecting the power supply. Count the beep signals upon connection. More than two signals indicate some problem with the installation.

## Usage

After installing and calibrating, take the boat for a test drive and store the attitude as described below.

Run the boat at cruising speed. Manually control the trim tabs until you find the best attitude. Then, press the left and right buttons together for 4 seconds. Now, the attitude is stored in memory, the indicator LED to the right of the AUTO button is lit up and ACS set in automatic mode.



In automatic mode, the desired attitude can be tuned by pressing any of the four buttons e.g. pressing starboard button once sets the boat 0.3 degrees to starboard. Pressing the uppermost button lowers the bow 0.3 degrees.



Now, if the speed is reduced, automatic control is suspended and the AUTO indicator starts blinking. The functionality is then temporarily interrupted to avoid deflecting the tabs at too low speed.

Automatic mode is re-entered every time you go out until the ACS is put into manual mode. By pressing the AUTO button you can toggle between automatic and manual mode. The running attitude remains stored although main breakers are switched off.

## Adjusting power trim

### POWER TRIM

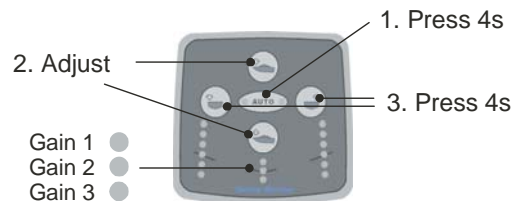
Increase speed to the maximum taking into account weather conditions. At high speed, the bow is pressed down and the trim tabs retract. When the tabs have reached uppermost position, power trim will operate the drive upwards until the uppermost position indicator LED is lit. Now, the power trim function can be scaled for your boat by manually adjusting the uppermost position. If the propeller cavitates, engine rpm increases rapidly or vibrations are felt, shortly press the power trim switch to lower the drive a bit. You have now adjusted power trim to the optimum and ACS will remember it although main breakers are switched off. You can readjust anytime when ACS is in automatic mode.

## Adjusting gain

The gain determines how fast the ACS should correct a list condition. It can be adjusted in three steps and the default setting is step 1. Step 2 provides a bit faster correction while step 3 is the fastest. The setting is optimized if a list condition is corrected without the boat leaning over to the other side and the trim tabs are not operated too often. As a rule of thumb, boats longer than 35 feet should use settings 1 and 2 while boats below 35 feet may use settings 2 and 3.

To change the gain setting, do as follows:

- Press the AUTO button for 4 seconds until the indicator LED starts flashing.
- Press the uppermost or lowermost button to adjust the setting.
- The three indicator LED's in the middle show the setting. The uppermost LED shows step 1, the 2<sup>nd</sup> LED step 2 and the lowermost LED step 3.
- Then, press the left and right buttons together for 4 seconds. Now, the LED indicator is blinking in the beginning and lit up when the new setting is stored.



**Auto return**

The ACS automatically retracts the trim tabs when the engine is shut off and they are no longer needed. This is to prevent fouling of the piston rods, which may destroy the actuator gaskets with resulting leaks.

**Shut down**

When the engine is switched off, and the trim tabs have retracted, ACS shuts down drawing minimal current from the battery. This feature prevents battery drain and the boat may be left for months with main breakers on.

ACS is activated next time the ignition key is turned to run position.

## Troubleshooting

### **No calibration**

When all the buttons have been pressed according to instructions, the ACS should calibrate. If it cannot calibrate, the AUTO indicator continues blinking after trying for a few seconds. It may depend on:

1. Wrong connection of trim tabs
2. Shortcircuit in the trim tab motor or valves

### **Two indicator LED's are blinking**

The current consumption of the valves controlling the trim tabs (only hydraulic trim tabs) is checked at calibration. Should it later on exceed the maximum, two indicator LED's start blinking. It may depend on:

1. Wrong connection of trim tabs
2. Shortcircuit in the trim tab valves

### **Four indicator LED's are blinking**

If the control panel cannot communicate with the main unit, four indicator LED's will start blinking. Check the wiring!

## Specifications

Compliance (Hydraulic tabs)	Bennett, Instatrim, Trimmermaster, QL Volvo Penta, TFX Teleflex, TX Controls
Compliance (Electromechanical tabs)	Lectrotab, Lenco, Eltrim. Minn Kota (ACS iC is compliant with QL Boat Trim System interceptors)
Compliance (Power trim)	All outboards and stern drives with hydraulic power trim. Not compatible with "electronic" engines (e.g. Volvo Penta D4, D6 and Mercury Verado). Please choose a product version for trim tabs only.
Boat length	15...50 feet
Tab type detection	Automatic
Gain	Automatic, adapts to the boat type
Size	120 * 110 * 40 mm
Weight	330 g
Protection by enclosure	IP 66
Operating temperature	-10...70 °C
Storage temperature	-40...+85 °C
Supply voltage	10...30 V dc
Maximum output current	18 A (When tabs activated)
Current consumption	0.05 A (When idle)
Maximum power trim current	2.0 A
Shut-down timer	Yes (After engine shutdown and no manual control)
Approvals	CE (Compliance with EMC regulations)



The CE marking assures that this product complies with the requirements of the EC directive for electromagnetic compatibility.

## Warranty policy

All ACSs (Attitude Correction Systems) purchased through authorized distribution channels are guaranteed against defects of material or workmanship for a period of 24 months from date of purchase. Service will be rendered, and defective parts will be replaced without cost to you within that period, provided the equipment does not show evidence of impact, liquid damage, mishandling, tampering, or chemical corrosion, operation contrary to operating instructions, or modification by an unauthorized repair shop. The manufacturer or its authorized representatives shall not be liable for any repair or alterations except those made with its written consent and shall not be liable for damages from delay or loss of use or from other indirect or consequential damages of any kind, whether caused by defective material or workmanship or otherwise; and it is expressly agreed that the liability of the manufacturer or its representatives under all guarantees or warranties, whether expressed or implied, is strictly limited to the replacement of parts as herein before provided. No refunds will be made on repairs performed by non-authorized service facilities.

### Procedure during 24-month warranty period

Any ACS that proves defective during the 24-month warranty period should be returned to the dealer from whom you purchased the equipment or to the manufacturer. If there is no representative of the manufacturer in your country, send the equipment to the manufacturer, with postage prepaid. In this case, it will take a considerable length of time before the equipment can be returned to you owing to the complicated customs procedures required. If the equipment is covered by warranty, repairs will be made and parts replaced free of charge, and the equipment returned to you upon completion of servicing. If the equipment is not covered by warranty, regular charges of the manufacturer or of its representatives will apply. Shipping charges are to be borne by the owner. If your ACS was purchased outside of the country where you wish to have it serviced during the warranty period, the manufacturer's representatives in that country may charge regular handling and servicing fees. Notwithstanding this, your ACS returned to the manufacturer will be serviced free of charge according to this procedure and warranty policy.

In any case, however, shipping charges and custom clearance fees are to be borne by the sender. To prove the date of purchase when required, please keep the receipts or bills covering the purchase of your equipment for at least two years. Before sending your equipment for servicing, please make sure you are sending it to the manufacturer's authorized representatives or their approved repair shops, unless you are sending it directly to the manufacturer. Always obtain a quotation for the service charge, and only after you accept the quoted service charge, instruct the service station to proceed with the servicing.



<http://www.mente-marine.com>

Mente Marine  
P.O. Box 472  
FIN-65101 Vaasa, Finland  
Email: [info@mente-marine.com](mailto:info@mente-marine.com)  
[www.mente-marine.com](http://www.mente-marine.com)

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