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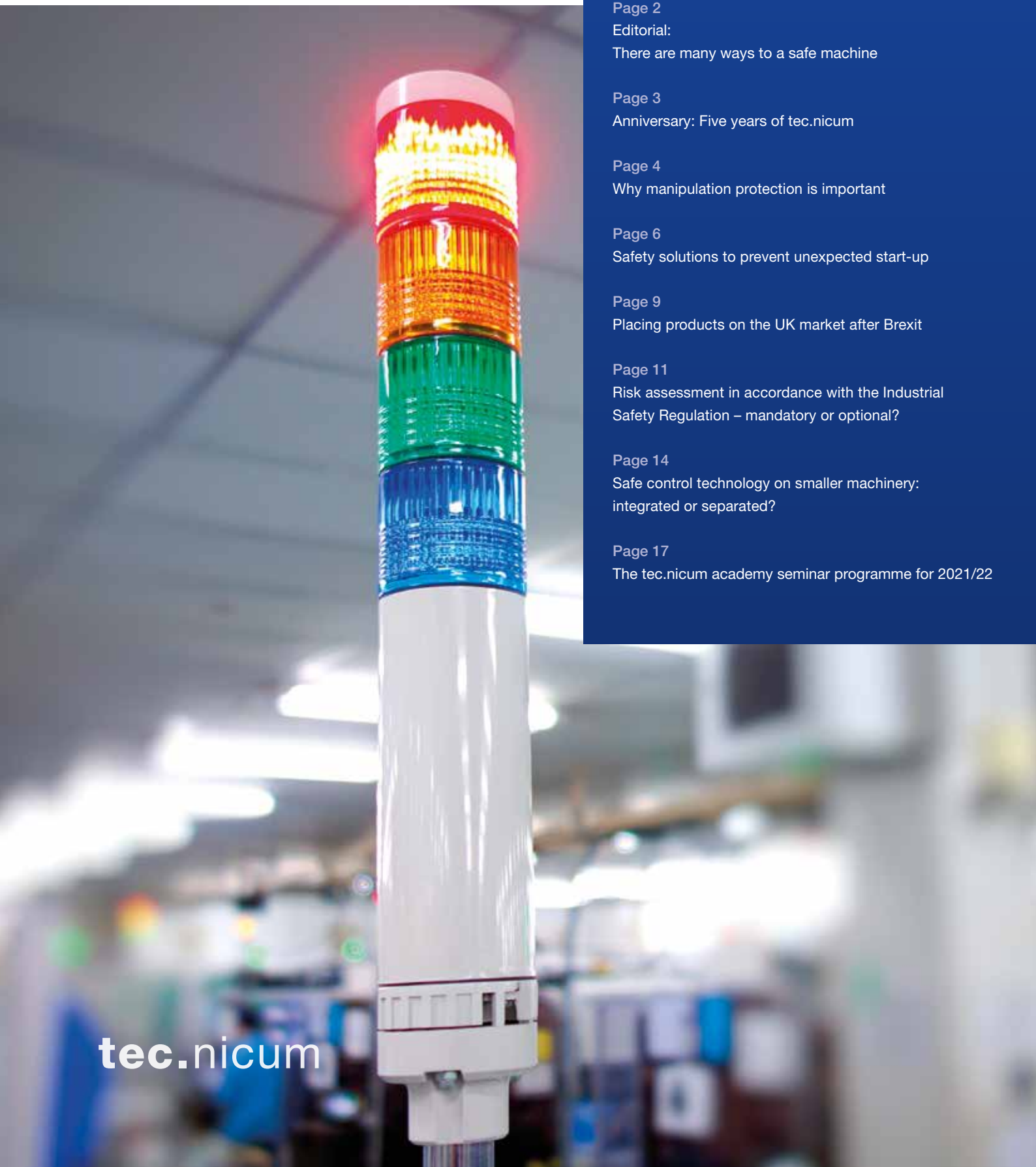


tec.nicum

Editorial

There are many ways to a safe machine

“Many roads lead to Rome” is a saying. It means that there are always several ways to achieve a goal. Allegedly, this eternally valid wisdom goes back to a gold-plated bronze column that Emperor Augustus had erected in Rome in the year 20 BC and on which the names of all capitals of the provinces of the Roman Empire could be read with their respective distance from Rome.

In this sense, we would like to show you various ways that lead to a safe machine and a safe working environment for your employees. ‘Safety integrated’ or ‘Safety integrated’, for example, are two different concepts with which machine safety can be implemented. In this issue of MRL News we explain in which cases one or the other makes sense.

There are also various methods when it comes to avoiding an unexpected start-up of dangerous movements in complex machine areas, for example by using single or double acknowledgment systems. And that’s a good thing, because it can prevent accidents, e.g. during repair and maintenance work, which often lead to injuries or are even fatal.

Unfortunately, there are also many ways to bypass a safety device. That is why protection against manipulation is very important. In this MRL News we present various options for recognizing and avoiding incentives for manipulation.

Anyone who is afraid of losing track of the multitude of options is advised to conduct a risk assessment, which is a good basis for the sensible selection of protective devices and other measures to be implemented.

Brexit is also a topic in this issue. The good news is that the roads that lead to the UK are still in place. However, there are new rules that have to be observed. Find out more on page 9.

A preview of the new seminars offered by the tec.nicum academy in the coming year is available in the calendar of events on page 17. There you will also find the seminars still taking place in 2021.

And finally, we are celebrating a small anniversary in this issue: tec.nicum has existed for five years! In this MRL News, we describe the path our team has come since the unit was founded in 2016.

Sincerely,
Your editorial team

Different concepts for machine safety: „Safety integrated“ or „Safety separated“.

Happy Birthday – 5 five years of tec.nicum

Services for machine and plant safety

tec.nicum, the service division for machine and plant safety belonging to the Schmersal Group, is celebrating its fifth anniversary. A lot has happened since tec.nicum was founded in 2016. Reason enough for a brief review.

In these five years we have:

- Made countless phone calls and successfully advised our customers on the optimal implementation of the complex requirements of the EC Machinery Directive 2006/42 / EC as part of the tec.nicum support ticket,
- Covered thousands of kilometres and prepared tailor-made standard research, risk assessments, SISTEMA calculations, validations, CE conformity assessments and technical documentation for renowned machine manufacturers in all industries,
- Reliably supported dozens of machine operators in documenting the safety status of their machinery, risk assessments, follow-up time measurements, modifications and retrofitting,
- Held numerous practical seminars on functional machine safety and continuously expanded the range of topics,
- Hired numerous highly qualified employees and expanded our global network of TÜV-certified security experts many times over.

In 2010 a small training centre was founded, followed by the new service division in 2016. Today, five years later, tec.nicum has established itself as an internationally recognized provider of security services.

We have been able to convince machine manufacturers and operators around the world of the services of tec.nicum with transparent and timely project processes when carrying out complex, exciting tasks. A development we are proud of.

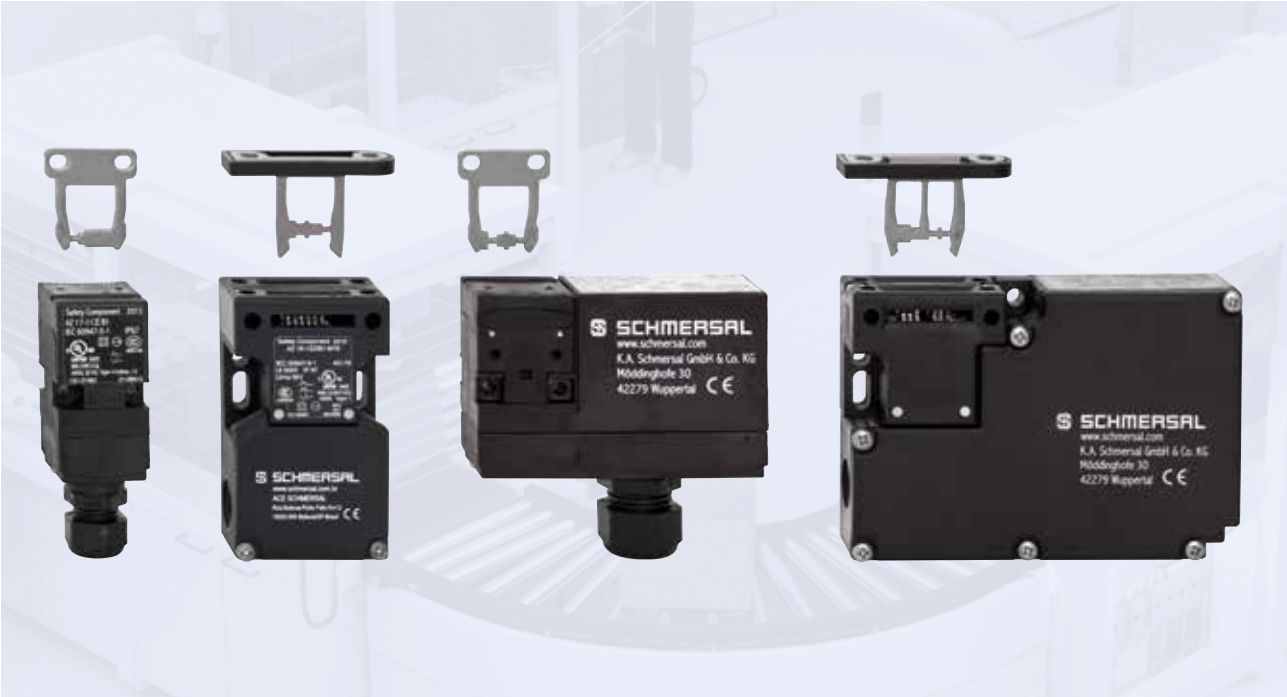
Prospects are good, our focus is clearly on growth. Our heart continues to beat for attention to detail and efficiency, always with the aim of finding the best solution for each customer.

In accordance with our own commitment: **tec.nicum** – excellence in safety – we care!

We look forward to the next few years and thank our customers for their trust and constructive cooperation. ■

Why manipulation protection is important

Manipulation of protective devices is responsible for 25 per cent of all occupational accidents



The AZ16 and AZ17 as well as AZM161 and AZM170 are the world's only electromechanical safety switches and solenoid interlocks with high coding in accordance with ISO 14119.

The manipulation of safety equipment is an underestimated phenomenon. In addition to the directive-compliant design of safety technology, protection against manipulation plays a serious role. Already during the design of a machine, it is important to counter manipulation incentives.

Why are protective devices manipulated at all? A study[1] from 2006 concluded that around 30 per cent of all protective devices are manipulated, at least temporarily. At the time, a quarter of all occupational accidents could be attributed to manipulation. The manipulation of protective devices has been made more difficult thanks to use of electronic sensors, particularly following the introduction of EN ISO 14119[2] in 2014, but it can be assumed that these figures have not changed significantly since. As modern production systems are becoming increasingly complex and more prone to error and since the requirements on productivity, and thus on operating personnel, are ever increasing, the incentive or the perceived need for manipulation continues to exist.

The time saved when carrying out troubleshooting or during setup operation is the reason most often given for manipulating protective devices. In addition, protective devices that once triggered, whether or not unintentionally, require time-consuming machinery re-setting are also prone to manipulation.

Responsibilities

The incentive to manipulate must be countered as early as the machinery design phase. Faults and the setup of machinery during formatting changes, for example, cannot be entirely avoided in practice, so it is the responsibility of the machinery designer to allow the user to eliminate faults and set up the machine using, for example, suitable operating modes.

This process is already a requirement under the EC Machinery Directive[3]. DIN EN ISO 12100[4] also requires that operating personnel must not be unduly impeded in their activities during intended use of the machinery. This requirement applies to all life phases of the machinery, i.e. the designer must provide measures for the safe installation of the machinery during installation.

The operator also has a responsibility to prevent incentives to manipulate the machinery. This is governed by the →

requirements of the Occupational Health and Safety Act[5] and the Industrial Safety Regulation[6]. In addition to his influence over procurement of the machinery, and thus its design, he is also responsible for creating suitable processes to prevent manipulation.

Assessment of incentive to manipulate

The IFA for example offers a number of tools[7] to quantify the incentive to manipulate and thereby make any corresponding measures assessable. DIN EN ISO 14119 is also dedicated to manipulation protection, as the locking devices covered by this standard are often the target of manipulation (attempts).

The revision of this standard, which is currently under final discussion, further specifies measures to protect against manipulation, in particular the table of measures to be used against manipulation (Section 7). Publication is expected in the first quarter of 2022.

Manipulation protection for safety switchgear

If design options have been exhausted or are not economically efficient, protection against manipulation of the safety switchgear comes into effect. What options are given here?

Even when mechanical safety switches are used, they can be thoroughly protected against manipulation by means of concealed installation. In other words, due to the structural conditions alone, actuation other than by the protective device is not possible. Hinge switches in particular are a good example here. With these switches, the mechanical system is fully encapsulated, and thus well protected against manipulation.

Even 'classic' safety switches with a separate actuator offer protection against manipulation attempts in their encoded version. The much-cited 'substitute actuator' on the keyring is then no longer enough to manipulate protective devices.

The safety sensors of the RSS series, such as the RSS16, offer needs-based tamper protection thanks to the RFID technology.

Driven by the requirements of DIN EN ISO 14119, many manufacturers have begun to rely on safety switches with high coding and electronic outputs. In this regard, RFID technology offers an easy way to realise a range of encoding options.

Automatic loading and unloading reduce the need for the operator to access the hazardous area, minimise downtimes and thereby reduce the incentive to manipulate. Light grids with corresponding muting sensors offer an efficient option here, so long as planning is carried out with due diligence.

If less emphasis is placed on preventing manipulation and more on minimising the incentive to manipulate, small programmable safety controllers, such as the PSC1, enable a range of clear and flexible safety solutions. Consequently, requisite operating modes can be realised without the need for significant effort, and reduced speed can be easily implemented when the guard door is opened. ■

[1] Apfeld, Huelke, Schaefer, Paridon, Windemuth, Zieschang, Preuße, Umbreit, Hüning, Reudenbach, Pfaffinger, Wenchel, Reitz, Pinter; Manipulation von Schutzeinrichtungen an Maschinen, Hrsg.: Hauptverband der gewerblichen Berufsgenossenschaften (HVBG). Sankt Augustin 2006
[2] DIN EN ISO 14119: Safety of machinery – Interlocking devices associated with guards – Principles for design and selection. Beuth Verlag Berlin
[3] Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery
[4] DIN EN ISO 12100: Safety of machinery – General principles for design – Risk assessment and risk reduction
[5] Occupational Health and Safety Act – Act on the implementation of occupational health and safety measures to improve the health and safety of employees at work.
[6] Industrial Safety Regulation – Regulation on health and safety protection when using work equipment, dated 3 February 2015
[7] IFA software: Assessment scheme for evaluating the incentive to bypass protective devices on machinery

Danger spotted, danger averted

Safety solutions to prevent unexpected start-up

Companies repeatedly have to contend with serious, even fatal, accidents caused by the unexpected or unseen start-up of complex machinery and systems.

The safety switch AZM201D with a double safety function is often used for setting up operations in robot systems.

Risks due to the unexpected start-up or restart of hazardous movements exist in accessible machinery areas or if protective devices can be can be bypassed and people are present in those areas without being noticed – perhaps on account of maintenance or repair work. These risks need to be determined as part of a risk assessment, which every machinery manufacturer or system integrator must carry out and document under the Machinery Directive.

The particular problems that this topic presents were the reason for a dedicated harmonised standard – EN 1037 'Prevention of unexpected start-up', the successor standard to which has been published as EN ISO 14118:2018.

EN ISO 14118:2018: Prevention of unexpected start-up

The standard offers an overview of a range of aspects and requirements that must be considered. In addition, it also lays down design safety measures that seek to prevent unexpected start-up in order to allow safe intervention by people in hazardous areas.

The standard refers to unexpected start-up due to all types of energy, i.e. energy supply (electrical, hydraulic, pneumatic), stored energy (gravity, tensioned springs), which is often overlooked, and other external influences (wind).

The following presents some example safety solutions on the topic, all of which are available in the range provided by Schmersal.

Versions of the stop command

In the following, it is assumed that a stop command is safely generated by a protective device being triggered in the input, logic and output chain with the necessary performance level and is executed in the form of a stop of category 0, 1 or 2.

The standard EN 60204-1 outlines the different categories according to which a stop command, depending on the best possible hazard reduction, can be executed

- as an uncontrolled shutdown (by immediately interrupting the energy supply: stop 0) or →

- as a controlled shutdown (by time-delayed interruption of the energy supply: stop 1).

Safety-related standstill monitoring is also required (see also EN ISO 14118:2018), if a stop command is executed as a stop of category 2, i.e. as a similarly controlled shutdown, but here the energy supply is maintained, even at standstill.

All Schmersal protective devices and safety-related control devices offer a wide range of options for the accomplishment of safety-related stop commands. Safety relay modules in the SRB-E series are especially suitable for stop category 0, for example.

Permanent stop command

A permanent stop command has a particular role to play when a person is required to work for an extended period of time in a hazardous area with blind spots.

In this context, 'permanent' means that no third person can initiate or cause the machine to start. A hazardous area can easily have many blind spots for third persons – consider linked individual machines, integrated production systems and machinery plants.

A simple yet more effective means of achieving this objective is to use lockout tags for movable guards (guard doors, safety grids, etc.). These accessories make it possible to secure interlocking devices (safety switches with and without interlock) in the open state by means of padlocks such that it is not possible to actuate the devices again. This effectively prevents reclosure of the movable guard and restart of a machine by a third person – both mechanically and in terms of control technology.

One design example is the AZM400 electronic solenoid interlock with lockout tag.

Key transfer systems also offer smart options for protection against an unexpected (unintentional) start-up, particularly when operators are working in a complex hazardous area or need to use special modes of operation.

Single and double acknowledgement systems

Such additional measures are not necessary in all cases. Also, not always are interlocking movable guards necessary that are safeguarded with interlocking devices. For example, sometimes it is better to use optoelectronics.

For other applications in complex hazardous areas, acknowledgement systems may be considered, whereby a distinction is made between single and double acknowledgement.

A single-acknowledgement system comprises an acknowledgement button fitted outside of the hazardous area, which cannot be actuated from inside the accessible area without triggering the protective function. The acknowledgement button must be positioned such that there is a clear view of the hazardous area.

The restart of hazardous movements must only be possible:

- After actuating the acknowledgement button following an interruption of the light curtain, or
- After closure of the respective movable guard, followed by actuation of the acknowledgement button (source: Employer's Liability Insurance Association for Raw Materials and the Chemicals Industry BG RCI, Sheet T 008).

The double acknowledgement procedure is explained here using the example of Schmersal's PROTECT SRB 100DR relay module. The function of the module ensures that the machine controller can only be switched on again if

- The operator firstly actuates a reset or restart button 1 located within the system and, after leaving the hazardous area, if applicable, closes and locks again a separating safety device – →

Especially for the stop category 0 the safety relay modules of the SRB-E series can be used.

- a reset or restart button 2, which is fitted outside, was subsequently actuated. A time window (adjustable via DIP switch) of 3 to 30 seconds is provided for execution of 'double' acknowledgement in which the actuation – in the sequence button 1 then button 2 – must take place. The time window can be oriented to the operational processes.

If the operator fails to press first button 1 or does not press button 2 within the time window, there is no release and the double acknowledgement process must be repeated. Further signal processing of the reset signal is then carried out via commercially available safety relay modules, such as the PROTECT-SRB series, i.e. the SRB 100DR module is a ballast unit with performance level 'e'.

The safety relay module PROTECT SRB 100DR can be used for the double acknowledgement function.

Signal processing of the falling or rising edge on reset buttons?

Whether a reset signal (synonymous with restart, acknowledgement or reset signal) is executed as a single or double after leaving a hazardous area, the same question arises: With electrotechnical setups, is the evaluation of the reset signal only permissible via the falling edge or via a rising edge as well?

After carrying out an FMEA (Failure Mode Effect Analysis), the DGUV's, Wood and Metal Department, has concluded that 'both variants function safely due to the edge evaluation when an error occurs. Not all errors are, however, recognised immediately in both solutions. This can lead to a false positive if another error then occurs. Decisive for the realisation of a reset signal is not the type of edge detection (high-low or low-high), but correct evaluation of the dynamic behaviour as well as the requisite error detection in the evaluation device. Even with a rising reset signal edge, the requirements in accordance with DIN EN ISO 13849-1 can be satisfied accordingly if implemented correctly.' (Source: DGUV-Information, 'Manual reset device for the reset function in accordance with DIN EN ISO 13849-1', edition 02-2015).

One execution example is the electronic solenoid interlock AZM400 with a lockout tag.

In addition, the following also applies to the reset function:

- It must be provided by a separate, manually operated device in the safety-related part of the machine control system, and
- The device may only be accessed if all safety functions and protective devices are functional;
- It must not itself initiate any movement or hazardous situation and the reset function is an intended action that enables the controller to accept a separate start command.

The performance level must not diminish the safety of the associated safety function. Further requirements on the topic of resetting can be found in DIN EN ISO 13849-1, Section 5.2.2. ■

The 'UKCA mark' becomes compulsory

Placing products on the UK market after Brexit

The United Kingdom of Great Britain and Northern Ireland (UK) departed the European Union on 'exit day', which was 31 January 2020. The transition period, which was agreed in the departure agreement of 12 November 2019, and under which the UK remained a part of the EU single market, came to an end on 31 December 2020. Since that date, a separate legal system has been in force in the UK, distinct from the EU single market, which has meant significant changes to market access conditions for products moving from the EU to the UK.

A transition phase is in place until 31 December 2022, allowing manufacturers to sell products in the UK bearing the CE mark or, alternatively, the UKCA mark. Until that date, the CE mark, CE Declaration of Conformity and, if applicable, EU type approval will continue to be recognised as equivalent alternatives to the corresponding UK elements.

After the end of the transition phase, i.e. with effect from 1 January 2023 at the latest, all manufacturers will be obliged to meet certain British requirements to be able to market their products in the UK. These include:

- UKCA mark on products – the CE mark will no longer be recognised. Stocks already in the United Kingdom by that date will remain unaffected.
- Creation and provision of UKCA Declarations of Conformity where required by UK guidelines (statutory instruments).
- Importer name.
- Appointment of a person based in the UK who can compile the technical documentation.

The UKCA mark must be affixed to the product itself. If this is not possible for space reasons, the UKCA mark, as with the CE mark, may alternatively appear on the packaging and the accompanying documents.

In addition to the manufacturer's information, importers must also display their name and address on the product. The importer must be based in the UK. This also applies to the person who can compile the technical documentation, as it must be possible for market surveillance authorities in the UK to contact that person in a legally effective manner. It is also possible to entrust compilation of the documentation to the importer. →

A UK Declaration of Conformity is mandatory for the UKCA mark – the Declaration is issued by the manufacturer and refers to national statutory instruments. The Declaration of Conformity is largely identical to the EC Declaration of Conformity, but it declares the product's conformity with British regulations.

As in the EU, the UK also has voluntarily applicable standards that trigger a presumption of conformity. If a manufacturer chooses to apply these 'designated standards', they can assume a presumption of conformity of the product with the requirements of relevant regulations for the UKCA mark.

The British government has published a list of 'designated standards', which to date contains the following product categories: machinery, pressure equipment, ATEX devices and electromagnetic compatibility.

However, if a product is subject to mandatory certification (e.g. for type examination) in the EU, this generally applies in the UK under the UKCA mark as well. It must be noted that the certifying body for the UK market must be based in the UK.

According to the VDMA, there were 148 UK Market Conformity Assessment Bodies (UKMCAB) listed by March of this year, but only seventeen of those were responsible for machinery. The VDMA is concerned that there may be bottlenecks when it comes to the testing of machinery.

Derogations for Northern Ireland

Northern Ireland is an exception and remains 'de facto' part of the European Customs Union. Consequently, products from the EU which bear a CE mark in accordance with EU harmonisation law can continue to be placed on the market in Northern Ireland. These products cannot be moved from Northern Ireland to Great Britain for sale. Conversely, products from Great Britain must bear CE marking if they are intended for the market in Northern Ireland.

Only if mandatory certification (type examination) by a notified body is prescribed for the product and the certificate originates from a British body is an additional marking with UK(NI) required. This latter point is, however, of little practical relevance to manufacturers based in the EU.

Further information:

- www.zvei.org
- www.vdma.org
- https://www.gov.uk/guidance/placing-manufactured-goods-on-the-market-in-great-britain
- https://www.gov.uk/guidance/designated-standards
- https://www.gov.uk/government/news/businesses-given-more-time-to-apply-new-product-safety-marking

The basis is the “current state of the art“

Risk assessment in accordance with the Industrial Safety Regulation – mandatory or optional?

Employers are obliged to assess and document the risks to their employees in the workplace. Carrying out and documenting the risk assessment not only helps to satisfy legal requirements, but also records business risks and, on the basis of a risk assessment, can determine which preventive occupational health and safety measures make sense.

This way, employers can minimise the costs incurred as a result of occupational accidents and work-related illnesses.

As such, it is important to comply with the statutory obligation to carry out a risk assessment, whatever the circumstances.

The legal basis of the risk assessment

The legal basis for risk assessment includes Art. 5 of the Occupational Health and Safety Act (ArbSchG). Additionally, individual European directives and the associated national regulations also set out specific requirements that must be satisfied. For the operation of work equipment and workplaces, this is the Industrial Safety Regulation (BetrSichV) or the Workplace Regulation (ArbStättV) and for the handling of hazardous substances, the Hazardous Substances Regulation (GefStoffV). Compliance with, inter alia, the following is also required: the Biological Substances Regulation (BioStoffV), the Noise and Vibration Occupational Health and Safety Regulation (LärmVibrations-ArbSchV), the Load Handling Regulation (LasthandhabV), the Maternity Protection Act (MuSchG) and the Occupational Health and Safety Regulation on Artificial Optical Radiation (OStrV) etc.

These regulations essentially only consider the potential hazards in the workplace from different perspectives or in respect of different aspects.

Decisive for machinery operators is the Industrial Safety Regulation, the first version of which was published in 2002, with the most recent amendment to the latest version published only in July 2021. Under the BetrSichV issued in the year 2015, companies may only make machinery available to their employees if its safe operation is consistent with the state of the art. The same requirement applies to old machinery. →

Technical rules of operational safety

The requirements of the BetrSichV in respect of the determination and assessment of hazards and the derivation of suitable measures are specified in the Technical Rules for Operational Safety (TRBS). These rules provide information on implementation in practice and indicate potential safety solutions. Additionally, the presumption of conformity also applies here: When the TRBS are applied, the requirements of the BetrSichV are considered to be satisfied. The TRBS are regularly updated to the state of the art and the most recent version is published.

What's more, there are also recommendations on operational safety (EmpfBS), which reflect the state of the art, occupational medicine and occupational hygiene as well as other guaranteed occupational science findings for the use of work equipment. In contrast to the TRBS however, the EmpfBS do not trigger a presumption of conformity when applied. However, their publication makes them state-of-the-art and should therefore be used.

The objective of the BetrSichV is to 'ensure safety and safeguard the health of employees while they are using work equipment. This should be accomplished by selecting appropriate work equipment and ensuring its safe use.' With this in mind, the risk assessment is a uniform tool for checking whether the work equipment provided is safe for its intended use.

The employer must, therefore, carry out a risk assessment to determine the hazards arising from the use of work equipment and to assess the interactions resulting from the work equipment itself, the working environment, ergonomic factors and the stresses and strains on employees. Using this information the employer must then derive requisite and appropriate protective measures according to the hierarchy of measures, namely technical – organisational – personnel.

Updating and regular review

The BetrSichV stipulates that a risk assessment must be carried out before selection and procurement of work equipment and before its first use.

An update is required if

- Safety-related changes to working conditions, including changes to work equipment, require it,
- New information becomes available, in particular findings from accidents or from occupational medicine, or
- A review of the efficacy of protective measures in accordance with Art. 4 (5) BetrSichV has demonstrated that the protective measures determined are not effective or sufficient.

The BetrSichV also prescribes regular review of the risk assessment according to the state of the art.

State of the art

The employer is also responsible for ensuring that risk assessments are carried out in an expert fashion. It may task reliable and competent persons to undertake risk assessment work, such as a specialist in occupational health safety. Such a commission may only be granted in writing.

Finding an expert to undertake a risk assessment can often prove challenging, however, as the expert must have sound expertise in order to be able to determine whether the protective measures are consistent with the state of the art.

This requirement comes from the fact that the use of work equipment is only permitted if

- A risk assessment has been carried out,
- The protective measures determined are consistent with the state of the art,
- It has been determined that use is safe in accordance with the state of the art.

The risk assessment procedure

The risk assessment includes the systematic determination and assessment/evaluation of potential hazards in the workplace and the determination of requisite measures. →

Its undertaking is divided into the following process steps:

- Obtaining requisite information
  This also includes the definition and systematic delineation of work equipment, the working environment and work activity.
- Determining the hazards
  This step requires determination of not only the relevant hazards, but also the types of exposure, the likelihood of damage and the extent of that damage.
- Assessing the hazards
  The question of whether work equipment is safe when used as intended must be answered with consideration for the state of the art, BetrSichV, TRBS, etc.
- Determining specific protective measures
  The requisite protective measures are determined according to the TOP principle (technical – organisational – personnel).
- Carrying out the measures
  The employer must monitor or check that the measures are actually carried out.
- Checking the efficacy of the measures
  This means checking whether the measures achieve the intended objectives and whether the hazards have been effectively eliminated.
- Documenting findings
  In accordance with Art. 6 ArbSchG, documentation is mandatory. The result of the risk assessment, the occupational safety and health measures determined and the result of their review must be documented at a minimum.

Conclusion

In accordance with the ArbSchG and BetrSichV, a risk assessment is a fundamental responsibility of every employer. The employer may, however, choose to commission an expert to carry it out. Doing so may be useful, as regular reviews of risk assessments are also required. Additionally, the current state of the art is always the basis for a risk assessment. Any adjustments to work equipment or protective measures that may be required are also based on the state of the art. As such, appropriate expertise is required for a risk assessment to be carried out, particularly with regard to 'actual' and 'target' states as well as with regard to the technical protective measures in accordance with the state of the art.

The qualified experts at tec.nicum can provide support in the carrying out and documentation of risk assessments. Our experts check machinery, systems and production lines based on a previously agreed upon priority list or checklist. In so doing, they follow the procedure set out in TRBS 1111, 'Risk assessment'. In addition, tec.nicum experts also explain what needs to be considered if machines need to be modified or if several machines are to be linked together into a new unit or system. If adjustments are required, then specific recommendations are issued. They also document the results of the assessment. ■

Further information on risk assessments

A webinar on the topic of risk assessments is now available on the Schmersal Group website: (only in German language) https://www.schmersal.com/service/webinare/

The speakers, Benjamin Günnel, Safety Consultant at tec.nicum (Wuppertal), part of the Schmersal Group, and Jürgen Heimann, Lecturer for Occupational Health and Safety and Product Safety at tec.nicum (Kirkel-Limbach), explain the procedure followed when carrying out risk assessments. They also explain the obligations on machinery operators under the BetrSichV and other sets of rules and which standards must be taken into account when carrying out risk assessments.

Integration is not always the best approach

Safe control technology on smaller machinery: integrated or separated?

Safety controllers are becoming increasingly popular as an alternative to relay modules, even on smaller machinery. The designer can opt for one of two concepts – safety integrated and safety separated. Some designers favour integration into the automation PLC, but a separate (small) safety controller offers clear benefits.

Safety integrated or safety separated – in other words, should the safety of machinery be integrated into the operational control system or be implemented separately, i.e. by means of separate hardware and software? This is the question that every machinery designer needs to ask.

Safety controller replaces relay modules

The question is especially important in the case of smaller machinery with a manageable number of safety functions and switchgear devices. There is a noticeable trend for machinery builders to replace multiple safety relay modules with one safety controller (safety separated) or with a PLC with integrated safety functions (safety integrated).

There is good reasoning behind this trend. In the first instance, machinery is becoming increasingly complex. It features additional and differentiated safety functions, in some cases offering interaction with the operator. Examples include setup with touch mode or troubleshooting. This does, however, presuppose that these options can be mapped and monitored in the safety-focused control system.

Additionally, the requirements on the safety of machinery are becoming increasingly stringent, partly due to growing awareness of hazards and partly due to increasing differentiation of general and machinery-specific standards.

An increase in productivity and availability

Equally important is the fact that differentiated, needs-based implementation of safety of machinery requirements can also enhance user operability and machinery productivity. Machinery builders can, for example, use a safety-focused control system to create the prerequisite for bringing only part of a machine to a halt in the event of irregularities. Additionally, safety functions can be linked together, which can also lead to increased productivity and avoidance of unscheduled downtime. Plus, the enhanced diagnosis options when compared to safety relay modules enable more rapid localisation of fault causes in the event of malfunctions. This helps to boost availability of the machinery.

Simpler and more flexible

If we compare safety solutions based on relay modules with those based on state-of-the-art control technology, whether safety integrated or safety separated, it becomes clear that from a certain complexity of the safety functions onwards, the effort required for wiring, documentation and validation of the module solution is disproportionately high. →

Developed for applications with a manageable number of safety switchgear devices – the parametrisable compact safety controller Protect Select.

With safety control systems, the wiring effort is reduced. Configuration is also simpler and at the same time enables better adaptation to the individual application, as it can be realised in wide-ranging areas through parametrisation and programming. This enables greater flexibility through simple infrastructure – an attractive combination both for the machinery builder and the user.

Integrated or separate?

So, to return to the original question: should the machinery builder accomplish these benefits with an integrated or separated solution for the safety of machinery? At first glance, there is more than one argument in favour of integration – the fact, for example, that common PLC generations cover safety of machinery tasks and that users can save on costs as well as space in the control cabinet. Plus, it's for good reason that integration has become a popular concept in automation and digitisation. In theory at least, integrated solutions promise robust coordination of functions – in this case, of operational and safety-related signals – and simple infrastructure with reduced hardware effort.

The benefits of 'safety separated'

In practice, there are clear benefits of a 'safety separated' solution and the designer would be well advised to consider and weight these benefits. On this basis, he can then decide which of the two concepts is more suited to the situation.

One of the positives of standalone machinery safety infrastructure is the fact that a safety concept can be accomplished independently of the automation solution and, therefore, independently of the manufacturer of the functional control system that may be specified by the machinery builder. Consequently, even when customer-specific automation PLCs are used, a standardised safety concept can be accomplished on an always identical component and hardware basis.

Another benefit is that you do not need to be a PLC specialist to program the safety functions – the range of language is manageable when compared to automation control systems.

The option to integrate remains open

Opting for 'safety separated' does not mean that integration is impossible. Quote the opposite in fact. Fieldbus protocols enable integration into higher-level control systems, which might be required when production systems comprising multiple subsystems from different providers need to be integrated. In that case, the safety solutions of the individual system must be connected in order to implement a higher-level emergency-stop function, for example.

If the higher-level safety concept is based on a safety integrated solution, machinery and subsystems that operate in standalone mode (without a higher-level safety PLC, e.g. during the commissioning phase) can often only be operated in a rudimentary manner. On the other hand, a compact safety controller like the PROTECT PSC1 offers a simple and flexible option by means of integrated safety protocols (Profinet Profisafe and EtherCAT FSoE) to operate such machinery encapsulated and, if required, to integrate them into fail-safe fieldbus architectures without having to make changes to the safety application.

Compact and complete

Manufacturers of smaller machines in particular are faced with ever more more stringent safety requirements. In addition, the expectations of end customers in terms of diagnosis options and ease of maintenance are also on the increase in this segment. →

A flexible and easy system solution:
MS4/5 safety switch mats for safeguarding hazardous areas – e.g. in robot cells – can now also be combined with the Protect Select safety controller.

The benefit:
Protect Select enables easy configuration of protective systems without programming knowledge.

The Protect PSC1 safety controller enables the realisation of ‘safety separated’ solutions. It also enables integration into higher-level infrastructure.

This requirements profile can be mapped easily and cost-effectively with a small safety controller. Depending on the application, the automation functionality, which is sometimes less complex than the safety-related functions, can also be accomplished with the small controller. In some cases then, integration is also possible in the opposite direction.

Parametrise rather than program

The Schmersal Group offers two options to help achieve a ‘safety separated’ concept on smaller machinery. The PROTECT SELECT small safety controller has been developed especially for this application, i.e. for a manageable number of safety switchgear devices. One of its main features is the lack of programming on the part of the user, who can instead select from pre-configured programs where only the corresponding parameters need to be entered. These applications cover a wide range of possible use cases. Additionally, the user can also activate functions such as free allocation of feedback circuits (EDM), start-up tests, cyclical testing, auto-start, etc. with every program. Additional functions such as further operating modes (setup mode, process monitoring) can also be accomplished.

Modular compact safety controller

If a higher level of customisation and adaptability is required, the programmable PROTECT PSC1 safety controller could be an option. Thanks to its modular design, it is easy to adapt to user requirements, irrespective of whether the signals from emergency-stop control devices, electromechanical safety switchgear, tactile protective devices, safety sensors or optical protective devices need to be evaluated. A number of modules are available for fail-safe drive monitoring, which reliably monitor parameters including position, speed and increment.

Additionally, the controller can also be supplemented with a universal communication interface, where the user simply selects and sets various fieldbus protocols such as Profinet, EtherCAT, EthernetIP or Profibus, CANopen, etc. using software. This interface also allows safe remote IO communication and the simultaneous connection of up to four systems via safety cross communication (Safety Master-to-Master communication) via Ethernet. An OPC UA server can also be integrated.

This shows that a ‘safety separated’ concept can also be connected and integrated and it offers clear benefits when it comes to standardisation, operating convenience and flexibility. ■

tec.nicum academy

Seminar programme 2021 – 2022

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Seminar topics	Wuppertal	Ulm	Wettenberg	Bremen	Online	In-house
Law						
NEW Machinery Directive 2006/42/EC – CE conformity assessment procedure	24/03/2022	On request	23/03/2022	On request	25/01/2022	On request
The legal aspects of the safety of machinery for managers **(1/2 day seminar)**	10/11/2021 10/11/2022	On request	On request	On request	On request	On request
The legal aspects of the safety of machinery for purchasers, designers, project coordinators **(1/2 day seminar)**	11/11/2021 10/11/2022	On request	On request	On request	On request	On request
The basics of occupational health and safety for managers	05/05/2022	28/06/2022	On request	On request		On request

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Seminar programme 2021 – 2022 (Continuation)

Seminar topics	Wuppertal	Ulm	Wettenberg	Bremen	Online	In-house
Standards – regulations						
Risk assessments for infection prevention	Dates on request: **mdahm@tecnicum.com**					
NEW Risk assessment and operating instructions	06/05/2022	On request	03/05/2022	On request	03/11/2022	On request
Application of EN ISO 13849-1 in theory and practice	16/11/2021 15/11/2022	On request	On request	On request	24/06/2022	On request
NEW Validation in accordance with EN ISO 13849-2 **(1/2 day seminar)**	23/06/2022	01/12/2022	On request	On request	17/02/2022	On request
NEW Application of EN ISO 13849-1 Introduction to SISTEMA	14/06/2022	29/11/2022	On request	On request	25/10/2022	On request
NEW Practical workshop Working with SISTEMA	02/12/2021 15/06/2022	30/11/2021 30/11/2022	On request	On request	On request	On request
The basics of the Industrial Safety Regulation (BetrSichV)	27/10/2022	On request	04/05/2022	On request	24/05/2022	On request
NEW Risk assessment for machinery and systems	On request	19/09/2022	On request	On request	17/03/2022	On request
NEW Technical documentation of machinery and systems	On request	20/09/2022	On request	On request	31/03/2022	On request
New-build, conversion, retrofitting – from manufacturer to operator? **(1/2 day seminar)**	06/09/2022	On request	On request	On request	On request	On request

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Seminar programme 2021 – 2022 (Continuation)

Seminar topics	Wuppertal	Ulm	Wettenberg	Bremen	Online	In-house
Application						
Energy management/ energy-efficient design of new and existing machinery	Dates on request: **mdahm@tecnicum.com**					
The basics of safety engineering – guards and protective devices	08/09/2022	On request	04/11/2021 02/06/2022	On request		On request
Electromagnetic compatibility EMC/EMVU in practice	Dates on request: **mdahm@tecnicum.com**					
Safe fluid technology – safely implementing EN ISO 13849-1	Dates on request: **mdahm@tecnicum.com**					
NEW Driverless transport systems and their integration into the production environment	17/05/2022	On request	13/09/2022	On request	08/03/2022	On request
Safety in integrated robot production systems	18/05/2022	On request	14/09/2022	On request	09/03/2022	On request
Human-robot collaboration		On request	15/09/2022	On request	10/03/2022	On request
Compact seminar on explosion protection	18/11/2021 17/11/2022	19/09/2022	31/05/2022	29/09/2022	On request	On request
Products						
Basic workshop on the PSC1 safety controller	03/05/2022		27/09/2022			
Experts workshop on the PSC1 safety controller	04/05/2022		28/09/2022			
The basics and inspection of opto-electronic protective equipment in accordance with the BetrSichV **(seminar objective: competent person)**	**Mühldorf** 26/10/2022, 27/10/2022					

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