

Powerful PLCs Increase Production

Satisfaction Guaranteed, From IT to Maintenance

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These days, powerful PLC-based control systems can handle most continuous, batch, motion, or discrete applications. Fast PLCs are available with large amounts of RAM (2-6 MB). They can process large amounts of information in real time. These modern PLC capabilities can be leveraged to achieve higher production and better order processing and inventory management in a batch blending system. The technology that replaced the original synthetic stucco batch process control system leveraged the existing PLC 5 investment by retaining the PLC 5 chassis and I/O. Key to the preservation: swapping the 5/25 processor card with a remote I/O card.

The batch blending system combines solid materials from silos with liquid ingredients pumped from totes in a mixer system. The process has some complexity, and various weighing and transport systems are involved, but mixing solids and liquids is the essence of it. The products this batch process produces are building materials (e.g., synthetic stuccos) that are sold in large pails.

A customer's order for a certain number of pails of a product causes an algorithm to use the formula for a specific product to create a set of steps referred to as a "batch." Any given step of the batch is either an addition of material, an automatic control action (e.g., turning on the auger), or a prompt for the operator to take an action and acknowledge the step.

Out With the Old

The batch system being replaced was controlled with an Allen Bradley PLC 5/25. Because it had only about 25kB of memory, the batch steps would not all fit in the PLC. Instead, the batch was created on a PC and constant handshaking had to take place to notify the PC to send the next step of the batch to the PLC.

Only one batch could be processed at a time. This was a fundamental design characteristic of the programming, not just a memory limitation. This meant a batch has to finish completely before another one could start – a very inefficient way to utilize the equipment. Worse, there are three mixers, so only one mixer could be used at a time.

The primary goal of the project was to create a software system with six batch routines - two per mixer – that would enable all three mixers to be active simultaneously and let a second batch be active for a given mixer before the first was completely finished. This design would increase throughput by 25%.

As presented in Control For the Process Industries, April 2005, Vol. XVIII, No. 04.
Published monthly by Putman Media Company.

Another important project goal was to provide a means to automate and integrate order processing, data logging, inventory management and any other IT function that might be added later. Some of these functions were handled by the new system; others were made possible by the “hooks” available in the new system to tie it to other computer systems.

And in With the New

The control system consists of an Allen-Bradley ControlLogix PLC, a computer (PC), and three PanelView terminals. The original PLC 5 rack and I/O were retained, but the PLC 5/25 processor card was removed and replaced with a remote I/O card. This was important because a large portion of the original hardware and installation investment was preserved. The new PLC has about 2 MB of RAM, is extremely fast, has Ethernet connectivity, and can be programmed in structured text as well as ladder logic. Ladder is a time-tested workhorse that provides a great troubleshooting interface.

Programming with Visual Basics

A new PC running Windows XP was loaded with Rockwell Software’s RSView application development software. The traditional purpose of this software is to allow an engineer to develop operator interface screens but there is much more that can be done with it.

The system created with RSView is usually called a human machine interface (HMI) since operator screens are an important part of its functionality. A significant thing about RSView is that it comes with Visual Basic for Applications (VBA). A knowledgeable programmer can create algorithms for virtually on purpose and create rock-solid integration to other systems. For example, Kredit used VBA inside the HMI program to access the file system of the PC and read, modify and write files and folders on the PC hard drive. The object model of the HMI is available to the VBA code, including the tags, screens, alarm objects, trend objects, etc. Many of the HMI tags connect directly to the PLC tags, which means tight, fast access to the VBA code. PLC is also available to the VBA code.

This is emphasized because it is quite different than creating custom programs in regular Visual Basic or C++ or a database package such as SQL Server. Those types of applications have issues that simply don’t come up when using VBA inside the HMI. Issues pertaining to drivers, DLL files, operating system compatibility, etc., don’t have to be dealt with. A new computer can be configured in minutes and, more importantly, a new computer can be configured with a minimum of or skills. Before this project, when the PC contained a custom program the worked with a database system, the plant’s operators were not sure the PC could be duplicated. In other words if the PC died, they were not sure they could restore the control system.

We were asked to create a control system that could accept a batch from any computer system running any operating system. The plant's current enterprise computer is an IBM AS-400 mainframe, but the design requirement was that the mainframe could be replaced with any other computer without requiring much of any reconfiguration of the batch control system. While that sounds daunting, the sheer generality of it suggested a simple method – simple if you leveraged the VBA in RSView.

The batch system we created was designed to use simple ASCII text files as input. Batches can be created locally by filling out a form in the RSView run-time application, or they can be made using Notepad or any other text editor. The resultant one-line batch spec is placed in a text file in a specific folder. Independent of this process, an event-driven VBA routine checks the folder every few seconds and if it finds a file, it processes it. The beauty of this modular, decoupled approach is that it doesn't matter how a batch file gets placed in that folder – if it arrives there, a batch will be initiated. As a result, any computer with an operating system that can write a text file can initiate a batch if it has access to the right folder over the network.

For a while, batches were located locally. But the day came when the corporate computer would create them remotely. Corporate IT personnel were expecting a typically challenging project to tie their IBM system to a Microsoft system. They were pleasantly surprised to discover that they simply had to drop a text file into a folder. No changes whatsoever were required to be made to the batch system to allow to accept and process batches from the corporate IBM mainframe. The IBM programmers had no trouble programming their system because creating a text file is so easy.

The original control system requires a proprietary program and a complex database application that was hard to set up change or maintain. In fact, it was not known if all the software needed could be obtained and configured on a new PC. With the new system, installing RSView and copying the application folder is all that is needed. Truly valuable was the fact that the entire third tier of very complex and poorly understood software was eliminated.

Throughput Increased 25%

The new control system leveraged the existing PLC 5 investment by retaining the PLC 5 chassis and the I/O, as well as associated wiring. The new ControlLogix processor easily fit into the existing panel. From a wiring and installation standpoint, the retrofit was painless. The new PC was loaded with RSView and connected to the PLC via the Ethernet. The VBA code responsible for so much processing lives inside the Rockwell Software RSView application. No additional software, drivers, or anything else is needed. VBA in RSView is a standard feature and does not require any additional software to function correctly.

The application folder was simply moved from the developing engineer's computer to the customer's production computer and it was ready to go.

The new batch control system increased throughput by 25%. The highly modular software system that was installed is totally amenable to change and has allowed modifications and improvements to be made on an ongoing basis and continually optimize and improve operations. Order processing and inventory management functions were also automated and integrated with the control system. At the end of the day, everyone, for corporate IT to the local maintenance department considered the project a great success.

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