

Article

Food and beverage - Power protection solutions for the food and beverage industry

The way we process and package our food has undergone a revolution with high levels of automation, monitoring and information systems. This has been driven by not only productivity improvement but also by a host of food safety requirements. The control room in a modern food processing plant can often resemble a small version of a NASA launch center. Many of these modern factories are also located in developing countries where the electricity infrastructure presents challenges in terms of power quality.

With these changes a high quality of electrical power becomes business critical which means food and beverage companies must carefully consider their approach to power protection. For example a haphazard approach of placing small UPSs on all digital equipment is not the way to go as many who have tried this approach can attest. The maintenance cost of regularly checking and replacing small batteries often installed in far from ideal environments can be prohibitively high and if maintenance isn't carried out the system reliability can be worse than having no protection. This is where good policy and practice documents become important.

As in any field good information is key to good decision making. What is the quality of the electrical supply to your plant – do you know? Digital metering is now available that will monitor and record electrical events. Comparing this information with plant performance provides very useful information. For example you may notice the lights dip at the same time as your Ultra High Temperature (UHT) plant trips off line. Often we hear plant staff referring to a voltage surge but usually the event is not a surge at all but a sag. With good metering you can see exactly what has happened to the utility power supply and often there are clues as to why. For example one of the most common faults of this type we see are single phase voltage sags caused by lightning, trees hitting lines and other common place distribution grid faults. Knowledge of the depth of these problems and their duration will also provide good information on the most appropriate power protection solution.

Knowledge of the quality of the electrical supply quality is even more important when constructing a green fields processing plant. Information on the supply quality may be available from the electricity utility, possibly even from other businesses already operating in the area. This can be critical information, especially in developing countries where the quality of supply can be poor. In most developed countries voltage regulation is not an issue but in developing countries the supply voltage can vary greatly and the level of voltage imbalance can be high. This is very problematic for industrial

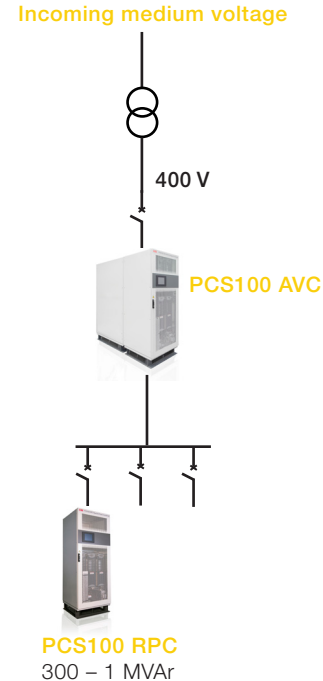


Figure one: A typical incoming power protection installation conditioning the incoming utility voltage and the factory power factor and harmonic draw

loads including direct on line connected motors and variable speed motor drives. For direct connected motors the high voltage can cause damage and saturation, low voltage substantial torque reduction and the imbalance, damaging negative sequence current flow. AC variable speed drives are also badly impacted by imbalance as the input current will be much higher through the rectifier on the higher voltage phases than the phases that are low.

Voltage regulation shown in figure one may be required to stabilize and regulate the incoming supply. Traditionally servo variac regulators have been commonly applied but now electronic voltage conditioners are available with higher efficiency and much faster performance such as the PCS100 Active Voltage Conditioner.

Most modern food and beverage plants will have a computer room or small data center along with the electrical control room. Here a centralized UPS solution is a sensible approach. Modern modular UPS solutions allow scaling of the power protection to match with load growth minimizing the initial upfront investment. They also provide greater system availability as modules can be swapped out in the event of a problem rather than having to be changed on site. Figure two shows a typical centralized power protection configuration.

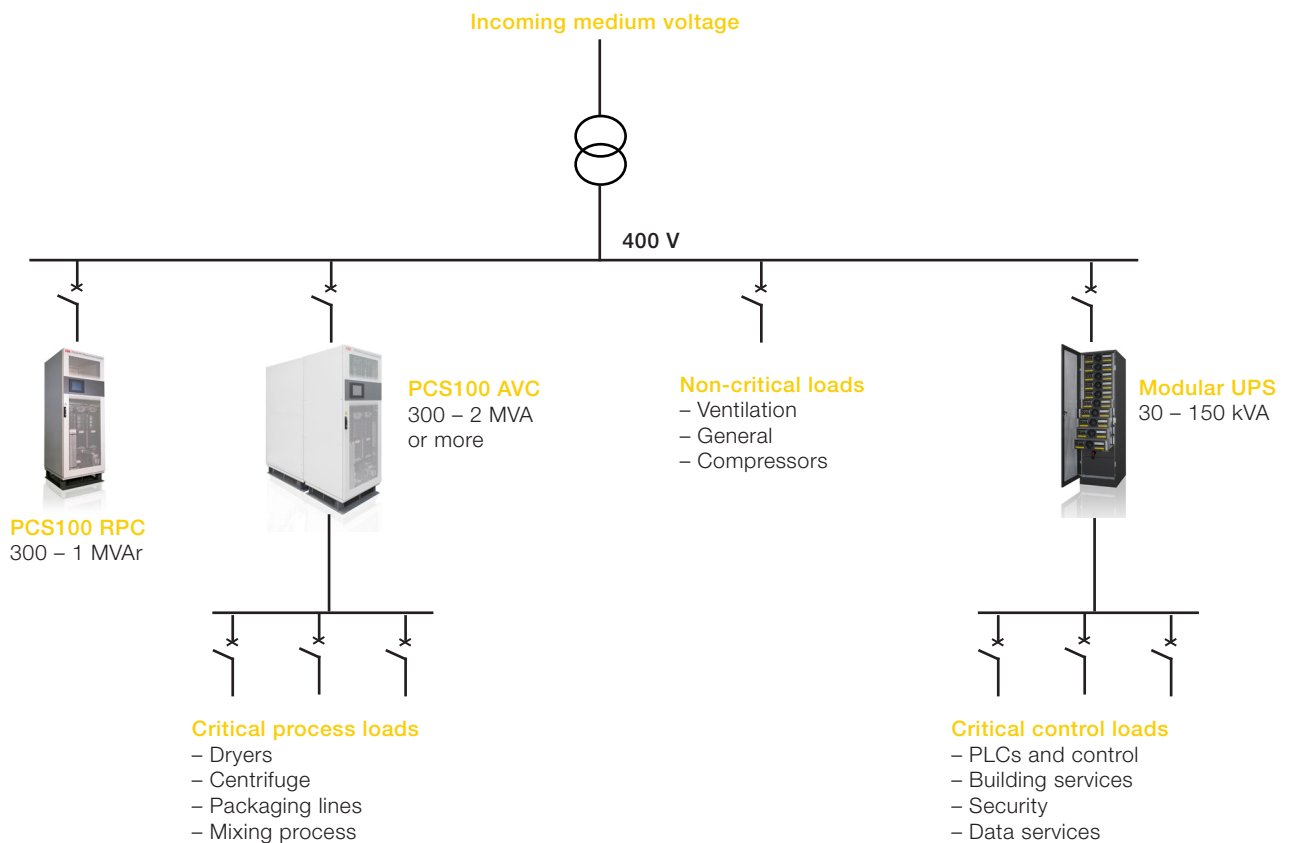


Figure two: A typical separated centralized power protection configuration for a food and beverage facility

The main factory loads also have a mix of connected equipment with greatly varying power protection requirements. The author suggests that these are categorized into the following classes of loads and protected as shown in figure two.

- Critical Loads** – Centralized UPS protection
- Sensitive Process Loads** – Active Voltage Conditioning protection or even industrial UPS if outages are present
- Non-critical** – Loads that can trip or fail and then restart without impacting on plant performance do not need protection and can be separated

Another consideration for many plants are regulations and limitations being imposed by utilities on the quality of the electrical power consumed by the plant. The primary focus is commonly power factor and harmonic levels which often have maximum allowable limits. Historically simple capacitor switched power factor correction has been sufficient. Now with large numbers of six pulse variable speed drives installed in many of these plants high levels of current harmonic draw can cause problems for poorly designed capacitor correction. New products are now available such as the PCS100 Reactive Power Conditioner that can correct both fundamental frequency reactive power along with 5th and 7th harmonics electronically. This can complement well designed harmonically blocked capacitor correction and wider band width active harmonic filtering.

With good information on the quality of the external electrical supply, good planning and use of leading edge power protection equipment modern food and beverage facilities, full of sensitive electronics, can operate safely and reliably.

Watch an application video on YouTube (3.43 minutes):
https://www.youtube.com/watch?v=sU9uMLX9plw&list=PL-Q2v2azALUPKFQqIbhFgabb_6df26fqU&index=40

Download ABB's food and beverage brochure for power protection solutions:
[http://www05.abb.com/global/scot/scot232.nsf/veritydisplay/f78a040f785bd3bdc1257d9b006adfe6/\\$file/2UCD301133-P_a%20Power%20protection%20food%20and%20beverage%20brochure.pdf](http://www05.abb.com/global/scot/scot232.nsf/veritydisplay/f78a040f785bd3bdc1257d9b006adfe6/$file/2UCD301133-P_a%20Power%20protection%20food%20and%20beverage%20brochure.pdf)

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