CONTROLLERS (PLC) SAFETY (SAFETY RELAY). OVERVIEW. PRIMARY REQUIREMENTS. FEATURES OF THE APPLICATION

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Many machines and robots require safety circuits to stop all or part of an operation in the event of an emergency event. These safety circuits are typically configured using safety relays, or a safety-rated programmable logic controller (PLC) or other safety-rated controller. One or more multi-function safety relays can often be used to replace many basic single-function safety relays, simplifying installations and saving money. In other cases, multi-function safety relays can be used instead of a safety-rated PLC, resulting in substantial savings while streamlining implementation and maintenance [1].

Most safety relay designs have traditionally used safety relays constructed with internal electromechanical, forceguided relays. The key advantage here is voltage flexibility, as nearly any typical control voltage can be switched. Typical voltages include: 5 V DC,12 V DC, 24 V DC, 120 V AC and 230 V AC. The nominal current at 24 V DC is about 6 amps for a resistive-based load. Contrast this with a safety controller. A safety controller is a solid-state device. This means that its outputs are “transistorized” and only designed to switch 24 V DC at a typical maximum of 2 amps. If you plan on controlling a higher power relay or contactor, then these outputs will work fine. However, if you are using a safety relay to control the final load switching using voltages other than 24 V DC, then this is an important consideration. Safety controllers are typically modular, so safety I/O can be added. The safety I/O expansion modules are either solid-state or electromechanical. If safety controller expansion modules are needed, these costs will be an important consideration. Expansion modules can also be added to a safety relay system [2].

Dedicated safety relays can deliver basic status information via front panel LEDs or by auxiliary contacts connected to indicator lights, which may be all that is needed for a basic safety system. More complex applications requiring more advanced diagnostics may be better served by expandable safety relay systems, which have the flexibility to send input, output, monitoring and error status information over a fieldbus network (such as DeviceNet) to an operator interface device. As one might expect, safety PLCs offer the highest degree of communication functionality, producing diagnostic status, controller status and communication status information. Additionally, they boast two-way communication capability (peer-to-peer) and can accept information from other devices over their communication network.

Selection of a safety control system can be approached from many different angles and with many different solutions. Available architectures, application requirements and cost constraints all play a role in the decision-making process. It is not mandatory, though, to settle on a single architecture for an entire application. The most efficient approach in some cases will be the hybrid - a solution that blends the best of several safety architectures. In fact, it is often difficult to choose a single architecture - exclusive of all others - that will meet all application requirements [3].

Typical applications for single-function safety relays include:

- stopping movement in a controlled and safe manner
- monitoring the position of movable guards
- interrupting a closing movement during access
- providing an emergency off/stop.

The cost and productivity advantage in many, and probably most, applications of safety PLCs over older technology is clear and measurable. OEMs and panel builders should consider a number of factors when exploring the potential benefits in their applications.

One of the first things to consider is the number of I/O points required. In applications with more than three safety functions, the safety PLC is almost always the right choice. This number might be smaller or larger depending on the application but remains a good rule of thumb. The simple economy of a single, multifunction device rather than a device for each I/O makes the PLC a clear choice in these applications.

In applications where more than three safety functions are required, the safety PLC almost always represents a smarter choice. The ability to rely on a single controller that combines control and safety functions can be part of a standard or failsafe network. Safety PLCs can replace multiple separate relays performing various functions, which reduces component costs. Built-in diagnostic tools reduce the time required to troubleshoot, repair, modify or upgrade safety PLC-based systems, providing additional ongoing savings and benefits. And safety PLCs can enable wireless device communications [4].

Reference:

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