The Right Medicine

Richard P. Bingham

There are a whole plethora of solutions on the market for power quality related problems, often called "mitigating devices." Choosing which one is the best for a particular facility and its problems is similar to a doctor prescribing the right medicine for a certain illness. It starts with the proper diagnosis of the problem, of which we have covered some of these issues in previous articles. Here we will focus on the medicine.

Sometimes the medicine can have adverse effects and actually can make the situation worse. This is not only a waste of money, but can do far more damage than having done nothing. This is true in power quality solutions, also. For example, there have been instances where harmonic filters have been placed in circuits that result in resonance conditions where the distortion levels are much higher after putting in the filters.

Match the solution to the problem. One of the most common solutions that people use are TVSS or transient-voltage-surge-surpressors. These can range from the outlet strip from Radio Shack or Comp-USA, to the large service entrance modules. Their purpose is to provide a low impedance path to shunt to ground of the high frequency transient voltages that can be very damaging to semiconductor and other devices. Using surge surpressors that are not approved by a regulatory agency (such as UL) can create a potential fire hazard if they fail to do large surge voltages, such as from nearby lightning strikes. The joule or energy rating of the box needs to match the application.

Another thing to consider with these solutions is, are they solving anything? According to a recent survey, over 90% of the power quality problems are sags lasting less than 1 second. What will a surge surpressor do for resolving this condition, when the voltage is reduced for a short duration? The answer is absolutely nothing, beside make the vendor of such devices wealthier. While there is a place for such devices, the claims by some vendors can be over zealous. A test conducted by NIST (formerly the National Bureau of Standards) showed that if some of these claims were true, then incandescent light bulb would be blowing up on a regular basis from transients. How often have you seen a light bulb fail once it is already turned on and running?

Voltage reductions, either sags, interruptions, or undervoltage conditions, require a solution that makes up for the missing energy. These solutions can range from automatic tap changing transformers, to battery-powered uninterruptible power supplies (UPS), to high speed static transfer switches (STS) that can switch between two different power sources within a quarter of a cycle. Of course, having a quarter cycle STS is a waste of money, unless you can convince the electric utility company to provide two feeds from different substation, otherwise the odds are that you will just be switching from one problem to another. Likewise, having a battery-backed UPS without a proper maintenance program in place for the batteries is equally ineffective.

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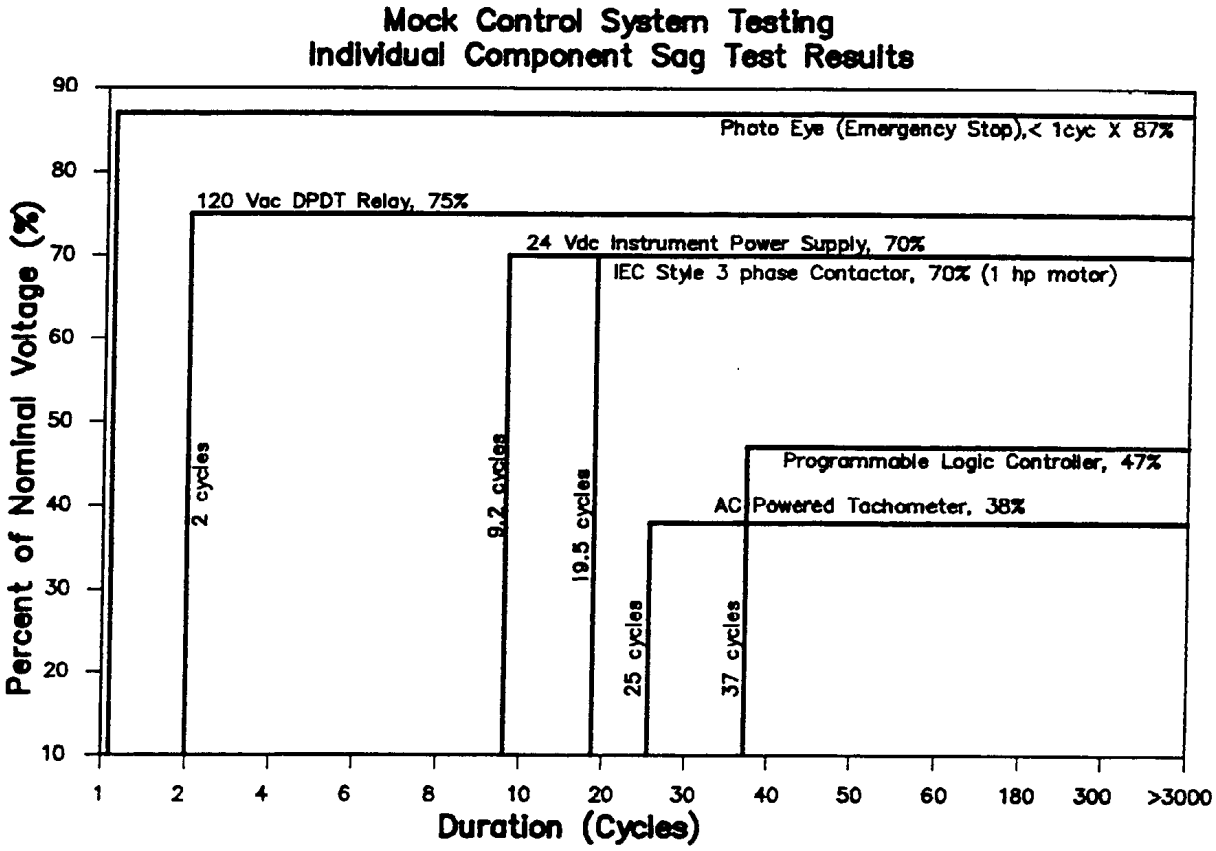
Sometimes the expensive solution is just that, expensive. The screwdriver is a very effective tool in fixing many power quality problems, by tightening loose connections, or wiring up outlets and distribution panels correctly. Putting a UPS on the PLC that controls some process equipment on the factor floor may a waste of money. It may turn out that the most vulnerable part of the system is the electric photo cell safety switch on the machine, that trips the process off on just a two cycle sag to 90% of nominal voltage, whereas the PLC can tolerate a much deeper sag for much longer to 47% for 37 cycles, as shown in the attached figure.

Remember, what it is really important is that the characteristics of the power required by the load equipment is **compatible** with the characteristics of the power being supplied, from the utility or through a mitigation device .



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