

CASE STUDIES

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Integrate Safety, Improve Productivity Metal-Stamping Machine Builder Uses an Integrated Control Architecture to Punch Up Performance

by Joe Feeley, editor in chief Control Design Magazine

Safety can play a big role in improving machine uptime and productivity. Safe, well-protected operators are better able to keep their machines running, and a well-integrated safety system actually can enhance the machine's productivity potential while protecting it from possible damage.

Some companies, builders and users alike, still regard machine safety as an afterthought to be minimally dealt with as a separate, unwanted cost item. Quigg International (www.quiggintl.com) doesn't appear to be one of those companies.

When automotive or aerospace companies talk to Quigg International about an automated metal-stamping system, the company is eager to show how its innovative machine design and advanced technology can deliver a return on investment that it's convinced will pay for the upfront costs.

The system integrator, located in Tecumseh, Ontario, specializes in implementing industrial automation, ranging from motion control to safety systems, for metal-stamping applications. Vice President Joe Quigg says his team understands that customers come to them with the need to improve machine performance and reduce costs.

Recently, a major automotive client looked to upgrade the automation and controls on an existing stamping press, improve employee safety and meet the compliance demands of Canadian safety standards. It asked Quigg International to help achieve these objectives.

Much Too Manual

On the customer's original system, a forklift operator loaded sheets of steel next to an operator loading station. The operator manually loaded the steel onto the stamping press one piece at a time. While this might have been accepted practice in the past, it put the operator close to the most dangerous part of the machine. "We determined to add a robot on the front end to do the high-speed heavy lifting of steel onto the stamping press and move the human operator out of the hazardous area," says Quigg. "This would allow operators to supervise the robot from a safer distance and help make sure the line will operate smoothly." The Quigg team set out to find a control system solution that would integrate these three disparate control disciplines into a single integrated system.

Three Goes Into One Fine

"This type of system previously would use three different control mechanisms—one each for safety, motion and automation—and each would require its own hardware, training and software, all of which increase operating costs for a company," says Quigg. The motion requirement actually was comprised of two different aspects of the job, he adds. "We needed robot control for the load/unload sequences, plus control of the coil-feeder function," he says.

Quigg looked at several options and selected Rockwell Automation based on the integrated control system it offered. "Of everything we considered, Rockwell Automation offered the best turnkey solution to tightly integrate the three systems required for this application," states Quigg. "The benefits promised to be less engineering and faster startup. We felt it would be the easiest to use, and Rockwell has the best product and application support available locally for us and our customer."

The Quigg team worked with Rockwell Automation to leverage the supplier's Integrated Architecture, which integrates safety and motion into one control platform and uses one software program and, says Quigg, one set of spare parts.

ONE FOR ALL

Quigg International leveraged the benefits of an integrated architecture on a press application, permitting safety, automation and motion applications to be done on one control platform, using one set of common components and one programming software.

“Because automation, motion and safety are all part of the integrated architecture, many of the components are common,” he adds. “One power supply handles safety, motion and automation; one chassis houses these components with access to common I/O, plus common cables and common communications.”

The new system also handled both the robot and coil-feeder motion requirements. “That was done using the embedded motion in the new control system,” says Quigg. “This functionality is not common in a controller that also is handling the high-speed tasks of a safety application.”

The upgrade included a Rockwell Automation Guard-Logix controller with Kinetix Integrated Motion, Ether-Net/IP communications, PanelView+ operator interface and RSLogix 5000 software to program the automation, motion control and safety functionality in one environment. GuardLogix controllers and Kinetix Integrated Motion are part of the Logix control platform.

Quigg says the platform provides his engineers with multidiscipline control with common programming, common networks and common control engine, along with integrated Safety Integrity Level (SIL) 3 control, in a single environment.

Using the GuardLogix controller and implementing Category 4 safety circuitry allowed Quigg’s team to build a machine with Guardmaster inter-locking devices to help prevent personnel from entering hazardous areas of the machine. “This allows the robot and automated press controls to run production without the typical slowdowns caused when operators need to enter potentially dangerous areas,” adds Quigg.

Quigg states the new system complies fully with Canadian standards CSA Z432-04, Safeguarding of Machinery; CAN/CSA-Z142-02 (R2007), Code for Power Press Operation: Health, Safety, and Guarding Requirements; and CSA Z434-03, Industrial Robots and Robot Systems—General Safety Requirements; as well as European safety standards EN954-1 and IEC61508.

“If metal scrap needs to be removed or the press needs maintenance, the system still has the safety gate interlock switches and light curtains and all the things that protect people who have to access the cell for maintenance and repairs,” explains Quigg. “The GuardLogix controller monitors the light curtains and gate interlock switches and controls the machine cycle, helping to make sure the press operates safely.”

One of the most unique challenges of this project was the need to integrate press, motion and safety controls into one system, recalls Quigg. “GuardLogix solves this problem by being part of an integrated control architecture that simplifies programming and configuration and improves system reliability,” he says. “The additional coordination and communication code required by disparate systems is eliminated in this integrated architecture. The benefits are less code to engineer, write and debug at the SI level and less to wade through at the user site when troubleshooting.”

Kinetix 6000 and 7000 servo drives used for this job feature a safe-off function designed to help improve safety while maximizing machine availability, says Quigg. With the safe-off feature, the drive output is disabled, with SIL 3 integrity, to help eliminate motor torque without the need to remove power to the drive.

“Tasks such as machine setup, cleaning, removal of jams and other maintenance work can be accomplished without removing power to the entire machine,” explains Quigg. “As a result, machine restarts are faster, which helps reduce downtime. Additionally, extraneous components such as output contactors can be eliminated, simplifying machine design, minimizing panel space requirements and reducing overall system cost.”

Multiple Benefits Achieved

According to Quigg, the machine upgrade met all of the customer’s safety and automation criteria, plus it proved its value in reduced downtime and increased productivity, and it improved the bottom lines of the system integrator and the end user.

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“At the system integration level, we can document savings of 71% in hardware, 60% on design time, 40% on the panel build, 58% on testing, 33% on installation and 50% of the startup costs,” states Quigg.

Using an integrated architecture from Rockwell Automation, Quigg claims he saved more than \$50,000 on costs for hardware, design, tests, installation and startup, compared to conventional costs of nearly \$90,000.

The customer was delighted with the multiple benefits provided by the integrated platform, adds Quigg. “These benefits included a more compact, space saving design, fewer parts, less training and less software, all of which helped reduce maintenance and ownership costs,” he says.

All told, he says, the automotive manufacturer realized savings of about \$2 million in extra production capacity during the first year, thanks to faster startup and a higher production rating. “At the customer site, productivity went up 400%, from 120 parts per hour (pph) to 600, and they enjoyed 10 days of additional production time due to the faster startup. They also reported faster changeovers and improved safety.”

As an additional benefit, says Quigg, the employees are working in a much safer environment. “Safety and production can go hand in hand,” he adds. “We’re proving it here. I’m proud of our ability to engineer a solution that helps meet and exceed our customers’ expectations. We were able to provide our customers with a safer workplace, increased production and reduced equipment costs

”As the economy continues to impose significant change on the face of the industry, Quigg says it’s important to recognize the need for adaptation. “Companies need to remain focused on improving efficiencies and maximizing productivity,” he says. “Being open-minded to innovative ideas and the implementation of new technology will help companies break away from the monotonous methodologies that worked until now, but which might not work in the coming years, to stay competitive in this changing economy.”