

Customer Case Study

Machine building

Multifunctional safety relays used in modular selective soldering systems

High degree of safety despite decreasing costs

Summary

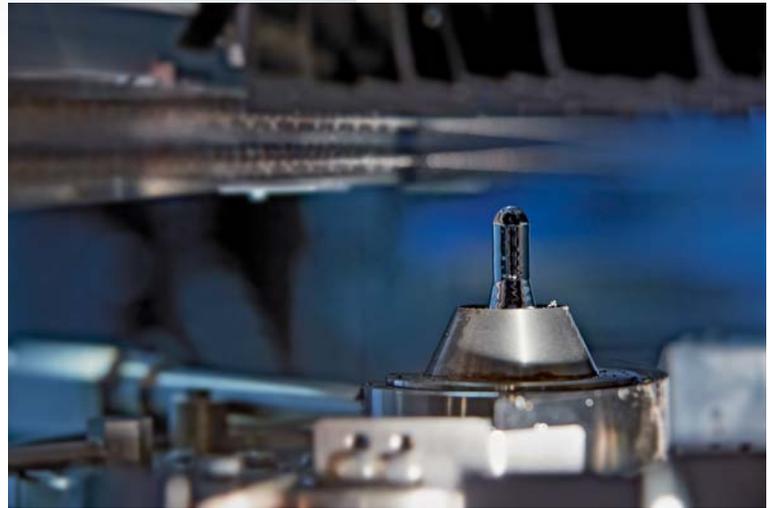
Innovative safety components and services from Phoenix Contact play a significant role here when it comes to protecting operators and machines.

Customer profile

Ersa GmbH is Europe's largest manufacturer of soldering technology. Safety technology has the highest importance, so Ersa has modularized the safety concept of its selective soldering systems.

Europe's largest manufacturer of soldering systems, Ersa GmbH, based in Wertheim, Germany, is one of the leading international suppliers of selective and wave soldering systems — and as such, needs to be able to respond quickly to changing business conditions. The company is a member of the family-owned Kurtz Ersa Group. Founded back in 1779 as a hammer foundry, Kurtz Ersa has become a globally active conglomerate. Its portfolio of products and services encompasses the electronic production equipment, metal components, and molding machines segments.

Ersa offers services and solution packages to help improve its customers' manufacturing processes. To live up to this claim, the soldering technology specialist must always be able to respond flexibly to user requirements. "Reflecting this situation, we have designed the control concept of our systems to be as modular as possible," explained Edgar Diener, who is responsible for the electrical design of the selective soldering systems that are part of the Electronic Production Equipment portfolio.



Challenge: Significantly lower space requirement

In recent years, the electronics sector has become much more competitive. Manufacturing companies must optimize their production workflows to address user demands for increasingly higher quality and shorter production times.

The selective soldering technique is frequently the only viable option if components must be soldered on both sides, and the wave soldering technique with the classic wave is no longer possible on the second side of the PCB. In compared to classic wave soldering systems, the selective soldering system generally requires significantly less space. In its minimum configuration, it comprises a programmable precision-spray flux system and a preheating soldering module. In soldering, flux is used to clean the surfaces of the components to be soldered and to remove any oxides from the solder.

The preheating process increases the temperature of a PCB before it comes in contact with the liquid solder. This initiates

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Figure 1: To automate its new selective-soldering systems, Ersä relies on multifunctional safety relays, as well as many additional components from Phoenix Contact.

the chemical action of the activator, vaporizing the solvent component in the flux. However, the temperature should be increased gradually and uniformly, to prevent mechanical stress in the PCB, which could occur due to differences in temperature. The maximum preheating temperature depends on the heat required to solder the board, the thermal stability of the flux, and the thermal load capability of the components. Depending on the customer's specifications, the function of the selective soldering system can be supplemented to include additional units, each comprising a preheating and soldering module.

Solution: Fast wiring without tools

As a result of the factors described above, Edgar Diener has decided to equip the Versa-Flow series with the new,

multifunctional PSR-MXF safety relay from Phoenix Contact. This ultra-thin 22.5mm safety component can process two local circuits and one higher-level sensor circuit up to PL e / SIL CL 3. Applications with compact space requirements can be implemented with the three-tier ME-MAX housing (just one of the housings available in the extensive Phoenix Contact product portfolio), which offers a total of 24 contact points (Figure 1).

The push-in connection system, which requires no tools, was also an important criterion in the selection of the safety relay. "Actually, I only want to use components that employ direct-connection systems as they facilitate simple and fast wiring," Diener explained. However, the diversity of functions and the related cost and space advantages were the decisive reasons for moving away from classic safety relays to the multifunctional PSR-MXF safety component.

Simple handling and superior flexibility

As the Ersä example shows, the PSR-MXF makes it possible to implement even modular concepts with ease. The patented concept comprises two independent shutoff levels in conjunction with two local functions and one higher-level safety function. This basic concept can be used as a platform for many typical machine applications. Compared to alternative concepts, the safety relay's integrated functionality significantly reduces the costs of verifying and validating the safety solution.

Edgar Diener explained: "In the future basic version – which will represent a significant percentage of the total business volume of



Figure 2: Versa-Flow selective-soldering systems

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the series – we can use just one instead of three safety relays.” Every additional module of the soldering system, which has its own control cabinet, can be integrated into the existing circuit concept. This can be achieved by looping the higher-level emergency stop signal from the fluxer module to all downstream sections of the circuit (Figure 2).

Ersa automation specialists also considered using a safety relay that can be configured by software. “However, after careful consideration, we finally selected the PSR-MXF multifunctional safety relay. This is because the complete system concept has been consciously designed to facilitate simple handling and to achieve a high degree of flexibility. If we had decided to use a configurable safety relay, this would have meant that every module expansion would involve having to individually adapt the software,” elaborated Edgar Diener.

This is especially important as the installation concept of the soldering systems has been created to achieve the highest possible degree of effectiveness. Ersa personnel can manufacture a new soldering system at the production line in nine 4-hour cycles. “Given this backdrop, the modular concept requires a distributed architecture and fine granularity under optimum cost and space conditions,” explained Edgar Diener (Figure 3).

Comprehensive support

During the risk assessment stage, which was moderated by safety experts from Phoenix Contact, the participants decided that the



Figure 3: A new soldering system leaves the production line in Wertheim, Germany, after nine cycles, each lasting four hours.

safety door locks of the individual function units – i.e., fluxer, preheating, and soldering module – must also act on the upstream and downstream modules. When opening a safety door, there is always the possibility that the operator can access adjacent areas. On the other hand, for process-related reasons, the complete line should not be shut down each time a door is opened (Figure 4). However, emergency stop devices are located along the system to ensure that the complete line can be reliably, safely, and quickly shut down.

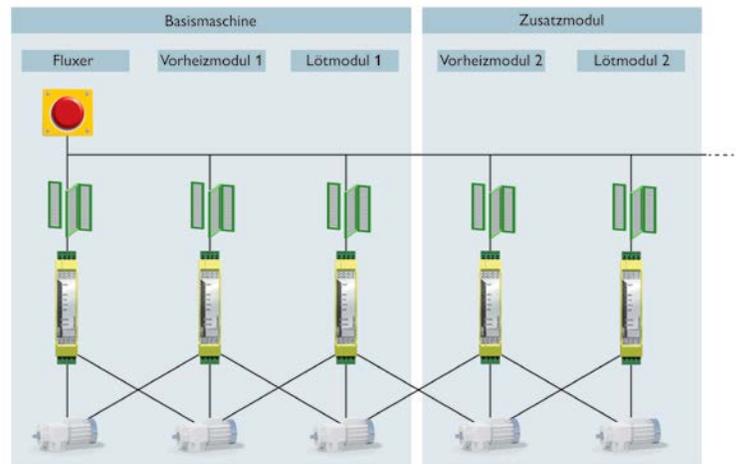


Figure 4: Safety concept of Ersa selective-soldering systems

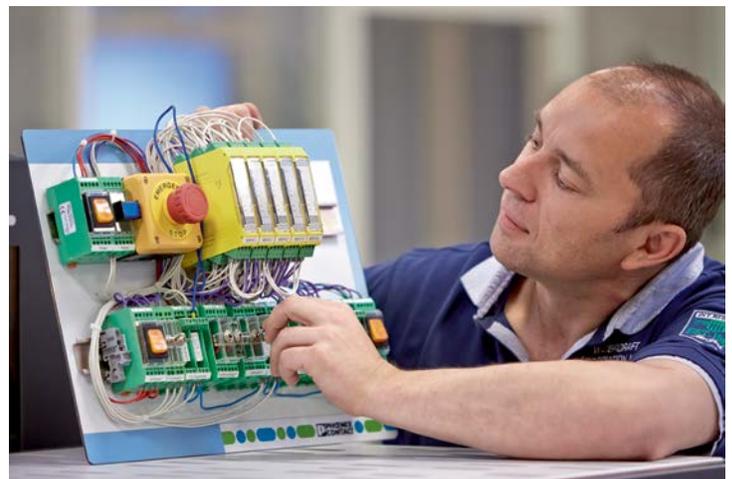


Figure 5: Edgar Diener, who is responsible for the electrical design of the selective soldering systems, checks the safety solution circuit using a demonstration board.

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The specialists also incorporated the impact of the new EN ISO 14119 standard into their safety-related assessments and evaluation. Once the requirements were clearly defined, Phoenix Contact provided Erska personnel with engineering support. Together, the team drew up the complete safety-related implementation at the circuit diagram level, taking into account various sensor/actuator combinations. To check the circuit, safety specialists from Phoenix Contact provided a wired demonstration board, which Edgar Diener and his team successfully used to fine-tune the functions (Figure 5).

Results: Everything from a single source

To automate its new selective-soldering systems, Erska not only purchased the PSR-MXF multifunctional safety relay from Phoenix Contact, but also Quint Power power supplies, standard relays, as well as customized preconfigured terminal strips mounted on rails. PSR-MXF safety relays can be used in basic machines as well as in modular safety concepts. Phoenix Contact's comprehensive product portfolio, complemented by the company's engineering expertise, helps users build individual solutions that offer true value and go far beyond the portfolio of classic suppliers in the safety technology domain.

Safety door locking mechanism ensures maximum safety

In many applications, the contacts of safety door locking systems are still wired in series to a safety relay. However, if several safety doors must be simultaneously opened due to procedural constraints, this can lead to an inadequate level of fault detection. Consequently, safety-critical faults can no longer be detected. This means that a second fault could cause the systems to go into a critical state. EN ISO 14119 — successor to EN 1088 — describes this phenomenon.

This is why it is so important that each of the PSR-MXF's three sensor circuits complies with the highest safety level up to PL e / SIL CL 3. The new family of multifunctional safety relays encompasses four-function versions for connecting to various signal transmitters, such as electromechanical switches, magnetically operated switches with antivalent sensor circuits, and OSSD-capable signals from optoelectronic protection devices. The sensors can be connected through either one or two channels. Both safety circuits can be connected independently of one another, either with an automatically or manually monitored start. Additionally, each function module offers three different connection systems: screw, twin spring-cage, and push-in technology.