SIMULATION SUITS SYSTEMS INTEGRATOR

Testing PLC Control Software Before Installation Minimizes Shutdown Costs and Raises Confidence for Day & Zimmerman. **By Marty Weil**

Day & Zimmermann International Inc. (DZII), Greenville, S.C., is one of the Southeast's leading process and industrial engineering firms. With a substantive percentage of its client base in the chemical and consumer products industries, DZII is often faced with major projects that must be implemented over very short time frames—the brief, scheduled shutdowns of their customers' production facilities (Figure 1).

"Primarily in the consumer goods industry," says Dave Johnson, systems engineer for DZII, "we do a lot of work over very short shutdowns. This means we only have a couple of days to check the software in the field before the facilities have to run again. We need to prove that our PLC control software will work before taking it into the field."

To successfully address such situations, DZII uses an I/O simulator to test PLC-based control systems and train the operators who run those systems. The simulator can be used to create a dynamic model on a PC that duplicates the behavior of the process to be implemented and provides the PLC with feedback (Figure 2). To the PLC, there is no difference between controlling the model and the actual process.

DZII has been using PICS simulation software from SST, Waterloo, Ontario, for more than five years. "The largest project," Johnson says, "was a controls upgrade for an entire line at a consumer goods facility. We had to tear out all the old hardwired control panels—the lights and switches—and replace them with PLC/MMI controls. PICS let us develop the software, test it, and have it installed with the new systems in a matter of days."

Simulation Expectations

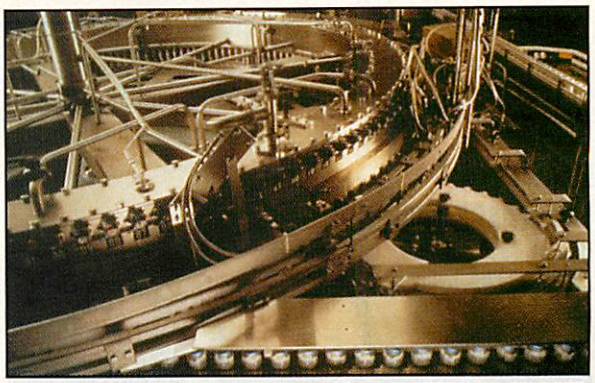
As programmable controller programs have become more complex—and are used in more mission-critical applications—simulation has become a necessary tool in the development, validation, and installation process.

Johnson says it's also easy to do. "It is quick to program, allows us to implement our database intact with a minimal amount of logic, and get up and running with simulation fast."

A good simulation package provides a working example of the control system and specification before it is installed. It can also act as a highly effective communications tool between the system integrator and the end user—it can highlight areas not sufficiently defined in the original specification, provide instant feedback on the performance of the system, and give the user assurance that the final system meets expectations.

FIGURE 1.

HOLDING THE LINE



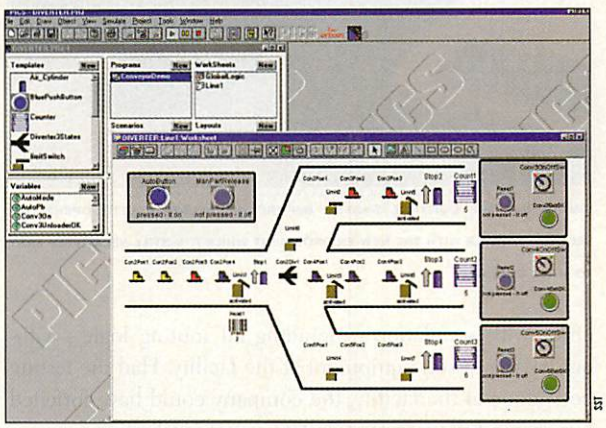
SIMULATION HELPS GREENVILLE, S.C.-BASED DAY & ZIMMERMANN'S CONSUMER-PRODUCTS CLIENTS GET THEIR PROJECTS IMPLEMENTED DURING BRIEF, SCHEDULED PLANT SHUTDOWNS.

It can also drive down costs. "The other tools that we were using before PICS," says Johnson, "required that we change our program—which is not very desirable and would take over twice as long."

According to Johnson, the time saved in start-up is the key. "We would not be able to do these quick start-ups unless we have thorough simulation beforehand," Johnson notes. He says debugging with simulation "has saved our

FIGURE 2.

SIMULATED CONVEYOR



A DYNAMIC MODEL ON A PC GIVES THE CONTROL SYSTEM THE SAME FEEDBACK AS THE ACTUAL PROCESS.

clients a considerable amount of money."

For example, Johnson cites an instance where DZII had 200 motors in a materials-handling application where the material itself could go in any of nearly 300 routes. The numbers of combinations made field-test virtually impossible, but DZII was able to test everything very quickly in the office with simulation—including all routing logic—without having to run equipment at the facility. Had the testing been done at the facility, the company could have forfeited hundreds of thousands of dollars in lost production.

"We can afford to bid a little lower than our competition, which enhances our competitive position."

FIGURE 3.

FAST-TRACK TRAINING

SIMULATING THE CONTROL SYSTEM BEFORE INSTALLATION LETS OPERATORS BECOME FAMILIAR WITH THE NEW ENVIRONMENT WHILE IT'S STILL RELATIVELY EASY TO MAKE CHANGES.

Beyond Development

At DZII, simulation is proving itself not only as a development tool, but as a real benefit in the approval process and as a training facilitator.

For engineering/consulting firms and system integrators, a key aspect of simulation is that it provides a means to measure and verify earned value for a software project. The client can come into the simulation lab, operate and review the system—essentially perform an acceptance test.

It's a great approval tool for the client, according to Johnson. "The client can see exactly what he's getting before it goes out in the field."

DZII customers run their prospective systems—and experiment with them—before they are installed. "That's where the customer makes most changes," notes Johnson. "They change their minds once they've 'driven the car,' and we can quickly make adjustments to ensure they get exactly what they want."

When an acceptance test is completed, the solution providers have a formal sign-off by the client—something that otherwise might not happen until the end of a project. With formal acceptance, consultants and integrators have the means to seek, justify, and obtain the additional resources needed to play out the "what-if" scenarios many clients use as they refine their projects over time. This procedure is a much better method of measuring earned value than the arcane methods long used in the construction-oriented disciplines.

Simulation makes a great training tool as well, Johnson says. "Before we take a system to the field, we or the client will train operators in the simulation lab. The operators run the system beforehand, and when the facilities go online after a shutdown, they're able to hit the ground running." (Figure 3.)

Simulation reduces learning curves and increases productivity in such instances, and it's providing these benefits at lower costs. Johnson cites the example of a project done without a simulation package at a major consumer goods supplier. It took approximately 200 man-hours to develop a makeshift simulation for operator training, and two people were required throughout the training to simulate the process.

If a simulation software package had been used, "only one person would have been needed to run the training process, and man-hours could have been cut in half," says Johnson. "The savings would have been 50% in every area where training was developed and applied."

Enhancing Competitive Strength

Simulation helps systems integrators minimize start-up time. "We can afford to bid a little lower than our competition, which enhances our competitive position," says Johnson, "and if we integrate simulation into development, we can debug as we go, saving time and money."

Typically, near the end of the design phase, DZII takes its PLC database and imports it into the simulator. Then it writes a piece of logic for, say, a motor. That is copied as many times as necessary to simulate all the virtual motors. Then DZII runs its PLC programming and, with higher-level logic, debugs the code, sees all the interlocking, checks all routines, plans for error handling, and builds in fault tolerance using the real-world model.

DZII has done more than 30 projects using simulation software in the last five years. "I would say we get a 200% payback on the time we put into it," says Johnson, "not to mention that the clients are able to have short shutdowns. Saving them a few hours in productivity more than pays for the application."

From a developer's point of view, simulation reduces risks and liabilities both at start-up and over the life of the system. It affords shorter testing times with more comprehensive data before installation, and it acts to prevent delays due to last-minute rewrites or specification changes. Ultimately, simulation empowers developers to deliver higher-quality software with greater up-front validation and improves communications between the developer and the client. It also speeds and simplifies training while reducing costs.

From a client's point of view, simulation reduces risks to equipment, personnel, and production while adding value to the deliverable. It allows for comprehensive off-line training, improving productivity and throughput. By promoting an early exchange of ideas between the user and the developer, it increases the likelihood that the user will define their system—and receive it—efficiently.

By dramatically reducing startup time and overall project length, and by allowing testing and training before, during, and after hardware installation, simulation can more than pay for itself from the client perspective. Importantly as well, it supports continuous improvement by allowing for off-line development and testing without impacting the online system.

"The benefits," Johnson concludes, "for consultants, engineers, integrators, and their end-users, are most definitely real—not simulated."

Marty Weil is an Arlington Heights, Ill.-based professional writer specializing in articles on software for industrial applications.

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