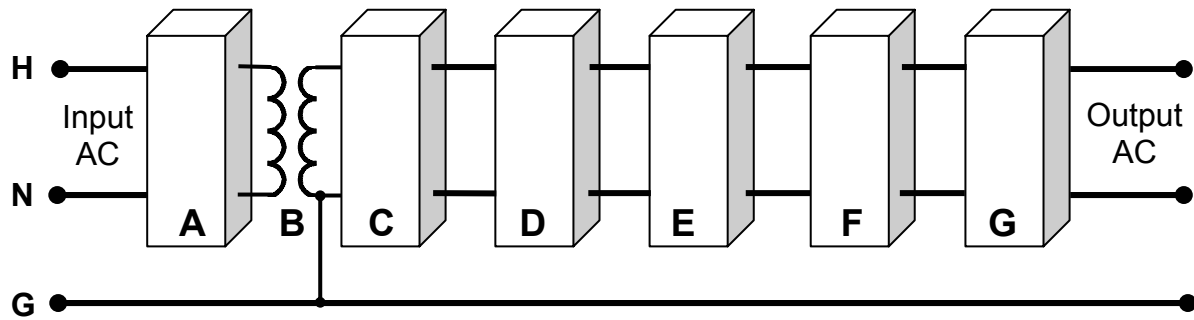


ETA Systems - The ABC's of POWER Conditioning®



A The Surge Diverter

This is the most commonly used "solution" because it is the least expensive and best-recognized power protection device. Surge diverters can only protect from transient voltages that exceed about 250 volts. When these large voltages occur, surge diverters clip the excess voltage and send it to ground where it is converted into a common mode power disturbance that can disrupt microprocessor function. Because transient voltages smaller than 250 volts slip by the surge diverter, the electronic system may be exposed to substantial degrading energy.

B The Low Impedance Isolation Transformer

The low impedance isolation transformer provides an inductive cushion for the load and enhances the operation of surge diverters and noise filters by re-establishing a vital neutral to ground bond permitted by National Electrical Code. The bond prevents the formation of common mode voltages created when surge diverters and noise filters shunt power disturbances to safety ground.

C The Power Line Filter

Power line noise filters address the low amplitude, high frequency noise disturbances that are missed by the surge diverter. Quality noise filters are often left out of many power protection devices. Like surge diverters, they operate by shunting noise to safety ground.

D The Voltage Regulator

Voltage regulators are responsible for keeping power line voltage within specified upper and lower limits. Many systems use switch mode power supplies (SMPS) which do not require tightly regulated voltage. This is fortunate since most voltage regulation technology is obsolete, generates noise, and is unsuitable for use with today's systems.

E The Battery Backup

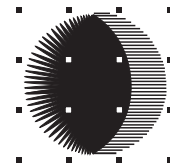
Computer systems can't function if there is an interruption to their supply of electrical power. In the event of a power outage, the battery backup converts reserve DC energy (stored in batteries) into AC power for the electronic load. The most common type of battery backup is the standby UPS, which switches to batteries when power is lost. More expensive on-line UPS systems are also available to provide constant AC to DC to AC power conversion. Many on-line systems can also regulate voltage. Few UPS systems, regardless of the design, provide good common mode protection because they do not include an output isolation transformer.

F The Frequency Regulator

Frequency regulators ensure that the power line frequency stays at a constant 60 Hz. (50 Hz. in Europe and much of the rest of the world). In most well-developed countries, frequency regulation is not required since the power utility provides very frequency stable electrical power. This is not always true in developing countries or when operating on generator power. When frequency regulation is required, an on-line UPS or inverter is the best way of providing frequency stable AC power.

G Ground Loop Control

When electronic systems are connected together throughout a building, the natural variations in electrical ground impedance cause noise currents to flow in the loops created by the grounding conductors of data and signal cables. Low frequency ground loop currents may cause audible hum while high frequency loop currents may alter data, cause communication errors or system reliability issues.

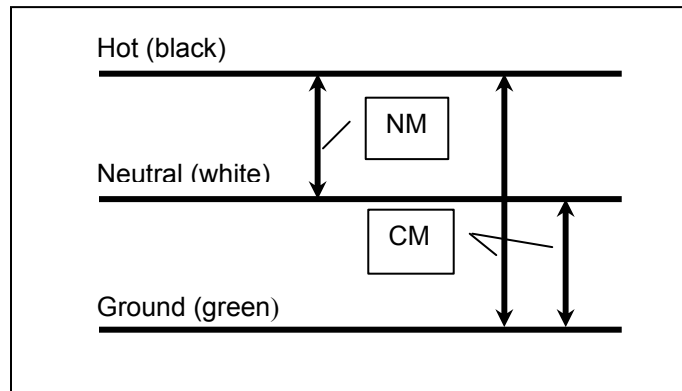


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POWER PROBLEM FACTS

Fact 1 Power problems can enter electronic systems through two different pathways or “modes” as they are technically known. The picture to the right illustrates these two modes. In the Normal Mode (NM), power disturbances enter the system using the path provided by the phase and neutral conductors (black and white wires connected to the receptacle). Normal mode disturbances are most often associated with events such as lightning, utility grid switching, facility load cycling, and similar events. Normal mode events are usually associated with power supply or other hardware failures.



In the Common Mode (CM) power disturbances enter the system between either current carrying conductor (phase or neutral) and the safety ground conductor. Much emphasis is placed on limiting common mode disturbances between neutral and ground. This is because common mode voltages can easily disrupt the microprocessor operation. Hardware damage is possible with common mode events, but unreliable operation, lockups, and “soft” failures occur far more frequently.

Fact 2 Power problems affect your system in four different ways. These ways are known as “The Four D’s” They are **Destruction**, **Degradation**, **Disruption** and **Dynamics**. They affect your system in the following ways:

Destruction occurs when a power disturbance is so large that its energy literally “blows up” or destroys a semiconductor device like a transistor or integrated circuit. Destructive disturbances can enter a computer system via either mode (see above) but are most often associated with Normal Mode pathways. Destructive power disturbances are the easiest to identify since they leave visible evidence of their occurrence – smoke, soot, and charred components. Establishing cause and effect is easy with destructive events.

Degradation occurs when lower amplitude power disturbances enter an electronic system and affect a semiconductor at a microscopic level. Solid state junctions are designed to operate at small voltages. Degrading power disturbances often exceed the voltage tolerances of the material. Erosion of the semiconductor material occurs (much like rust damages metal) leaving less of the semiconductor material to handle the current needs of the circuit. Higher operating temperatures are the result. Damage from degrading events tends to be cumulative. Eventually so much damage occurs that the semiconductor junction experiences “thermal runaway” and fails. Establishing cause and effect may be difficult or impossible since there are no visible failure indications.

Disruption occurs from power disturbances that are of such a frequency and amplitude that they can mimic actual logic signals causing the computer system to make incorrect decisions. Disruption also occurs when neutral to ground (common mode) voltages become excessive. Another major cause of system disruption is the presence of ground loops in the networked environment. Ground loops are a major cause of data communications errors and slow system throughput. Disruptive events are difficult to document and may be easily mistaken for software “bugs” or operator errors. Disruptive events are the most common cause of “No Problem Found” service calls.

Dynamics – Power quality problems can affect the dynamics of an audio or video system by deteriorating the quality of both sound and image. Power line disturbances raise the system’s “noise floor” to the extent that interference can be both heard and seen

Fact 3 As early as 1986, the semiconductor industry recognized the need to protect the devices it manufactures from power disturbances during the quality control phase of their manufacturing process. They published the first (and still recognized) guidelines on the maximum levels of normal mode and common mode power disturbances that should be present in the semiconductor environment. Their guidelines clearly state that power disturbances up to those described in ANSI-IEEE C62.41 (maximum 6000 volt) must be reduced to less than 10 volts Normal Mode and .5 (one half of one) volt Common Mode. Respecting these guidelines will ensure that destruction, degradation, and disruption are prevented and that dynamics are preserved.