

Introduction to the New Electric Outboard Motor

This document provides basic information on how to use the new electric outboard motor, which has been installed on Meritorious. For those who have used the electric outboard on the J/80, the new motor is a bit different. On Meritorious, the battery and the motor are separate, and the battery stays in the cabin. The battery is secured to the cabin sole underneath the main hatch, and it should not be moved.

Raising and Lowering the Motor

The tilt mechanism is a bit different from the one on the gas-powered outboards. Like the others, there is a tilt lever (blue tip) on the starboard side of the motor that has to be raised to tilt the motor upward. It has more intermediate positions than the other motors. When putting away the boat, the motor should be raised two or three notches to clear the water. You may want to raise it more while sailing.



There is a blue tab on the port side of the motor that engages a tilt lock. When the tab is in the “up” position, the tilt lock is engaged and the motor will not tilt up unless the lever on the opposite side of the motor is lifted. The tilt lock setting does not matter if the motor is in forward, but the motor may tilt up in reverse if the tilt lock is not engaged. Check that the lock is engaged by trying to tilt the motor without using the tilt lever.



Unlike the other motors, this one cannot be lowered from an intermediate position. When the motor has been tilted out of the water as it normally is when not in use, to get the motor into the vertical position, it must be tilted all the way up, then lowered all the way down.

Battery Power Switch

The battery has a power switch. The battery must be on to use the motor and to charge up. The switch should normally be left in the “ON” position, but the battery will turn itself off if unused for 7 days, so if you are uncertain, check that the battery is on. The display will be on if the battery is on.

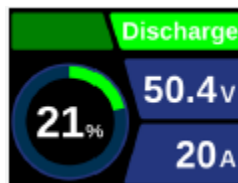
The front of the battery looks like this. The power switch is the round metal pushbutton in the center, as shown below:



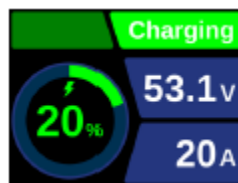
Pressing the switch momentarily will turn on the display briefly, about 10 seconds, but this will not turn on the battery. To turn the battery on or off, the switch needs to be pressed and held for 3 seconds (the battery will make a clunking sound). If the shore power is plugged in, the fan on the charger will normally start running when the battery is turned on.

Battery Display

The battery has a display above the power switch that shows information about the status of the battery. Under normal usage, the display should look like this:



When the shore power is plugged in and the battery is charging, the display should show that the battery is charging:



The charge may not read 100% even if the battery has been charging for a long time.

If the battery is having any problems, the box in the upper right corner of the display will turn red and say "Error". In certain cases the battery will shut itself off.

Motor Power Cutoff Switch

There is a power cutoff switch for the motor, located inside the starboard lazarette. The power switch needs to be turned to the “ON” position, by rotating the red knob $\frac{1}{4}$ turn, to use the motor. The switch should be turned to “OFF” when the boat is being put away.



Motor Tiller

The motor controls are on the tiller. The tiller has a control panel, a pad for the kill switch, and the throttle handle.



Motor Kill Switch

Like other outboards, the motor has a kill switch. The motor will not work without the kill switch installed. The kill switch pad is on the top of the tiller, just forward of the display. It is held on by magnets; there is no mechanical attachment.

If the kill switch is removed/pulled off of the tiller, the motor will stop turning, but the display will stay on. The throttle needs to be returned to neutral when the kill switch is re-installed in order to start the motor again.

The kill switch should be stowed in the lazarette, by the motor cutoff switch. The small carabiner can be attached to the backstay bridle or the padeye for the backstay tensioner block on the top of the transom when the switch is installed on the motor.



IMPORTANT WARNING ABOUT THE KILL SWITCH: the kill switch generates a **MAGNETIC FIELD**. The magnetic field can interfere with electronic devices, **INCLUDING MEDICAL IMPLANTS** such as pacemakers. Keep the switch at least 50 cm (about 2 feet) away from medical devices, magnetic media including credit cards, and electronic instruments.

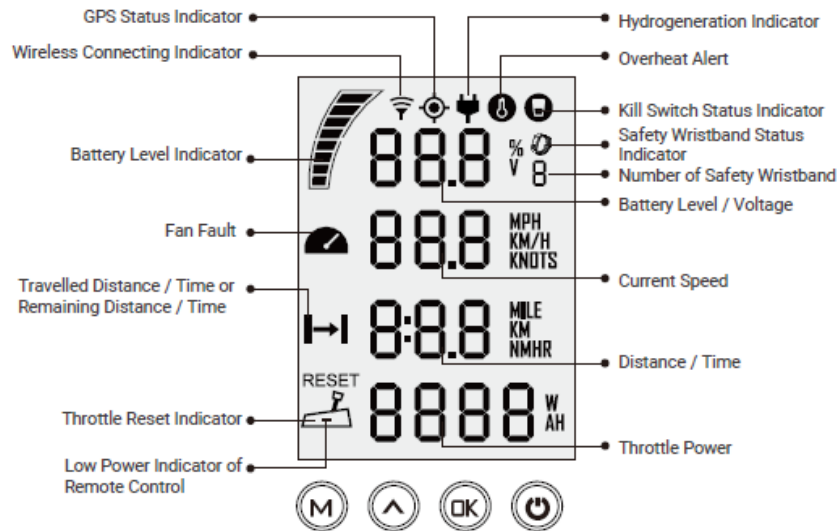
Throttle

The electric outboard does not have a gear selector as found on the gas-powered outboards. The neutral position is essentially the off position, where the motor does not turn. There is a detent - a notch or “click” you can feel - to indicate that the throttle is in the neutral position. Turning the throttle handle out of the neutral position will control forward or reverse speed, depending on which side of the detent you turn it to. To the left is forward, to the right is reverse.

NEVER go directly from forward to reverse or vice versa. Always bring the throttle to neutral and check that the prop has stopped spinning before changing directions.

Motor Control Panel

The motor control panel consists of a display and a set of buttons. The motor is turned on and off by pressing and holding the power button, which is on the right below the display. **Make sure that the throttle is set to the neutral position before turning on the motor.**



- The top line in the display shows the percent of charge left in the battery.
- The second line shows the boat speed. The motor contains a GPS receiver, so it can measure speed over the bottom.
- The third line shows the run time. By default, the display shows how much time the battery has been used, which might not be very helpful. Pressing the arrow key (^) below the display will toggle between time used and remaining run time (→ ■) at the current throttle setting.
- The bottom line shows how much power, in Watts, the motor is using at the present throttle setting.

If the display flashes “Reset” in the lower left corner, it means that the throttle handle should be turned to the neutral position.

The display backlight, which is helpful for nighttime use. Momentarily pressing the power button when the motor is on will toggle the light.

Specifications & Performance

The motor power is 3 kW (= 4 hp), which is a little less than that of the gas-powered outboards. It is difficult to do an exact comparison, because the quantity that really matters is how much thrust (force) the motor produces, and that depends on the propeller too. The electric outboard has a different propeller and does not spin as fast, so the amount of thrust generated is hard to compare.

The battery type is lithium ion phosphate. The voltage is typically around 50 V. The battery capacity is 8345 Watt-hours or 163 Ampere-hours. The maximum motor power is 3 kW, so at full throttle, the battery should last 2.8 hours (2 hours and 48 minutes). Full power is rarely needed, though, so in actual usage, the battery should last longer.

Some testing was done to see what numbers can be expected. The hull speed of the Merit 25 is almost exactly 6 knots. At full throttle, in light air or off the wind, the motor is capable of driving the boat at 6 knots. Going into a 10 - 12 knot headwind and chop, the speed at full throttle is around 4.2 knots.

Speeds at intermediate throttle settings (in flat water and light air):

Power (W)	500	750	1500	2250	3000
Speed (kts)	3.0	3.3	4.2	5.0	6.0

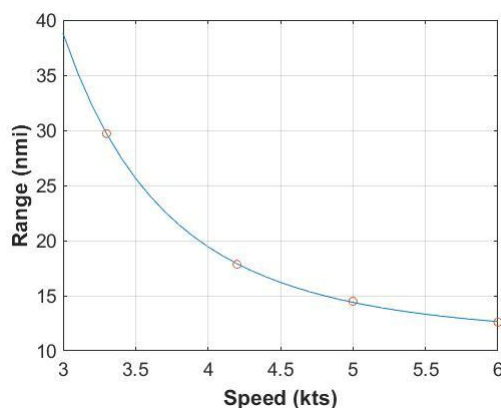
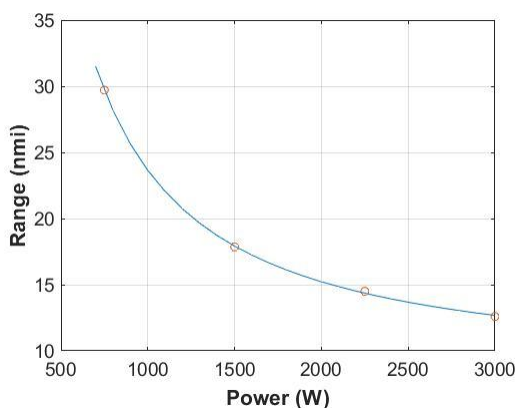
For docking, unless it is blowing hard, 80 - 100 W is enough to approach the dock.

How fast the battery runs down depends on throttle setting and boat speed. The relation is not linear; in other words, going slower will increase the time more than 1:1. The following measurements of remaining run time at different throttle settings show the effect (these were taken with less than a full charge):

Power (W)	750	1500	2250	3000
Time (hr:min)	9:00	4:15	2:53	2:06

It can be seen that at 750 W, which is one-quarter throttle, the run time is more than four times the value at 3000 W, which is full throttle.

Range, i.e., how far you can go, is the more relevant question in most cases. The following graphs of range versus power and speed are approximate but are based on actual measurements and give an idea of the difference throttle setting makes.



(The motor display can be set to show the range for the amount of charge left in the battery, by changing the configuration settings. This is an estimate given the present speed and charge. Since the speed is affected by tidal currents, the estimated range will be affected as well.)

This relation is true of any outboard, not just the electric. A gas tank the same size as the battery contains a lot more energy, so managing the throttle with the gas-powered outboards is usually not an issue (our 3 gallon gas tanks, when full, contain around 100 kWh of energy, vs. 8.3 kWh in the fully charged battery). The battery has enough capacity for most trips, but if the remaining charge is a concern, it is important to understand how throttle affects range.