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THE

GATEKEEPER

Man-Machine Safeguarding News

November 2016

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Schedule

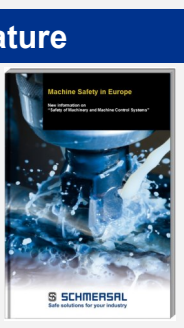
Understanding Machine Safety Functionality

Join us for this informative hour long webinar, as we discuss some common safety functions and considerations which should lead to a safe condition.

Wednesday, November 30
2 pm EST | 11 am PST

Register for the webinar

Literature

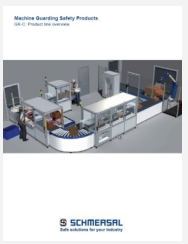


Machine Safety in Europe

Our latest book examines European machine safety standards and communicates the basic principles of machine safety at an international level. Hardcover.

Order a complimentary copy

Reference



GK-C Brochure

This 12 page brochure provides an overview of our various safety product lines.

Download the PDF here

Application Finder

Our Application Finder is a helpful tool for users to select suitable switchgear for variety of machine safeguarding applications. It is now available for iPad and Android tablets. Download the free app here:

Available on iTunes
Available on the Android App Store

Or view on the web

Contact Us

Visit our website
Online Product Catalog

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Fault Masking

Series connection of multiple switches in a circuit, or "daisy chaining", is a widespread practice around the world and is commonly used in single-channel designs. It is accomplished by wiring normally closed (NC) contacts in series and normally open (NO) contacts in parallel. It is often casually applied in higher risk safety applications, requiring dual channel design, without a full understanding and consideration of its limitations and their potential consequences.

The major problem with daisy chaining electromechanical safety switches is fault masking. This is a condition where multiple faults may occur in the system that may not be detected. The ability to withstand fault accumulations within a safety circuit is a requirement for high risk applications needing a PLd or PLe, Category 3 or Category 4 design as per ISO 13849. A failure within electromechanical devices can easily go undetected and/or uncorrected by opening and closing an electromechanical switch downstream since they cannot perform self-diagnostics.

Daisy chaining of electrical safety interlocks remains an attractive lower cost alternative for machine designers, especially on higher risk machines that might otherwise require multiple safety controllers or safety I/O of a programmable controllers to achieve the desired safety control category. However, there are a variety of fault conditions that may lead to a loss of the safety function; therefore extreme care must be taken when designing a safety system with daisy chained switches.

For more information
Check out our full technical article on Fault Masking. The article discusses this potential problem with the practice of wiring safety devices in series and provides several solutions for overcoming it.
► More

Related Product Highlights

PROTECT SRB-E
Safety controllers can be used to improve Diagnostic Coverage (DC) by performing direct monitoring of a safety circuit. PROTECT SRB-E multifunctional, configurable, electronic safety controllers feature integrated microprocessors which not only allow for self-diagnostics but also allow monitoring of a safety circuit up to Category 4 / PLe per ISO 13849. Options within the series allow this high level of DC to be maintained while monitoring multiple switches by eliminating fault masking.
► More

Electronic Safety Sensors and Interlocks
These switches and sensors feature integrated microprocessors which perform self evaluations to detect faults. Most are available with serial diagnostics to integrate them into higher level systems. These devices can be wired in series without loss of safety category or performance level.
► CSS Pulse Echo Safety Sensors
► RSS RFID Safety Sensors
► Locking devices

Schmersal Safety Solutions
AS-I Interface is a safety bus system with a simple, series wired structure. Schmersal offers all the components for setting up a complete AS-I system, including system monitors, cables and connection hardware, and a diverse range of compatible safety devices such as keyed interlocks, solenoid interlocks, safety sensors, E-Stop button, control panels, emergency cable pull switches, limit switches, and safety foot switches.
► More

Ask The Expert

Kartik Vashi,
TÜV Functional Safety Engineer
ID-No. 10045/15

Q: When interlocking devices with dry (potential free) contacts are series connected, what is the maximum Performance Level (PL) that can be achieved?

A: It is possible to achieve maximum PLd when interlocking devices with dry contacts are series connected with dual contacts with a dual channel monitoring safety relay. With series connection, it is only possible to get maximum 60% Diagnostics Coverage. This is because of an issue of accumulation of faults where "fault masking" can occur.

ISO 13849-1 refers to Diagnostics Coverage (DCavg) of the SRP/CS shall be at least "low" which translates in to minimum 60 percent according to table 6 from clause 4.5.3. This means 60 percent of the faults shall be detected. There is also possibility of fault masking where it could be possible to lose Diagnostics Coverage (DCavg) to none, so it is also possible for your PL to go down to PLc. For more information refer to our Fault Masking White Paper or the ISO/TR 24119 technical report *Safety of machinery -- Evaluation of fault masking serial connection of interlocking devices associated with guards with potential free contacts*