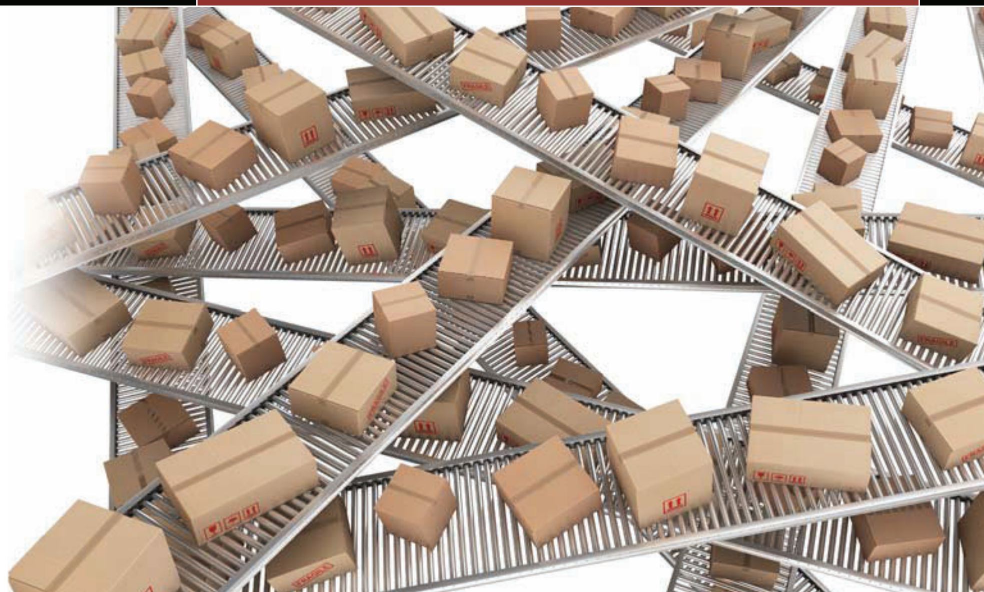

CRACKING THE CODE

See how a global consumer goods manufacturer improved productivity and plant efficiency by rewriting and standardizing the entire plant code.

By Michael Shell, PE Project Lead, and David Imes, Senior Engineer, Polytron

>> With aging equipment worth tens of millions of dollars running nonstop, a global consumer goods manufacturer based in the Midwest was faced with the decision to standardize a complex conveying system that carried finished product to palletizers. Over the years, different integrators and plant personnel had programmed and reprogrammed the system's logic. Now, nothing was standard.

As a result, productivity was suffering, and troubleshooting the system required excessive downtime. Even hardware problems were difficult to find and correct because they were hidden by code issues. Standardization could make everything run smoother, but it could be costly and include risks of its own.

Time for a Full Code Rewrite

Rockwell Automation Solution Partner, Polytron, a system integrator, was called in to review the system. Even though riddled with potential risks, it was evident a full plant code rewrite was needed. Effectively, the logic for the system would have to be rewritten totally, and all naming conventions would have to be redone.

The system includes:

- More than 20 outputs from packaging going to seven palletizers.
- Six Allen-Bradley® ControlLogix® programmable automation controllers (PACs) from Rockwell Automation.
- About 400 motors, all controlled by Allen-Bradley ArmorStart® and Allen-Bradley Bulletin 160™ variable-frequency drives (VFDs).
- 12 barcode-scan points.
- Numerous merges, switches, diverts and more along miles of conveyors.

The consumer goods manufacturer decided the benefits of standardization far outweighed the risks and costs of the project. These benefits include:

- **Major Downtime Reduction.** The plant was experiencing excessive downtime because problems with the conveying systems were backing up and stopping production.
- **Major Reduction in Partial Loads.** Productivity was suffering because the system was creating partials — splitting a full pallet-sized slug of product into smaller slugs — or when extra product had to be pulled manually.
- **Faster, More Accurate Troubleshooting.** Lack of standardization made it difficult to pinpoint the cause of productivity problems.
- **Easier Optimization and Scalability.** With standardized code, it would be quick to implement new hardware.
- **Better Identification of Hardware Issues and Limitations.** A code rewrite would make it easier to identify which equipment is impacting performance.

Seven Steps to Better Efficiency

A full code rewrite is a major undertaking, but if handled correctly, the disruption to production is surprisingly minimal, and the return on investment (ROI) can be enormous. To duplicate preexisting logic in a standardized format, the Polytron team followed a seven-step process that led to a robust new solution for a nearly vertical start-up.

1. Identify the standard. First, the team customized Polytron's code standard to meet the client's specific needs, and generated a functional specification document outlining the programming structure, nomenclature, tags and standard routines shifting from ControlNet™ to an EtherNet/IP™-based architecture for PAC communication.

The team then created sample code and routines using Rockwell Automation FactoryTalk® software and development tools available in CPR 9.0. Polytron built a library of generic routines that could be configured and applied to every equipment type whether it be belt, roller or accumulation conveyor, or a divert or switch.

2. Develop a logic narrative for the system. The existing code was reverse-engineered and listed as a logic narrative describing how each piece of equipment and conveyor would work together.

Polytron then created Add-On Instructions (AOI) using standard User Defined Tags (UDT) to control the ArmorStart and Allen-Bradley Bulletin 160™ VFDs effectively and consistently, which were all controlled via DeviceNet™. *See page 45 for more information about AOIs.*

The AOIs and UDTs included the Hand-Off-Auto logic (HOA), auto logic (Run command), fault handling, alarming and human-machine interface (HMI) status messaging. Using Rockwell Software® RSNetworx™ from Rockwell Automation, the team determined how the six PACs would interact with other equipment, naming conventions and data transfers.

Once everything was clearly laid out and approved by the client, the team began working on the new code.

3. Develop the code. Using the agreed-upon standard and sample routines, the system integrator developed the code in an entirely new program file. The code itself would be object-based using the AOIs, ensuring strict adherence to the standard.

Developing the code was a two-step process. First, repetitive logic was developed using Polytron's code generator tool that ensures no mistakes are made during data input and editing. Next, Polytron engineers wrote the more intricate, custom portions of the code as detailed in the logic narrative.

4. Create the emulation model. A PolySim℠ emulation model was developed, enabling the team to test the manufacturer's new control system in real time, applying real factory situations. The PolySim system included connecting the model to all six PACs and nearly a dozen FactoryTalk View SE HMIs.

This enabled Polytron to test more variables and receive more data faster than running the system in the field. And a major benefit is that it's done without affecting real production. By reducing efforts needed on-site, the system integrator nearly eliminated program-related risks during start-up and created major savings for the client.

5. Conduct an in-house Factory Acceptance Test (FAT). At this stage, Polytron presented and ran a demo of the system to the manufacturer. The system was pushed to the limits in attempt to "break the system," so that the team and client would be confident that the new code could manage their product properly.

6. Conduct field installation and testing. Next, the logic was downloaded and put through a rigorous validation process. The same scenarios validated using the PolySim model were validated in the field.

In the first week, the team saw significant improvement in system performance — both in reduction of partial, incomplete loads and downtime. The majority of problems that showed up were equipment- and hardware-related issues that had, until then, been masked by the old code.

Because the team used the emulation model to conduct the FAT, a nearly vertical start-up was achieved, with no need for weeks of late nights and weekends trying to get the system up and running properly. In fact, the manufacturer

The logic was rigorously validated.

>> Solution Partner Program

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estimates that the emulation-based FAT cut onsite validation time by 50%.

7. Perform formal training and documentation. Because success depends on the ability of plant personnel to support the system, Polytron conducted detailed, code-specific training. Putting performance in the hands of the manufacturer's workforce allows the plant to maximize the new code on a day-to-day basis to achieve business goals and objectives.

Standardization Pays Off

After the code rewrite, downtime has been cut in half and partials associated with one section conveyor — once as high as 23% — reduced to 15% and continues to fall. The manufacturer's goal is to reduce partials to less than 10%.

Standardization helped to eliminate excessive downtime associated with problems in the system. Now, programmers and technicians can use the new code to identify the cause of productivity problems (factors such as equipment issues or product handling issues).

Also, the manufacturer has recognized a notable decrease in disruption to warehouse workforce.

In addition, the new code has made it easier for revamped packaging lines and warehouse conveyors to support the new systems.

While conducting the code rewrite, Polytron completed a full system audit for the manufacturer. As a result, the standardized code makes it easier to spot equipment issues, make corrections and bring the hardware back to centerline. □

Rockwell Automation Solution Partner Polytron, Inc., a systems integrator based in Duluth, Ga., provides manufacturing intelligence, process engineering and training services for manufacturing systems in the food and beverage, pharmaceutical, consumer products and water wastewater industries.

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