Application Note #1 - Reducing Motor Noise

Introduction

What's all this talk of attaching capacitors to the motor leads? It's one part of a very important phase in the construction of a radio controlled robot that can seriously affect drivability. This document attempts to briefly cover the most important facets involved and provide practical methods for your use.

The definitive source of electronic noise reduction techniques is the book Noise Reduction Techniques in Electronic Systems by Henry W. Ott. It sells for about $70 and is complex as well as instructive. Of particular note, Ott's "noise reduction checklist" begins with the following items:

- Enclose noise sources in a shielded enclosure
- Filter all leads leaving a noisy environment
- Twist noisy leads together

These are covered individually below.

1. Shielded Enclosure

Fortunately the case of your motor usually takes care of metallic shielding issues. But there is a sinister possibility here that if the frame of your robot is used as a conduction path for any currents (like the frame of an automobile) and it is in contact with the motor case, you're injecting motor noise into your power system.

The best way to prevent this is to simply avoid using the robot frame as a power conductor of any sort. Note that with some automotive winch motors it's difficult to avoid as the motor case is usually tied to one of the brushes. A possible solution here is to mount the motor on rubber isolators to insulate it from the remainder of the frame.

For reference, AISI 1045 carbon steel is twice as effective at absorbing magnetic fields as stainless steel and 1000 times as effective as aluminum!

2. Lead Filtering

Motor capicitors will take care of this for you. Your goal is to mount them as electrically close to the motor brushes as you can. The brushes spark and within those are the source of radio frequency noise. Good motor capacitors help clamp this down.

There are many schools of thought on the proper arrangement of capacitors on motor brushes. This is because noise suppression in general is a real electronic "black art." Figures 1 and 2 show the two popular methods. Figure 1 uses a single cap right across the motor brush leads. Figure 2 adds two more caps, one from each brush to the motor case. Experiment to see which works better for you.

A good value capicitor to use is 0.1 microfarad monolithic ceramic rated for at least three times the motor voltage.

Figure 1

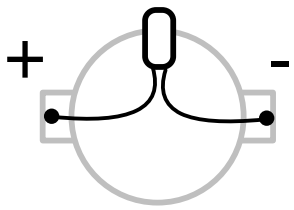
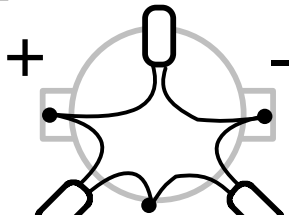


Figure 2



3. Twisted LEads

This is probably the simplest yet most overlooked method of noise reduction available to the robot builder. Twisting noisy, high-current leads together forces the magnetic fields of noise currents to cancel each other out.

Six twists per foot!

You should twist the leads from your batteries to your power controller as well as those from your power controller to your motors.

  E-mail: support@teamdelta.com