

AC Power Panel Loading

The focus of this article is to submit a simple concept that will improve any electrical distribution system and make it more technology friendly.

Today's technology is ever changing but there are five statements that can be made that will stand the test of time.

1. There will be more, not less electronic technology employed in every aspect of our lives and almost every product that we use at work, home and play.
2. The technology of tomorrow will be more sophisticated than it is today.
3. We will be more productive and our lives more enjoyable as a result of advances in technology.
4. With every advancement all will become more dependent on technology.
5. When technology is not working properly it will disrupt our lives more than it does today.

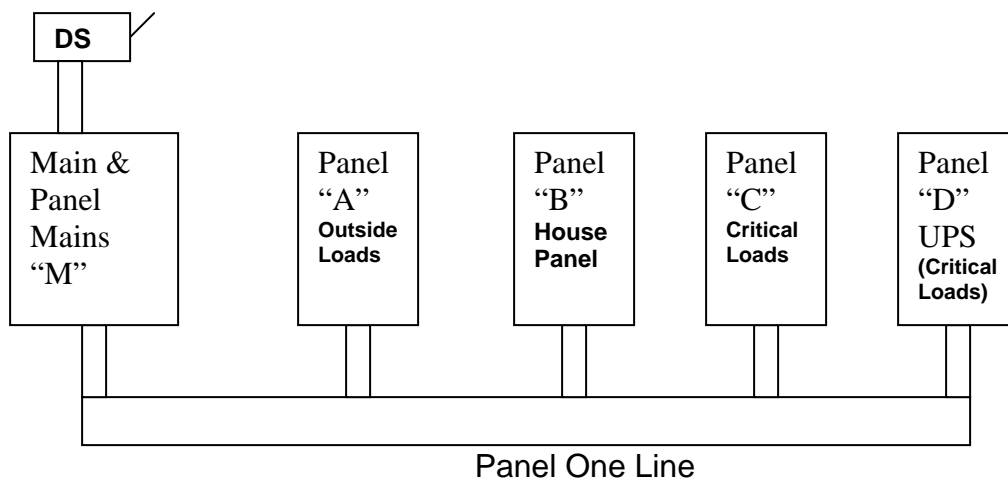
Technology runs on electrical power in one form or another. The majority of technology will be driven by the electrical systems installed (with some modification) in our factories, businesses and homes. The electrical infrastructure we put in place to power technology will become more important with every advance in technology. Some AC powered technology today has special requirements and we can expect to see a geometric increase in special requirements for very sophisticated devices. The majority of the future technology will depend on the AC power electrical distribution system in place today or that is yet to be installed.

A general statement can be made that the electrical systems in most buildings were not installed with consideration to today's technology much less what may be in our future. Today the electrical infrastructure is often the reason for technology equipment failure. That statement is easily supported and a conversation with companies that install technology will confirm this fact. Most buildings are poorly grounded, if properly installed in the beginning the electrical system's design was not for technology equipment and it is probable the electrical system has lacked proper maintenance. Add to that if any surge protection was installed it most likely is not installed to best industry standards or adequate for the level of exposure.

All of the above statements are worthy of an individual article but the focus of this article is electrical panel loading. Keep the big picture in mind, but focus on some very basic design concepts.

When an electrical design is completed it should separate (or segregate) sensitive equipment from “dirty” loads and “back door” loads. We will consider dirty and back door loads as every load that is not sensitive for this example. Examples of dirty loads are HVAC systems, motor loads of any type, welding equipment, VFD’s, gas igniters or any load that will add noise, impulses or requires significant inrush current. There are a few exceptions to the “inrush current” rule or list and they will be address later.

To keep the article simple the below electrical system will be our example. The main (M), disconnect (DS), all distribution panels (A-D) and outside circuits are all to be provided the appropriate surge protection device. A white paper is available on the proper application of surge protection devices (SPD).



The main panel is designed to support the distribution panels as well as the disconnect (DS). AC Power to the disconnect switch and package HVAC unit on the roof of the building is provided by Panel “M”. Disconnect “DS” provides power to a roof mounted HVAC package system. Any roof mounted “DS” should not be powered by a critical load panel or the panel that powers the UPS.

It is common to see facilities where the “DS” for the computer room HVAC system is powered by the computer room panel. This is a formula for disaster and the “DS” for computer room air conditioners should never be powered by the panel that powers the computer room UPS.

Should lightning strike the roof mounted equipment, even with a properly installed lightning protection system, some of the lightning energy is going to follow the electrical conductors that power the roof mounted HVAC system back to the source of the power. In a case like this the lightning energy will be flowing to any and all lower potentials. If the source of the power for the roof mounted HVAC system is the same panel that powers the computer room equipment including the UPS and the highly sensitive loads the UPS supports it is not hard to imagine the damage potential.

The multiple layers of surge protection devices (those installed on panel M, A, B & C will not see the over voltage event (lightning) until after it has entered panel "D". Events like this have occurred and the author has seen an entire data center taken off-line for days due to the damage resulting from improper panel configuration and loading.

Panel "A" is the closest panel to "M" (wire length) and Panel "D" is the further most panel (wire length). Therefore all of the SPD in front of panels "C" & "D" will see any surge energy prior to the SPD installed to protect panels. Think of the SPD as a series of filters. Properly installed this is the basis of a system approach to surge protection.

Panel "A" in the one line drawing of the electrical system should support any outside loads. Included would be parking lot lights (and/or the contactors), wells, lights, powered signs, well(s), lift station, etc. These outside loads will often require special treatment with surge protection devices and that is covered in the white paper on the application of surge protection devices.

Panel "B" in our example is the "house load" panel. All circuits that are non-critical to the operation of the facility such as general purpose duplex outlets (non-sensitive or non-critical loads), water heater, drinking fountain(s), etc. should be powered by this panel. The loads powered by this panel should not include any networked device.

Panel "C" is the critical or sensitive load panel. Examples of the connected equipment would include anything that meets the definition of critical or sensitive and most often would include items from the below list.

Computers	Copy Machines	Security Alarm
Laser Printers	Ink Jet Printers	Video Security System
Fire Alarm	Fax Machines	Telephone System

The goal is to keep any sensitive or critical load or device power source as far away from any surge event or power anomalies as possible in the design of the electrical system. This will allow the surge protection devices to do their job and protect the connected equipment from damage. The more robust equipment is closer to the entrance point of the surge and the least robust is as far away as possible. There are deviations and modifications to any electrical system to meet site, building conditions and equipment requirements but the basic concept remains the same.

Questions, suggestions and input will always be welcome. If you have any recommendations please let us hear from you, we would welcome your suggestions and input.