

Mitigating EMI with Power Electronics

LED light flicker and other electronic interruptions are common on sites with power electronics and motor loads. Phase Technologies equipment is installed on thousands of sites without EMI issues. This document provides several methods of mitigating electromagnetic interference (EMI) and best practices for avoiding it completely.

Input Noise

Input noise can be identified when LED lights flicker inside a home or business, when a converter or drive is powered on. These lights are typically fed from the same source as the converter or drive.

Solutions

- 1) Install an isolation transformer on the input of the converter or drive. This is the single most effective solution to mitigate the effects of EMI.
- 2) Rotate input wires (L1, L2) to get converter or drive off the lighting circuit. See **Figure 1**.



Figure 1 – Rotating input power cables can often resolve LED flicker



- 3) Ensure that power cables are routed in continuous metal conduit away from lighting circuit wires and if they must cross, cross at 90° angles.
- 4) Measure ground rods. Measured value should be 4 Ohms or less. Add ground rods or improve existing to reach 4 Ohms resistance or less.

- a. Ground Resistance Meters (see **Figure 2**) can be found online for around \$200.
<https://www.amazon.com/ETCR-ETCR2100A-Digital-Resistance-0-01-200%CE%A9/dp/B00P8VHMDO>



Figure 2 – Earth Ground Resistance Meter. Measured value should be 4 Ohms or less


- 5) If allowed by local electric code, isolate the equipment ground from the main panel ground.
- ⚠️ **WARNING!** Never operate Phase Technologies equipment without a reliable ground!
- 6) Dimmer switches can cause LED light flicker. Test this by dimming the lights. If the dimmer affects the frequency of light flicker, try replacing the switch with an alternate brand. LED bulbs that are not dimmable can have this issue as well. 0-10V Lutron dimmers, or similar, work best for LED lighting.
- 7) Replace one or more LED bulbs with incandescent bulbs. This increases resistance and can redirect high frequencies to ground.
- 8) Add an Astrodyne EMI filter to the input of the converter or drive. Available at www.mouser.com
- a. Acceptable filters for single phase input:
- Series 091
 - Series 091M
 - Series 092

- iv. Series 092M
- v. Series 095
- b. Acceptable filters for three phase input:
 - i. Series RP300
 - ii. Series RP305
 - iii. Series RP310
 - iv. Series RP320
 - v. Series RP325
 - vi. Series RP327
- 9) Install line-to-ground capacitors on equipment input or input of lighting circuit
 - a. Phase Technologies part number: SVK4510
- 10)  **WARNING!** This solution is for 1LH products only! Doing this on any other drive will void warranty.
Turn DIP switch 2 ON to change the switching scheme.
 **WARNING!** This will increase the amount of heat the IGBTs generate. Check parameters OVERTEMP DERATE ENABLE and MINIMUM DERATE FREQUENCY to ensure these are set properly for your application. Performing this change on any model other than a 1LH will void the warranty.

Output Noise

Output noise can be identified when LED flicker is isolated to a piece of equipment that the phase converter or drive is supplying power to.

Solutions

- 1) Install an isolation transformer on the input of the converter or drive. This is the single most effective solution to mitigate the effects of EMI.
- 2) Rotate output wires (T1, T2, T3) to take the manufactured phase off the control transformer.
- 3) Measure system grounds and improve ground until measured value is 4 Ohms or less.
 - a. Ground Resistance Meters (see **Figure 2**) can be found online for around \$200.
<https://www.amazon.com/ETCR-ETCR2100A-Digital-Resistance-0-01-200%CE%A9/dp/B00P8VHMDO>
- 4) If allowed by local electric code, isolate the equipment ground from the main panel ground.
 **WARNING!** Never operate Phase Technologies equipment without a reliable ground!
- 5) Install GPS filter on input of machine experience LED flicker
 - a. Phase Technologies part number: LF0018
- 6) Reduce the other items in the area that may be introducing harmonic noise – Can other VFD's or electronics be turned off?