Smart industry

Smart Industry Forum
What role does power play in the IIoT?

Submitted by Dianne Denison on 12/04/2017

Most manufacturing executives agree that 2018 will bring forward quantum leaps in efficiencies as the IIoT base cases are better defined, economically justified, and delivered through collaborative teams. Admittedly, the IIoT is as transformative to manufacturing as was the Industrial Revolution itself. And, proving in the “base case” opens opportunities to deploy technical and business solutions.

Solutions with accompanying economically-justified “base cases” will take the lead. One such base case is in the area of improving one of the most costly and critical raw material inputs in production–energy–and even more specifically, high quality power. Given the rapid deployment of equipment that is more sensitive to voltage disturbances, poor power quality will continue to plague ongoing operations and efficiencies. Simply put, power quality is important. [See graphic]

According to Rockwell Automation, more than 70% of production-line failures are due to poor power quality. For a manufacturer, production-line failures can cost millions in lost revenue and added costs. Clearly, a deeper understanding of the causes, symptoms, impact to production, and the actions needed to be taken to proactively monitor, measure and address ongoing power-quality issues is a priority. Certainly, a focus on power quality will prove to be one of the most important “base cases” as we deliver the IIoT.

So, if we can correct poor power causing production-line shut downs (in the extreme), then the economic impact of this “base case” will clearly be justified.

Historically, power producers (ex: electric utilities) have designed power systems to provide power to all, regulated by some form of a Public Utilities Commission (PUC). Much like the Ma Bell, the power company’s mission was to provide a universal service power to “all.” As early as 1968, the U.S. Navy specified power quality requirements and specifications. Later, much work was done by the Scandinavians and others to raise awareness and improvements in voltage quality. But, even today, the topic of power quality creates differing levels of understanding and interpretation.

No longer can energy producers see manufacturing as the “load” on the system–or a one-way ticket–as manufacturing consumers also drive “dirty power” back to the utility, with impact not only to the grid, but to their consuming neighbors on the grid. All parties would agree that we want *Perfect Power Quality Nirvana*–where power is always available, within voltage and frequency tolerances and has a pure noise-free sinusoidal wave shape.

Poor power-quality symptoms include variations in current and voltage, harmonics, resonance and other abnormalities. Linear loads don’t create distortions in the sinusoidal wave shape–non-linear loads often are the culprit. Machines (such as variable frequency drives, by example) that produce non-linear loads are one of the largest causes of harmonics.

When concerned with harmonics, some of the larger areas to focus on might include service transformers loaded near their peak rating or the use of power-factor correction capacitors, when voltage distortion readings exceed 8%, or when over 20% of the total load is non-linear.

Manufacturing floors today use an increasingly larger percentage of variable frequency drives (VFDs), due to regulatory and energy-efficiency benefits. There is an increasingly larger percentage of VFDs on specific lines. Some industry experts estimate that more than 40% of motors sold today are designed for VFD use, and the number is increasing rapidly.

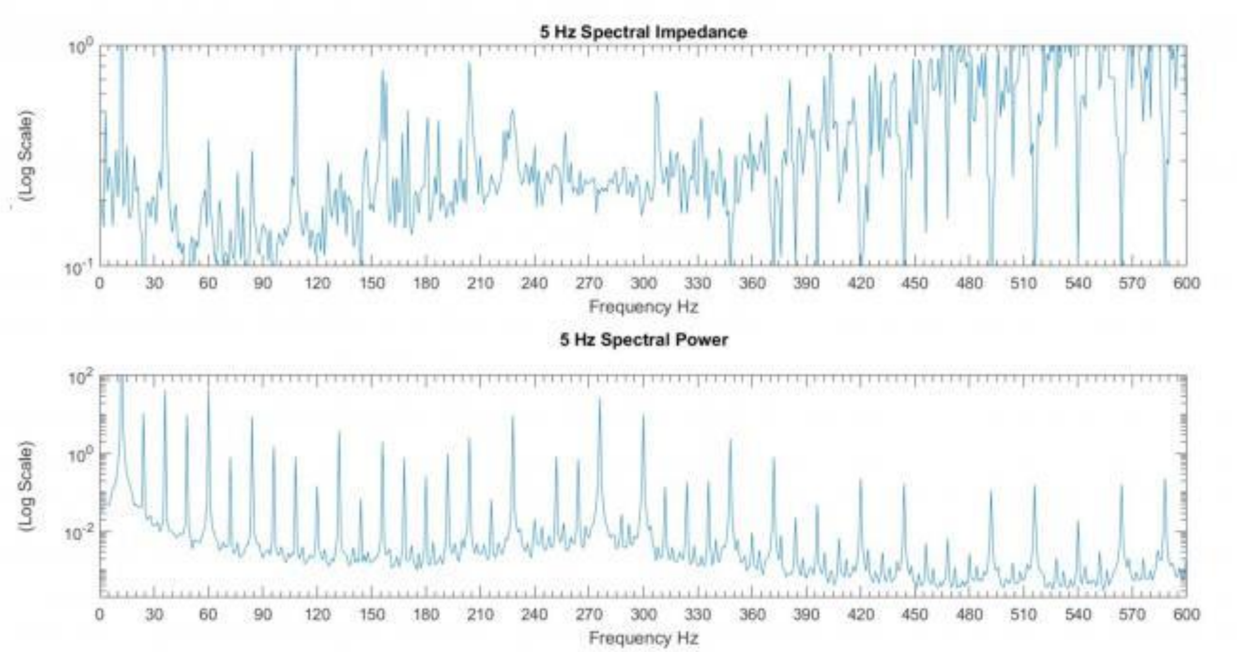
A large number of VFDs used together can sometimes (very quickly) turn from chorus to cacophony–as identified by higher voltage/current imbalances, higher harmonics, and increased resonance between devices. Operations personnel might see a loss of power, increased heat, or in the extreme, production failures. Company product managers will complain that products aren’t available to meet customer demand, and corporate executives will be impacted by lower profitability, to name a few. Company personnel can also turn from chorus to cacophony.

When the production line fails, it's “Houston, we have a problem." These situations typically require remedial “patching” at the sub-panel, which addresses the immediate tactical need at hand.

To address any given problem, we must first identify and measure the root cause(s) of the problem. This means measuring, monitoring, analyzing and interpreting real-time data along the bus/ production line structure. Placement of monitoring and metering equipment appropriately along the line and bus structure to collect real-time data is critical. Data analytics platforms are certainly necessary to collect the relevant real-time data for analysis and interpretation. Experienced operations and data-analysis experts are needed to interpret the data, and convert the data into actionable insights.

Finally, the data needs to be presented in a format recognizable to the user, who can then make decisions with these insights. So, the process is multi-phased. Measured and observed data should be compared against standards, best practices, historical data, and the ongoing process and strategic direction for the company.

Typical observations might include the likely set of data including voltage / current imbalance, harmonics, resonance, and perhaps even more granular insights in the area of resonance between VFDs. A recently conducted study outlines measured data taken from a production line when drives were failing without known cause or warning [see graphic]. Interesting to this study, a large number of even harmonics were apparent, driven by resonance created between drives. In this case, remedial recommendations might involve movement of existing electronics on the line, or implementation of mitigation strategies such as installation of passive harmonic filters (capacitors, inductors, resistors) to remove unwanted distortion and loss of power quality, to name a few.



Power-quality issues are here to stay, and will only increase in importance and attention. The manufacturing environment is dynamic, fast-paced and exciting–all reasons why we all are so committed to the success of our industry. Processes and business models change, along with the increasing use of new technologies that create opportunity and tax our power quality. Human errors can impact power quality, and if all else fails we can always blame those pesky squirrels on the power lines as the true cause of power disturbances.

One thing is certain–there is no “one size fits all” solution. We must therefore apply logic, reason, experience, knowledge, process and best practices. Thanks again for all of those science teachers who thought we weren’t always listening in class! We must strive for *Perfect Power Quality Nirvana* by reaching some optimal mix, and apply repeated attention and process to ensure power-quality metrics are achieved, production is most efficient, and profitability hurdles met.

A best-practice approach might suggest a site or, better yet, an enterprise-wide protection and mitigation strategy toward power quality. Edward Deming argued correctly that a focus on quality results in decreased cost, improved efficiency and increased revenue. Manufacturing must continue to direct attention toward power-quality issues. The power-quality recipe should include defined process from assessment through recommendation, passion, practice and continuous improvement. Repeat. Then repeat again.

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Link to article

https://www.smartindustry.com/blog/smart-industry-connect/what-role-does-power-play-in-the-iiot/