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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), Isolation Transformers, and Power Conditioners 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 (Vto) to the input transient energy (Vti), 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 neutral and the ground conductors. Ideally, no common mode noise should exist since the neutral and ground conductors are connected. Unfortunately, common mode noise does find it's way into electrical sys-tems because of noise injection into the neutral or ground conduc-tors from overloaded power cir-cuits, wiring faults, and other equipment on the same line. Electronic circuits must co-exist with the same grounding system as the utility in order to avoid noise on the ground lines (also known as inter-system ground noise). The utility ground system is designed to carry all faults and any unwanted currents. There-fore, 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 good common mode 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. 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 (lightning, etc.) 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.

Power Purifier

Since the Controlled Power Company *Power Purifier* is a double magnetic conversion system (see Application Note IPPS#11), it delivers a common mode noise attenuation of 140 dB and a normal mode noise attenuation of 120 dB. This is the best noise attenuation on the market, protecting mission-critical equipment from 99.95% of all power problem occurrences. 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 *Power Purifier* offers 10,000,000 times more protection than an unprotected system, and 1000 times more protection than most other protective devices on the market today. Use the *Power Purifier* when mission-critical applications require clean, noise free power.

Other Technologies

Surge suppressers or TVSS attenuate voltage spikes (and sometimes noise) which occur on the hot conductor. Surge suppressers provide adequate normal mode attenuation, but no common mode attenuation. In fact, if the TVSS is connected to the neutral conductor it may cause common-mode noise. Surge suppressers also provide no harmonic attenuation or voltage regulation, leaving your system minimal protection.

Unshielded isolation transformers provide limited levels 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.

The Controlled Power Company *Power Purifier* is a better solution to attenuate electrical noise than either surge suppression or a standard isolation transformer because it’s attenuation level is higher. In addition, the *Power Purifier* also provides line voltage regulation, ride-though capability, and harmonic attenuation (See Application Notes IPP#14, IPP#12 and IPP#11), protecting mission-critical applications from 99.95% of all power problem occurrences.

Summary

Electrical equipment require clean, noise-free power to function properly and without glitch- es. The Controlled Power Comp-any’s *Power Purifier* provides top of the line electrical noise at-tenuation to help electrical equip-ment perform optimally. The *Power Purifier* will also keep your operations free of transients, voltage fluctuations, voltage surges, and it will attenuate harmonics.

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