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TECHNICAL INFORMATION AND PRODUCT SOLUTIONS

March 1999

Ground Skew: Ground Loop and Ground Voltage Differentials

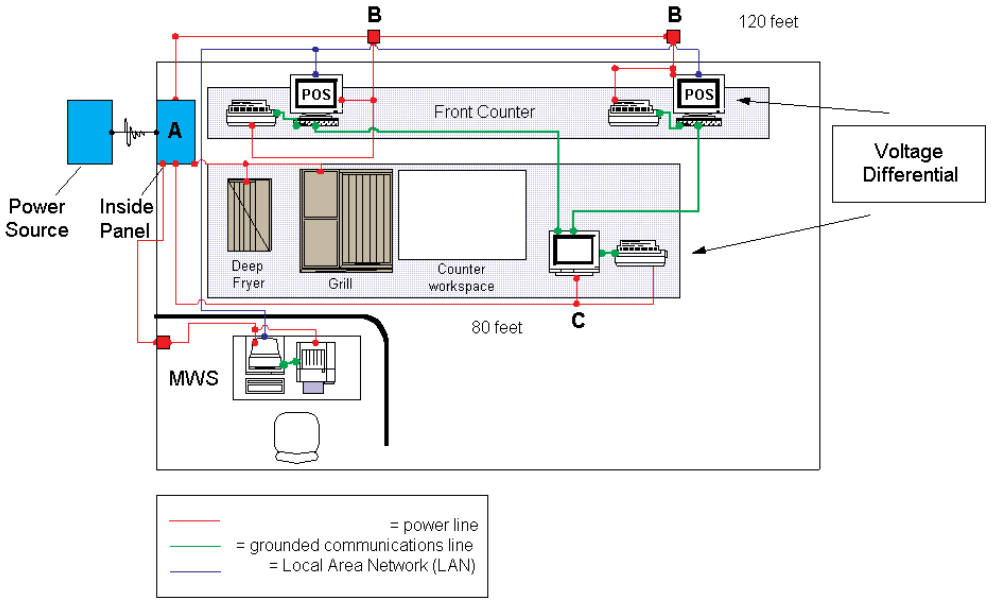
The electronic systems that operate and facilitate our businesses have always been vulnerable to disruption and destruction from electrical impulses and noise on the AC distribution system. As technology advances and our reliance on these systems grows, these problems become more pronounced and the impact becomes more costly. Today, electronic equipment critical to operating successful businesses, such as networked computers, point-of-sale (POS) equipment and industrial process control networks, are linked together by power and data wiring. Together, these create new and complicated paths for power currents and transients. Resulting problems such as ground loops and varying voltage potentials between communication ports can destroy, degrade and disrupt the sensitive circuits within the systems.

What is a Ground Loop?

A ground loop is a wiring condition in which a ground current may take more than one path to return to the grounding electrode at the service panel. It is commonly found in networks that use grounded communication methods (such as RS232) to link the various peripherals in the systems. In these cases, the computers within the network are usually connected to a common ground through both the communication line and the power line.

Ground Skew: Quick Service Restaurant Environment

Front registers (B) and kitchen monitor (C) are connected to the inside panel board (A) by two different branch circuits.
The grounded communications line between B and C creates a ground loop and potential voltage differential.



Causes of Ground Voltage Differentials

Ground loops themselves are not a problem. The problem occurs when two linked devices within the network see momentary voltage differences between the ground points to which they are attached. These voltage differences, referred to as *ground skew*, often exist at frequencies higher than the standard 60Hz power frequencies; and are caused by noise current flowing along the power line. These may be injected or induced into the line from compressors, switching transients, other loads or lightning. Transient voltage surge suppressors, wiring errors or electrical faults also contribute to stray electrical currents passing through the ground paths of an interconnected system. Differences in wire lengths and wire sizes within that system will effect when transient differences in ground potential are seen by each peripheral.

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Problems Caused by Voltage Differentials

Voltage differentials are generated when errant currents flow through the impedance in the power system ground wire. These voltage differentials exist throughout the interconnected system when there is equipment also joined by a grounded communications cable. These voltage differentials may disrupt logic; causing lock-ups or incorrect operation as voltage levels are interpreted incorrectly within the systems' logic circuits. In addition, I/O ports and other components are likely to be degraded or destroyed by voltages which exceed the allowable voltage specification.

ONEAC Solves Ground Skew Problems with its Patented ONEGROUND™ Technology

Breaking the flow of current in the ground loop can eliminate ground skew problems. This can be achieved by isolating the data line using fiber optics or isolated communication topology, but this solution is often cost prohibitive. Running dedicated lines with isolated ground conductors is not only expensive to setup and maintain, but it does not eliminate ground loops caused by data circuit connections. The best and most cost-effective solution is the elimination of the power ground path at high noise frequencies (where ground skew occurs) without removing the path at power frequencies. In this way, ground differential potentials will be eliminated, while safety grounds are maintained.

ONEAC's ONEGROUND technology does just that. Built within ONEAC ONEGROUND power conditioners are the components necessary to filter out harmful noise currents in the ground path (which cause ground skew damage) while still maintaining all safety grounds for leakage and fault ground current. The device works on the principle of creating a high impedance in the ground path at high frequencies while maintaining a "zero" impedance at power line frequencies. By increasing the high frequency impedance in the ground line, the resultant voltage produced by transient ground currents is substantially reduced, thereby reducing the opportunity for disruption or destruction of the communication line.

ONEAC ONEGROUND technology is currently available in select ONEAC products.

Ground Skew:
Office Environment

A grounded communications line connects terminals throughout an office environment. These terminals are powered by different branch circuits and, therefore, are subject to voltage differentials.