

EMC App Note

Motor controllers are considered as a component in a system. EMC can only be tested in a complete system thus stipulations relative to EMC do not apply directly to the motor controller. The purpose of this document is to introduce strategies that can be used in a system to reduce the emission of EMI as well as reduce sensitivity to incoming radiation.

Electromagnetic Compatibility (EMC) is the ability of equipment or a system to function satisfactorily in its electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment. EMC is classified into electromagnetic interference (EMI) and electromagnetic susceptibility (EMS).

Grounding

Use a vehicles metallic chassis for ground or the metallic frame of a machine that is tied to earth ground. This will allow electrical faults in contact to the chassis to be safely dissipated until other protection devices in the system respond. The power wire may be run on the length of the chassis.

Avoid Ground Loops

A triangle of ground wires can form an antenna which is susceptible to electrical noise. All devices should be connected to a single point ground; this will prevent multiple ground loops being created.

The dangers of creating multiple ground loops are further explained in our Ground Loops app note.

Isolation

Ground loops can be further disrupted by using opto-isolator circuits. RoboteQ offers both RS232 and USB isolation modules to isolate the system from PCs, PLCs and other devices that can create multiple ground paths.

Wire Length

Lengths of cable can create standing waves and thus act like an antenna. It is recommended to keep cable lengths, both motor and power, as short as possible

Twist/Braid Power and Motor Wires

To further minimize the antenna effect of motor wires, twisting or braiding the motor wires will greatly reduce the pickup of radiated noise. To minimize the amount of noise radiated in the first place, twist the power and ground wires together at least one twist per inch.

Shielding

While all wires carrying a current have the potential to create EMI, the use of a mesh shield around the wires will reduce the EMI effects. Wires may be shielded individually or a shield conduit may be used around the twisted pairs and braids. The shield should be grounded on both ends to avoid its acting as an antenna.

The use of a grounded faraday cage enclosure around the controller can further reduce EMI.

Inductive Loads

Relays and contactor coils and produce a large amount of unwanted noise. Circuits that use these inductive loads should have a high speed fly back diode to suppress this noise. The diode will allow energy stored in the inductor to be dissipated. For maximum noise suppression the diode should be located as close to the inductive load as possible.

Snubber Circuit

An external RC snubber circuit, a resistor in series with a capacitor, will act to reduce EMI by dampening voltage and current noise. For maximum suppression the snubber should be located as close to the controller as possible.

Ferrite Beads

Installing ferrite beads over the controller output wiring, such as Fair-rite brand 2675665702 type "75" low frequency, and 2631665702 type "31" high frequency, will help reduce EMI by attenuating PWM harmonics. For maximum EMI suppression the beads should be located as close to the controller as possible. More product information can be found at <http://www.fair-rite.com/design-tools/>