Embracing the Benefits of Integrated Safety

Machine safety has evolved throughout the industrial age, moving from insignificant to critically important, from mechanical to electronic, always advancing and improving. Today, worker safety on the plant floor stands poised to take yet another step forward by harnessing new technologies and changes in standards and embrace the world of integrated automation. The results hold the promise of innumerable benefits from greater efficiency and flexibility to lower costs and fewer chances for operator error.

Thanks to the easing of the restrictions that once kept software-based safety systems out of automation, discrete manufacturers now are able to move away from standalone, dedicated equipment to integrated solutions that allow safety functions and automation and control operations to run on the same system, reducing wiring costs and spare parts inventory while applying common engineering tools, techniques, and procedures. Although the evolution to integrated safety has been a slow process for a variety of reasons, a compelling case exists for letting go of the hardwired equipment that has defined manufacturing safety systems to this point and embracing an integrated approach.

Understanding machine safety: A brief history

The benefits of integrated safety perhaps can best be understood by first setting machine safeguarding in historical perspective. A century ago, machine safety controls did not exist. Accidents and injuries on the shop floor were commonplace. In an attempt to reduce incidents, manufacturers began to apply basic wiring techniques and components—such as limit switches, relays, and pushbuttons—to establish early machine guarding.

A leap forward in the 1970s saw the application of hardwired devices for safety applications. Safety was ensured through dedicated, stand-alone mechanical systems such as safety switches, door interlocks, light curtains, and safety mats. E-stop devices, interlocks, and similar devices were wired to the control cabinet and into the safety relay, ensuring that if anything went wrong, the relay would disengage the power and stop the machine. More sophisticated products evolved, including parameterized and configurable relays and stand-alone controllers. As larger, more elaborate machinery developed, however, the safeguarding process became complicated, cumbersome, and expensive.

Then, early in this century, microprocessor technology leapt forward, reaching the point where safeguarding solutions could confidently make use of PLCs and safety networks. Coupled with recent changes in industry standards, the way opened for the application of integrated safety systems based on a software platform instead of hardwired components. Integral to the change was the move in 2002 by the National Fire Protection Association to revise its electrical standard for industrial machinery (NFPA 79) to harmonize it with its European counterpart, IEC-60204. The new standard allowed “firmware and software-based systems listed for such use” to be used in safety applications and eliminated the exclusive requirement for hardwired connections of sensors and actuators to electromechanical (safety) relays. It also allowed E-stops to be attached to safety certified networks.

Achieving the benefits: A new approach

Spurred by advancing technology and now sanctioned by industry standards, single system platforms for safety and automation have become, today, not just feasible, but desirable. The result has been an evolution, however slow, from relays, configurable relays, and stand-alone safety PLCs to integrated safety systems that are more efficient, flexible, and economical. As the diagram shows, increases in
product costs and application complexity are driving the transition from stand-alone systems (lower left quadrant) to integrated safety controllers, distributed systems, and PC-based systems (upper right quadrant).

Although some resistance to the new approach remains, the benefits of integrated systems are apparent. Consider these factors:

* Installing conventional safety systems in parallel to automation and control functions increases engineering effort;
* Using two separate systems linked by hardwired circuits increases wiring, labor, design, maintenance costs, and the complexity of the system overall;
* Using custom engineered methods of wiring and monitoring safety devices increases downtime because of a lack of diagnostics; wired relays deliver limited information; and
* Purchasing stand-alone safety PLCs and automation controllers typically requires working with different vendors, increasing the time, effort, and inventory needed to maintain two platforms that use different programming tools, maintenance skills, and training needs.

Further, worries that integrating the safety function with other operations would jeopardize worker safety are no longer valid. Current CPUs are faster, more powerful, and readily able to handle any and all required safety diagnostics. The use of high-end processors within controllers coupled with new and improved Ethernet networks have dispelled most arguments that safety may be compromised.

Finally, redundancy remains. Integrated systems are equipped, for example, to examine all E-stops and perform diagnostics. Every safety input has a corresponding output that pulses the safety device to ensure it is mechanically viable. If problems are detected on the I/O card, the power is disengaged. Similarly, at the communications level, if the correct data are not received at the right time, the controller enters a safe mode. With so many advantages, it simply makes more sense, technically, to consider an integrated approach.
Examining the bottom line: Total cost of ownership

It also makes sense economically: integrated safety compliance positively impacts the bottom line. A look at the total cost of ownership (TCO) shows why. When evaluating an investment, many manufacturers fail to consider the softer expenses, making a decision purely on the basis of product cost. However, the significant additional cost of installing and maintaining two separate systems should not be overlooked. (The two accompanying graphs visually reflect cost of ownership and product cost vs. functionality.)

For companies who find an integrated approach outside their comfort zone, integrated control technologies—for example, those from major automation suppliers such as Siemens Energy and Automation—are available to embrace both standalone and integrated philosophies. The same hardware platform can be fully dedicated to safety while sending diagnostics to standard PLCs. Such an installation offers the economic benefits of using the same programming, open Ethernet for communications, and the same hardware and engineering—all from the same supplier.

Notes Michel Jabbour, Manager, Safety Business for Siemens: “Although not necessary, we still see a lot of companies buying two controllers from two different suppliers to perform these functions. Even though a safety integrated approach has many benefits, if a company feels it must maintain a separate PLC for general machine control in parallel to a safety PLC, Siemens offers a PLC platform that can simplify the application by providing one hardware platform, one engineering tool, and a certified safety bus.”