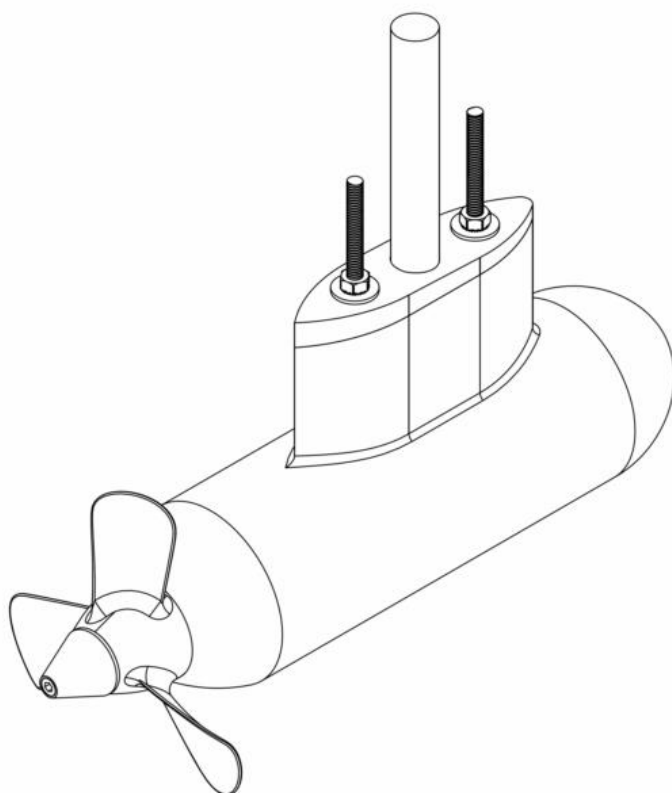




# USER MANUAL

## INBOARD MOTOR AC



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## **GENERAL INFORMATION**

### **USE OF THIS MANUAL**

Copyright © 2013 Aquamot. All rights reserved.

Reproduction, transfer, distribution or storage of part or all of the contents in this document in any form without the prior written permission of Aquamot is prohibited. This manual contains important safety and operating instructions for the safe and effective operation, maintenance and possible correction of minor malfunctions of the INBOARD MOTOR AC. It is therefore obligatory that every person who works on or with the INBOARD MOTOR AC is completely familiar with the contents of this manual, and that he/she carefully follows the instructions and important safety instructions contained herein. Installation and maintenance of the INBOARD MOTOR AC systems may only be performed by qualified and authorized personnel, in accordance with regulations and in compliance with the mentioned safety measures. Keep this manual in a safe place!

### **VALIDITY OF THIS MANUAL**

All of the specifications, provisions and instructions contained in this manual apply solely to standard versions of INBOARD MOTOR AC delivered by Aquamot.

### **GUARANTEE SPECIFICATION**

Aquamot guarantees that this unit has been built according to the legally applicable standards and specifications. Should work take place, which is not in accordance with the guidelines, instructions and specifications contained in this user manual, then damage may occur and/or the unit may no longer meet its specifications. All of these matters may mean that the guarantee becomes void. The guarantee is limited to the costs of repair and/or replacement of the product. Costs for installation labor or shipping of the defective parts are not covered by this guarantee. During production and before delivery, all equipment is tested and inspected. The standard warranty period is two years after purchase.

See EC Declaration of Conformity.

### **LIABILITY**

Aquamot can accept no liability for:

- Consequential damage due to use of the INBOARD MOTOR AC
- Possible errors in the manuals and their consequences.

## **SAFETY GUIDELINES AND MEASURES**

### **WARNINGS AND SYMBOLS**

The following warning, caution and attention symbols are used in this manual.



#### **WARNING!**

A WARNING refers to possible injury to persons if the user does not (carefully) follow the procedures.



#### **CAUTION!**

A CAUTION sign refers to possible significant damage to the equipment if the user does not (carefully) follow the procedures, restrictions and rules.



#### **ATTENTION!**

An ATTENTION sign refers to procedures, circumstances, etc. which deserve extra attention.

### **USE FOR INTENDED PURPOSE**

The INBOARD MOTOR AC may only be used for ship propulsion and according to the installation, operation and maintenance instructions of this manual.

### **GENERAL SAFETY AND INSTALLATION PRECAUTIONS**

- Read this manual thoroughly before installing and/or using the electric components
- Follow the assembly instructions carefully
- Only work with the controller when the drive is switched off. It is important to switch off the power supply of the electric drive with the main switch. Remove the key and keep it with you so that nobody else can turn it back on
- Be aware of your speed. The speed is often underestimated because of the lack of sound
- Be alert to your surroundings; silent sail means that others can hardly hear you
- The motor has non-shielded rotating parts. Be sure that loose clothing cannot get caught in the shaft or coupling. Avoid contact with rotating parts
- Make sure that when building the motor, the wiring is properly insulated. A short circuit can cause fire



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## **WARNING REGARDING LIFE SUPPORT APPLICATIONS**

The INBOARD MOTOR AC is not intended for use in any medical equipment that is intended for use as a component of any life support system, unless a specific written agreement pertaining to such intended use is executed between the manufacturer and Aquamot. Such agreement will require the equipment manufacturer either to contract additional reliability testing of the INBOARD MOTOR AC and/or to commit to undertake such testing as a part of the manufacturing process. In addition, the manufacturer must agree to indemnify and not hold Aquamot responsible for any claims arising from the use of the INBOARD MOTOR AC in life support equipment.

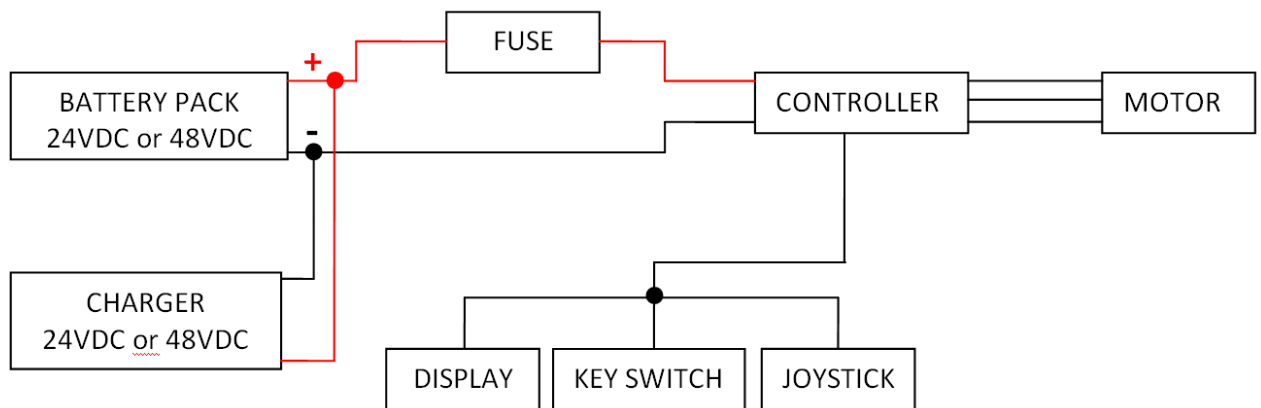
## **WARNING REGARDING THE USE OF BATTERIES**

The battery pack that is suitable for the INBOARD MOTOR AC is a 48 Volt battery pack. The battery capacity can be chosen by the customer.

Pay attention to the following when working with batteries:

- Someone should be within hearing distance or close enough to come to your aid when you work near a lead-acid or Li-Ion battery
- Have plenty of fresh water and soap nearby in case battery acid contacts skin, clothing or eyes
- Wear complete eye protection and clothing protection. Avoid touching eyes while working near a battery
- If battery acid contacts skin or clothing, wash immediately with soap and water. If acid enters the eye, immediately flood the eye with cold running water for at least 10 minutes and get medical attention immediately
- NEVER smoke or allow a spark or flame in the vicinity of a battery or engine
- Do not short circuit batteries, as this may result in an explosion and fire hazard! Take extra care to reduce the risk of dropping a metal tool onto a battery. It might spark or short-circuit the battery or other electrical part and it may cause an explosion
- Remove personal metal items such as rings, bracelets, necklaces and watches when working with a battery. A battery can produce a short-circuit current that is high enough to weld a ring or anything like it, to metal, causing a severe burn
- NEVER charge a frozen battery
- Excessive battery discharge and/or high charging voltages can cause serious damage to batteries. Do not exceed the recommended limits of the discharge level of your batteries
- If it is necessary to remove a battery, always remove the grounded terminal from the battery first. Make sure all accessories are off, so as not to cause an arc
- Be sure that the area around the battery is well ventilated while the battery is being charged. Refer to the recommendations of the battery manufacturer
- Batteries are heavy! It may become a projectile if it is involved in an accident! Ensure adequate and secure mounting and always use suitable handling equipment for transportation.

## HOW IT WORKS



## INBOARD MOTOR AC SYSTEM

The main parts of the system are the battery and controller, supplying the motor with energy, and the motor with propeller providing the thrust for the propulsion. The system is operated by the joystick that gives speed and direction information to the controller so it can give the right amount of power to the motor. Information about battery voltage, remaining power, thrust power and more is shown on the display. Furthermore, there is a fuse for protection for powering on and off. The motor controller is the key element in the system. It manages operation and protection.

## COMPONENTS

The INBOARD MOTOR AC comes with the following components:

- Motor controller
- Submerged AC motor with suspension
- Display
- Key switch
- Joystick
- Fuse
- Signal cable for display and controller
- Custom made power cables

Please check the contents of the box before you start with the installation. If any of the items is missing, please contact your supplier.

## MOTOR CONTROLLER AND AC MOTOR

The motor controller is specifically designed for controlling the speed of the sensorless Asynchronous AC INBOARD MOTOR. This controller-motor combination is specifically designed for electric propulsion in boats. The controller is equipped with a number of specific features that are important for electric propulsion in boats; e.g. the cooling is temperature controlled.

The motor is placed below the hull, submerged in the water. It uses the latest asynchronous technology which results in high efficiency and a high power output to volume / weight ratio. If you switch on and off and immediately on the controller it can be a failure on the display due an intermediate circuit charging. So please recycle the power for solve this problem.



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## **DISPLAY, JOYSTICK AND MOTOR SWITCH**

The display gives information on battery status, motor status, failures, key switch hours and has a separate motor switch for switching the system on and off. The display is connected to the motor controller. The joystick (to be ordered separately) is used to control the speed in forward and backward direction when sailing. The joystick is connected to the display.

## **OPERATION**

### **SWITCHING ON AND OFF**

The system is switched on by turning the motor switch key in clockwise direction.

The motor switch has two positions: "off" and "on".

The system is switched off by turning the motor switch key counter-clockwise to the "off" position.

### **USE OF THE FULL COLOR ON BOARD COMPUTER**

#### **1. Page: Main**

The right hand side of the back-lit display shows the charge status of the main battery in %. The status is colored in three sections, full is green, down 50% (adjustable) is yellow, down 20% (adjustable) is red. In this section the controller cut off the power to a limited speed of the motor. Line under the display shows the charge or discharge current (A) and the battery voltage (V). In the middle of the display is the throttle control, sectioned in three fields (green field is economic drive, yellow is mixed power and red field shows full powered motor. Between the field of throttle control is a warning sign for failures.

#### **2. Page: System Overview**

At this page it is shown if you have any failures or not. If you don't have any failure you will find the words at controller and display "No fault on node". On the other side it is shown "Faults active on node". If you have a look at this fault the error will be written at the display. For further questions please contact your Aquamot dealer or Aquamot.

#### **3. Page: Status**

Here you will find information regarding the battery and motor status. At the top box you see the information for the battery status: the battery voltage and battery current. Below is shown the motor status (AC voltage and AC current of the motor). Furthermore the temperature of the controller is shown.

#### **4. Page: Configuration**

You can change some parameter regarding the battery adjustment in this menu. You can change it with the buttons on the display. You have to recycle the power for saving this data in the motor system. Please note that it takes one battery cycle to accept the parameters in the motor system. Below you will find the description of the specific parameters:

Nominal Battery V: you can adjust the nominal voltage of the battery pack. It isn't allowed to change this + or – 10% of the nominal voltage of the motor

Overvolt Start Ctback: At this level the cutback of the power will start

Overvolt Limit: At this level the system switch of automatically

Undervolt Start Ctback: At this level the cutback of the power will start

Undervolt Limit: At this level the system switch of automatically (battery protection)

Reset Voltage: At this cell voltage the display shows 100% at the main screen

Discharge Voltage: At this cell voltage the display shows 0% at the main screen

Cutout Level: The bar on the right side of the main screen starts to get from yellow to red at this percentage

Warning Level: The bar on the right side of the main screen starts to get from green to yellow at this percentage

Cell count: You have to choose the cell count for the display

Discharge Rate: Here you can choose how long it takes when you discharge the battery with max. power consumption. The value is in millisecond. Zero means 28 minutes.

#### 5. Page: Fault Log

Here are all failures shown which happened in the past.

### **USE OF THE JOYSTICK**

The desired power and speed can be adjusted in forward and backward direction with the joystick, by turning it over the full stroke. This happens without intermediate steps.

### **DEPARTURE**

Before departure, always check the system for correct functioning.

Follow these steps:

1. Disconnect the shore connection.
2. Put the joystick in the neutral position.
3. Turn the system on with the motor switch on the display.
4. Check the battery condition.

### **ARRIVAL**

Follow these steps after arrival:

1. Put the joystick in the neutral position.
2. Check the battery condition.
3. Connect the shore connection and make sure it works properly.
4. Reload the batteries after arrival.

## **INSTALLATION**

During installation and commissioning of the INBOARD MOTOR AC, the safety instructions above must be followed.

### **MOTOR**

An INBOARD MOTOR AC electric drive system is quiet and has little vibration when installed correctly. In order to achieve this, pay close attention to the placement of the motor.

The motor must be installed by qualified personnel. Below are some support guidelines for installation. First two preparatory actions need to be taken:

1. The axis of the propeller shaft should be the same like the axis of the motor
2. An external thrust bearing is recommend or it is compelling necessary for the power of more than 11kW
3. The screws of the suspension must be tightened firmly.



## **MOTOR CONTROLLER**

When mounting the controller, there must be at least 50 mm space above and under it. There must also be sufficient space for the cable connections.

Note the following when installing the motor controller:

- Make sure that there is adequate ventilation and do not cover up the suction and blast hole
- The motor controller must be mounted at a dry, well protected and accessible location in the boat
- Never install a controller near a so-called wet or open battery
- Air-intake of the controller must be sufficient
- Ensure that the intake opening cannot be blocked
- The controller must be mounted on a flat surface

## **DISPLAY**

The display is usually mounted on the control console of the boat. The location of the display is not critical, it is important that (rain) water does not remain on the display and can run off. Upright or slightly slanted installation is recommended. This does not apply to an indoor arrangement.

## **JOYSTICK**

The joystick is mounted vertically, for instance, on the control console.

Note:

- The joystick is splash proof only. Therefore, the joystick should not continuously be in contact with water. Position the joystick carefully
- The handle has to be able to rotate freely in both directions
- Choose the location so that the risk of turning the handle in the unwanted direction is minimal.

## **WIRING**

The power cables for connecting the batteries and the power cables from the motor controller to the motor are not included. Please only use these cables for installation.

## **CALIBRATION OF CONTROLLER**

The parameters of the controller are predefined by Aquamot and can't be changed by the customer. For further questions please contact your service partner.



## **MAINTENANCE**

### **PREVENTIVE MAINTENANCE**

Check your whole system regularly on the following points:

- Check the bilge and motor compartment for unwanted moisture or water
- Check the operation of the automatic bilge pump
- Check the system for irregularities, such as abnormal noise, vibration and wear.

Keep the system always connected (even in winter storage) to the shore connection. This will keep the batteries in 100% condition and prevents self-discharging of batteries.

If the system is not going to be used for a long time and a permanent shore connection is not available, then charge the batteries for 100% and remove the fuse.

### **MAINTENANCE**

After approximately 2000 hours of use, the carbon brushes inside the podded motor need to be replaced. This maintenance can only be done by Aquamot, please contact your Aquamot service contact.

### **ANODE PROTECTION**

The propeller shaft is protected with a sacrificial anode. Check the anode for corrosion on a regular base; at least once every year.

Replace the sacrificial anode when half of the anode has been lost to corrosion.

### **CAUTION!**

Never coat anodes with paint or anything else, for it will lose its function.

## **TROUBLE SHOOTING**

In case of a failure, the INBOARD MOTOR AC full color display shows the error to help you find the cause. If you cannot solve a problem, contact your local Aquamot Service Centre.

See [www.aquamot.com](http://www.aquamot.com)

## EC DECLARATION OF CONFORMITY

We,

Manufacturer: Aquamot GmbH

Address: Heroalstraße 5, 4870 Vöcklamarkt, Austria



Declare under our sole responsibility that the inboard motor with the power of

- **Power: 7000W**

and with the motor number

- **Mot. No.: 16119**

are in conformity with the provisions of the following EC directives:

- Electromagnetic Compatibility (EMC) Directive 2014/30/EU EMV
- The following harmonized standards have been applied:
- EMC Emission standard for industrial environments EN 61000-6-4:2007
- EMC Immunity standard for industrial environments EN 61000-6-2:2005

Furthermore we hereby declare that the same products are intended to be incorporated into other machinery, and must not be put into service until the relevant machinery into which it is to be incorporated has been declared in conformity with the essential requirements of the following EC directive:

- Machinery Directive 2006/42/EC

The following harmonized standards have been applied:

- Rotating electrical machines EN 60034-1:2004

Vöcklamarkt, 25-02-2016