Build an Electronic Choke for Under $20

www.jaygeeracing.com

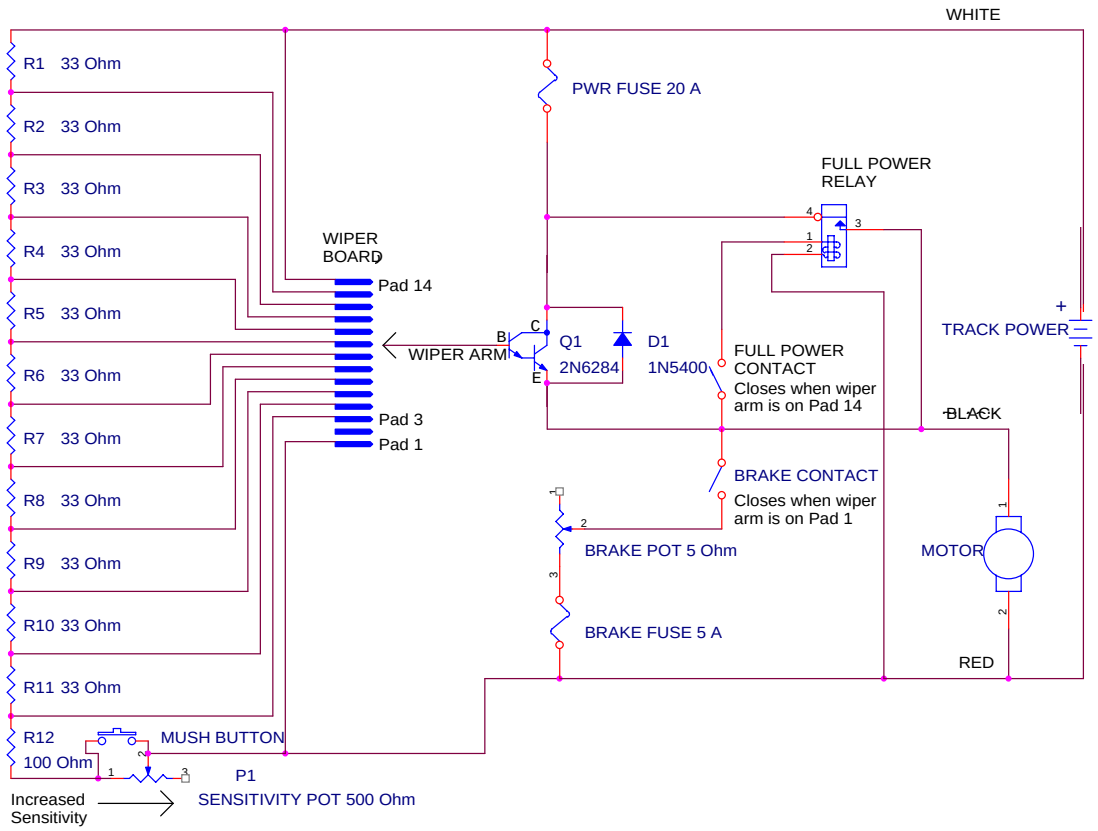
Electronic chokes, aka voltage limiters, are most often used by scale racers to smooth out the response of high-powered Eurosport cars on twisty flat tracks. They are also used by HO and 1/32 club racers to make overpowered cars more drivable. However, a group of racers in Evansville, Indiana have started using voltage limiters when running in breakout races…tuning the controller to slow their cars down just enough to avoid lap times lower than the breakout time.

FastLane Raceway runs weekly races using sealed 16D motors, using a breakout to even out the field due to motor disparity. Rather than re-gear his car to limit its top speed, Guillermo Suar, of Mount Vernon, Indiana, added an adjustable voltage limiter circuit to his electronic controller, allowing him to dial in exactly the lap times he wanted.

This article will explain the principles behind adjustable electronic voltage limiting, then show you exactly how Guillermo added it to his own controller. While the principles explained in this article could apply to any controller using a voltage follower transistor control circuit, the specifics of the implementation will vary from brand to brand. Contact your controller manufacturer for details before attempting any modifications.

Let's first review briefly how a voltage follower circuit works. Pictured below is such a circuit, taken from earlier articles published on controller design.

Figure 1. JayGee Racing Linear 100 Prototype Voltage Follower Circuit

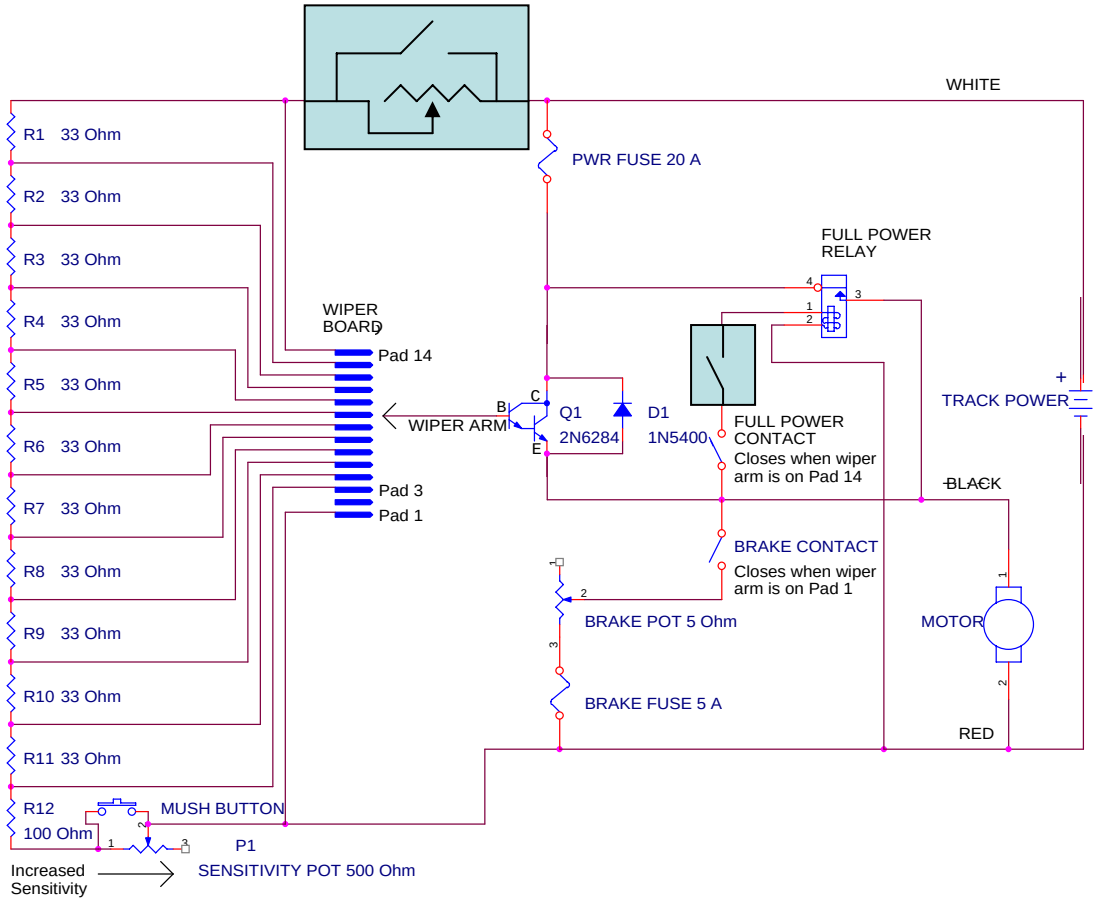


The transistor control circuit is called a voltage follower, for reasons that will become quickly apparent. Once the voltage on the wiper rises above 0V, the transistor begins to conduct. When that happens, the voltage applied to the motor rises from 0V to a level just below that of the wiper. The motor voltage moves in lockstep with the wiper voltage, following along as the wiper moves from tap to tap. In this circuit, the wiper voltage will go as high as the track voltage. A mechanical switch then energizes the full power relay to eliminate transistor losses at full throttle.

One approach to building an electronic voltage limiter would be to disable the full power relay and limit the voltage applied to the resistor array, thus limiting the voltage supplied to the motor. This is the approach that Guillermo followed.

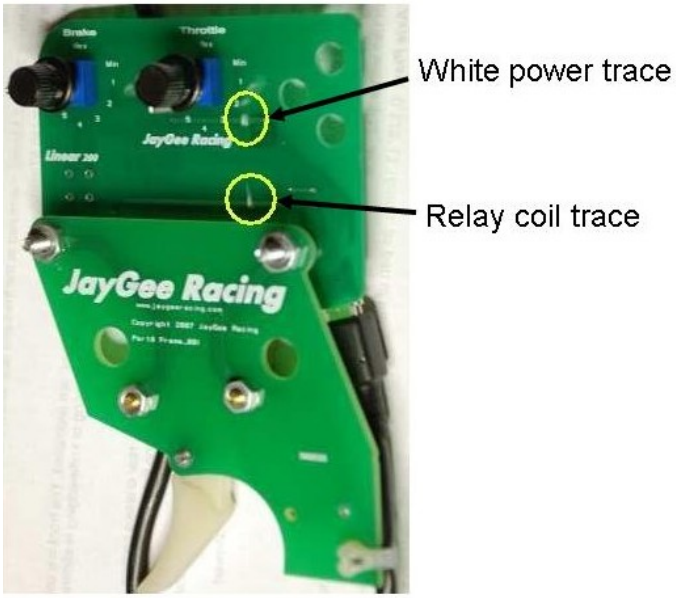
In Figure 2, a pot has been placed between the resistor array and track power, limiting the voltage applied to the wiper. A set of switch contacts allows the pot to be bypassed when full power is desired. A second set of switch contacts is placed in series with the relay coil to prevent it from energizing. By using a double pole switch, both sets of contacts can be incorporated into a single toggle switch mounted on the controller handle. The toggle switch then turns the voltage limiter on/off and the pot controls how much the voltage is limited.

Figure 2. Linear 100 Prototype with Adjustable Electronic Voltage Limiter



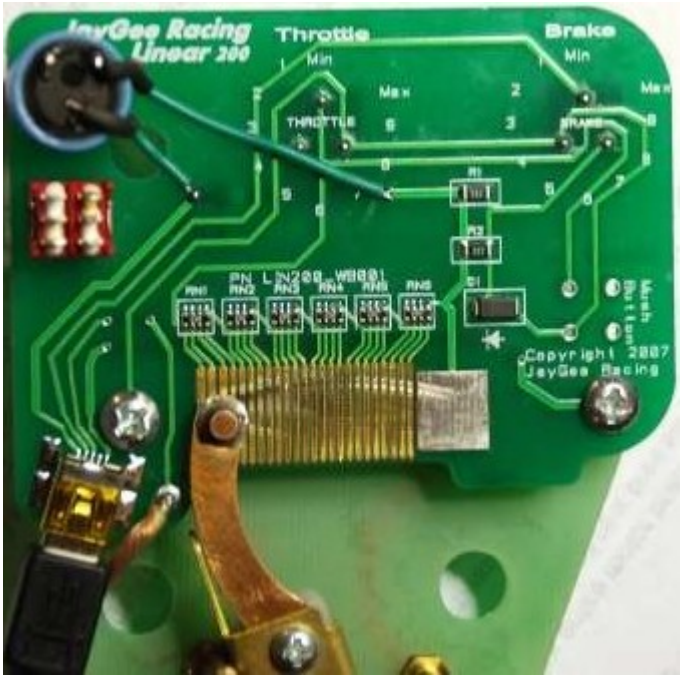
A clean, professional…and dare I say, *SANO* piece of work by Guillermo. The voltage limiter pot and on/off toggle switch are installed in the choke control mounting holes provided on the controller's wiper board.

Guillermo started by cutting two traces on the Linear 200's wiper board. Cutting the WHITE power trace allowed him to insert the voltage limiting pot between the track power and the resistor array. Cutting the relay coil trace opens the circuit between the relay contact in the controller handle and the relay coil.

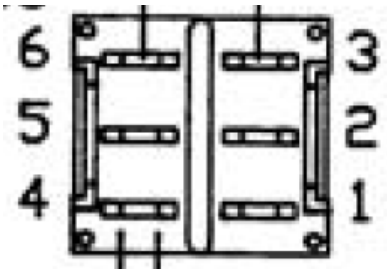


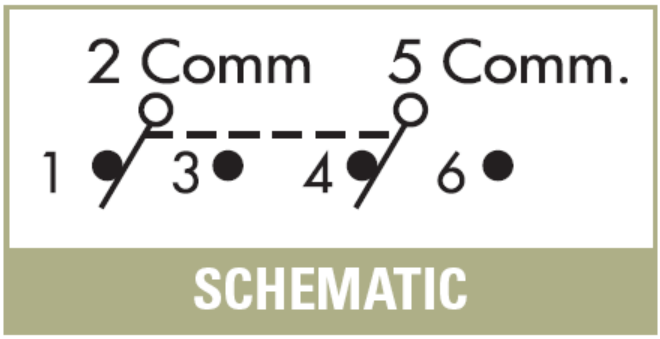
He then mounted the toggle switch and a 100 ohm pot on the board as shown, splicing the pot into the WHITE power trace where the vias pass through the board. While he had originally used a 100 ohm pot, he's thinking of using a 250 ohm pot to limit the voltage even more.

The pots are available from Digikey www.digikey.com and their part numbers are 392JB101-ND (100 ohm) and 392JB251-ND (250 ohm). You'll also want to order a knob for the 0.125" (3.18mm) pot shaft. The toggle switch is also available from Digikey, part number EG2455-ND.

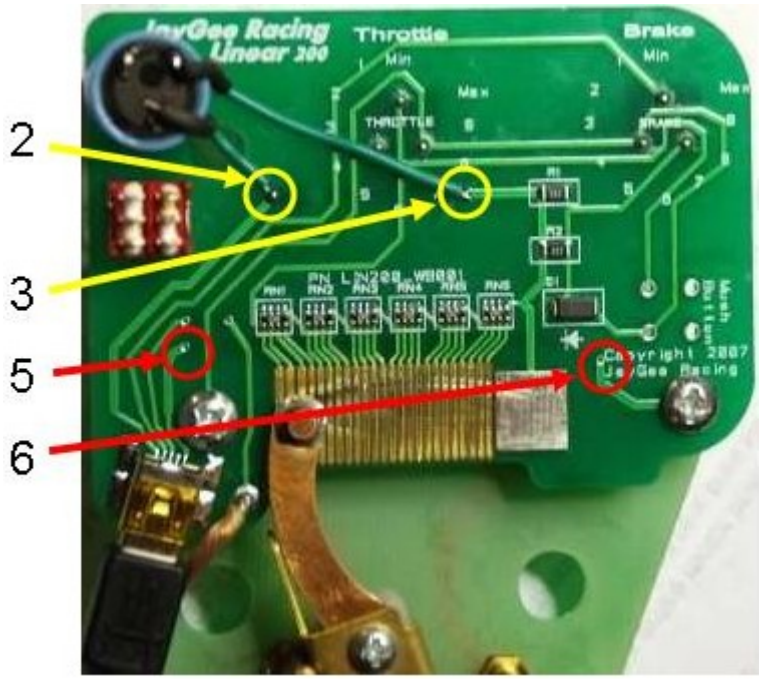


The last step is to wire up the toggle switch. The schematic for the toggle switch is shown below.





The switch is wired up so that circuit to the full power relay coil is closed at the same time the voltage limiting pot is bypassed.



Wiring complete…time to go racing!

Some words of caution. This electronic choke design limits the voltage to the motor by increasing the voltage drop across the controller's power transistor. This increases the heat that must be dissipated by the controller's heat sink. When used with low current (5 amp or below) motors…HO, Falcon, 16D, etc…the Wakefield type heatsink used on many controllers such as the Linear 200 Pro 40 will be sufficient. For C-Can motors, a larger heatsink such as that used on the Linear 200 Pro 40E may be required…and even then, a fan may be needed to help keep it cool. For Eurosports, both the larger heatsink and fan will definitely be needed.

Jeff "JayGee" Goldberg
Guillermo Suar