

Using an Automatic Transmission in an EV

David Harrington 4-6-2008

This article is about what it is required to run the automatic transmission in my 1996 Honda Civic LX Sedan. The techniques used in this article could be used in any other automatic transmission, but no guarantee on how well it will work.

How Automatic Work: An automatic transmission shifts through gears automatically. It does this from analyzing the engine RPM, torque and speed. Most of the time the transmission will shift around 2500 to 3000 RPMs, which is not always the best for DC motors. DC motors like to be 4000 and higher RPMs, and usually the transmission has shifted by then.

The automatic transmission has a Torque Converter (TC) instead of a clutch system. The TC also is responsible for building up the pressure required for shifting into gears and holding them in place. The TC needs to be spinning at a certain RPM to keep that pressure up, and for the Civic it is 700 RPMs. That means that the DC motor must be idling, which is something that most motor controllers will not do by default. There is a plate that connects the engine to the TC and it is called a Flex Plate. The Flex Plate is the key to building the coupling that will attach the DC motor to the transmission.

Most EV's use a manual transmission and have the option of not using the clutch and directly mounting the DC motor for the transmission shaft. You cannot do that with this automatic transmission because the transmission shaft is actually two shafts in one. One shaft is the pump for the transmission fluid and the other is the actually driving shaft.



This is the automatic transmission without the torque converter installed.



Here is the Torque Converter. This side connects to the shaft on the transmission.



This is the Flex Plate. This connects the engine to the transmission much like a Flywheel from a manual transmission, except this is thinner than a flywheel. It is normally part of the engine and not a transmission so make sure you keep this before you get rid of your engine.



This is the whole setup put together. I have to design a motor coupling and adapter plate for this setup since there are none out there for this automatic transmission.

How I am using the Automatic Transmission: I will be mounting my K99-4007 to the Flex Plate, which is then mounted to the TC. I will then mount the whole setup to the transmission. I will be using the motor at 96 volts, and my calculations come out to be a 14% Duty Cycle on the controller to idle the motor at 700 RPMs. Now I am using a controller of my own design, so I can set it up to idle the motor at 14% duty cycle by using a 700 Ohm resistor and placing it in series with the Potbox throttle control. This may also work on any other controller, but I have not tested it.

I am also considering making a quick shut off switch for the controller so when I am at a light I can kill the power and save the energy that is required for idling. I would place the car in neutral and hit the "sleep" button of sorts, and then when the light is about to turn green, turn it back on and put the car into D2 again and drive off. Normally when I am waiting at the light I watch for the other light to turn yellow anyways, so it wouldn't be a big deal for me.

The transmission on the Civic has multiple gears to choose from. There is D4, D3, D2, Park and Reverse. D4 uses all four forward gears, D3 uses gear one to three and D2 uses only second gear. My calculations on my particular setup show that D2 will get me from 0 to 55 MPH, which is more than adequate. My current thought is to use D2 for around town and D3 for highway performance and hills. When the car is completed I will be doing a test on all the gears and how many amps are being used at certain speeds in certain gears. This transmission is also electronically controlled and has an electronically locking torque converter. I believe I have found a way to manually engage it so I can use it in D2 and lock it in when I am moving. A locking torque converter means that once the car has reached a certain speed, it will engage and create a solid connection from the TC to the transmission instead of the TC spinning faster than the transmission shaft as it usually does during normal operation.