

# NORMALIZING NETWORK CONNECTION DIAGRAMS

## HOW INNOVATIVE CHANGES MADE LOCALLY HELPED SIMPLIFY AND IMPROVE IIC DRAWINGS GLOBALLY

### Have Some Standards

A few years ago, our Industrial Information and Control (IIC) group kicked off a project for a Federal client to install a SCADA system in a mission-critical site. Historically, engineering packages required for this sort of installation were created in programs designed for IT applications. Finished drawings looked like block flow diagrams or organization charts and were riddled with problems:

- Cumbersome to design, the drawings tended to be cluttered with shapes, but lacked detailed information that was required to fully understand, assemble, and configure network equipment.
- Without a standard format to follow, each package varied by designer. We had to acclimate to a drawing (i.e. get inside a designer's head) to understand how the network was depicted. As a result, analysis paralysis was a common issue when starting a project.
- Field commissioning personnel often did not know exactly how they were supposed to configure

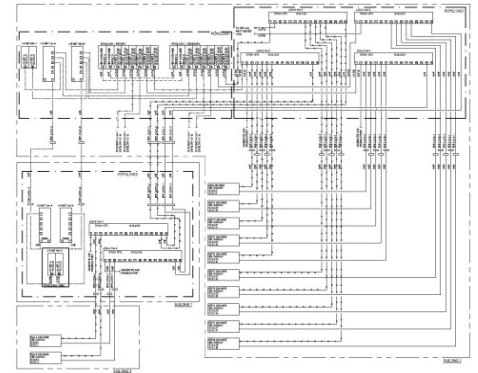
a network or its components from a drawing; many decisions were made on site. Therefore, engineers couldn't test the system before it was built because they could not anticipate how the field personnel would configure the network.

With an opportunity to build a network the way we wanted to, POWER set out to normalize network connection diagrams. Ultimately, we wanted to standardize IIC packages and offer a more technically descriptive solution than the block flow diagrams typically seen in the industry.

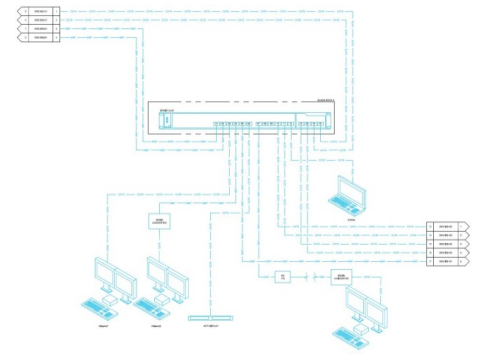
### A Switch per Sheet

Generally speaking, a proper network document is not unlike a piping and instrumentation diagram (P&ID) and, if accurate, the network equipment could be programmed directly from the document; akin to how a PLC can be programmed from a good P&ID.

Using that method, we moved away from depicting an entire network on one sheet and instead broke the network down into multiple drawings – essentially illustrating one switch per sheet. This change gave us more space on a drawing to illustrate port connections, communication protocols, VLAN associations, security requirements, media types, and accessories and components; all of which were missing from the conventional block flow diagrams. Standardizing the format of a network diagram in this way opened a floodgate of additional benefits:



*An example of an entire network depicted in one drawing...*



*...versus our drawing of a single switch. Our approach is clear, concise, and contains more information for precise installation.*

- We established a process for creating drawings, instead of starting anew for each project.
- With a repeatable format in place, our team can avoid analysis paralysis. We can look at a drawing and quickly orient ourselves to any network, versus getting inside an individual's head to decode how they designed the network.
- The standards are teachable, so our team no longer experiences the workflow bottleneck that previously occurred. Once a team member has learned the



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format, he or she can assist with network drawings and we can all work on different parts of the package simultaneously.

- Standardized network drawings allow our team to perform a thorough QA/QC on the IIC package, identifying issues in the network before it goes live.
- Creating standards helps support trouble shooting and maintenance for the site installers. From our drawings, they have all the information they need to configure switches and program ports the way our engineers intended: no more surprises out in the field.
- The new method is scalable. By assigning each network component its own paper space, we eliminated the problem of the network incrementally “outgrowing” a single sheet.
- Breaking the design up into multiple documents provides a major cybersecurity advantage in that the information is distributed over many drawings, as opposed to one sheet indicating the topology of the entire network.

end client was the ultimate compliment. Our standards make life easier for our team and for our clients – doing good work speaks for itself.

### **Speaks for Itself**

Recently, POWER received an RFP from a prime contractor for a project in a Federal facility where we had not previously worked. The government client gave the contractor drawings from another facility - half the world away - and requested that drawings for their project follow those same standards. You can imagine our surprise when they handed us our own drawings to be used as the basis of design! We knew why we liked our system, but being recognized as a success by the