- **Sensorless** With this design, the ESC has a special startup sequence to orient the rotor and start it spinning. Once it's moving, it uses back EMF (feedback) to track the position of the rotor as the motor spins.

- **Sensored** technology has traditionally been favored for RC cars, as it eliminates "cogging," i.e., motor stuttering when starting to move. But with advances in sensorless technology, cogging has almost been completely eliminated, and sensorless motors now offer a simpler, more powerful solution.

MOTOR RATINGS—KV & RPM

Brushless motors are given a Kv rating, which is equivalent to the rpm (rotations per minute) per volt; it lets you determine how fast that motor will rotate when supplied with a given voltage. With no load, a 2200Kv motor powered by a 4S LiPo pack (14.8 volts) would spin at 2200x14.8 = 32,560rpm. The current rating (C) specifies the maximum continuous and/or burst current that the motor is able to handle. When selecting a battery and ESC, be sure to select ones with a continuous-current amp rating that's at least 20 percent greater than that of the motor.

Generally, to match a nitro engine, racers aim to keep their motor rpm within the range of 30,000 to 45,000. This also enables lower-end motors such as a Feigao to run cooler; more expensive motors such as those by Neu and Castle Creations are more efficient and are rated to 60,000rpm.

ESC & MOTOR SELECTION

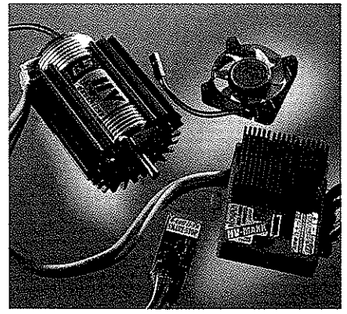
You must choose a motor and ESC of the appropriate size for your car. You wouldn't expect a 4-cylinder, 1.5L engine to drive your Dodge pickup, and neither will a V-10 diesel run in a Civic, so choose carefully for the best results.

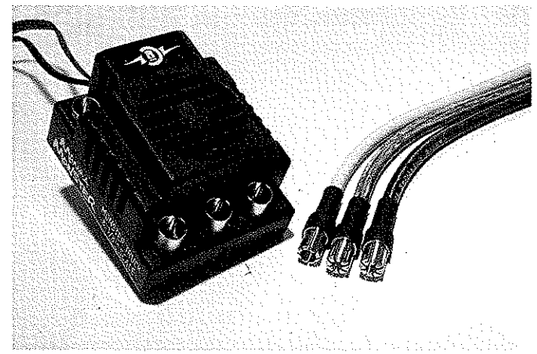
You are probably looking for a motor in the 36- to 44mm-diameter range with a length of 60 to 80mm; 60mm is usual for 1/8 buggies, and 70 to 80mm is usual for 1/8 truggies and monster trucks.

Your desired kilovolt (Kv) rating will depend on your supplied voltage, but as a rule:
2000 to 2700Kv = 4S LiPo = 5S A123 pack
1800 to 2200Kv = 5S LiPo = 6S A123
1500 to 2000Kv = 6S LiPo = 8S A123

Castle Creations, Losi and Novak all offer ESC and motor combinations for 1/8 conversions. Each combination has its own pro's and cons; it depends on what you are looking for and how much money you can spend. When set up appropriately, these off-the-shelf combinations provide exceptional performance that overshadows that of their nitro counterparts.

The Castle Creations Mamba Monster Max (MMM) provides two motor options—the 2200Kv for 1/8 truggies and the MT and





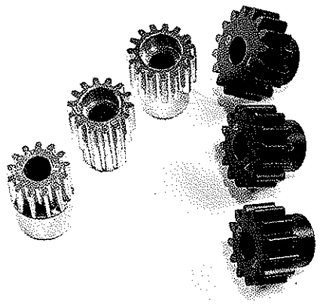
2650Kv for buggies. The ESC runs the same software as the renowned Mamba Max, so it can be configured from your PC and supports everything from 2S to 6S. The MMM combination was recently selected by Traxxas and HPI for the new 2009 Brushless E-Revo and E-Savage models.

Losi's X-Celorin conversion kit comes with four motor options from 1300Kv to 2400Kv for plenty of options to suit your battery choice. This ESC typically supports 2S through 5S LiPos and is easily configurable at home as well as at the track because it can be programmed via "Card" or laptop.

The Novak HV kits have been around for some years but were recently refreshed to include a low-voltage cutoff (LVC), and the motors have upgraded, larger, 5mm shafts. The Novak HV is rated for up to a 4S LiPo, and it has a higher, 3000 to 5000 kilovolt, range. The advantage of the Novak ESC was its use of sensored technology to provide smooth starts, but with advances in sensorless motors and ESCs, this isn't much of an issue anymore.

Above and beyond the conversion kits already mentioned are a number of other motor and ESC manufacturer combinations. The main motor alternatives include, but are not limited to, Feigao (at the lower end), Medusa (in the middle) and Tekno/Neu Motors at the high end. Every manufacturer offers brushless motors in various sizes, colors and Kv ratings. Tekin is due to release an 1/8-scale combo soon; its RX8 promises strong performance.

When choosing your ESC, consider the manufacturer support; that $60 eBay special might look attractive, but if it fails within the warranty period, you might not have the support that U.S. vendors such as Castle Creations, Novak and Losi—to name a few—provide.



PROPER GEARING

Your motor and battery choices (and the speed you want) will determine the gearing of your new brushless build. One of the best resources available for gearing is this website gearing guide http://scriptasylum.com/rc_speed/. Here, you have the options of entering all of the vehicles, voltage, motor, tire choice and desired speed, and it will compute the required pinion gear.

Most conversions run the pinion directly against the spur gear, which is fine as long as you use the "hardened pinions" from RC-Monster.com, RRP, or Novak.

In terms of speed, for the track, you'll generally be gearing for a high 30 to low 40mph Bashers might want 50mph. After changing your gearing, check the temperature of your motor and ESC every 5 minutes to ensure that they are not running too hot because temps over 200 degrees will destroy your motor and possibly your ESC. Motor temp should be less than 170 degrees. If you are geared appropriately, this should not become a problem.

GENERAL RULES OF BRUSHLESS GEARING

Hot motor, cool controller, cool batteries = Undergeared; use smaller pinion
Cool motor, hot controller, hot batteries = Overgeared; use smaller pinion.
Warm motor, warm controller, warm batter-