

The popularity of integrated control and safety continues to improve

It's been a slow road for integrated control and safety, but its use and the related safety standards are maturing.

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Aug 25, 2016



Machine safety is required, so how are builders and industry making it happen? Is it safe for you to stick your hand in there (Figure 1)? Getting started with integrated control and safety is a project-by-project decision.

Integrated control and safety is a suitable solution to just about any machine application from small, lean automation to a large multi-station assembly line, but are there areas where it really shines? And what is available to help simplify this integrated control and safety solution? Industrial automation suppliers have online information and a range of products to answer these questions. Let's take a look at safety and more specifically at how integrated control and safety is being implemented.

Getting started

"Safety is safety, regardless of how it is designed and wrapped into the machine or automated system," notes Alan Metelsky, chief controls engineer, new product development at The Gleason Works in Rockford, Illinois. "It is important to note that implementing integrated control and safety does not provide you with a more or less safe machine. The performance level (PL) or category does not change. You can achieve the same exact performance level while using a stand-alone safety relay or a stand-alone programmable safety controller or by implementing a safety PLC such as a B&R Integrated Safety hardware into your application."



A truly integrated system

While large machines are excellent candidates for integrated control and safety, it is suitable for use on machines large and small.

Just as with any application, each safety function on a machine has a required performance level based upon the risk assessment, continues Metelsky. "The same design practices remain in place for any safety control system—component selection, system architecture and conditions of use factor into achieving the level of reliability that a given safety function requires," he says.

Safety design is involved from the beginning of the project. "We ensure that safety is addressed from the proposal stage all the way through to startup, acceptance and training," comments Mike King, functional safety engineer, TÜV Rheinland, and director—automation, electrical, instrumentation, IT at The JDI Group in Maumee, Ohio. "Safety has to be part of the core design process from beginning to end. We always inquire as to where the client is within the machinery safety lifecycle, as defined by ISO 12100 or ANSI B11:0. If a risk assessment has already been done, we will review it with the end users. If not, we offer our services to help complete that and Rockwell Automation's Safety Solutions are helpful, in that regard, from start to finish."

Sodecia GTAC, a Canadian full-service supplier of automotive chassis, powertrain and body assemblies, starts by assessing the overall I/O count estimation, functionality requirements such as e-stops, safety gates, human presence sensing and budget, explains Brent Lekx-Toniolo, controls concept developer at Sodecia in London, Ontario. "From there we can develop our concept and design direction," he continues. "We perform a risk assessment starting at the design phase of the machine. The assessment drives what safety integrity level (SIL), category (Cat) or performance level (PL) we'll be aiming for. In the case of Beckhoff TwinSafe, we generally have the ability to hit the desired level required, be it small, simple systems on to larger, more complicated systems."

The integrated option

Whether it's a simple machine or larger system, machine builders are finding integrated control and safety works with a wide range of machines (Figure 2). "Typically we use a safety processor for single and multi-station machines," notes Dean Colwell, controls engineering manager—assembly and welding automation at Fori Automation in Shelby Township, Michigan. "This approach allows for better machine diagnostics and fewer compromises and system capability. It's becoming increasingly rare for us to use safety relays in our designs."

There are few differences in design between small, medium and large systems for Fori, continues Colwell. "Typically single station machines will get an integrated safety PLC such as a Siemens Fail-Safe CPU or similar, the same as individual stations in an assembly line. In the case of an assembly line, there will typically be a cell controller—a supervising Fail-Safe CPU—to tie all the control and safety together. This includes safety coordination, such as safety hand-off where a rail-guided cart progresses through a series of automated stations. Our general approach is to integrate safety at the station level and scale up based on the scope of the project."

Colwell prefers integrated safety as it allows for a simpler distributed design approach. "This means that the safety devices and the input to the safety PLC reside in the same location making troubleshooting easier. Integrated systems allow for better defined and finer resolution in diagnostics messages."

Integrated control and safety has come a long way, and it has been a long road. "When safety technology was in its infancy, nearly all machine safety was handled by hardwired sensor and relay systems," comments Zachary Stank, product marketing specialist for safety at Phoenix Contact USA. "It wasn't until the mid-2000s, when safety standards were updated to include integrated safety control devices, that we started to see safety devices being designed and integrated into PLC systems. More recently, the influence of Industrial Internet of Things (IIoT) has really pushed the market toward integrated safety and control. The need for real-time diagnostics and data has moved integrated safety from widely accepted to a must-have on most control systems."

Size matters when integrated

A truly integrated safety system incorporates standard control, safety control and motion control into one controller, says Chris Brogli, safety business development manager at Rockwell Automation. "This type of integrated safety programmable automation controller (PAC) provides advanced control features, maximum flexibility and enhanced diagnostics, which help improve both safety and productivity," he says.

Other systems include semi-integrated or discrete control where a separate safety relay or safety controller is connected to the standard programmable logic controller (PLC) for basic diagnostic information on the state of the safety system. These types of systems provide diagnostic feedback but do not provide advanced functionality or enhanced flexibility, which is generally required for larger, more complex systems.