Customer Case Study
Machine building

Plastics manufacturer discovers easy safety solution

Summary

- MGS Automation must meet many standards for functional safety when building machines
- As part of an automation upgrade, MGS wanted to distribute safety I/O across the machine without running wires or upgrading to an expensive safety PLC
- The project called several remote substations from the main control panel requiring both local and global safety control
- MGS Automation implemented Phoenix Contact SafetyBridge technology, which allowed remote safety inputs/outputs that communicate over Ethernet

Customer profile

The MGS Manufacturing Group serves the plastics industry through its core competencies: engineering, design, product and process development, tooling, injection molding, automation systems, turnkey manufacturing cells, and multishot technologies. With more than 30 years of experience, MGS has developed a reputation for providing innovative manufacturing solutions.

The MGS Automation division provides custom automation systems as well as design, development, and validation for numerous market sectors including medical, consumer products, energy, and electronics. While many automation companies focus on one style of service or product, MGS Automation specializes in and provides many types of automation services to offer solutions for assembly, packaging, and testing/validation of products. A few examples of equipment platforms offered by MGS include rotary index, linear index, pallet transfer, continuous motion, bench-top, machine tool tending, and press-side integration. By offering a variety of equipment platforms, MGS is able to tailor each project to a customer’s budget, annual volumes, and life of program.

Challenge: Tougher safety requirements

Like most manufacturers, MGS Automation must meet many standards for functional safety when building machines.

When it comes to functional safety, today’s machine builders have more options than in the past, but these choices can be confusing. Which is the better choice for a particular job: programmable, network-enabled safety controllers or spatially limited, configurable safety relays?

In the past, MGS Automation used a central safety logic controller with all safety input and output devices wired directly to that unit. As part of an automation upgrade, MGS wanted to distribute safety I/O across the machine without running wires or upgrading to an expensive safety PLC. The project called several remote substations from the main control panel requiring both local and global safety control.

Configurable safety relays

Configurable safety relays are similar to hard-wired safety relays, but contain the logical processing power required to configure...
multiple safety sensors using a single device. These devices can usually report status back to a master PLC via an RJ45 or fieldbus module connection.

These relays require less wiring time and usually don’t require extensive training to configure. However, configurable relays are not ideal for distributed safety applications because they cannot communicate over a safe network.

**Programmable fail-safe PLCs**
The programmable fail-safe PLC is generally the preferred safety solution when an application has a high I/O count. A programmable fail-safe PLC has more processing power and safety functionality. These specialized PLCs offer better integration, programming resources, and a larger amount of usable safety signals for functions like safe motion and robot control. The fail-safe PLC uses a standardized safety network to communicate to safe I/Os on the network.

While there are numerous advantages in safety functionality, the fail-safe PLC is not ideal for all applications. The deep integration of safety logic and communication into the central PLC means strong dependence on single-source providers. It also will increase demands on the engineering and logistic control, and does not allow flexibility in component selection.

**Solution: Bridging the safety gap**
MGS Automation implemented Phoenix Contact SafetyBridge technology. This allowed remote safety inputs/outputs that communicate over Ethernet.

SafetyBridge technology makes it possible to eliminate the strong dependence between the fail-safe PLC and the safety protocol by achieving two conditions:

1. The safe logic must not be an integrated part of the central PLC, but rather decentralized and separated from the standard PLC, similar to a configurable safety relay.
2. The safe logic must communicate via special protocol over an already installed standard network to read safety input signals from distributed sensors and write safety outputs to actuators.

The logic module is distributed in the network and handles all safety logic processing on-site. Processing this safety data is done via internally redundant processors, much like a configurable safety relay can process its own safety program. Unlike a configurable safety relay, however, the distributed logic module can communicate to its associated safe input and safe output signals via a special protocol on the standard network.

This safety protocol does not contain any network or PLC-specific dependencies, but operates on the “black channel” principle, like that of a PROFIsafe system. The entire network, including the standard PLC and all infrastructure components located in the data path of the safety signals, is part of the black channel. Safety failure is only implemented at the end points of communication, which can detect failures within the black channel with a residual failure probability for the highest safety levels.

Using this principle, engineers at MGS could maintain centralized safety logic control over the equipment, while reducing the amount of wiring to the main control panel. The safety logic module links to a programmable automation controller (PAC) using EtherNet/IP, so the controller can monitor all safety signals and validate the safety logic.

From the user’s point of view, the safety logic module and its associated safe I/O modules are realized into one configurable safety relay function responsible for all safety functions. Thanks to the black channel communication philosophy, the end user does not need a detailed network view to configure the safety function.

The application also required standard control at each substation. MGS used Phoenix Contact Ethernet bus couplers that had been
previously installed, and installed standard modules alongside the safety modules to control the substation from the central PAC over Ethernet.

**Results: Safe and easy**

MGS Automation liked the ease of distributed I/O across various locations on the machine with a single point of control. Integration with the Rockwell PAC and EtherNet/IP protocols was another advantage. The free SAFECONF configuration tool simplifies the setup process.

SafetyBridge combined the advantages of programmable and networked fail-safe PLCs with those of configurable safety relays, while meeting all of the required safety specifications.

Figure 3: SafetyBridge combines the advantages of programmable and networked fail-safe PLCs with those of configurable safety relays, while meeting all of the required safety specifications.