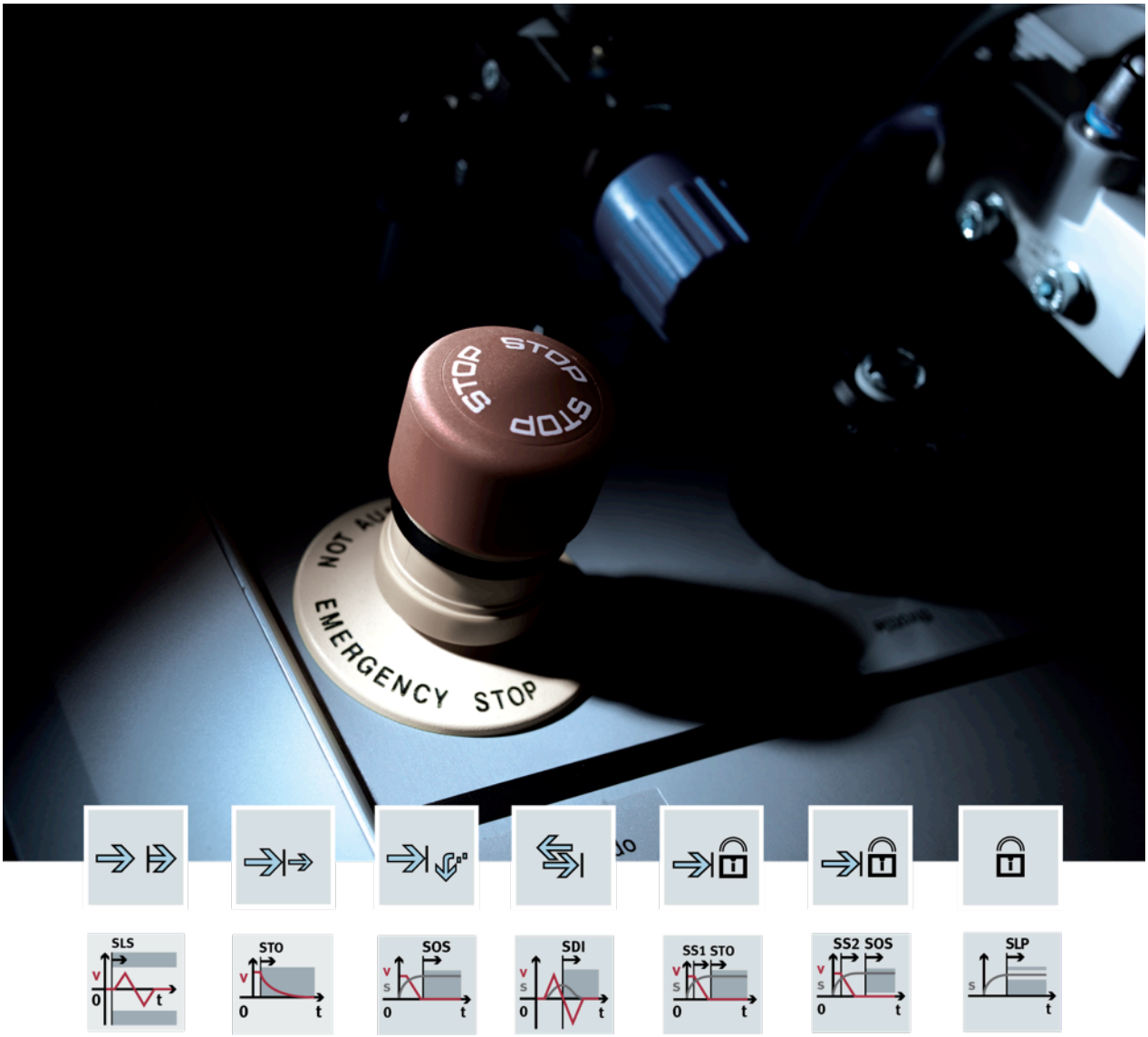
White Paper
Integration of functional pneumatic safety devices into control systems
How engineering-in safety has changed in the last several years thanks to new components and systems



Over the past several years, controls engineers have become adept at applying controls systems to machine safety applications. The issue is that safety is a moving target. There are new and revised international standards to contend with. Furthermore, the supplier community is moving swiftly forward in developing solutions that render the old way of doing things obsolete. This white paper presents three functional examples of how engineering-in safety has changed in the last several years thanks to new components and systems.

Suppliers and OEMs must establish closer communications in order to achieve optimum safety through new functionally integrated systems. The following examples focus on pneumatics, but the same principles apply for electronic actuation.

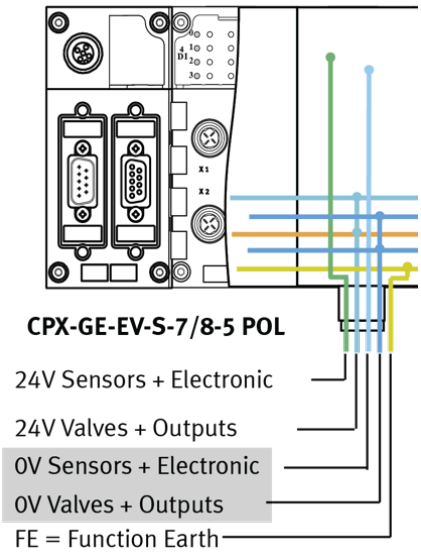
In this paper we'll take a look at a few common safety concerns and see how integrated safety solutions can help to solve them.

Example 1. Remove Power from Pneumatic Valves

On its face, this seems like the simplest of applications. As a basic requirement of existing Lock Out/Tag Out (LOTO) regulations, the ability to remove output power from a valve manifold without interrupting bus communications has been a common feature of valve manifolds for many years. However, two "new" requirements are emerging.

The first is the finer level of granularity now required. In the past, it was often acceptable or even desirable, to remove power from the entire manifold at once. Modern safety applications often benefit from the ability to remove power only from the valves that are pertinent to a specific segment of the application. Modern valve manifolds that can segment output power allow the engineer to greatly simplify this common task. A single valve manifold can be supplied that segments output power into several zones. This allows the entire manifold to share a communication adapter (EtherNet/IP, DeviceNet, etc.) as well as plumbing and mounting elements. Integrated diagnostic feedback will also allow the controls engineer to determine which segment of the valve manifold has power and which does not.

Another common consideration in the application of valve terminals into modern safety machinery is the requirement to be able to remove power at both the 24VDC connector and the 0VDC connector. As simple as this sounds, many common valve terminals share the 0 volt pin between valves and the power for the communications adapter. True galvanic isolation between these two elements of the system allows for reliable communication during these safe shutdowns. A valve terminal that can combine this feature with the ability to be divided into multiple power zones has the potential to save a design engineer a great deal of time, energy, and money.



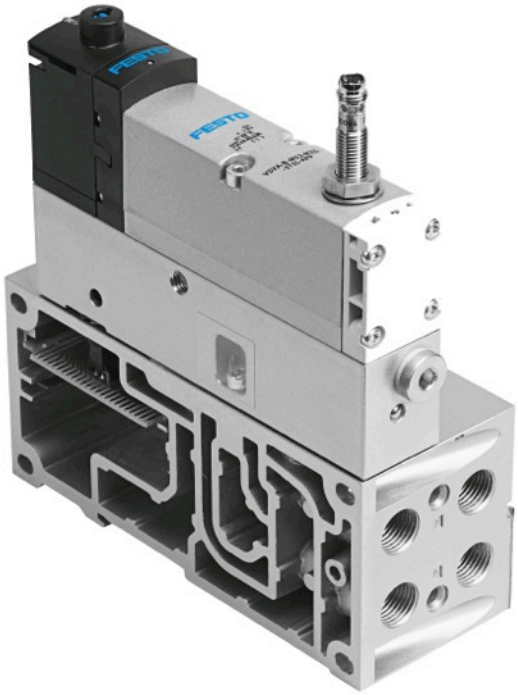
Summary: Example 1

Old solution: Separate valve manifolds for each segment of the application.

New solution: Modular valve terminals that allow the segmentation of output power into zones with the added ability to access 24V and 0V pins for output power within each zone without interrupting power to the communications adapter.

Example 2: Prevention of Unexpected Startup

Various methods exist for preventing unexpected startup of pneumatic systems. A simple, yet elegant solution is to simply shut off the pilot air to the valve manifold. Most modern industrial valve manifolds include a facility for plumbing pilot air the manifold through a separate galley. Some enterprising engineers realized that by installing a solenoid valve upstream of this supply, they could effectively disable any movement by the valves on the manifold. Historically, this required an additional solenoid valve to be mounted separately from the manifold with all of the additional layout, plumbing and electrical connections needed to accomplish the function.



Valve terminal manufactures have started to integrate this function directly into select manifold products. In addition to simplifying the realization of this function, safety is enhanced by a sensor that is integrated into the valve to feed actual spool position back to the PLC. The integration of a sensor to positively indicate the spool position gives an added level of security that the valve has achieved the proper position. The valve also features a dedicated port to sense pilot port pressure as an additional feedback channel.

Summary: Example 2

Old solution: External solenoid valve to switch pilot air supply to the valve terminal.

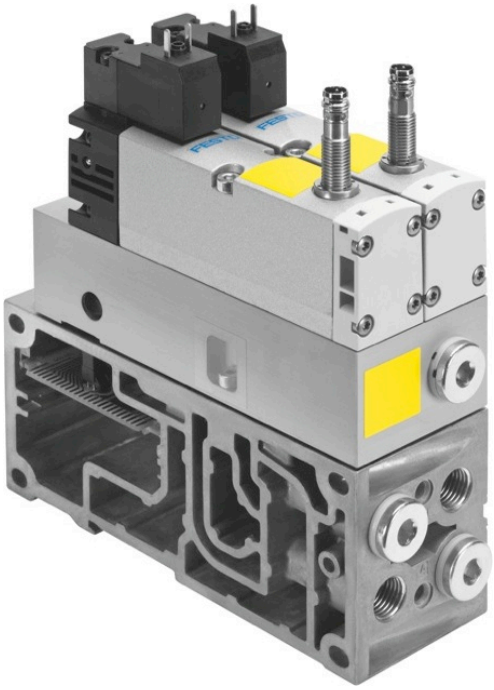
New solution: Solenoid valve installed directly on the valve manifold with integrated position sensing and pressure switch connection.

Example 3: Reversing a Movement – Safety Valve for Presses

Pressing applications often require the highest level of safety performance. Any fault in the system should cause the cylinder to move to the safe position. A common solution to this problem is to combine two solenoid valves in such a way that only when both solenoids are powered will the press cylinder advance. If one or both the valves fail to advance, the cylinder will automatically retract. To assure that any failures are detected, direct feedback of the actual valve spool position is sent to the plc. When configured correctly at the PLC, any failure at either solenoid or at either valve spool sensor will deactivate the circuit, causing the press cylinder to retract. In this way, Category 4, Performance level e can be achieved.

Previously, machine manufactures needed to design, install, test and validate a solution that achieved this function by plumbing together a complex variety of solenoid valves, functional fittings, tubing and sensors. In many cases, the best efforts under these circumstances resulted in safety performance that was not sufficient for the application, necessitating costly additional safety measure.

Modern solutions, like the VOFA from Festo, provide machine designers with a complete, certified solutions that achieves the required performance level with an off the shelf component. These solutions can even be integrated into a valve terminal that services other pneumatic actuators on the machine. This solution further simplifies the overall design without sacrificing performance.



Summary: Example 3

Old solution: Complex assembly of discreet components.

New solution: Integrated, certified, off the shelf solution that integrates seamlessly with existing pneumatic manifold technology.

These are only a few examples of the types of applications that can be solved by modern, integrated pneumatic solutions. Following are other common application categories that are easily solved by integrated solutions.

- Two hand operation
- Reducing speed
- Reducing pressure and force exhausting
- Exhausting
- Reversing the movement
- Stopping, holding, blocking
- Protection against unexpected start-up

A few short years ago, engineers had few options when trying to solve these applications. Engineers at the forefront of adopting new safety standards gained skill and experience at solving these new problems in creative and effective ways. While applications still exist that require a new, custom solution, many of these applications can now be solved with standard, off the shelf, integrated solutions. Don't hesitate to contact leading vendors in industry to learn more about these new solutions.

It is important to perform a proper risk assessment of a machine and determine what the appropriate safety measure should be. For example in some cases exhausting air will not always provide the safest solution and instead stopping and holding might, for example in a vertical load. There are now many resources available to design engineers to assist in implementing appropriate solutions. → Guidelines such as this one from Festo provide a useful starting point for engineers who are tasked with solving modern safety applications.

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http://www.festo.us/safety