

Overview

For every job there are right tools and wrong tools. While it is possible to use a wrench to drive a nail, a hammer is the correct tool. In the case of electric vehicles, the controller is only one part of the right set of tools.

Selecting the right controller and the right motor is important to achieve the best vehicle performance. A system such as a motor/controller combination is only as strong as its weakest link including the batteries, contactor, wiring, fuses, etc. Eventually the weak link will break and result in a damaged controller, burnt motor, or both.

One good way to visualize how the motor/controller works in a vehicle is to think of it like a garden hose. Water is supplied by a well to a spigot, which then controls the flow of water down a hose to the nozzle, where it comes out. In a vehicle, the battery supplies current to the controller, which adjusts the current going down the wires to the motor where it turns the wheels.

The Job

Different jobs have different requirements. A golf car on a course has different needs than a utility vehicle that is hauling boats or dirt. Knowing how the vehicle will be used is a good starting point selecting the right motor/controller combination.

In most cases, just upgrading the stock controller to one of the Alltrax High Performance controllers is all that needs to be done.



Some questions to consider about how the vehicle will be used are:

- Very hilly area?
- Carrying more than 3 average sized people?
- Hauling or moving dirt/boats/vehicles?
- Looking for significant increase in speed?
- Tires over 22" tall?

If the answer is yes to any of above questions, then just the stock motor and/or controller will not be enough.

The Tools

A controller works like a dimmer switch for a light. It varies "power" by modulating voltage. By using a controller, it allows the user to vary the current to the motor thus adjusting the speed of the vehicle. A larger controller is capable of providing more current thus allowing the motor to produce more torque.

- Changing the controller on a series motor will not increase the speed of the vehicle.
- On a shunt wound motor changing an Alltrax controller will increase the speed of the vehicle, but changing to a larger Alltrax controller from a smaller Alltrax controller will not change the top speed.



A motor converts electrical power into mechanical energy. There are various motors designed for specific applications such as speed, torque or general use. The hp ratings, wire gauges, brush sizes, motor casing thickness and armature size is determined by its application.



Choosing the right sized motor for the application is critical. In about 75%-80% of the customer's applications, the stock motor is more than sufficient. Increasing torque or speed requires larger motors capable of handling the current and heat generated by these applications.

Pitfalls

Too small of a controller

Using too small of a controller for the application leads to a situation called "being controller limited". This is especially common in vehicles with lift kits and large tires. It also occurs on hilly terrain, multiple people or loads such as hauling tools, dirt, vehicles, etc. The stock controller might not have the capacity to supply the motor with what it needs to move the vehicle to peak performance. An undersized controller can not provide the current to the motor to keep the vehicle from slowing down on a hill.

Upgrading to a larger controller will usually fix the problem, but too large of a controller can create other issues.

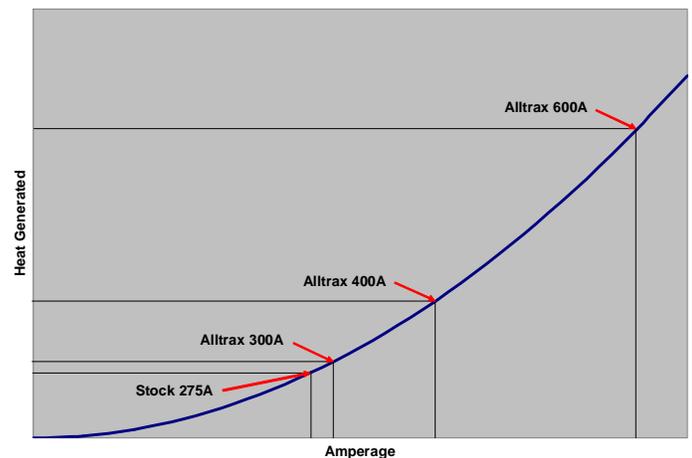
The wrong type or too small of a motor

Different applications call for different needs. Motors usually fall into three broad categories. There are high speed motors, high torque motors and motors with good speed and torque. The stock motor in most golf cart applications is of the later type. If the application requires moving a heavy load then the preferred motor

is a high torque motor. For general everyday use either a stock motor or one similar.

Putting a high speed motor into a vehicle whose primary application is moving loads is like putting a Dodge Viper motor in a Mac truck. It will work, but the performance will suffer considerably and eventually it would fail under the strain.

There is also another part of the pitfall, a big controller on a smaller motor. Replacing a 275A stock controller with a 600A controller in a vehicle with a stock motor seems like a good idea, right? After all, by increasing the current, the available torque goes up by a factor of 1.4x – 2x. Unfortunately, it is not the wisest thing to do.



Motors are an electro-mechanical device and can accept current above there maximum rating until obviously the motor burns up. Higher performance or HP motors are built to withstand the higher current, torque and heat with larger brushes, wire thickness and thermal insulation, including higher tension brush springs.



Not changing wire size when upgrading

Changing the wire size of the motor and batteries is just as critical as choosing the right motor and controller. Just like a water pipe, wire is limited in how much it can pass based on its diameter.

The larger the diameter the more current it can pass. Using a smaller gauge wire in a high current application will actually limit performance. As the current hits the ceiling of what the wire can carry, the extra current is converted to heat. If the wire can only carry 300 amps and the controller is supplying 400 amps, the extra current that is meant for moving the vehicle is now wasted in heating the wire.

The stock wiring in golf cart applications is #6AWG. This wire is good for about 300 amps. When using a 400A or larger controller and/or a non stock motor, it is a good idea to change the wire to #4AWG.

Selection Guide

The following is a small guide to help choose the right motor and controller for the application.

Conclusion

Selecting the right motor and controller combination can be a daunting task. Having a good understanding how the vehicle will be used helps. Using the right motor and controller not only increases performance, it will last longer. Using an undersize motor or controller in the wrong application is just asking for trouble.

Using the guidelines presented here should answer a lot of questions about what to use.

If there are still questions about choosing the right controller or motor, contact Alltrax or one of its authorized dealer/distributors located on our new web site for more information.

Application	Terrain	Tire Size	Usage	Controller	Motor
Golf	Flat	Stock	Light	300	Stock
Golf	Moderately Hilly	Stock	Light/Medium	400	Stock
General Usage	Flat/Moderate Hilly	Large	Light/Medium	400	Stock
General Usage	Moderate/Very Hilly	Large	Heavy	400 or higher	Torque
Driving	Flat	Large	Medium	400 or higher	Speed
Utility	Flat/Moderately	Stock	Medium/Heavy	400 or higher	Torque

ALLTRAX Inc., Company History:

The company founder developed our core technology at the race track for high power electric vehicles. Throughout the 90's, the market demanded robust and high performance electronic controllers. In 2001 ALLTRAX was formed based on the E-race car developed technology.

Today, Power Conversion Engineering (PCE) is the research and development arm and ALLTRAX provides the industry a powerful and robust controller to meet all your recreational, industrial, and commercial electrical vehicle needs.

For more information please go to <http://www.alltraxinc.com>



"The company was founded at the track"