Switching Inductive Loads

Switching inductive loads such as relays, solenoids and motors can generate transient voltages of many times the steady-state value. For example, turning off a 12 volt solenoid can easily create a negative spike of 200 volts. Worst case, these transients can destroy your controller. In milder cases, they can cause program failures and flash memory corruption. In the case of high current, high inductance devices, the spike need not even be directly connected to the controller to cause damage or program failure. Controllers damaged from inductive spikes are considered to be abused and are not eligible for warranty repair.

A detailed study of dealing with inductive spikes is beyond the scope of this manual. For more information, a good starting point is The Art Of Electronics, 2nd Ed. pages 52-53.

The following steps are a good starting point in dealing with inductive spikes:

A) If you are driving an inductive load with DC, place a diode in parallel with the load. The diode can be a general purpose power diode such as a 1N4002. The banded end of the diode should connect to the positive side of the load.

B) If you are using a relay to switch an AC-powered inductive load, put a varistor in parallel with the load. The varistor voltage rating should be about 1.5 times the peak-to-peak steady-state voltage of the load.

C) Relays switching an inductive load may require a capacitor placed across their contacts. 0.1ufd to 1.0ufd is a good starting point. If the relays are switching an AC load, place a 100 ohm resistor in series with the capacitor.

D) Do not use the controller's ground or power conductors to carry inductively switched loads. Route all such conductors directly to and from the power supply and as far away from the controller as possible. A separate power source for large inductive loads is strongly recommended. In the case of very large inductive loads, a separate enclosure for the controller may be required.