

ELECTRICAL NOISE ATTENUATION

General

Any electrical system, particularly microprocessor based equipment such as industrial computers and data acquisition systems, require clean, noise-free power to perform optimally. The utility companies provide the essential clean power to commercial and industrial facilities regularly. Unfortunately, due to power electronic circuits, welders, variable speed drives, and SCR controls used in computers and many other electrical systems, electrical noise is introduced on the facility's own power distribution system which leads to the corruption of the clean power.

For AC (alternating current) systems, electrical noise is a distortion of the normal sine wave. Some effects noise has on electrical systems are data loss, computer lock-up, equipment malfunction, and occasionally destruction. Therefore, noise attenuation devices are a necessity. Electrical noise attenuation devices, such as, TVSS (Transient Voltage Surge Suppression), noise filters and shielded isolation transformers reduce electrical noise to safe levels. Although it is impossible to totally eliminate electrical noise, it is possible to drastically reduce it to tolerable

levels. Noise attenuation is expressed as a ratio of the output transient energy (V_{to}) to the input transient energy (V_{ti}), or by decibels (dB). Table 1, below, shows the relationship of this ratio to decibels. Most electrical systems are provided with 40 to 60 dB attenuation, which is barely adequate, whereas attenuation of 120 dB or greater is required for sensitive systems. There are two main types of noise, common mode and normal mode (also known as transverse mode).

V_{ti}	V_{to}	Ratio	Decibel (dB)
100	1	100:1	40
1000	1	1000:1	60
1,000,000	1	1,000,000:1	120
10,000,000	1	10,000,000:1	140

Table 1

Common Mode Noise

For AC power systems, the term "common mode" refers to noise or surge voltage disturbances that occur between the line and ground conductors, or the neutral and the ground conductors. Ideally, no common mode noise should exist between the neutral and ground conductors since they are connected. Unfortunately, common mode noise finds it's way into electrical

systems because of noise injection into the neutral or ground conductors from overloaded power circuits, wiring faults, and other equipment on the same line. Electronic circuits must co-exist with the same grounding system as the utility. The utility ground system is designed to carry all faults and any unwanted currents. Therefore, it is important to have a

properly connected grounding system. The impulses on ground can rise in excess of 6000 volts into a piece of electrical equipment without any form of noise attenuation. High magnitude impulses of this nature will destroy or render any electronic circuit useless.

Normal Mode Noise (Transverse Mode Noise)

The term “normal mode” refers to noise or surge voltage disturbances that occur between the hot and neutral conductors, or between the line conductors. Most normal mode disturbances result from load switching within a building (motor type loads being a major contributor). On rare occasions, surge voltages that come

from outside of the building (i.e. lightning) enter on the hot conductor and are primarily considered normal mode since the neutral conductor is at ground voltage. Surge suppressers limit surges and sometimes normal mode noise to safer values, offering minimal protection. By attenuating normal mode noise,

electrical circuits will not feel the direct surge from the power line. This attenuation assures proper operation and no stress to the electrical components which translates to more operational uptime, as well as, less maintenance and repairs.

Ultra-K

The Controlled Power Company *Ultra-K* is a double shielded (triple shielded optional), isolation transformer system. It delivers a common mode noise attenuation of 126 dB (146 for triple shield), whereas most other K-rated transformers only provide up to 60

dB noise attenuation. The *Ultra-K* also provides a normal mode noise attenuation of 3 dB at 1000 Hertz and 40 dB per decade thereafter. Note from Table 1 that going from 60 dB to 120 dB is two times greater in decibels, but the noise attenuation is 1000 times

greater! The *Ultra-K* offers 10 million times more protection than an unprotected system, and 1000 times more protection than most other protective devices on the market today. Use the *Ultra-K* when mission critical applications require clean, noise free power.

Other Technologies

Surge suppressers or TVSS's are good when used to attenuate voltage spikes, but they are not good for noise attenuation when used alone.

High frequency noise filters pass the 60 hertz line frequency easily, but present a high impedance path to attenuate unwanted noise of high frequency. These filters are often combined with a TVSS

and other power conditioning equipment to provide noise attenuation, making it an expensive option.

Standard unshielded isolation transformers provide some level of noise attenuation. They accomplish this attenuation because the primary and secondary windings are isolated from each other and electrical

noise does not transmit well magnetically or through the air. Controlled Power Company's *Ultra-K* is a better solution to attenuate electrical noise than surge suppression, noise filter, or a standard isolation transformer because it's attenuation level is higher due to its isolation and triple shielding characteristics.

Summary

Electrical equipment require clean, noise-free power to function properly and without glitches. The Controlled Power Company's *Ultra-K* incorporates a high

frequency noise filter and a TVSS to provide top of the line electrical noise attenuation helping electrical equipment perform optimally. The *Ultra-K* will also keep your

operations free of transients, and it is designed to handle harmonics with K-ratings of K-4, K-7, K-13, and K-20.



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1955 Stephenson Hwy. Troy MI 48083
www.controlledpwr.com email: info @ controlledpwr.com
Phone: (800) 521-4792 Fax: (248) 528-0411