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Grounding and Shielding Tips

It is wise to spend time to understand the coupling mechanisms of electrical noise that creates Electro-Magnetic Interference (EMI) when building electronic equipment. It is advisable to plan a method of noise abatement during the design and building of a machine, rather than trying to problem solve EMI issues once the machine is built.

To avoid electrical noise issues, all aspects of the machine design must be taken into consideration. The best process is planning for the best grounding method. When the best grounding methods are not achieved, improved grounding and shielding methods must be used instead. An example is a power output connection that is magnetically cross coupled to the data line from a servo controller. In this instance, the data line has high speed noise, potentially causing a noise problem. The data line must be single-ended or the differential output will reject the noise. Therefore, the best method to avoid cross coupling is to take both the source and the receiver into consideration. Ensure the two signals are laid out so individual conductors are surrounded by a magnetic shield, grounded on both ends. Shielding both the emitters and the receiver is recommended if the cable cannot be relocated.

It is preferred that the grounds are near the inputs and outputs at the ends of the signal. If this cannot be done, a braided shield grounded at one end is recommended over no shield at all!

Un-terminated shields with PWM signals as powerful as a servo controller should not be used. Understanding coupling mechanisms is extremely beneficial, especially in a situation where the potential of capacitively coupling high rise time is present.

It is necessary to ground the magnetic shield; however low frequency can sometimes result in the generation of currents in two ground points between single-ended signals called "ground loops." A common alternative that does not result in the redesign of a system is using a multi-shield connector. The outer shield is grounded at both ends and the inner shield is ground referenced at the source of the signal.