Installation guide

How to install an electric Green Marine motor system.

Powerful
electric propulsion

Table of contents

1. Introduction

Thank you for purchasing a Green Marine electric motor system, and for choosing performance, comfort, durability and reliability. This manual is written to help you with the installation of the GM4, GM8.5, GM10, GM17.5 and GM22 motor systems. All components have been developed to meet the highest quality requirements. We believe that if you handle the motor system well, you are able to enjoy it for a lifetime. With Green Marine, you are truly ready for the future.

With this manual, you will get the most out of the motor system. How the motor system is installed determines its performance. Our advice is to follow this manual as closely as possible during installation, or to ask one of the affiliated Green Marine installers to install the motor system for you. Will you install it yourself? We can help you with commissioning the motor system, ensuring proper installation.

If you have are any questions, suggestions or other types of feedback, you can always contact us – we're happy to hear from you.

2. Safety

Our systems are designed to be safe to use. Even though we do everything we can to ensure that safety is not an issue, there are risks associated with working with electronics and moving parts. It is therefore important to be aware of the safety guidelines of the motor system.

2.1 Safety symbols

CAUTION
This symbol indicates the risk of possible injury to the user/installer, extensive material damage if the user or installer does not avoid this risk, or void of warranty if this step is not followed.

TIP
With this, Green Marine emphasizes the importance of a certain action for the installation of the motor system.

2.2 General guidelines

- It is important that the motor system works at the prescribed voltage. The prescriptions can be found on the datasheets of the motor systems.
- We recommend that the installation is carried out by a qualified installer. In the event that the motor system is installed by a private individual, a commissioning must be carried out by Green Marine.
- Use only original or recommended accessories.

CAUTION
If the motor system needs to be repaired, use only original replacement parts. The use of non-standard parts can result in serious injury or damage.

- Keep electronics away from water.
- In the event of overheating, smoke development, or as soon as you suspect a defect, switch off the motor system immediately via the main switch. Please contact Green Marine or a Green Marine designated installer.
- Observe the permissible ambient temperature for the use of the motor and battery system and the charging of the battery system. See the relevant datasheets for more information.
- It is important that live cables or cords are the correct diameter for the maximum current of the motor system. See the relevant datasheets for more information.
- It is important that the length of live cables is as short as possible to minimize resistance in the cables. If the cable length is more than 2 metres, a cable with a larger diameter will have to be used.
- Always use the correct size cable lugs on the cables and the correct pliers to squeeze the cable lugs. Using the wrong lug creates higher resistances and can lead to heat generation.
- Regularly check live cables or cords to which the device, component or module is connected for insulation damage or breakage. If damage or rupture in the cables or cords is detected, the appliance must be taken out of operation immediately until the cable or cord has been replaced.
- The GM system should only be used by qualified individuals, and who are physically and mentally fit. Observe national regulations. Keep the motor system and control options out of the reach of children or individuals who are unable to handle them properly.

3. Preparation

Proper preparations will ensure that the installation of the motor system goes smoothly and that the motor system functions efficiently and safely.

- **Please read this manual in full first**
  Be aware of the safety precautions.
- **Check that the motor system components are complete**
  Do this on the basis of the scope of delivery and the packing slip(s) of the motor system. If you are missing something, please contact Green Marine.
- **Inspect the motor compartment**
  Check the room where the new motor system will be installed for damage and wear. Reinforce the mounting points as needed to absorb vibrations and movements while boating. Also check that there is enough space for the new motor system.

TIP
Make sure that all components remain easily accessible even after installation for service and maintenance.

- **Ventilation**
  Ensure that there is sufficient ventilation around the motor and electrical components to prevent overheating. Good ventilation ensures that moisture and heat are removed from the room. Harmful gases can be released in the event of overheating or short circuits in the batteries, which also requires good ventilation.
- **Clean and dry room**
  Make sure that the motor system can be installed in a clean and dry room and that this room also remains dry. This means that:
    - There is no permanent bilge water where the motor and batteries are installed.
    - There is a safety against the boat flooding, for example with a bilge pump that ensures that no water can reach the motor system.
    - You take into account condensation, which means that moisture can also reach the system components from above. Where necessary, you can cover a component or place it in a different place. Good ventilation also plays an important role here.

TIP
Check the various rooms for leaks. Check all bulkheads, seals and other points where water can penetrate and seal them properly.

- **Propeller and propeller shaft**
  In many cases, you can continue to use the boat's current propeller in combination with your Green Marine motor system. Please ensure that the current drive shaft and propeller are compatible with the new motor. An incompatible propeller can cause 1) the motor system to become less efficient or make more noise, or 2) cause the motor to provide insufficient torque to drive the propeller, causing the motor to heat up faster, provide less power, and potentially overheat.

CAUTION
Damage caused by the use of a non-compatible propeller will void the warranty on your motor system.

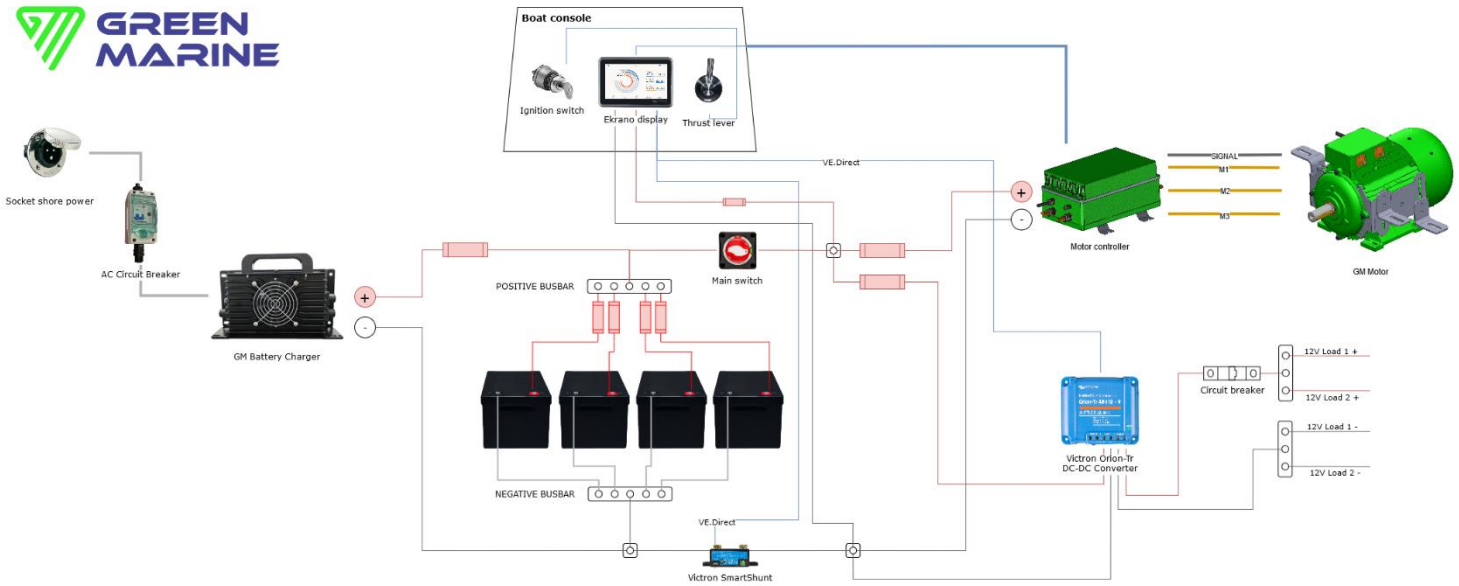
TIP
For the recommended propellor size per motor, please refer to the relevant datasheet. The right propeller ensures higher efficiency, optimal power, and (even) less noise while boating. Sometimes only an adjustment of the current propellor is necessary. Both the adjustment and a new propeller can be arranged via Green Marine. Are you unsure about the existing propellor? We are happy to help you. Before setting up the motor system, it is important to know whether it is a left- or right-hand propeller.

- **Weight distribution**
  Check the weight distribution of the boat to avoid stability problems, and make adjustments if necessary. This is especially important when using a lead-acid battery due to the high weight of this battery pack. Lithium batteries are lighter, but they still need to be installed with a correct distribution of weight in the boat.
- **Cooling system (with water cooling)**
  Check that the existing water inlet and outlet are suitable for the new cooling system of the electric motor system.
- **Earthing**
  Ensure proper grounding of the electrical system to avoid electrical faults and safety hazards.
- **Control panel**
  Prepare the location where the thrust lever, ignition switch and the display will be installed.

4. Installation

In this section, we explain the installation of the motor system.

4.1 Connection diagram



4.2 Electric motor

4.2.1 Preparing the motor foundation

The motor foundation must be sufficiently rigid to ensure good alignment between motor and propeller shaft and to be able to absorb the vibrations and thrust pressure while boating. Drill holes in the hull of the boat can weaken the hull structure. If necessary, combine these drill holes with crossbars, trusses or other reinforcements.

TIP
When determining the dimensions of the foundation, take into account a free space of at least 10 millimetres between the motor and the foundation.

4.2.2 Motor installation

We supply motor mounts for the installation of the motor system. Mount these in the same direction as the electric motor. Make sure that the two motor mounts at the front of the motor are adjusted to the same height, and the two motor mounts at the rear are adjusted to the same height. The front of the motor and the rear of the motor will often be installed at a different height to allow the motor to properly align with the propeller shaft.

4.2.3 Propeller shaft installation

The propeller shaft should have a minimum diameter depending on the type of motor.

Motor type	Minimum diameter propeller shaft
GM4, GM8.5 & GM10	25 mm
GM17.5	30 mm
GM22	35 mm

For the connection of the propeller shaft to the motor shaft, it is recommended to use a flexible coupling. A Python-Drive contains both a thrust bearing and a flexible coupling that both absorbs the thrust and facilitates the alignment of the motor. For the installation of the link, we refer to the manual of the Python-Drive.

CAUTION
Install the motor as closely in line with the propeller shaft as possible. Suboptimal alignment can cause increased power consumption, overheating, vibration, and a slower and less dosed response from the thrust lever to the motor. Check the alignment even when the boat is in the water.

CAUTION
For the GM17.5 and GM22 motor, a thrust bearing between propeller shaft and motor is mandatory.

4.3 Motor controller

Green Marine supplies motor systems with a separate controller box, or with an integrated controller, also known as an integrated drive (ID). With the ID variant, you can skip the assembly of the controller box (4.3.1) and the connection of the motor to the controller (4.3.2).

4.3.1 Mounting controller (only with a separate controller box)

The controller box can easily be mounted in the motor compartment with the supplied brackets. Try to install the controller in a sturdy and vibration-free location as much as possible. Especially for the air-cooled controller, it is important that the heat can be dissipated properly. In general, the motor compartment should be dry, clean and well-ventilated to allow heat and moisture to escape.

TIP
It is preferred to install the air-cooled controller box in a vertical position, so that the cooling fins are facing upwards. This makes it easier to evacuate warm air upwards.

TIP
Install the controller close to the motor to keep the cable lengths and thus the resistance in the cables as low as possible.

4.3.2 Connecting to motor (only with a separate controller Box)

When connecting the controller, it is important to connect the power cables to the electric motor correctly. You connect the sensor cable to the motor via the 6-pin plug connection (black cable). To connect the power cables to the motor, use the connectors, attached to the end of the cables.

Connect the power cables correctly from the motor to the controller:

- Controller 'M1' connects to motor '1'
- Controller 'M2' connects to motor '2'
- Controller 'M3' connects to motor '3'

CAUTION
Incorrect installation of the power cables between controller and motor will result in damage.

4.3.3 Connection to the battery

To connect the motor system to the battery pack, use the two battery cables, positive (red) and negative (black), which are attached to the motor controller. The positive cable must be connected to the main power switch. The negative cable on the negative (main) pole of the battery pack, in most cases this is the negative busbar (see wiring diagram). Wait to connect until you have installed the battery pack, main fuse, and main power switch.

CAUTION
Make sure you have the polarity of connecting the batteries correctly (positive cable to the positive terminal of the battery and negative cable to negative terminal of the battery). Incorrect polarity can seriously damage the motor system and will directly lead to a faulty controller.

4.3.4 Connection to steering console

To connect the motor system to the steering console (lever, ignition switch and the display), a signal cable is used from the motor controller. For the display, we use the Victron Ekrano display with Green Marine integration as standard, but other display options are possible.

TIP
To route the power and signal cables, use cable ties and/or cable trays to bundle the cables and prevent them from becoming loose or damaged.

4.4 Cooling system (only with liquid-cooled controller)

In case the motor system has a liquid-cooled controller box, a cooling system is also supplied. The cooling system depends on whether there is a keel cooling system in the boat or an outside water inlet.

TIP
Water cooling is recommended in case the motor compartment is not sufficiently able to dissipate the heat from the motor and controller through the air.

4.4.1 Keel cooling

Keel cooling involves a closed cooling system filled with coolant that is cooled by means of a keel cooler on the hull of the boat. The following things are important when installing the keel cooling:

- Make sure that the keel cooling expansion tank is installed above the highest level of the electric motor.
- Use a flexible hose between the keel cooling to the expansion tank, between the expansion tank and the pump, between the pump and the liquid-cooled motor controller, and between the controller back to the keel cooling.
- Mount the pump in a sturdy and vibration-free location to minimize damage and wear from vibrations.
- Use water hoses with an internal diameter of 10 millimetres. We can supply these on request.
- Mount the hoses with stainless steel hose clamps. Make sure all hoses are securely attached to prevent leakage.
- Keep the hose lengths as short as possible, with as few bends as possible to keep the resistance in the hoses as low as possible.

TIP
After installation, check all hose connections again and test that there is no coolant leak.

4.4.2 Outdoor water cooling

With outside water cooling, as the name suggests, outside water is used to cool the motor system. When installing the water cooling, the following things are important:

- Use a flexible hose to connect the water inlet to the water filter, the water filter to the pump, the pump to the motor system, and the motor system to the water outlet.
- Install the water filter (and water drain) above the boat's waterline.
- Mount the pump in a sturdy and vibration-free location to minimize damage and wear from vibrations.
- Use hoses and pipes with a sufficiently large diameter (10 millimetres) to ensure water flow without too much pressure drop. This is important for the pump to work efficiently. We can supply these on request.
- Avoid sharp bends in the hoses to optimize flow.
- Mount the hoses with stainless steel hose clamps. Make sure all hoses are securely attached to prevent leakage.
- Keep the hose lengths as short as possible, with as few bends as possible to keep the resistance in the hoses as low as possible.

4.5 Battery

This manual describes how to connect the motor system to the battery pack. For the specific installation of the battery pack, please refer to the manual of the chosen battery pack.

4.5.1 Installation

It is important to install the batteries in the boat in a safe way for the correct operation of the battery pack that you do not have to worry about.

- Carefully lift the batteries into the boat, and gently lower them to the ground/frame.
- It is important that the batteries are properly attached, protected against shocks and vibrations, and they cannot freely slide in the boat after installation. For example, you can use a sturdy plate on which to mount a battery box in which you can place the batteries. Use sturdy straps or clamps to secure the batteries so that they cannot move while boating.
- Allow enough space around the batteries for inspection, maintenance, and possible replacement.

- Make sure the weight is well distributed and the boat is straight on the water after placement.
- Make sure the batteries don't get in the way of the daily use of the boat.

TIP
We advise short cable lengths: the longer the cables, the higher the resistance in the cables. This causes heat generation and power loss.

- Place the batteries in a clean and dry place in the boat, above the bilge water level.
- Good ventilation is important because almost all types of batteries can release (toxic) gas in the event of overheating and/or short circuits.

TIP
When in doubt regarding ventilation, you can install mechanical ventilation. Feel free to consult your Green Marine dealer or contact Green Marine directly.

4.5.2 Connecting

After installing the motor in the boat, you can connect the battery pack to the motor system. See also the connection diagram in section 4.1.

- Before connecting the battery pack, turn off all system components.
- Between the positive (main) pole of the battery and the positive connection of the motor controller, install a main fuse and the main power switch. Connect the (main) positive pole of the battery to the main fuse of the motor system. (250A for GM4/8.5/10 and 500A for GMM 17.5/GMM 22, is delivered together with a fuse holder).

CAUTION
Failure to install the main fuse can lead to serious damage to the controller, power cables and battery and even to the occurrence of a fire in the event of a short circuit in the controller or the battery power cables.

- Connect the main fuse to the main power switch. Make sure the main power switch is not turned on.

CAUTION
Keep the main power switch turned off during the remainder of the installation.

TIP
Make sure the main power switch is easy to reach. In the event of an emergency, maintenance, or other type of work on the motor system, this should always be switched off so that the batteries are no longer in contact with the motor.

- Connect the main power switch to the positive terminal of the motor controller.
- Then connect the (main) negative terminal of the battery to the negative terminal (black) of the motor controller.

4.6 Battery charger

In order to charge the battery pack, a suitable battery charger is included, which charges the battery with the correct charging characteristics and current. We also supply a shore power set that supplies the battery charger with electricity from a shore power connection. This manual describes the installation of Green Marine's standard lithium battery charger. If a different battery charger is used, we refer to the manual of that charger.

PLEASE NOTE
If you use a charger that is not supplied or advised Green Marine, we cannot guarantee that the battery will be charged correctly and therefore do not provide warranty on the battery pack.

4.6.1 Charger

- Attach the battery charger to a sturdy and stable surface to minimize movement and vibration while boating. Use screws or bolts that are appropriate for the material of the mounting location.
- Ideally, install the charger vertically so that the cooling fins are facing up. In this way, heat is dissipated as optimally as possible. The battery charger may become warm while charging the battery pack.
- Make sure that the distance to the battery pack is not unnecessarily long.
- Install the battery charger in a well-ventilated place to prevent overheating. Avoid enclosed spaces without air circulation.
- Choose a dry location, protected from water and moisture to prevent corrosion and short circuits.
- Use cables of the correct thickness that are suitable for the current of the charger. Ensure that the cables are properly insulated to prevent short circuits.
- First, connect the positive main terminal of the battery to the positive (+) terminal of the battery charger. Then connect the negative (-) main terminal of the battery to the negative terminal of the battery charger. Avoid wrong polarization.

TIP
Make sure the battery charger is easily accessible for maintenance and operation but does not get in the way when using the boat.

4.6.2 Shore power set

A Green Marine motor system is equipped with a shore power set suitable for a standard 230V/50Hz Dutch shore power connection.

- Install the socket of the shore power set in an easy-to-reach location so that the charging cable can reach the shore power without it getting in the way. The socket must be well protected from water and weather conditions.
- Install the RCD fuse box between the socket and the charger in a clean and dry place.
- Connect the charger to the fuse box via the plug on the charger.

4.7 Operation

For controlling the motor system from the boat's control panel, we provide an ignition switch, thrust lever, and display. These can be connected via the signal cable from the motor controller that splits into three different cables for connecting these controls.

4.7.1 Thrust lever

The Green Marine motor system is equipped with our standard thrust lever. Proper installation of the lever will ensure a good experience while boating and prevent dangerous situations. The location of the thrust lever and the rotation direction of the propellor is important to communicate to an installer in advance, in order for the lever to be installed correctly.

- Mount the thrust lever in a suitable location, easily accessible to the driver.
- Install the lever in a way that you cannot accidentally walk or bump into it.

CAUTION
If you accidentally touch the thrust lever, the boat accelerates which can lead to dangerous situations.

- Mount the thrust lever with the lever in a vertical position or facing up when it is in neutral.
- Connect the lever to the motor controller via the 3-pin plug connection (part of the wiring harness).

4.7.2 Ignition switch

To start the motor system, an ignition switch is used.

- Mount the ignition switch in a suitable location (e.g. the steering console) so that it is easily accessible to the driver.

CAUTION
The motor system must be quick and easy to switch off in the event of an emergency.

- Connect the ignition switch to the motor controller (part of the wiring harness) via the 2-pin plug connection.

4.7.3 Display

By default, Green Marine uses a Victron Ekrano display with its own integration for use with our motor system. We supply the Ekrano screen including SmartShunt. The wiring diagram shows the display. Check out the Victron documentation for the latest information on the Ekrano display and for using the display in combination with other on-board systems. To provide the Ekrano screen with the motor information, a 3-pin cable is connected from the motor controller (part of the wiring harness).

It is also possible to choose other display options, such as a battery monitor from Victron or a display from Raymarine.

4.8 On-board electronics

The (existing) on-board electronics can be connected to the new main battery of the motor system via a DC/DC converter (not included as standard) to convert the current from the battery to the voltage of the on-board electronics. If the main battery is connected to (existing) service batteries, for example to power the bow thruster, the lighting, and other electronic devices on board, an inverter with charging characteristic must be used so that the service batteries are charged correctly. Green Marine can of course also supply these service batteries.

CAUTION
A service battery has a separate electrical circuit, always make sure this circuit has its own fuse and main circuit breaker, or a circuit breaker.

5. Commissioning

Commissioning is important to ensure that the motor system is installed correctly and has been tested before use. In the event that the motor system is installed by a private individual, commissioning should be done together with Green Marine.

5.1 Check the installation

Before you start the motor system for the first time and start a test drive, it is wise to check the following:

- **Cables and hoses**
  Check that they are properly connected and tightened securely. Check that (battery) cables and hoses are not hanging loose to prevent damage during use. Use cable ties and/or cable ducts for this.
- **Nuts and bolts**
  Check that all nuts and bolts are tightened securely so that all components are permanently attached to the boat and vibrations are minimized.
- **Propeller shaft alignment**
  The propeller shaft alignment may be different when the boat is in the water than during installation. Double-check the alignment and adjust the position of the motor via the included motor mounts if necessary.
- **Ventilation**
  Can heat, moisture and any gases from the battery be properly dissipated?
- **Bilge water**
  Are all components installed above the maximum level of the bilge water? Is bilge water drained properly? Are there no cables running through the bilge water?
- **Grounding**
  Ensure that the electrical system is properly grounded to avoid electrical faults and safety hazards.

5.2 Starting the motor system

- After closing the main switch, the motor system can be started via the ignition switch. The controller's contactor will emit an audible 'click' after a few seconds.
- The thrust lever must be in neutral before the motor system can be started. If you have tried to start the motor while the lever was not in neutral position, put the on/off switch first in the off position, then in the on position, and try again.

5.3 The test drive

- Do you experience strange noises and/or excessive vibrations from the motor system? If these occur, the motor system must be switched off and Green

Marine must be contacted as soon as possible. Green Marine does not accept any liability if you continue boating.

- During testing, check the temperature of the electric motor and controller to ensure that the cooling is adequate. In water cooling: check the system for leaks and check the water flow to ensure that the cooling is working effectively.

CAUTION
During commissioning, the rotating propellor can cause dangerous situations. Also be mindful that surfaces of the motor and controller can become hot.