THE BENEFITS OF SURGEX SURGE SUPPRESSION

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Fundamental differences between Shunt Mode and SurgeX surge suppressors are examined. It is shown that the indiscriminate use of Shunt Mode surge suppressors in applications such as sound systems and computer networks can cause more problems than are supposedly eliminated by the use of such devices. Suggestions for optimal deployment of both types of devices are presented.

INTRODUCTION

Multiple sources of transient electrical noise (surges) including motors, HVAC equipment, photocopiers, power tools, etc, are present in all modern buildings. Surge energy conveyed by building power systems may also result from external sources such as nearby lightning strikes. To minimize the likelihood of injuries to personnel and damage to equipment due to electrical surges and accidental fault conditions, in North America the National Electrical Code (NEC) specifies that all exposed electrical equipment in building electrical systems is to be connected ("bonded") together and ultimately bonded ("grounded") to an earth "Building Ground" connection at the electrical Service Entrance. This requirement is addressed by the building Equipment Grounding system.

Equipment Grounding (EG) systems incorporate combinations of conduits, raceways, and dedicated Equipment Ground conductors associated with the Hot and Neutral conductors of branch circuits. Connections to EG systems are made via the "U-Ground" contacts (often referred to as the "Green Wire") in electrical outlets. By merely being "plugged-in", installations of electronic equipment (computers, sound systems, etc.) are automatically "grounded" and thus made as safe as possible for operation by non-technical personnel.

NORMAL EQUIPMENT INTERCONNECTIONS CREATE "GROUND LOOPS"

Interconnections between groups of grounded electronic equipment via "network" cables (which incorporate dedicated signal and shield "ground" conductors) are commonplace. Inductive coupling of powerline surge energy into the "Ground Loops" formed by these multiple "ground" connections is inevitable, as current will flow in any conductive path (loop) exposed to the magnetic fields associated with nearby power conductors and electrical equipment. The consequences often appear as noise in sound systems, and mysterious computer network problems ranging from data corruption all the way to catastrophic failure of interface devices, and will be especially evident in installations involving equipment with Pin-1 Problems [1].

It is often suggested that "surge suppressors" (devices which limit the magnitude of surge energy) might address these problems. Power "Outlet Bars" with internal "Shunt Mode" circuitry are obtained and installed in various equipment locations throughout the building. While perhaps surprising, it is not unusual to find that the net results from these efforts often range from no difference at all through vague "improvements" to outright worsening of the original problem(s). In some cases the "improvements" first realized will unpredictably disappear after sometime for no apparent reason.

SHUNT MODE SURGE SUPPRESSORS

Shunt Mode surge suppressors operate by redirecting (shunting) incoming surge energy onto their associated EG conductors, with the result that the local ground reference potential rises due to the current flow through the impedance of the circuit path back to Building Ground. For a ground path length of more than a few feet, this impedance can be substantial, resulting in significant voltages with respect to other "grounded" areas in the building. Any and all equipment connected to a Shunt Mode surge protection device will thus experience an abrupt elevation of its local EG reference potential during surge events. For non-networked standalone applications this may be an academic issue. The additional drawbacks described below are considerably more serious, however.

MOV'S

Metal Oxide Varistors (MOV's), the principal component(s) which divert incoming surge energy into EG conductors in virtually all Shunt Mode surge suppressors, exhibit a "fixed clamping voltage" characteristic, above which they rapidly change from virtual open circuits into low resistance conductors. For a transient surge duration of not more than a few milliseconds, the resulting power dissipation in MOV's can be tolerated. In the event of a continuous overvoltage condition of any significant duration however, MOV's rapidly heat up and then either permanently revert to their non-conductive state, or fail catastrophically with the attendant possibility of fire.
Irrespective of cost or manufacturer, the cumulative (sacrificial) effect of repeated surges over time will ultimately cause MOV's to fail one way or the other. Recent MOV-based surge suppressor devices made to Underwriters Laboratories (UL) 1449–2 (2nd ed.) specifications incorporate a fuse element which disconnects the power in the event of catastrophic MOV failure. Older MOV-based devices do not have this feature, however, and non-catastrophic MOV failure leaves the attached equipment completely unprotected, usually without the knowledge of the owner! To ensure continuously safe operation, MOV-based surge protection devices should be tested on a regular basis.

SHUNT MODE SURGE SUPPRESSORS IN EQUIPMENT NETWORKS

It is not uncommon to encounter "Shunt Mode surge protected" equipment interconnected by network cables to other equipment elsewhere in a building which, for whatever reason are NOT connected to Shunt Mode surge suppressors. During a surge event, "unprotected" equipment will experience little if any elevation of its ground reference potential, whilst "protected" equipment will experience an abrupt and often substantial rise in its ground reference potential. The resulting surge currents flowing in network cable ground loops are thus considerably increased by the use of Shunt Mode surge suppressors at only one or some equipment locations

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rather than ALL locations involved in the network. Installing identical Shunt Mode suppressors at all equipment locations may reduce the magnitude of this problem, but only to the extent that the impedances of each ground path into which noise energy is shunted are the same, a condition which is not likely to exist in all but the smallest of systems.

THE SURGEX ALTERNATIVE

SurgeX surge suppressors act first as low pass filters which simply block the high-frequency (HF) components of powerline surges. The remaining low-frequency (LF) surge energy is diverted into a bank of capacitors where it is stored for the duration of the event and then slowly discharged back across the incoming hot and neutral conductors without involving any connection to Equipment Ground. SurgeX surge suppressors can thus be placed anywhere along a power circuit without the ground reference elevation disadvantage of Shunt Mode surge protection devices.
SurgeX surge suppressors incorporate "floating clamping voltage" circuitry which will withstand considerable over-voltage conditions of indefinite duration without damage or degradation of performance, and are UL certified to a Surge Endurance specification of A-1-1, the highest possible rating available [2]. Most importantly, SurgeX surge suppressors do not incorporate sacrificial components of any kind, effectively guaranteeing an unlimited service life without the requirement for testing and/or periodic maintenance.

THE BOTTOM LINE

During a surge event, Shunt Mode surge suppressors located at the equipment load end of a branch circuit will cause an increase of local ground reference potential regardless of manufacturer and/or price. Without periodic testing there is no guarantee of long-term protection due to the sacrificial nature of key components used in these devices.
SurgeX surge suppressors do not require periodic maintenance or testing, and do not cause an elevation of the local Equipment Ground reference potential during surge events regardless of where they are installed in an electrical power system. This is truly a quantum leap in real powerline SURGE PROTECTION!

References:
[1] N. A. Muncy, Noise Susceptibility in Analog and Digital Signal Processing Systems, J. Audio Eng. Soc., Vol. 43, No. 6, 1995 June
[2] The UL A-1-1 Surge Endurance testing procedure involves the application of a minimum of 1000 surges of 6,000 Volts at 3,000 Amperes (the highest surge voltages and currents likely to be encountered in a typical building), as specified in IEEE/ANSI C62.41-1991.

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