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Safe axes from Kollmorgen

Safety concept S700 ensures the best safety, leads to 20% more productivity and reduces system costs by 20%

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Safety is very highly valued in the world of automation, especially in drive technology. The Machinery Directive will implement adjustments relating to health and safety requirements that will become law on December 29th, 2011. Safe motion is required to ensure problem-free machine set-up, fewer breaks in operation, and shorter machine start-up times. This enhances machine availability and increases productivity. Implementing the new safety requirements does not stipulate a greater financial investment. Kollmorgen has demonstrated with its Safety concept S700 servo drive that a cost-effective, individualized, concept is possible while meeting safety levels SIL 2 or PLd and SIL 3 or PLe. To meet the individual requirements of each application, Kollmorgen offers integrated safety cards and standardized function blocks; options that provide clear advantages over conventional solutions.

A number of new features can be implemented with Kollmorgen's innovative Safety concept. For instance, in the event of a machine fault the reaction time is only 2 to 3 ms, instead of 30 ms for external safety solutions. Kollmorgen has focused on regulating low speeds with their system and has applied for a patent on this new technology. Furthermore, faults occurring with long delays can be detected immediately with a safe deceleration ramp. Plus, safety functions can be combined to monitor the braking process on a low speed system. Kollmorgen's safety solution uses standard components making for an easy retrofit. No additional costs are required for feedback because the safety functions are compatible with all of the most commonly used standard feedback solutions. Users do not need to invest in a second feedback system or a costly sin-cos feedback device. Another attractive feature of the Safety concept S700 is that the commissioning times, recorded for initial commissioning or after a format change, are shorter.

The new specifications of the Machinery Directive demand that no hazard can arise from machines - hazard analysis in accordance with EN ISO 14121-1. Now that electronics, and in particular programmable electronics, have found their way into safety engineering, safety can no longer be described with the simple categories system as specified in EN 954-1 alone. New evaluation criteria were therefore defined for the following aspects:

- Failure rate of components
- Diagnostic coverage
- Avoidance of faults with a common cause

The applicable standards are EN 62061 and EN ISO 13849-1, which are used to determine the hazard and IEC 61508 and EN 61800-5-2, which are used to describe the safety functions. Since there is no such thing as "zero risk" in a technical context, this translates into achieving an acceptable level of residual risk. The safety function to be considered for a given application depends on the control system. Therefore, safety must be designed for the individual system in a way that the likelihood of a malfunction occurring is sufficiently low. In the past, systems were "safely shut down" in the event of faults or for setting up the machine, resulting in longer downtimes and a greater failure quota because of switching operations.

Verification of functional safety

Once the safety function is designed and implemented, the Performance Level (PL) and Safety Integrity Level (SIL) are verified and validated. The relationship between the PL and SIL is defined using the PFH value (probability of failure per hour). For example: safety levels PLe and SIL 3 are available if PFH value is ≥ 10-8 and < 10-7. Software packages are available to help users determine the average PFHD value of safety functions in machines and installations. Therefore, PFH values calculated with the PACscal or Sistema safety calculators provided by the Institut für Arbeitsschutz der Berufsgenossenschaften (IFA) can be verified against the specific Performance Level or Safety Integrity Level. It is recommended that the various subsystems - connected sensors, I/O, control, and actuators - be verified step-by-step and globally.

Personal safety has the highest priority

The personnel installing or working on the machinery must not be exposed to any hazard. Achieving this requires the implementation of a series of important, complimentary, measures. Guaranteeing safe operation is a substantial step in this direction. For example, work to eliminate operating errors with "safe software" and "safe parameter transition" and similar functions by having clearly structured, memorable operating actions, unambiguous functions and incorporate protective mechanisms into the machinery to prevent hazards to personnel with emergency shutdown responsibilities.

In addition to safe software processes, it is important to provide good conductor track spacing on the boards and to minimize plugged connections, especially for tested circuits and safe wiring. Every conceivable fault must be considered. For critical subsystems, redundancy is extremely important so

that a single fault does not immediately jeopardize safety. This procedure is made clear in the example of the implementation of the highest safety level SIL 3 (safety integrity level).

The safety functions integrated into the S700 servo drive contribute to the need for personal safety and higher machine availability, thereby enhancing productivity. For example, the S700 enable users to safely hold a load or slow down machinery, even with the motor switched on. Kollmorgen's consistent, TÜV-certified safety concept comprises as standard a tested integrated STO (Safe Torque Off) - restart inhibit as specified in EN 1349 SIL 2 and EN 62061 PLd and optional safety expansion cards. These cards permit numerous safety functions such as "Safe Stop", "Safe Limited Speed" and "Safe Direction" for SIL 2 or PLd or also SIL 3 or PLe applications.

Rapid and simple implementation of complex safety functions

The S2 expansion card covers the safety functions related to stopping the machine and the essential safety functions for motion monitoring, and thus complies with safety level SIL 2. These are, concretely, the stop functions:

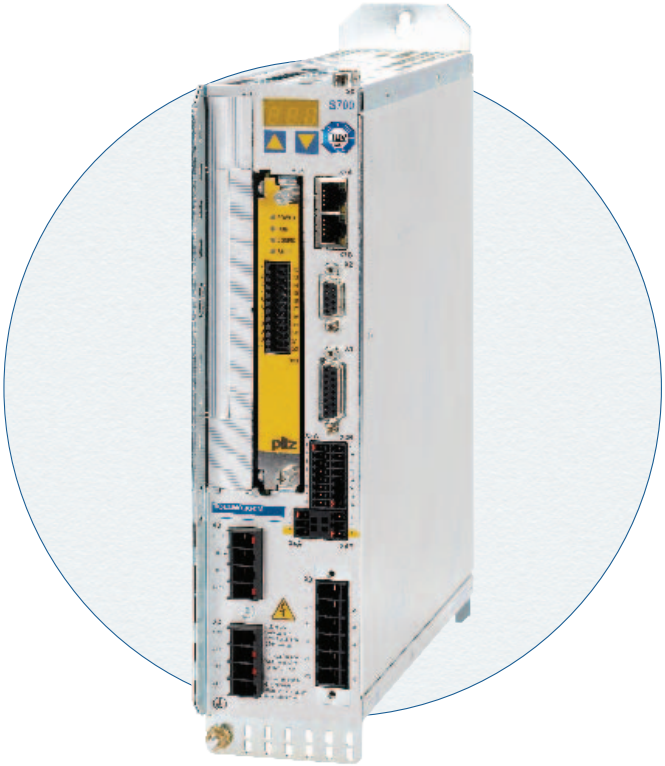
- STO - Safe Torque Off
- SS1 - Safe Stop 1
  This function concerns a controlled shutdown with subsequent interruption of the power supply.
- SS2 - Safe Stop 2
  This function concerns a controlled shutdown with subsequent active monitoring of the shutdown.

The motion monitoring functions provided by S2 expansion cards include:

- SOS - Safe Operating Stop
  The motor is regulated with respect to torque
- SLS - Safely-limited Speed
  Provides the option of specifying a deceleration time
- SSR - Safe Speed Range
  This function is used to monitor a lower speed limit, with continuous monitoring possible.
- SDI - Safe Direction
  The SDI function monitors the direction of movement. This function is very often combined with the SSR safety function, to monitor direction of movement and speed simultaneously.

The S1 expansion card covers the safety functions related to stopping the machine and the motion monitoring functions of the S2 card. It also provides two additional and substantial safety functions:

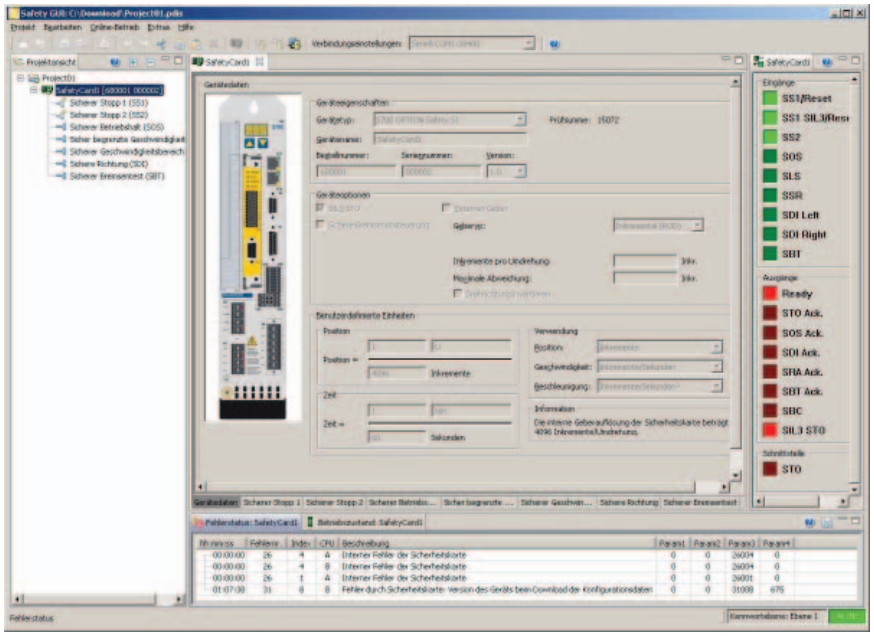
- SBC - Safe Brake Control
- SSF - Safe Second Feedback
- This function provides safe axis monitoring



Easy to use software and simple hardware installation

The S1 and S2 optional safety expansion cards are inserted into the appropriate slot in the S700 drive and configured using the Safety GUI software. This password-secured software is used to specify the safety functions. Only a few parameters need to be entered, for example in SI units. Each function has a clearly laid out input window.

Kollmorgen makes a complete, configurable, safe, and space-saving servo drive system. Along with the servo drive, feedback cable, and motor, a safety card is contained within the servo drive. Competitive solutions require external safety control that, in some cases, means users will experience a delay of up to 30 ms in a fault event, instead of the nominal 2 to 3 ms delay that is achieved with a Safety S700 drive. Additionally, competitive solutions require at least two additional feedback devices, meaning that three cables are needed when the safety cable is included. Using the Kollmorgen safety solution for axis monitoring can deliver cost savings of up to 50% when compared with competitive options. In addition, because there is no cost for a customized adjustment system costs are reduced by 20%. Safe processes with markedly less downtime increases machine availability and productivity by a clear 20%.



Conclusion

With some thought and armed with the knowledge of coupling mechanisms, users can be equipped to effectively minimize EMI issues when best practices are not available.

About Kollmorgen

Kollmorgen is a leading provider of motion systems and components for machine builders around the globe, with over 70 years of motion control design and application expertise. Through world-class knowledge in motion, industry-leading quality and deep expertise in linking and integrating standard and custom products, Kollmorgen delivers breakthrough solutions unmatched in performance, reliability and ease-of-use, giving machine builders an irrefutable marketplace advantage.

For more informations contact us.

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