The Turck portfolio offers users a large range of different safety components – from the safety sensor to mechanical switches right through to safety controllers

Keep Safe!

Relay-based, centralized or decentralized: There are many routes to the safe machine – Turck supports users here with an extensive safety portfolio

Machinery Directive 2006/42/EU requires every manufacturer to assess the risk of their products in order to ensure the safety of persons that come into contact with the machine. Manufacturers follow a three step process in order to reduce the risk of danger caused by the machine to an acceptable residual risk: Risks first of all have to be minimized by design measures as much as possible. Residual risks must then be reduced through the implementation of technical protection measures. For the third step in the reduction, the manufacturer is required to create user information such as operating instructions, which must provide information on the correct and proper handling of a product.

When people talk about safety or machine safety, they usually mean the second step. However, the design of these technical protection measures is not defined specifically. As a result, several different safety concepts exist with specific advantages and disadvantages: There are firstly centrally hardwired systems with safety relays, and secondly centrally wired applications with safety controllers or safety PLCs. A third variant involves the use of decentralized safety concepts with IP67 I/O modules combined with central safety PLCs or decentralized IP67 safety controllers. Passive safety solutions are also an option for suitable applications.

Central safety systems with relay technology

Like conventional automation technology, the automation of safety functions was originally based on relay technology. Safety relay technology is also still used

today. The logic is formed here using hardwired contacts. The advantage of these kinds of installations is the fact that they are relatively inexpensive in terms of hardware and can be understood worldwide. No software is used here. However, relay technology is definitely unmanageable for larger and more complex safety installations. The finding and diagnosis of faults are very costly. The self-testing of the system is also not possible.

Central systems with safety controllers

Above a certain level of complexity, the implementation of safety applications is cheaper through the use of safety controllers. Safety controllers or PLCs can run programs that – to put it simply – are written to link specific actions with certain conditions and Boolean operators (AND, OR, NOT, XOR). Although the wiring of these applications is simpler than with relay technology, all safety signals have to be routed to the central controller in the control cabinet, which therefore requires long commissioning times.

The advantage of the safety controller is the fact that safety programs can be copied and used multiple times for similar machines. Expansions of the safety functions can be implemented relatively easily. It is also possible to depict safety applications graphically on HMIs. Information and signals are transferred both from the controller to the PLC and also from the PLC to the controller.

XS26 safety controller easily expandable

For central installations, Turck offers the SC10, SC26 and XS26 safety controllers from its partner Banner Engineering. All three devices can be used as a device/slave in Profinet, Modbus TCP or Ethernet/IP networks. This allows users to always have the same safety architecture and application, regardless of the market for which an installation is designed.

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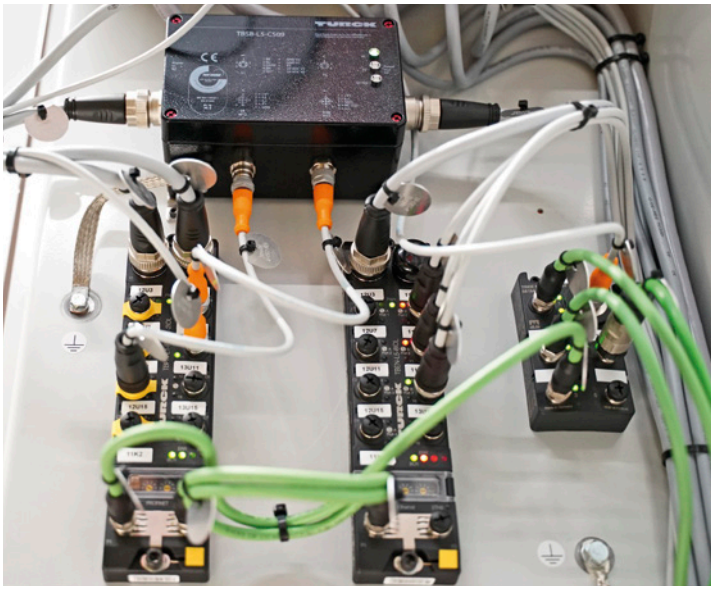
Even for machine safety solutions, there is no such thing as a one-fits-all solution. Depending on the size and application, centrally controlled installations, decentralized or those with passive safety are the best. However, decentralized safety solutions with IP67 components are unavoidable for anyone looking for flexibility and short commissioning times for price-sensitive applications. For this Turck has the right safety portfolio for a wide range of application scenarios.



This safety application is controlled by the TBPN (left) for testing in the factory. A Profisafe controller then takes over the application in live operation at the end customer. All actuators connected to the IO-Link master (middle) are safely disconnected with the TBSB Box (above)

Safety programming by drag and drop

Users can write the programming of the controller application in Banner's free Safety Controller software. This provides an easy-to-use graphical user interface for configuring and simulating safety applications and various export options for the documentation. Ready-to-use program blocks for conventional safety components enable the programming of safety applications by drag and drop without having to write any program code. The programs can then be copied and transferred to other controllers using USB sticks. In this way, programs can be designed and tested on the desktop computer and then transferred later to the application. The wiring must be carried out locally in the field using conventional point-to-point connections.

The ISD safety protocol is a special feature of the SC10 safety controller. ISD (In-Series Diagnostics) enables up to 32 safety devices to be linked as slaves in one in-series connection. The protocol is modulated to 24 V. In this way, information on switch states and diagnostics of the safety sensors can be called up by the PLC. This feature is otherwise only offered by expensive safety PLCs with fieldbus or Ethernet communication.

Many safety controllers can also be expanded easily. If all inputs and outputs on the XS26 controller are assigned, additional I/O can be provided using expansion modules. Up to eight units can be added by the user. Input or output modules, as well as OSSD or relay modules are available.

The labor intensive wiring required for the commissioning of a central safety architecture is often a disadvantage. Local protection boxes can then be used as an intermediate solution, in which the decentralized IP20 controllers are installed.

Rapid commissioning through offline engineering

The safety application on Banner's autonomous safety controller can be programmed and tested beforehand even if a machine or the individual machine module are still offline. The ability to test safety programs on the desktop computer and in the workshop considerably shortens the commissioning time. In live operation the central safety PLC can take over the application via a multiprotocol Ethernet connection. Integrated modular machines can thus control their safety functions locally at the module.

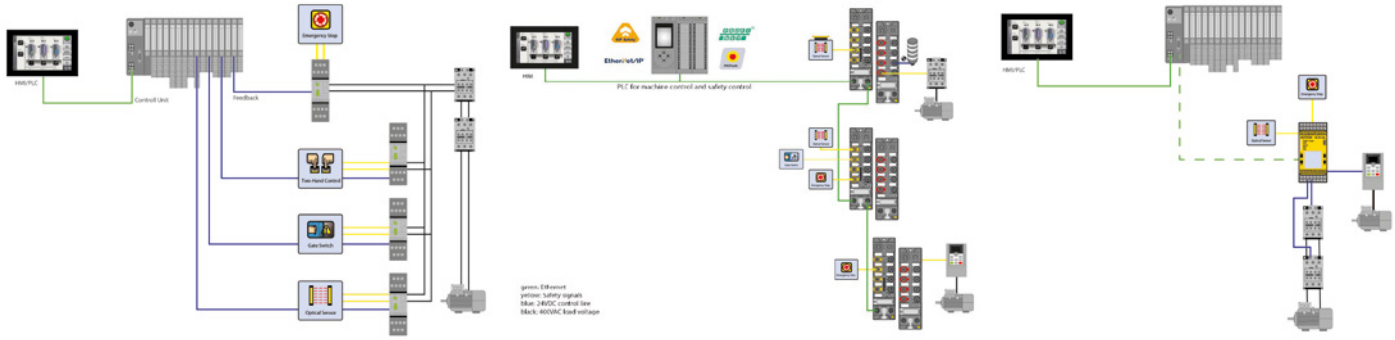
Decentralized safety concepts, centrally controlled

The use of decentralized safety installations with IP67 components is unavoidable for anyone wishing to minimize the setting up of central or decentralized protective housings in order to wire and commission their machines quickly. As is generally the case in automation technology, decentralized architectures are also being increasingly used in safety technology.

Two types of systems are used here: Decentralized concepts, which collect the safety signals on the IP67 I/O modules and bring them to the central safety PLC via fieldbuses or secure Ethernet protocols. And fully decentralized installations, which control safety applications directly in the field on IP67 safety controllers. Which of the two alternatives is better depends on the individual case. Both decentralized architectures offer the benefit of efficient wiring with Ethernet cables using standard connectors. The high information density and the possibility to exchange meta information simplify the commissioning and diagnostics of applications.

Long cycle times demand large safety distances

In applications using central safety PLCs, the protection devices may require larger distances from danger sources if longer reaction times have to be allowed for due to the bus cycle times required and the use of cascaded messages.



Turck's TBPN and TBIP safety I/O modules for Profisafe and for CIP safety can both be used for solutions requiring central or decentralized control. Both module versions are available as full safety modules with four safety-related universal inputs/outputs and four safety-related inputs which can collect up to 16 single-channel safety signals. The modules can reliably switch up to 2 amps per output, with up to 9 amps per module. They are suitable for use in applications up to PL e, Cat. 4, SILCL 3.

If in certain applications fewer safety-related inputs/outputs are required while standard I/Os are needed at the same time, Turck offers an innovative special solution in the form of its hybrid modules, both for (TBPN) and CIP Safety (TBIP). The hybrid modules come with two safety digital inputs as well as two safety universal digital inputs or outputs and four universal standard digital standard inputs or outputs. They switch the same currents and can be used in the same safety categories as the full safety modules. The hybrid safety modules come with two Class A I/O-Link master ports; the second port can be used for safety disconnects.

All Turck safety modules have a safety controller on board, which can be used to implement preprocessing for time-critical applications or also safety applications without a connection to a failsafe PLC. The integration of a stand-alone application in a safety control system with Profisafe or CIP safety communication is always possible at a later time. The modules can be programmed easily with a software tool. Its integrated web server simplifies diagnostics and commissioning during operation. Their robust design with fully potted module electronics makes all modules suitable for use in harsh industrial environments. They comply with protection types IP65/IP67/IP69K and also operate reliably in an extended temperature range of -40…+70 degrees Celsius.

Decentralized safety concepts offer a high level of flexibility, shorten commissioning times and simplify modularization

Decentralized safety solutions: The TBSB safely disconnects the actuator voltage V2 of downstream components

Decentralized solution with passive safety

The so-called passive safety is a variant of decentralized safety concepts. These applications are relatively inexpensive and offer an ideal combination of the advantages of central and decentralized safety architectures. Unlike conventional safety technology, passive safety applications do not supply every actuator via a separate safety output. Passive safety simply ensures that the voltage of a group of actuators is safely disconnected in critical situations. For this the I/O groups used ensure full galvanic isolation between the sensor voltage (V1) and the actuator voltage (V2). The actuator system of the machine is switched off irrespective of its state.

Safety also with IO-Link

Turck offers a comprehensive concept of passive safety solutions. All Turck I/O components, including the IP67 I/O-Link master, offer full galvanic isolation of V1 and V2. Turck I/O hubs for transferring up to 16 digital signals via IO-Link also isolate V1 and V2. This makes it possible to design safety-related I/O-Link applications even without an IO-Link Safety protocol. The TBSB safety box was developed by Turck specifically for safety disconnections. It is connected to the safety channel of a safety module (from Turck or another manufacturer) in the field and safely switches off the actuator voltage of the downstream modules when a safety event occurs.

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