SICK insight MAGAZINE

: FOCUS **THE FUTURE OF INDUSTRIAL SAFETY**

NETWORKING SAFETY AND PRODUCTIVITY

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INCREASED MACHINE EFFICIE
MOVABLE PROTECTIVE FIELD

Dear Readers,

Industrial safety technology has always had an integral part to play in automation engineering. Whether it comes in the form of a customized solution or an integrated safety concept with a high level of diagnostic convenience, if safety technology provides sustainable solutions for helping production processes run smoothly – or even optimizing them – it is a matter of technological sophistication. One of the major challenges associated with Industry 4.0 is making production processes flexible. Many production companies are looking to Industry 4.0 to provide ways of setting up flexible production processes with a high degree of automation. State-of-the-art production plants already contain elements that live up to the requirements of Industry 4.0 – and are waiting for their full potential to be exploited. The factory of the future is increasingly set to blur the lines between humans and machines, with teams containing robots and people working side by side. This requires a different approach to safety that addresses the need to respond to a range of situations with high flexibility.

Our tailored, customized solutions, safety systems, and services are underpinned by the 70 years of experience we have acquired from equipping numerous machines and plants – and they are ready for the requirements that the future will bring. A system that uses light curtains from SICK to prevent dangerous injuries on machines such as presses and punching presses represented one of the first solutions to be successfully launched on the market in this context, offering the ability to eliminate significant areas of risk to customers and machine operators alike.

It is already possible to adapt safety sensors accurately to the current machine process. New technologies currently in development will enable even closer coordination with processes in the future. Intelligent algorithms are making it possible to move away from digitally switching safety technology in favor of a continuous machine response based on the current position of the worker or the plant. This means that the worker approaching the machine no longer triggers a complete shutdown, but instead results in the working speed being reduced to an appropriate level or the directions of movement being modified so that the person's safety is ensured at all times and yet production can still continue.

In this issue of our customer magazine, you can find out about the applications we have already implemented as well as innovative safety technology concepts for carrying out production in a way that is both compliant with legislation and fit for the future.

We hope you find this issue informative.

Dr. Robert Bauer
Chairman of the Executive Board of SICK AG

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Protection and navigation support
KUKA is helping operators and robots work safely alongside one another by equipping mobile robots with safety laser scanners from SICK.

NCY THANKS TO BOUNDARIES

04

Consistently safe
Functional safety for autonomous functions in plants and products. An interview with Dr. Georg Plasberg and Heike Göggel, R&D Industrial Safety Systems at SICK.

Flexible, but always safe
SICK offers functional safety solutions that optimize the ways in which humans and machines collaborate during production.

Imprint

Issue 1/2016

Publisher:
SICK AG · P.O. Box 310 · 79177 Waldkirch, Germany
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INTERVIEW WITH DR. GEORG PLASBERG AND HEIKE GÖGGEL

PROTECTION WHILE MANAGING COMPLEXITY

Functional safety protects plants and maintains their productivity levels. With the latest functions found in plants and products becoming increasingly autonomous, features that consistently maintain safety are becoming essential not only for operators and users, but for the plants and products themselves too. This is an area in which the principles underpinning functional safety are set to play a major role. As the market leader in industrial safety systems, what is SICK's take on the changes that are taking place? What does it believe the future will hold? SICKinsight spoke to Dr. Georg Plasberg, member of the Management Board at SICK AG, and Heike Göggel, Innovation Management R&D Industrial Safety Systems at SICK AG.

SICKinsight: In your view, what is the role of functional safety in today's world?

G. Plasberg: Today's functional safety is based on the principle of detecting the presence of a person or a body part and then having a machine switch off in good time. This prevents a collision between moving parts and people, achieving the ultimate aim of eliminating a source of danger. That's the key feature of the safety technology we are familiar with nowadays – the kind which, in Europe and America at least, has carved out an excellent position for itself. What it has led to are huge drops in accident numbers; if the right safety devices are available, then they are able to rule out certain types of accidents altogether. Right now, we are seeing this technology take on an even more international profile – as well as heavy investment in safety by many countries whose industry has been significantly expanding in recent years, like China.

H. Göggel: Another trend is developing in the form of automated processes outside the typical setting of a factory building. More and more areas like service robotics are starting to emerge alongside conventional factory and process automation. It is essential to consider what kind of safety technology is right for performing automated functions in these contexts.

SICKinsight: What role does functional safety play in productivity?

G. Plasberg: Over the last few decades we have seen increasingly sophisticated safety concepts being incorporated into production processes, and this has resulted in a dramatic fall in accident rates. At the same time, plant productivity has soared.

> "We are already aiming to achieve fully integrated networking of small production cells."
>
> *Dr. Georg Plasberg, member of the Management Board at SICK AG*

This is a clear sign that installing the appropriate safety mechanisms makes a machine not only safe, but also productive. And that's not even counting the time, resources, and costs saved from dealing with accidents.

SICKinsight: What exactly are "the appropriate safety mechanisms"?

G. Plasberg: There are two main ways in which customers can benefit from safety technology: fast commissioning – which in turn means much faster system effectiveness – and reliable sensors, which lead to uninterrupted production coupled with improved system efficiency. So what can we do to help them achieve these benefits? We want to make it easy for our customers to work with their applications, throughout the entire life cycle of the plant. That's something we start doing right from the engineering stage, by providing data and descriptions that are easily comprehensible. Easy commissioning is another tool we use, and we also know that maintenance, plant troubleshooting, and any changes that are made to ongoing plant operations are factors in the customer's experience. It doesn't really matter whether the people carrying out the commissioning of our safety systems are less trained workers or experts – or whether they are working with simpler applications or high-end collaborative environments. What does matter is that our devices are extremely usable, because we want to avoid the worst-case scenario of safety functions failing to work as a result of errors that were made when the devices were being set up. We make enormous efforts to ensure that the sophisticated functions featured into our devices translate into functions that are easy to use and descriptions that are easy to understand – making our devices safe for the wide range of operators who use them. This issue of usability has also been one of the pillars of our development process for some years now. To gage it, we enlist external test subjects whose product knowledge is not very extensive, and we've had excellent results from this process.

SICKinsight: You said that you provide customers with data. That takes us on to the subject of digital engineering.

G. Plasberg: I can see another change happening in the future eventually. As safety functions become more complex, the engineering and validation processes associated with them become more challenging too. At some point this will mean that it is no longer possible to perform on-site validation on the actual object, whether that's a machine or a plant. As a result, we will find that most validation in the future will have to take place in simulation models. This is already starting to happen. It will require standards-based methods in place to ensure the process remains safe, but I believe that will not come fully into play until the future. In my view, there will be no other way to keep very complex safety systems sufficiently validated further down the line.

H. Göggel: If you look at today's simulation programs, however, that's a very big step forward. Safety technology hasn't been factored into them yet. This process is gradually beginning to emerge, with some initial projects that require data for simulating safety functions. Production plants have always been modeled and calculated in the CAD systems that are used for them, almost in their entirety. Today, however, there is still a divide between the mechanical engineering aspects – the plant itself, in other words – and what actually happens during operation. Although the individual machine parts are represented digitally and networked, the people involved are not yet being simulated. There are now discussions happening about creating models of people and simulating them in every position, carrying out every kind of activity – even tripping or tying their shoes. This means calculating everything that happens in this world and pretending to the PLC that it's the real world – creating the opportunity to simulate even unusual operating modes from an external vantage point. The complexity of the validation process, which Dr. Plasberg touched upon, is reflected in this wide variety of situations that could occur. Design work has to take place well before a physical sensor can actually be installed, and this relies on data models – something which, as the sensor manufacturer, it naturally falls on us to provide.

SICKinsight: How would I use the appropriate safety mechanisms in a machine to boost productivity?

G. Plasberg: Right now, we are already aiming to achieve fully integrated networking of small production cells. This will make the control loops in production control smaller and speed up interaction between them. Making the interaction between humans and machines much closer-knit – or even creating collaborations between them – is associated with much more complicated safety processes, which slow down or prevent certain machine movements or production processes depending on a person's position. This, however, reflects a completely different approach to implementing safety functions and machines. Functional safety in modern production systems is a fundamental step on the road to increasing flexibility. However, true flexibility is created not by the coexistence of systems separated by barriers, but by genuine collaboration. How this can be set up is being considered in automation engineering under the topic of human/robot collaboration.

H. Göggel: Human/machine or human/robot collaboration is one response to meeting demands for individual batch sizes and flexibility during production while at the same time increasing productivity. Industry 4.0 is making it possible to keep up with these changing productivity requirements. Manufacturers are looking for flexibility in not only the types of products they make, but also how many – they want to be able to adapt quantities to demand at short notice. This involves expanding plants or other areas taking on the production of certain parts, as well as bypassing bottlenecks by bringing flexible robot workstations into play. For this, you need safety solutions that are able to respond with just as much flexibility. With the Flexi Soft Designer software, it is possible to link sensor functions intelligently and monitor statuses – either on site or from a remote location.

SICKinsight: And that brings us on to our next subject: networking.

H. Göggel: Flexi Soft is our intelligent safety controller. By networking sensors, it is able to make them more beneficial and increase the added value they deliver. So if I can combine the function of one sensor with the function of another, what that adds up to is more than just the sum of its parts. This means that SICK is already able to offer a safe solution for applications that want to carry out both speed monitoring and safe zero speed monitoring, for instance.

G. Plasberg: Combining communication methods with sensor functions opens up application solutions that offer many benefits. The question is how we create advantageous applications at both product and system level – and we have seen some interesting results from the attempts at answering this. The functions that we are already offering, like shared protective field switching for automated guided vehicles based on encoder inputs, are a good example. Another is the cascading that Flexi Loop enables, which allows us to turn simple switches into an overall system for protecting doors that offers several benefits to customers.

H. Göggel: We are going to see even more of this in the future. At the moment, we create intelligent networks made up of our yellow sensors for safety applications. Given the demands of Industry 4.0, however, there is bound to come a time when we have to integrate non-safety sensors into a system as well in order to develop a productivity-enhancing solution that is still safe.

G. Plasberg: We already offer safe subsystems like the Safeguard Detector, a certified full protection package designed for monitoring residual stacks of cartons at packaging machines. Processes like this are complex, but we have made them manageable for customers.

SICKinsight: Data security is another point to consider during networking.

G. Plasberg: Yes, it is very important – and it has to be assured if networks are going to be extended. However, this isn't a subject that's restricted to safety technology.

H. Göggel: But it still has many unanswered questions. It is extremely difficult to quantify what risks data security might face as a result of external access to systems. There is still a lot of discussion to be had about interaction between safety technology and IT security, and many aspects require standardizing.

G. Plasberg: We need to define what exactly constitutes the kind of critical scenario that requires intervention. Deliberate attacks at an IT level are one area, but careless modifications and even deliberate manipulation of safety measures are other important aspects we need to consider nowadays. Factors like these are why regular reviews of security functions have always had an important role to play at an organizational level. Where technology is concerned, regular checks via the control level are a common practice in networked systems – for example, using the connected devices to perform a CRC check that determines whether the configurations still have the same settings as they originally did. This happens often in sectors like the automotive industry, where automated tests identify whether the right sensors are still connected and the configurations are still the same. It's very important from a safety perspective.

SICKinsight: Thank you for your time.

HIGH DEGREE OF AUTOMATION VS. FLEXIBLE PRODUCTION WORKFLOWS

FUNCTIONAL SAFETY IN HUMAN/ROBOT COLLABORATIONS

One of the major issues associated with Industry 4.0 is making workflows flexible – and that includes closer interaction between humans and machines. Part of this current move toward more integrated working is a need for humans and machines to work together safely, and in view of this, functional safety will take today's production systems one step closer to more flexibility. Human/robot collaboration (HRC) looks at how this can be achieved.

>> There are different forms of automation depending on how humans and machines work together. If the ultimate goal is complete collaboration – where humans and robots share the same workspace and carry out their work at the same time – then it makes sense to develop solutions that employ coexistence or cooperation as initial steps toward this. Doing this requires not only an in-depth understanding of robotics applications, but also expertise in assessing risks and access to the right portfolio of safety solutions.

SICK as a partner for HRC solutions

Every process in developing HRC systems starts with a risk assessment. To conform to the Machinery Directive, an extensive assessment of possible hazards must be carried out for every machine as defined in EN ISO 12100. As robot systems have to complete motion sequences that are usually very complex, the robot safety standard EN ISO 10218 also requires that each motion sequence is analyzed in addition to hazards being assessed. Environmental factors and basic conditions associated with the HRC application must also be considered and documented in the risk assessment. These are absolutely essential steps in defining what form the appropriate safety measures should take.

Creating solutions for the various safety measures required in human/robot collaborations incorporates a whole range of technology types and components, which have to work together as efficiently as possible and avoid any impact on the workflow – and thus on productivity. In response to this, SICK offers various harmonized safety solutions that make it possible to map the safety function in full, whether it is being retrofitted in existing plants or integrated into new ones. Not only that, but machine and plant manufacturers – as well as system integrators – are given consistent support when putting their protective measures in place, through access to SICK's extensive services. In this case, a plant walk-through is followed by the risk assessment of the specific HRC solution and a safety concept tailored to suit the exact needs of the application is created. SICK also provides support for technical integration, machine acceptance, and documentation if required – and even includes regular checks in its range of services.

HRC	Different workspaces	Same workspace
Sequential processing	No interaction	Cooperation
Simultaneous processing	Coexistence	Collaboration

TYPES AND EXAMPLES OF HUMAN/ROBOT COLLABORATION

Coexistence

Insertion station with rotating table on a welding robot cell, e.g., in the automotive industry.

- **Risk assessment:** The hazard is posed by the rotating table, since the robot is operating in an area which is fenced off and, therefore, secure.
- **Possible protection:** A vertically mounted safety light curtain, such as the deTec4 Prime, functions as a primary protective measure to shut down the rotating table. A cascaded, horizontally mounted light curtain monitors whether there are any objects in the safety area (presence detection).
- **More productivity:** The rotating table is able to restart automatically once the horizontal protective field has been released.

Cooperation

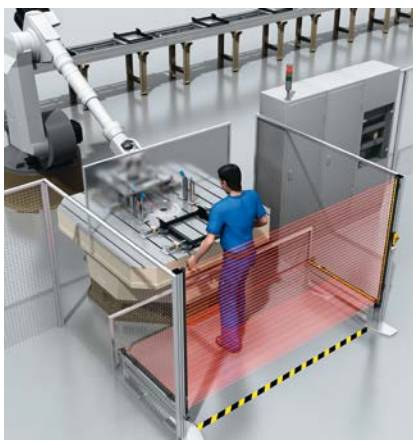
At a transfer station, a worker gets preassembled modules ready for an assembly robot. The robot grabs one module each time and brings it to the final assembly process.

- **Risk assessment:** Occasionally it happens that the robot and worker are in the transfer station area at the same time. When the worker inserts the modules, a hazard may be posed by the robot moving at high speed.
- **Possible protection:** S3000 safety laser scanners with 4 simultaneous protective fields, combined with the Flexi Soft safety controller (Sim-4-Safety). Violating protective fields 1, 2, or 3 triggers a reduction in the robot speed, violating protective field 4 activates a safety-monitored stop.
- **More productivity:** Instead of coming to a complete stop, the robot initially continues working as the worker approaches it. Its movement is stopped safely only once the worker is in the direct vicinity of the transfer station (protective field 4). Once protective field 4 has been released, the robot continues working.

Collaboration

Attaching non-rigid parts in electric motor assembly, for instance. A safely monitored robot on a mobile work station takes assembly groups from the conveyor belt and presents them to the worker in an ergonomic position.

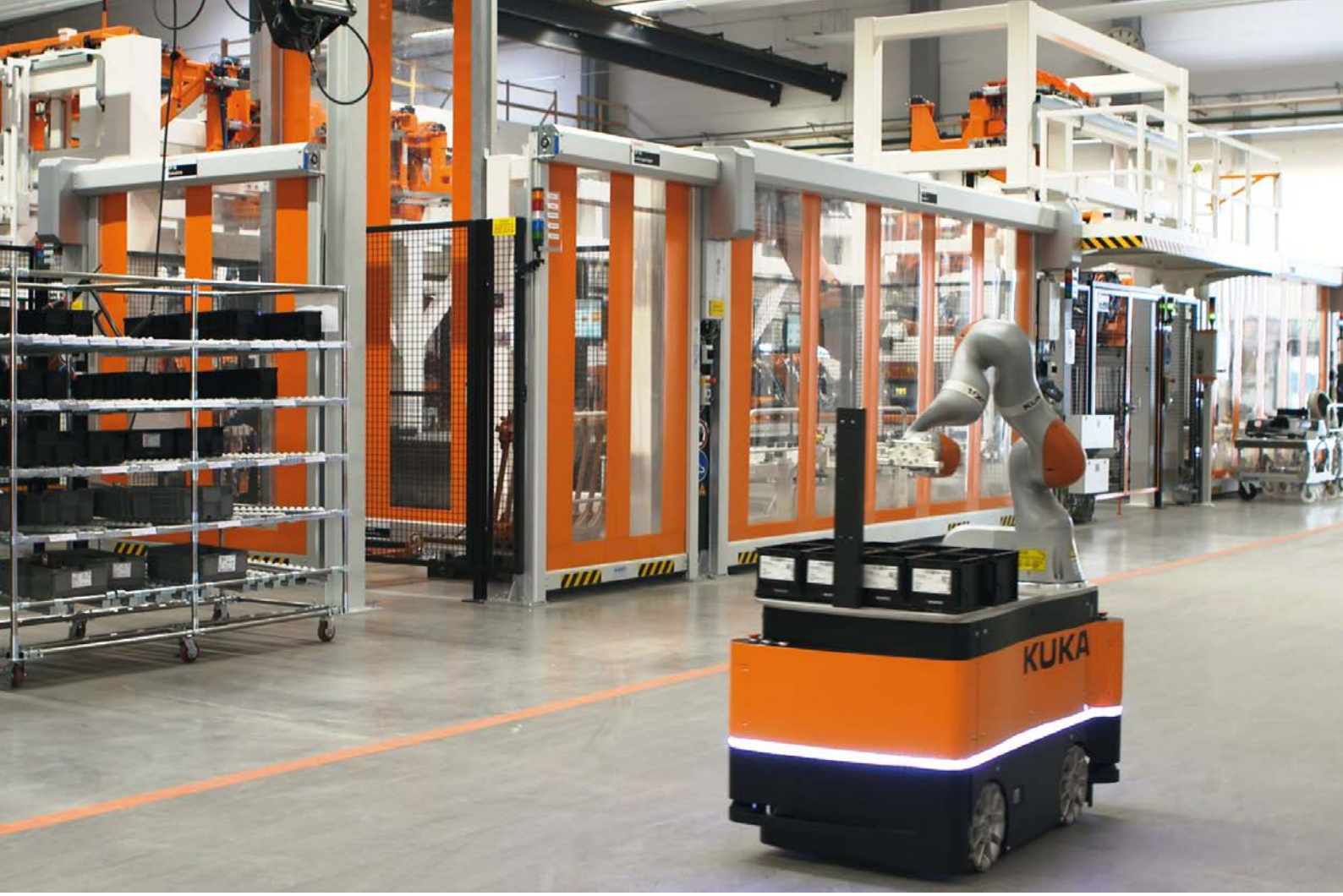
- **Risk assessment:** The robot's movements may cause collisions, shearing, and crushing.
- **Possible protection:** Horizontal hazardous area protection with microScan3 Core safety laser scanner. Limiting the Cartesian workspace as well as the robot's force and torque; monitoring working speed when the protective field is violated. Sheathing the robot tool in an ergonomically shaped housing in order to reduce hazards.
- **More productivity:** The robot station is mobile and can be used at designated stations as necessary. The robot grabs the right devices from the conveyor belt and carries out subsequent steps on the workbench independently. *(tm)*



Coexistence

Cooperation

Collaboration



SICK PROVIDES PROTECTION AND NAVIGATION DATA FOR KUKA'S KMR iiwa

MOBILE ROBOTS IN PRODUCTION – CREATING SAFETY AND MORE

Industrial production in the future will see us working with assistants that are modular, versatile and, above all else, mobile. In KMR iiwa, KUKA Roboter GmbH has developed a fully automated, autonomous solution that combines the LBR iiwa lightweight robot and the OmniMove mobile platform. KUKA's long-standing partnership with SICK has played an integral role in the process, thanks to safety laser scanners that provide both a protective function and navigational support in the KMR iiwa. This enables the worker to interact directly with the robot, which moves autonomously. No physical guards are required, making this system genuinely true to the spirit of creating sustainable flexibility in production.

>> The ability of mobile robots to move independently through factory halls and transport goods or workpieces represents the future of logistic processes in production. For the robot manufacturer KUKA, the future is already here. In its production workflow, the KMR iiwa picks boxes containing materials and delivers them to the production line as and when they are needed. It shares the routes it travels, as well as the shelving areas, with tugger trains and workers. KUKA's new materials are ordered automatically through its ERP systems and suppliers – a practice that lines up with the principles of Industry 4.0 – and are then distributed among workstations by the KMR iiwa, entirely autonomously. However, the company's focus is on more than just the production skills the robot offers in-house. "The KMR iiwa offers all kinds of application possibilities," says Peter Gmeiner from Industrial Business Development, Mobile Robotics at KUKA. "These range from fetch-and-carry services to roles in producing small quantities at multiple workstations, all the way through to complex, flexible production workflows in the automotive and electronics industries. Combining the sensitivity of the LBR iiwa with the mobility of the KMR iiwa also opens up the potential to add real value to quality assurance processes."

A significant challenge for navigation and safety

For some years now, KUKA has already been successfully integrating SICK solu-

tions into its OmniMove heavy-duty platform. These vehicles are able to move up to 90 tonnes and work on the basis of interaction between the S3000 safety laser scanner from SICK and KUKA navigation software. When the KMR iiwa was being developed, it was essential to find exactly the right technology for the job, plus excellent application knowledge and in-depth cooperation with a technology partner. It therefore became another application with equipment from SICK, this time using a pair of more compact S300 safety laser scanners. The 270° scanning angle of these devices ensures all-round surveillance. Multiple protective fields that offer flexible configuration options are especially important in applications that use compact, mobile robots – and the 16 freely configurable protective fields offered by the S300 allow flexible adaptation to a range of traveling situations and environmental conditions. Mobile robotics also require vehicles that are as compact and rugged as possible, and have to consider the amount of energy that components consume. Its small size means that the S300 offers the right technical credentials in this respect too, and this made it one of the key building blocks in creating a solution to suit KUKA's needs.

Scanner data for autonomous navigation

So how does the KMR iiwa receive control signals for moving to a position – in other words, how does its autonomous navigation work? To achieve this, the KUKA navigation software uses information including data supplied by the safety laser scanner from SICK. This means that the S300 provides more than just straightforward protection. "The navigation software continually evaluates the distance measurements taken by the safety laser scanner. It then uses this information to create a kind of 'map' of the environment and determine the KMR iiwa's position within these coordinates," explains Klaus Mattuschat, who heads up the OmniMove team in Mobile Robotics at KUKA. "Objects that are always found at the same point, like pillars in the hall or fixed parts of plants, are interpreted as established reference points. However, moving objects or objects that undergo dynamic changes are ignored, so to speak. In most cases, the KMR iiwa either moves along defined paths from one specific point to another, or it navigates freely. It's able to avoid objects that are in its way by itself."

More than just protection: the S300 safety laser scanner.

Safety for mobile industrial robots

One of the most significant challenges facing mobile robotics is how to design systems in a way that accommodates what the applicable standards specify: for example, EN ISO 10218 Parts 1 and 2. The technical specifications of ISO/TS 15066 also apply to collaborative systems in particular. In addition to system design requirements, an individual risk assessment conforming to EN ISO 12100 must be carried out for each KMR iiwa application. This is an all-encompassing risk analysis that sees KUKA working in close collaboration with customers and/or system integrators.

Mobile systems: A cornerstone of the intelligent factory

The intelligent factory concept envisages individual production elements being networked with one another during production. This requires the data that is captured, evaluated, and transmitted by sensors to be reliable. Maintaining transparency at all stages of the production and logistics chain is crucial for this data. It is not just data networking that is important, however: Mobile systems like the KMR iiwa provide a link between individual stages of work, especially in automated and networked production environments. They represent a new form of mobility – one that also relies on innovative solutions to protect humans and materials. *(tm)*

More about the customer at:
www.kuka-robotics.com

SAFETY SOLUTIONS FROM SICK: KEEPING AUTOMATED GUIDED VEHICLES AND SYSTEMS SAFELY ON THE MOVE

HEADING TOWARDS THE FUTURE

In many industries, automated guided vehicles (AGVs) and automated guided vehicle systems (AGVSs) are making production and logistics processes more flexible. They are already available on the market in a whole range of variants, and their diversity is increasing all the time. But whether they come in the form of an automated or partly autonomous guided system, a transfer car, a manned forklift truck, or a narrow aisle truck – and however complex they might be – SICK has exactly the right sensor solution for them. When AGVs and AGVSs are controlled with greater efficiency and precision, productivity goes up too. Sensors from SICK can be used for tasks such as contour or reflector-based navigation, rough and fine positioning, measuring and identifying, as well as optical data transmission. They also meet every requirement when it comes to providing protection in line with standards, protect people against accidents, and help prevent collisions – which in turn keeps goods and equipment protected. Thanks to all these features, unnecessary downtime is no longer something to worry about.

>> Automated guided vehicles (AGVs) are floor-bound conveying vehicles that feature their own travel drives as well as automated control and non-contact steering. They are used for pulling or carrying conveyed goods and have active or passive load-carrying units. Automated guided vehicle systems (AGVSs) are floor-bound conveying systems used within a plant and feature automated vehicles for material transport. They are used both inside and outside buildings. AGVSs consist of one or more AGVs, plus a master control station, equipment for establishing locations and recording positions, data transmission devices, infrastructure, and peripheral equipment. Mobile material transport systems are generally performing pallet and container transportation tasks and are used in virtually every industrial production environment, although they are becoming an increasingly common sight in service robotics too. SICK offers a comprehensive product portfolio for automated guided vehicle and system applications, including laser scanners that enable AGVs and AGVSs to navigate and determine positions as well as safety laser scanners designed to protect people and prevent collisions. Determining object positions and measuring distances are tasks that are equally well suited to this equipment. Thanks to bar code reading systems attached to AGVs and AGVSs, or RFID technology, it is also possible to identify goods and storage places.

Traveling unmanned yet safe

Automated guided vehicles can at times reach extremely high speeds; while some only travel in one direction, others are able to move forward and backward as well as negotiate curves. The heavy loads that the vehicles are often carrying present an additional risk while they are on the move. Risk assessments in line with specifications by the relevant legislative authority need to be performed on each AGV and AGVS to determine exactly which risks they do pose. This information is then used to identify the protection or safety measures that are necessary for meeting all the safety requirements of ISO 13849/EN 1525 (soon to become ISO 3691-4). Safety technology from SICK ensures that AGVs and AGVSs offer this protection in line with standards – even at an international level (EU, US, and CN standards). The equipment available covers everything from small carts (automated guided carts or AGCs), some of which only move in one direction, to large-scale AGVs featuring field switching that operates dynamically according to the vehicle's speed, direction, and task.

Relevant standards and directives for AGVSs and AGVs

- Machinery Directive 2006/42/EC
- EN/ISO 13849-1
- EN 1525 – Automated Guided Vehicles (C standard), soon to be ISO 3691-4
- VDI 2510 – Automated Guided Vehicle Systems (AGVSs)
- VDI FA309 – Guidelines for AGVs Safety
- International: Turkey GB10827.1999, GB/T30029-2013, US ANSI B56, EU EN 1525

Safety technology for enhanced efficiency and safe movement

SICK offers modular safety solutions that comply with standards and provide all-round, uninterrupted protection for AGVs and AGVSs alike – no matter how complex they might be. With safety controllers, reliable and rugged components such as safety laser scanners and encoders can be combined to form a complete safety solution that meets the exact needs of the vehicle type and the task at hand. A system like this can protect people and objects against collisions, optimize navigation and travel routes, measure distances, and determine positions – and not only that, but also identify goods and unoccupied storage places in applications such as automated pallet handling. Safety solutions by SICK are easy to integrate into existing safety concepts and are fit for the future thanks to their ability to be extended at any time. The enhanced precision and efficiency they create help reduce downtimes and boost productivity, ensuring processes remain smooth and safe – and their applications go beyond simply the fields of production and logistics.

MODULAR SAFETY SOLUTIONS FOR ALL-ROUND PROTECTION OF AGVs AND AGVSs, CONFORMING TO STANDARDS

Safety laser scanners	Hazardous area protection	Navigation/Positioning
S300 	• Protection of small AGVs or AGCs and pallet shuttles • Compact design • 3 m protective field range • Adapts to space being monitored according to steering angle • Multiple directions and up to 16 field sets possible	S300/S3000 Professional CMS: • Detection of contours and reflectors within the scanning range for environment detection that supports navigation • Extraction and transmission of measured distance data for position-determining detection of the geometry and position of pallets
S3000 	• Protection of medium-sized and large AGVs • Adaptation and monitoring according to load and speed • Non-contact all-round protection • Also available as Cold Store variant for use in cold areas	

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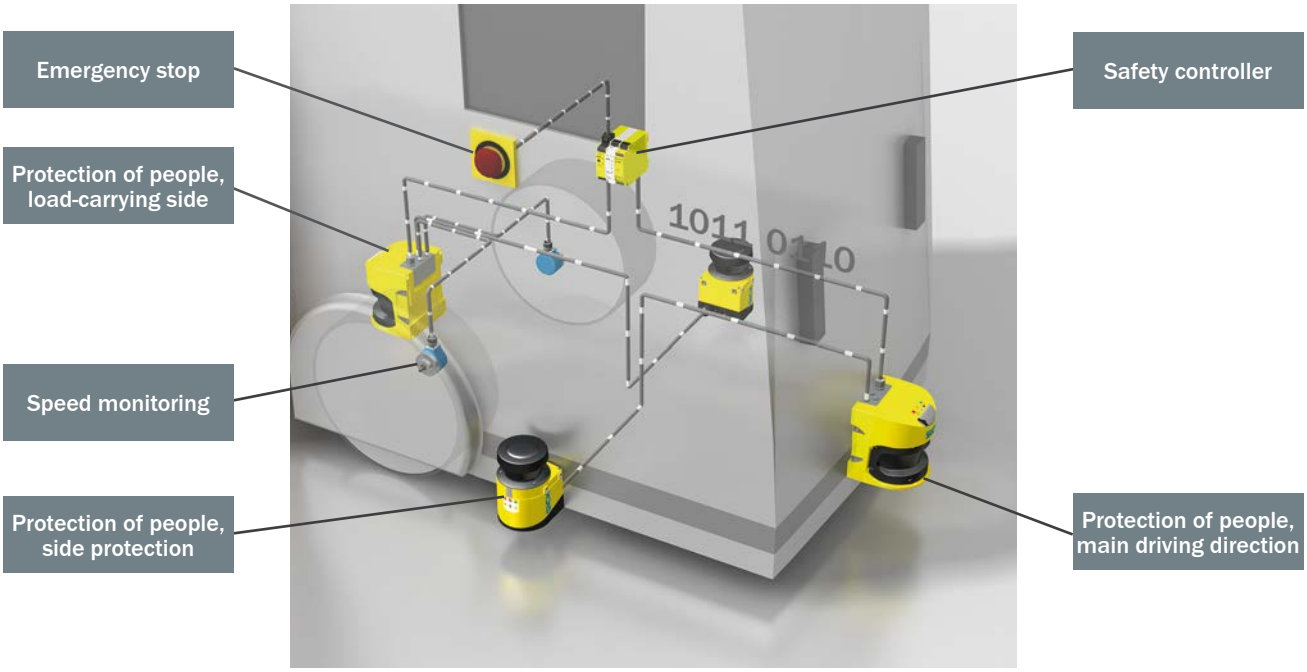
Safety controllers	Safety automation
Flexi Classic 	• Protective field switching, adaptation in line with direction of travel • Integration into vehicle
Flexi Soft 	• Programmable software • Complete monitoring of all safety signals • Integration into vehicle • Optimized AGV maintenance • For monitoring direction of travel and speed; can be extended to include the Drive Monitor FX3-MOC0 module, which supports all standard encoder interfaces

+

Encoders	Collision avoidance
DBS60 	• Speed and position determination using data relating to the steering angle and path (input signals) • Using two encoders ensures a dual-channel structure for dynamic field switching when safety laser scanners are being used

On page 21, you can find out more about the application possibilities that the new DFS60S Pro safety encoder offers for AGVs.



Equipment for protecting people, plus protective field adaptation in line with the direction of movement, on an AGV.

Three questions for...

Dr. Günter Ullrich, VDI expert committee AGVS, FORUM-FTS

SICKinsight: What trends and developments do you see the AGVS industry bringing in the future?

G. Ullrich: I think we'll see an unprecedented diversity of applications start to develop. It used to be that AGVSs were given a somewhat restricted range of jobs in production logistics, assembly, and hospital logistics, but in the future they are set to break beyond these boundaries, taking on additional tasks not only in these conventional environments but also in new applications, where service is at the fore and the systems are coming into contact with staff who have no training in using them.

SICKinsight: What will sensor manufacturers need to adapt to in the future?

G. Ullrich: The entire industry is changing. New applications are looking for intelligent 3D solutions, and there are new companies seeking this too. Just now, AGVSs are the central focus of a general interest in autonomous driving. The lines between autonomous driving as it is used in on-road applications and in service robotics are becoming blurred. Vehicles are becoming more intelligent because this is what users expect from automated systems nowadays. Sensors have to be three-dimensional and have the capability to generate and process data flows in significant quantities. Not only that, but it must be possible to combine them with sensor systems.

SICKinsight: What requirements will this result in, particularly where safety technology is concerned?

G. Ullrich: AGVSs are still faced with some restrictions today because of the need to train people in how to use them. In the future, this will no longer be an acceptable state of affairs, as the systems will be used in places like hospitals and care facilities and will have to accommodate all kinds of people – patients, children, and seniors, for instance. There is also continued focus on how the systems can be used outdoors. It's not just the AGVS industry that is looking for reliable, safe systems that don't suddenly stop just because it's raining or the sun is low – the automotive industry wants this too.

AT YOUR SERVICE: CARE-O-BOT®4, THE ELECTRONIC BUTLER

Since 1998, the Stuttgart-based Fraunhofer Institute for Manufacturing Engineering and Automation IPA has been conducting research that has helped it develop a service robot for households, hotels, hospitals, care homes, as well as other public and private spaces. The fourth generation of this friendly assistant, Care-O-bot®4, reached its completion in 2015. Featuring two arms, innovative joints around the hip and neck areas, and a multitude of sensors, it offers a greater range of movement and more flexibility than its one-armed predecessor – making it a much more elegant solution for tasks like pouring a beverage into a glass. What is more, the IPA team has made this a well-mannered robot, accommodating users' expectations that service robots should demonstrate politeness and an intuitive demeanor. Care-O-bot®4 is capable of more than simple gestures such as nodding or shaking its head: It also knows how to keep a respectful distance and stay discreetly in the background when it is not needed, as well as communicate whether it has understood a command and what action it needs to take. The robot moves on three steered wheels concealed under a round platform. Constantly on the move, it has to avoid collisions with furniture and walls, must not create a hazard for people, and needs to identify the best way of navigating even difficult routes – through doors or narrow passageways, for instance. This is where SICK sensor technology comes in. Care-O-bot®4 is equipped with three S300 safety laser scanners that feature 50 protective fields and are attached to the robot's triangular chassis, ensuring navigation remains safe and providing hazardous area protection on the move. Its neck, meanwhile, has a Visionary-T streaming camera that provides 3D visualization, enabling both gesture recognition and collision awareness. The safety technology is controlled by the Flexi Soft safety controller – demonstrating that service robotics is another field in which SICK is ensuring safe conditions. *(ro)*

Additional information:
www.care-o-bot-4.de

S300 safety laser scanner.

Flexi Soft safety controller.

Visionary-T streaming camera.

INCREASED PRODUCTIVITY THANKS TO SAFE DRIVE AND MOTION MONITORING

SAFE MOTION CONTROL: SAFE PROCESSES WITHOUT INTERRUPTIONS

Nowadays, machine and plant operators are faced with a challenging task: creating flexible production workflows with a high level of automation while at the same time ensuring that people, machines, and plants stay protected. As one of the technology and market leaders in industrial safety technology, SICK is a one-stop shop providing a comprehensive range of safety solutions. Its safe motion monitoring system, Safe Motion Control, includes innovative safety concepts that have been developed for safe monitoring of drives and machine motions. This makes it possible to increase the availability and efficiency of machines while offering a high degree of safety.

>> The way in which interactions between humans and machines are shaped is set to have a significant effect on performance and productivity in tomorrow's industrial environments. Innovative safety technology concepts such as Safe Motion Control make it possible to monitor the movement of a machine at any time, helping ensure that interaction between machines and their operators remains safe. By safely monitoring the machine parameters of speed, travel, and acceleration, it is possible to draw an exact distinction between the machine movements which are dangerous and those which are safe. All the signals from the safety sensors and actuators can be combined, generating information that indicates whether a machine operator is actually in danger when he or she enters or creates an interruption in a hazardous area. This means that it may be possible for operators to intervene in the machine even while the process is running – preventing interruptions, minimizing downtimes and unintended shutdowns, cutting down cycle times, and boosting efficiency and availability in machines and plants.

SAFE MOTION CONTROL – EXTERNAL AND INTEGRATED SAFETY CONCEPTS

Safe drive and motion monitoring is based on the safety or control concept being used.

Advantages of an external safety concept:

- Excellent protection against manipulation thanks to separation of safety and automation tools
- Independence from the drive system
- Entire safety solution in one piece of software, saving time and money
- Monitoring of multiple drives in a single system
- Verified and industry-specific application packages from SICK, cutting down on engineering work

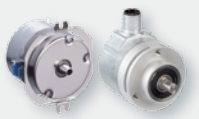
The universal motion control sensor for stationary and mobile safety applications

Drives and axes that are integrated into safety functions should be equipped with certified safety encoders such as the DFS60S Pro. The requirements presented by mobile and stationary applications, and the complexity inherent in safety technology evaluations, indicate that using this kind of technology brings benefits in practice.

DFS60S Pro safety encoder

- Functional safety encoder conforming to the requirements of the Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA)
- Reliable, rugged signaling device for stationary and mobile safety applications
- Safe drive monitoring up to safety integrity level SIL2 and performance level PL d, with just one encoder
- Safe electrical and mechanical design
- Simple to integrate into the system

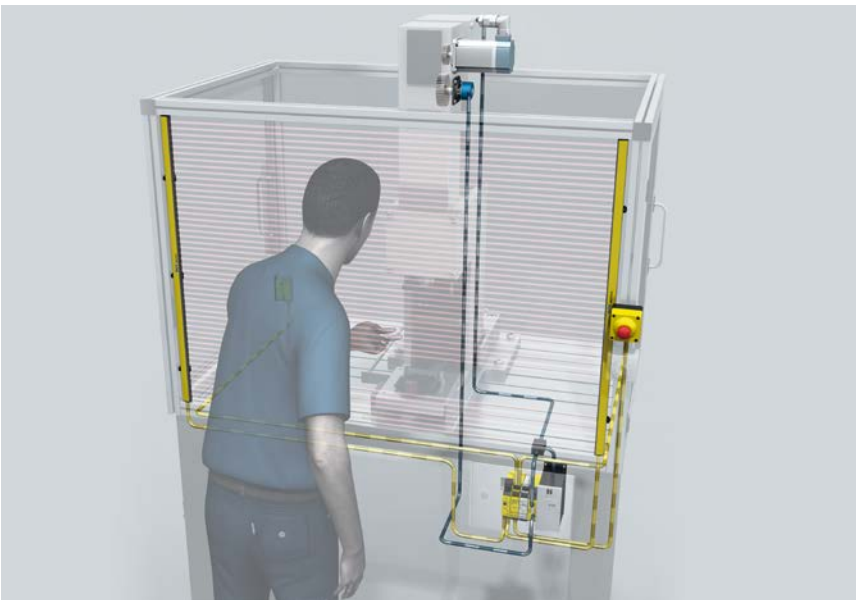
SRS/SRM50 and SKS/SKM36 safe motor feedback systems with HIPERFACE® hybrid interface



- Standard interface for electric drive technology
- Transmission of analog and digital sensor values
- Implementation of speed measurement with highly precise analog sine and cosine signals (process data channel)
- Transmission of digital absolute position via the parameter channel

Drive Monitor FX3-MOC0: Expansion module for Flexi Soft safety controller

- New machinery concepts using safe interaction between humans and machines
- Safe movement monitoring instead of machine shutdown
- High machine availability
- Increased efficiency and productivity
- Monitoring of all kinds of drive concepts – for both electric and hydraulic drives
- Safety sensors such as the DFS60S Pro safety encoder are the perfect addition when it comes to implementing universal safety concepts, from the sensor to the controller and all the way through to the actuator
- Can be used in mobile and stationary safety applications
- Easy to manage numerous safety functions



Safe drive monitoring with Safe Motion Control – a complete solution for a servo press.

Other Motion Control sensors

If motors with HIPERFACE® technology are being used, the safe Drive Monitor FX3-MOC0 module uses the signal from a HIPERFACE® drive for electrically driven axes (e.g., in the case of SRS/SRM50, EFS/EFM50, and SKS/SKM36 safe motor feedback systems). This ensures that the necessary shutdown functions are provided and that the required performance level (PL r) is achieved – with a second independent signal (e.g., from an encoder) also involved if necessary.

Motion Control safety controllers

Flexi Soft and the Drive Monitor FX3-MOC0 can be used to monitor both electrically and hydraulically driven machines. In the event of an interruption of the safety light curtain, for instance, this equipment prevents the need to switch the entire drive control system to a safe energy-free state in order to trigger the required stop response. Drive technology in machine tools – particularly presses – is seeing a shift in favor of electric drives, generally of the servo variety. Electric drives make it possible to feed energy into more specific points in a process – enabling more accurate control of processes, cost savings, and improved product quality. The faster traversing movements of the axes also boost productivity.

Achieving the required performance level using simple, safe solutions

Two encoders can be connected to each Drive Monitor FX3-MOC0 module, with the following PLs achievable:

- PL e for one axis with non-safe motor feedback (MFB) and additional external encoder
- Up to PL d for two axes, depending on the motor feedback being used (safe or non-safe MFB) and without an additional external encoder
- PL d for one axis and a DFS60S Pro safety encoder

Motion control experts at SICK on the DFS60S Pro safety encoder

SICKinsight: Your intention is to make developing and building safe solutions easier through the use of a safety encoder. Is it at all possible to quantify the savings that can be achieved by using this component?

H. Krebs: Well, every application is very different, particularly when it comes to safety and machinery. If you want to use standard encoders and still create a solution that is safe, you will need more sensors and more I/Os than you would if you used a safety encoder – and that means more engineering work. There is also the need to comply with certification requirements. That means you have to draw up an assessment of the plant or machine, ensure and document the fact that the right devices for the safety concept in question are being used and that they fulfill certain quality criteria, and do much more besides. So instead of going to all this effort, you now have the option of using the certified DFS60S Pro safety encoder, whose parameters you can simply take from the SISTEMA library and integrate into your system.

SICKinsight: What is the benefit of establishing the safety concept independently of the drive itself?

H. Krebs: Doing this affords the machine manufacturer the freedom to concentrate on just one safety concept – which means only having to deal with one type of technology and focusing employee training on that alone, even if customers who use the machine rely on different drives. The signals coming from the safety encoder by SICK are useful for both safety assessments and drive control. And in addition to the encoder itself, we offer a whole range of components designed with safety in mind – so we can provide an almost one-stop shop for everything, if that is what the machine manufacturer is looking for.

SICKinsight: On the drive side, however, is the designer still able to work flexibly?

A. Bäurer: Very much so – SICK's components are designed to accommodate a decentralized world. Some of our customers' main focus is on the control aspects of applications. The Flexi Soft safety controller helps integrate the encoder information into the higher-level data structures via PROFINET, Ethernet/IP, EtherCAT, or other communication standards, depending on the customer's preference. This is another way in which our products provide flexibility, besides their wide range of designs and facilities for connecting. The biggest advantage, however, is the fact that the customer's system only needs to be configured once. The safety engineering then only has to be created once on this basis, and can subsequently be transferred to other drive systems – whoever the manufacturer of the drive electronics might be.

SICKinsight: You have already launched the Drive Monitor FX3-MOC0 as a safe component. What other benefits does the DFS60S Pro safety encoder offer in this respect?

H. Krebs: If you are working with standard encoders, you need two of them on the Drive Monitor to reach the same level of safety as you would get with a safety encoder. This is the only way to create a dual-channel structure. Two components – and all the additional wiring that goes along with them – mean additional costs for both engineering and assembly work, however. So then we have to turn the focus back to simplicity, and that is where this safety encoder excels. The Drive Monitor was our gateway into the world of safety applications. Now, we're moving on to the next step and simplifying the realization of safety applications.

SICKinsight: What applications can the DFS60S Pro safety encoder be used for?

H. Krebs: Given the current trend of industrial vehicles becoming smaller, more flexible, and more agile, I can see this sector becoming a real area of focus for the device. Other examples of where it might be used are handling processes in logistics applications, in the context of plant safety. It's also worth mentioning cranes and winches, as there are several fields of application in which this equipment could be used with asynchronous motors – an inexpensive kind of motor that is suited to many tasks in which significant forces are the focus, rather than highly dynamic processes. As well as this, there are applications in high-bay warehouses, involving hazardous areas where warehouse operators do not and should not go.

SICKinsight: What does safety mean in the context of encoders?

A. Bäurer: It's not just electrical safety that matters – the mechanical connection and what results it achieves in a safety assessment are especially crucial aspects too. That is why the IFA has developed and published a new testing principle that outlines how to test and certify angle and distance measuring systems intended for functional safety. We have worked in close cooperation with the testing institute to develop and certify the DFS60S Pro safety encoder in line with this principle. A new aspect to consider is that requirements for functional safety in encoders have been defined and established for the first time, with the aim of creating a uniform market standard. As a result, the DFS60S Pro is the first safety encoder that not only adheres to this testing principle, but also meets the very latest requirements relating to functional safety.*)

Heiko Krebs, Manager Business Unit Encoders, SICK AG

Andreas Bäurer, Project Manager for Encoders, SICK AG

*) www.industr.com/A-und-D-Magazin/135374

Safe monitoring of automated guided vehicles – Using spaces more efficiently

The Safe Motion Control solution from SICK, consisting of the DFS60S Pro safety encoder and the Drive Monitor FX3-MOC0, is the ideal solution when it comes to safe drive and motion monitoring for mobile machinery such as automated guided vehicles (AGVs). This combined safety solution helps machine manufacturers and system integrators save time during not only system engineering, but approval procedures too. What is more, it keeps technical and legal risks to a minimum – such as those associated with self-evaluation of solutions using non-safety-certified standard products. The Drive Monitor FX3-MOC0 expansion module developed for the Flexi Soft safety controller reliably captures the direction of travel and speed parameters of the AGV, as well as providing all the most commonly used interfaces for encoders. Encoders can be connected to the Drive Monitor FX3-MOC0 at a central point and used for monitoring the direction of travel, the speed, or even the brake ramp. This monitoring feature opens up the possibility of optimizing the protective fields associated with the safety laser scanner attached to the AGV – and the space available for movements to take place can be used more efficiently as a result.

DFS60S Pro safety encoder – Safe monitoring with just one encoder

The DFS60S Pro safety encoder is attached to the AGV's drive axis and provides support for performing safety functions such as SSM (safe speed monitor) and SLS (safely-limited speed). Interaction between the encoder and the control system enables the control system to reduce the speed of the AGV as necessary. The SBC (safe brake control) and SS1 (safe stop 1) or SS2 (safe stop 2) drive monitoring functions make it possible to trigger and safely monitor an emergency stop of the AGV. The DFS60S Pro safety encoder also acts as a reliable signaling device for automated guided vehicles that have complex navigation requirements. As AGVs are given more and more freedom to move around, safe movement monitoring has to overcome the obstacles that this brings. Transport vehicles with differential drives feature two independent drive units, enabling movements such as rotation on the spot. Without safety-certified encoders, executing complex processes like these would require significant time and effort to be spent on creating the right control system. The certified DFS60S Pro, on the other hand, provides a simple and safe way of recording direction of travel and speed information, resulting in safe movements. In turn, this makes it possible to create separate, independent travel profiles for vehicles.

Advantages of an integrated safety concept:

This concept can be implemented using not only HIPERFACE® motor feedback systems (SRS/SRM50 and SKS/SMK36), but also motor feedback systems featuring the HIPERFACE DSL® digital interface (EFS/EFM50 and EKS/EKM36). The single-cable technology used with HIPERFACE DSL® cuts the amount of cabling work the manufacturer has to do in half.

Advantages:

- Only a few male connectors and cables are required
- Fewer components
- Complete drive system from one manufacturer
- Quick certification
- Short response time for errors
- Easy availability of the control parameters

(ro)

A TECHNOLOGICAL LEAP FORWARD THANKS TO safeHDDM™

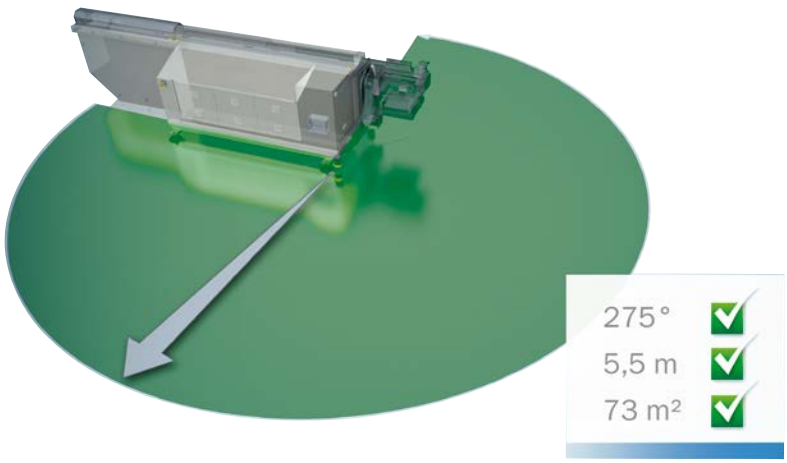
microScan3:
PROVIDING A NEW PLATFORM FOR SAFETY

With microScan3, SICK is embarking on a new era for safety. This new generation of safety laser scanners is based on the patented safe measurement principle safeHDDM™. What this has resulted in is outstanding reliability under challenging conditions and an extensive scanning range – all in a single highly compact housing. What is more, the microScan3 delivers the right features to meet requirements for straightforward, intuitive operation.

>> More than 20 years of experience with safety laser scanners and their applications in industrial environments have gone into the development of the microScan3. The aim in creating this equipment was to combine safety – that is, safe detection of people in hazardous areas – with productivity. Thanks to safeHDDM™, the microScan3 offers outstanding reliability, even when ambient light or dust come into play, as the stop signal is only issued when there is actually a risk to people present.

safeHDDM™: More than just new technology

The microScan3 emits 80,000 individual pulses per scan – compared with conventional measuring processes, this ensures that several times the amount of data are available for evaluation. The microScan3 uses this multitude of individual pulses to calculate 700 safe measured values. New filters and intelligent algorithms ensure that safeHDDM™ is safe and that the microScan3 is able to detect even those objects that have just 1.8% remission, such as black clothing. At the same time, the new technology creates improved reliability when dust and ambient light is present in the environment. One of the key criteria when using safety laser scanners is the scanning range to size ratio – and thanks to safeHDDM™, the microScan3 is not only extremely compact, but is also able to monitor large areas measuring as much as 73 m². Another significant advantage of using a state-of-the-art safety laser scanner is its suitability for corner mounting, allowing it to monitor two sides of a machine. While a scanning angle of 270° is theoretically enough to cover this, the microScan3 is the very first safety laser scanner to feature a scanning angle of 275°. Without these additional 5°, safety gaps can easily emerge if a laser scanner is mounted without precision – meaning that the microScan3 eliminates this problem altogether.



275° – ensuring uninterrupted safety even when the equipment is mounted in a corner. A 5° larger scanning angle prevents any safety gaps from arising, even if mounting has been carried out imprecisely.

Do performance and safety have to mean complexity?

With state-of-the-art technology on board and significantly better performance, it would be easy to assume that this innovative solution goes hand in hand with more complex commissioning and operation. However, the microScan3 represents another platform – for safety in this case – that has enabled SICK to combine straightforward, intuitive operation with intelligent connectivity. This makes it the perfect answer to demands for better productivity, flexible production, and excellent system throughput. Even configuration is a quick process with the new Safety Designer software. And during operation, the status indicators, LEDs, and display remain easily visible from many different angles – even from a long distance away.

Important diagnostics messages can be selected directly using pushbuttons during operation, and appear on the display. Safety made simple – with the microScan3. *(tm)*

USABILITY – MAKING TECHNOLOGY EASY TO USE

WHY MAKE THINGS COMPLICATED WHEN THEY COULD BE SIMPLE?

The team involved in developing the new deTec4 Prime safety light curtain, left nothing to chance and put it to the test – including its usability. Joining forces with staff at the Usability Competence Center at Furtwangen University in Germany, they subjected the equipment to a practical test, applying a classic usability study to determine how test subjects would cope with handling the deTec4 Prime.

>> The object of the exercise was to discover whether SICK's customers and service technicians would be able to follow the concept of the deTec4 Prime. To answer this question, Usability Competence Center staff at Furtwangen University started out by hypothesizing which operating steps users could potentially find problematic. Their theories were then subjected to a systematic series of tests.

Prof. Dr. Gerhard Kirchner from Furtwangen University's Faculty of Business Administration and Engineering sums up the results of the analyses and testing: "By and large, the tests proved that the concept is understandable. However, there were clearly areas in which both the product itself and the technical information could be improved." Describing the process, Lena Neumann – a staff member at Furtwangen University focusing on usability engineering and research – says: "All the test subjects had to solve the same tasks. We had set out the standard procedure in the test manual. This meant not only observing how the test subjects worked on things, but also creating actual tasks for them to do – and ensuring that they all did the same ones. We filmed the whole thing and noted down our observations, as well as grouping and prioritizing problematic areas according to the nature of the problems."

The deTec4 Prime team then used the findings from this process to optimize the safety light curtain in additional ways. The results of this included an ingeniously simple connector concept, faster light curtain commissioning thanks to optimized visualization using an integrated laser and alignment display, and minimizing the connection work associated with cascaded systems.

Keeping a finger on the user's pulse

To achieve success on the market, consumer products such as smartphones have to combine simple operation with an attractive design. Over time, tests comparing products have proven user-friendliness to be one of the most important aspects that users consider.

"You might not think that this applies so much to industrial products, but usability is becoming an increasingly important factor here too. The market is looking for safety and operating efficiency based on excellent ergonomics and product-related information created in an appropriate format for the target audience, but it's also looking for appealing design." Those are the observations of Prof. Robert Schäflein-Armbruster, who directs the Usability Competence Center at Furtwangen University. "Usability is especially important in safety contexts. Let's say you press the wrong button on a coffee machine. What might happen is that you simply end up with an espresso rather

From the left to the right: Prof. Robert Schäflein-Armbruster, Lena Neumann, and Prof. Dr. Gerhard Kirchner from the Usability Competence Center at Furtwangen University.

than a latte macchiato. Operate a machine, plant, or safety device incorrectly, however, and you may have a real safety issue on your hands. And that even goes right back to the installation stage, when the products aren't providing any real feedback and the user is lulled into a false sense of security. It also relates to the subject of manipulation, which is what happens when products do not fit the natural environment where they are supposed to be used. What we need to do is focus on exactly those people who are using products, and design both products and product-related information in a way that makes manipulation either unappealing or unnecessary."

More complex situations need usability

"The more complex systems are, the more usability is required to say in good conscience that they are operating at the peak of their abilities," posits Prof. Dr. Kirchner, looking to the future of self-controlling, networked production. "If multiple large machines are interacting with one another and moving orders between one another, I want to be sure that they really are carrying out the correct processes."

Modern data technology will allow the plants of the future – particularly those with complex configurations – to be designed in a virtual environment and validated using simulation models. Usability aspects that focus on safety can already be incorporated into the design process, representing a point at which virtual engineering and usability intersect. By obtaining results more quickly and gaining feedback on specific aspects during the development stage, it will be possible to create alternative product concepts at a much earlier stage in the process of creating products.

Additional information:
www.hs-furtwangen.de/usability

deTec4 Prime: USABILITY PUT TO THE TEST

The introduction of the deTec4 Core and deTec2 Core safety light curtains has made protecting hazardous points and access points easier than ever. The latest variant of the deTec4 Prime takes this technology one step further.

The new deTec4 Prime safety light curtain is an upward step in the successful deTec4 Core concept, rounding out the range of these products. At the same time, it combines the features of the existing light curtain variants in a single device and offers new functions on top – and does all this in the compact, space-saving design of the Core variant. The deTec4 safety light curtains are electro-sensitive protective devices that comply with performance level “e” in accordance with EN ISO 13849 and SIL3 in accordance with IEC 61508.

Functionality made simple: The deTec4 Prime safety light curtain.

Graduated protective field heights

Graduated in 150 millimeter increments, the deTec safety light curtains can implement 13 different protective field heights from 300 to 2,100 mm. The deTec product family offers the right solution for every application. The deTec4 Prime stands out as a multi-talented piece of equipment. It is able to cover virtually every standard application thanks not least to its flexible connection concept.

Better performance with less wiring and intelligent standardization

In applications where machines are positioned close together, it is easy to reduce mutual interference of safety light curtains by means of beam coding with DIP switches. The option of cascading up to three systems for presence detection reduces the amount of wiring and the number of safety capable inputs in the control cabinet. The local reset function also saves wiring and programming effort in the control system. A T-connector makes it possible to use only one cable to the control cabinet, as well as status displays on senders and receivers, and thus reduces costs and minimizes machine downtimes. Four system plugs are available for configuring the required deTec4 Prime functions. Configuration is

"In all times of change – and we are currently experiencing one of those in many respects – the ability to collect empirical data from substantiated sources is worth its weight in gold, and gives you the security of knowing that you are moving in the right direction."

Prof. Robert Schäflein-Armbruster, director of the Usability Competence Center at Furtwangen University

done without software, both simplifying storage and reducing costs.

Fast commissioning thanks to visualization by means of integrated laser and alignment display

All deTec safety light curtains save significant commissioning time and costs thanks to integrated LED displays and diagnostic functions. During commissioning, the deTec4 automatically adapts the scanning range exactly as required. The integrated alignment display in the new deTec4 Prime guarantees even faster, more reliable positioning of the sender and receiver in relation to one another using four LEDs, as well as automated calibration of the scanning range up to 24 m at 30 mm resolution. Four blue LEDs indicate that operators are in the green zone with this yellow technology – in other words, that they are achieving good results.

Rugged and reliable with IP 67 enclosure rating and ambient operating temperatures to –30 °C

With IP 65 and IP 67 enclosure ratings and an operating temperature range of –30 °C to +55 °C, the safety light curtain is also ideal for use in challenging environments. Metal and plastic components are combined within the impact-resistant housings in a way that allows deTec safety light curtains to stand up to the very toughest requirements effortlessly. Thanks to their shock resistance and highly rugged front screens, they work reliably even under extreme conditions.

Simple assembly with innovative mounting and no blind zones

Thanks to the innovative Flexfix mountings, it is possible to mount all deTec safety light curtains on a variety of machine types in a matter of minutes. After it has been mounted, the light curtain can be rotated before it is finally secured in the Flexfix bracket, ensuring a continuous protective field up to the ends of the housing.

Whether it is being used in the automotive, part suppliers, or packaging industries, or in mechanical and plant engineering, two major points demonstrate the viability of functional safety technology: rapid commissioning, enabling significantly faster system effectiveness; and continuous production, which improves system efficiency. Its flexibility shows that the concept of the new deTec4 Prime safety light curtain has been designed with this in mind. The deTec4 Prime safety light curtain represents an upward step in this successful concept, rounding out its range of products. *(as)*

SAFELY BRINGING MODULAR MACHINE CONCEPTS TO LIFE

MORE PRODUCTIVITY AT EVERY STAGE

Manufacturers of FMCG (Fast Moving Consumer Goods) require modern production lines to provide flexibility and modularity. Complex production and packaging processes in particular are areas in which modular mechanical engineering is already commonly used – meaning state-of-the-art machine concepts consisting of various machine modules, some of which may even come from different manufacturers. To create a flexible production environment, the modules need to be changed and combined in different ways to accommodate the FMCG manufacturer's needs. This presents a real challenge when it comes to implementing machine safety specifications.

>> Is it possible to be flexible and still highly productive? With consumers' tastes changing at an increasingly rapid rate and the growing trend toward batch size 1, demands are being placed on the production process as a whole to provide more flexibility. Accommodating this need, however, still has to leave room for the entire system to continue delivering excellent efficiency, availability, and, therefore, productivity (overall equipment effectiveness, or OEE for short). Replacing individual machine modules, integrating new modules into the overall equipment setup, and combining new sets of modules all results in significant amounts of wiring and programming work for the operator – a fact that is true in both safe networking of machine elements and other activities besides.

Are higher-level safety controllers the only way to achieve networked safety?

In cases where safety functions in one machine module need to be available to other modules as well, the process logic of these overarching functions has to be networked. The latest point at which this can happen is when the individual machine modules are put together in the overall equipment network. If a fault occurs, it may be sufficient to shut down just one machine, depending on the nature of the problem and where it has arisen. However, cases requiring all upstream machine modules to be shut down too (continuous material transportation applications, for instance) have always required a higher-level safety controller in order to prevent damage or product losses. The controller transmits

the relevant signals to the machine modules that are affected. Higher-level controllers entail a great deal of manual programming, especially if machines from different manufacturers are being used – and this goes beyond just the initial programming work they require. It is particularly felt in the amount of work required to carry out changes, and not only costs time and money, but also makes the system more complex. In turn, this results in longer downtimes and poorer OEE.

Now, flexibility and productivity can be combined

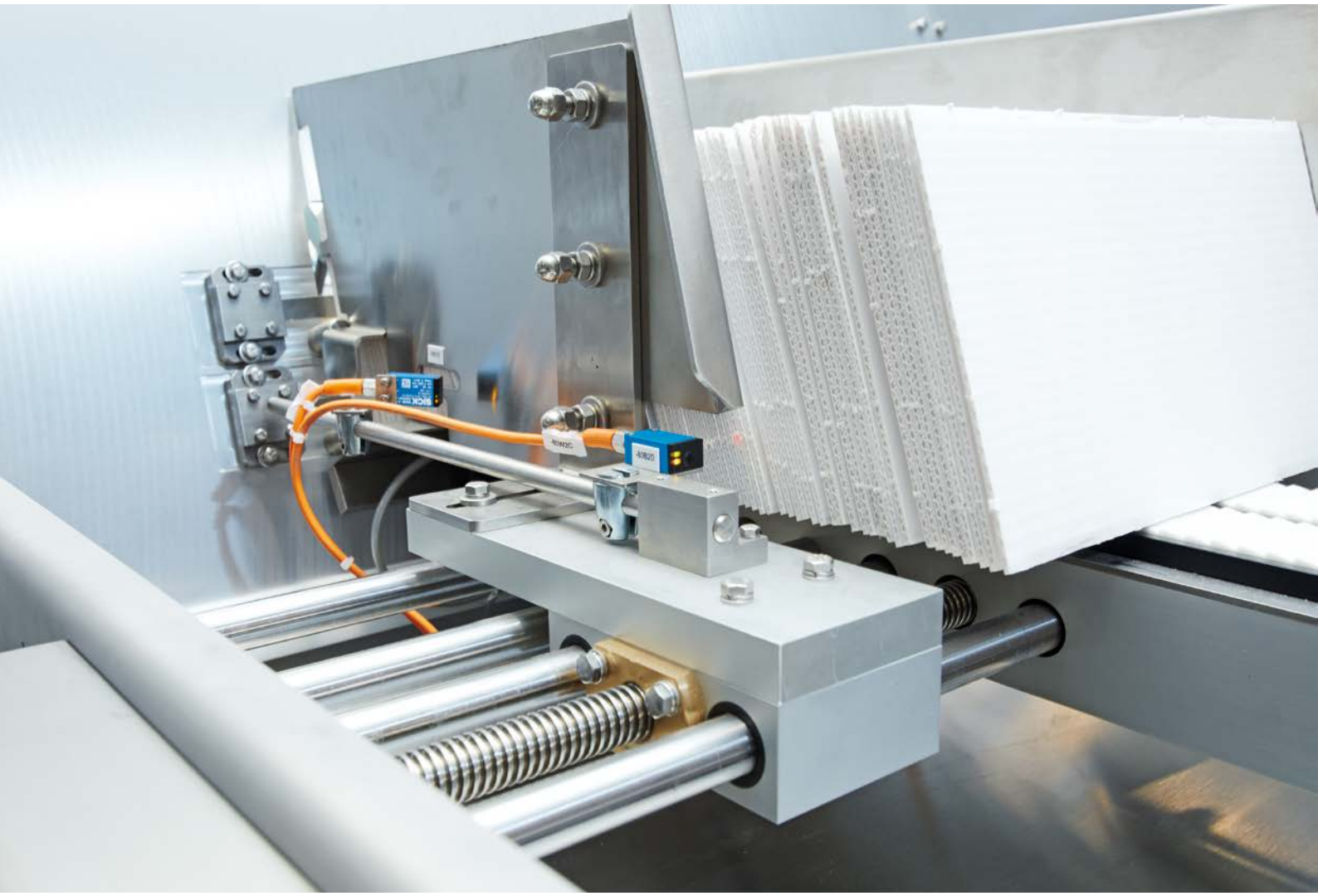
Flexi Line from SICK makes it possible to connect up to 32 Flexi Soft stations safely and link safety functions across multiple machines. Flexi Line is included as a standard function in the Flexi Soft main module – meaning no additional modules are required, and no programming for the function needs to be carried out in the higher-level controller. Another benefit is that the plant operator only has to define the required process map once before handing it over to the machine manufacturer. This allows the operator to create solutions for safety applications throughout the entire plant – opening up the possibility of even putting individual machine modules into operation in a sequence or integrating individual machine elements into the overall plant at a later stage. And no addressing is required either: A straightforward teach-in function is used to remove or add Flexi Soft stations, and make changes to their order. This significantly reduces the amount of programming work.

Particularly where modular mechanical engineering is concerned, Flexi Line therefore offers a number of benefits, providing a less complex, less error-prone way of creating safe networking. It means faster product changes in Fast Moving Consumer Goods environments. And more productivity at every stage. *(tm)*

Flexi Line from SICK links safety functions across multiple machines.

RESIDUAL STACK MONITORING WITH Safeguard Detector

CARTON MAGAZINE: MAKING RIGID HOUSINGS A THING OF THE PAST



Requirements for protecting machinery have changed more and more with the increasing use of automation. In the past, protective devices in the work process were something of a nuisance; for this reason, they were often not used at all. Innovative technology has enabled protective devices to be integrated into the work process. As a result, they are no longer an obstacle for the operator and even help productivity in many cases. Reliable protective devices that are integrated into the workplace have thus become indispensable nowadays. They are a useful tool in achieving the goal of continuous production, which in turn improves system efficiency.

>> SICK developed the certified Safeguard Detector safety system as a means of ensuring flexibility when changing carton blank formats and providing protective safety technology at the same time. One application in which the new safety system for packaging machines can be used is carton magazines that require contact protection. When it comes to material transportation in particular (of flat carton blanks, for example), packaging machines present a risk of the operator reaching through an empty magazine and into the machine while it is still running, sustaining injuries as a result. Using Safeguard Detector, injuries may be prevented.

Reliable protection – even without material

The packaging material in the carton magazine of a packaging machine acts

as a physical guard during operation. If there is sufficient material in the magazine, then it is not possible to reach into the mechanics while the machine is running. This protection ceases to function as soon as there is too little material left in the magazine, as the moving mechanics in the packaging machine are left exposed and pose a risk of serious injury. Until now, the only solutions available for this issue have been impractical in nature, either requiring the carton magazine to be installed at unreachable heights or involving extensive protective clothing, a mechanical tunnel occupying a great deal of space, and only a small number of format changes – or none at all.

A functional safety system

Safeguard Detector consists of the Flexi Soft safety controller and two MultiPulse photoelectric proximity sensors, which monitor how much material is in the packaging machine magazine. The sensors mounted at the side monitor the stack of cartons. If the level has reached an excessively low point, the system issues a warning so that it can be topped up in time to prevent the machine from stopping. The modular Flexi Soft safety controller evaluates the sensor signals. Certified function blocks that enable quick commissioning of the two MultiPulse sensors are available for the Flexi Soft. Additionally, the Flexi Soft gateway allows diagnostic measures to be implemented in several stages. These are useful for alerting operators in cases where, for instance, the magazine needs to be topped up or it will become empty within the next half an hour.

Space-saving magazine monitoring

The small sensor housings require hardly any space at all, making the carton magazine very easily accessible. The operator is able to keep topping up the magazine as the packaging machine is running. The compact MultiPulse photoelectric proximity sensors mounted at the side of the magazine establish new horizons for machine design, and format adjustments in the carton feed are easier to perform than in conventional systems. What is more, there is no mechanical tunnel at all.

The small housings used with the MultiPulse photoelectric proximity sensors require hardly any space.

When a format change takes place, there is no need for any alterations in the layout of the safety-related equipment, as the side guides of the carton magazine consistently maintain the same distance from the contour of the format blanks.

Conforming to functional safety requirements

The self-testing process, which conforms to functional safety requirements, can only be ensured when all the components are working in a system. The two photoelectric proximity sensors provide the required pulsed signals, which are analyzed using the Flexi Soft safety controller. Thanks to the Safeguard Detector safety system, there is no risk of the operator becoming injured by reaching into an empty carton magazine.

An intelligent safety solution from a single source

Through its Safeguard Detector, SICK provides both pulsed sensors and intelligent signal evaluation with Flexi Soft in a single package. To make programming Flexi Soft a straightforward process, SICK has created special function blocks for each of the individual Safeguard Detector variants – allowing safety functions to be programmed simply using drag-and-drop. Sample programs are also available for integrating extended functions. Machine developers and plant operators can rest safe in the knowledge that they are using not only reliable, tried-and-tested components, but also a safety system that has been subjected to a safety assessment and is TÜV Süd-certified as PL d according to EN ISO 13849 as well as SILCL2 according to EN 62061.

Switch to autopilot

In addition to a straightforward presence signal, the MultiPulse photoelectric proximity sensors are able to indicate an error-free condition and the status of the application. This informs the controller that the sensor has detected the object with 100% certainty and thus that no defects, such as a wire break or sensor malfunction, have occurred. A simple oscillating circuit made up of the object, the optics, and the sensor electronics is what makes this possible. A second switching point ensures that sensor manipulation is virtually impossible. The controller monitors the oscillating circuit, which oscillates at 2 Hz or 10 Hz.

Modular and intuitive configuration: The Flexi Soft safety controller from SICK

The Flexi Soft concept offers a whole range of main modules, expansion modules, Motion Control modules, and gateways that can be used to create a customized, efficient solution for the safety application in question. It is also an efficient tool in the packaging industry, which uses machines with a large number of doors and flaps that require protective measures. Flexi Soft minimizes the amount of wiring work required in these applications. Not only that, but it also makes it possible to network overarching safety functions in modular machines – and integrate these into the standardized plant control system. The license-free Flexi Soft Designer configuration software offers intuitive programming, rapid commissioning, and continuous monitoring. The entire configuration can be documented in multiple languages at just the touch of a button. *(as)*

PSDI FUNCTION IN PRESSES

THE SIMPLE, SAFE WAY TO INCREASE PRODUCTIVITY

Thanks to the PSDI (Presence Sensing Device Initiation) function in the Flexi Soft safety controller, it is possible to control the press cycle in manual insertion presses using a safety light curtain in PSDI mode. As soon as the worker removes his or her hand from the hazardous point, the press automatically restarts. Not only does this remove the need for two-hand control devices, it also offers clear benefits when it comes to providing workers with ergonomic, safe workstations – and ensures that more of the machine capacity is utilized.

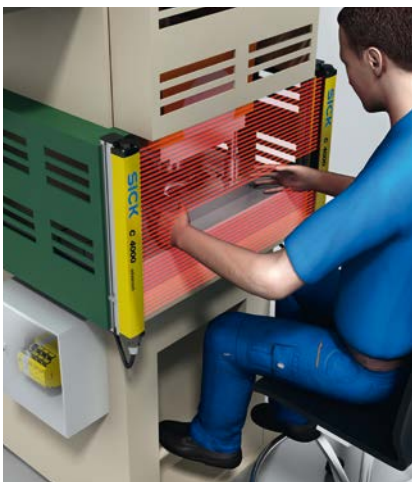
>> Whether an application needs to protect people in hazardous areas, at hazardous points, or in access areas, SICK's extensive expertise and wide-ranging product portfolio enable it to provide the right solution for every task. An excellent example of how safety can lead to more productivity comes in the form of the PSDI function provided by the Flexi Soft safety controller in combination with safety light curtains. Together with safety controllers, type 4 safety light curtains protect workers' hands and fingers if they reach into the hazardous point of a press – and offer many other benefits besides.

Safety now comes with more productivity

When using a conventional two-hand control device, workers are required to actuate the two control elements simultaneously using their hands in order to trigger the dangerous movement, such as the working stroke of a press. The circuit has to stay activated until the press cycle – and, therefore, the dangerous movement – is complete. Only then can the worker pick up the next workpiece. This procedure can have a negative impact on workstation ergonomics, leading to more errors and a drop in productivity as a result. There is also the risk of accidents in the event that a worker makes accidental contact with the circuit. A pneumatic press provides an example of a simple way in which the PSDI function can create a long-term increase in productivity. As workers have both hands free, they are able to pick up the next workpiece as soon as they have placed the first one in the press. There is no need for the press cycle – or the dangerous movement – to be completed fully. The PSDI function thus represents a step that, although simple, enables much more of the machine's capacity to be utilized and productivity to increase significantly as a result.

Safety and more besides

Safety solutions for machines and plants nowadays have to do more than "just" protect against accidents – we are increasingly seeing the need to offer added value with respect to automation engineering. Extensive application knowledge, a broad-ranging product portfolio, safety controllers that are ideal for the task at hand, and the right advice from the very start of the project are the keys to this, even when using PSDI in presses. *(tm)*



PSDI function: The safe way to increase productivity.

NEW EN ISO 14119 STANDARD FOR INTERLOCKING DEVICES

STR1 – SWITCHING TO SAFE INTERLOCKING

Since the end of 2013, the new global standard EN ISO 14119 (Safety of machinery – Interlocking devices associated with guards – Principles for design and selection) has been taking the place of the former European standard EN 1088, subject to a transitional period of 18 months. The scope of EN ISO 14119 in fact extends to all machines that use interlocking physical guard (protective doors, for example). The new standard defines various types of interlocking devices, as well as outlining the differences between physical operating principles and actuating principles and introducing a qualitative assessment for actuator coding. It provides manufacturers of both machines and interlocking devices with useful information on designing interlocking devices and mounting them in a way that prevents manipulation. So what is SICK's response to the launch of the new EN ISO 14119?

In the new EN ISO 14119 standard, the focus is firmly on ways in which potential manipulation can be reduced. It provides a methodology for evaluating the motivation to defeat interlocks, and a selection of preventive measures where these are necessary, divided into general measures (relating to the interlocking device) and additional design measures (relating to the machine). The information defines and distinguishes between four interlocking device types, which are used according to the actuation method in question (mechanical or non-contact). Based on these four types and the applicable actuator coding level, necessary or recommended measures are derived for mounting or testing purposes. The description of the advantages and disadvantages offered by each type of technology makes it easier to design and select interlocking devices.

Compliant with the standard, yet flexible: STR1 and TR10 Lock

How has SICK modeled its portfolio of safety switch products in line with the launch of the new EN ISO 14119 standard? By introducing the STR1 transponder safety switch and the transponder-monitored TR10 Lock safety locking device, SICK has given the market access to locking devices that conform to EN ISO 14119 design type four. These are available with a coding level that is as low or as high as is dictated by the coding requirements. Depending on the coding level, the new STR1 and TR10 Lock now enable machine manufacturers to dispense with the need for additional mounting steps such as concealed mounting, mounting outside the scanning range, or an additional interlocking device for plausibility checking purposes.

The STR1 features a compact VISTAL® housing that ensures outstanding mechanical stability. Excellent electromagnetic compatibility (EMC) provides the safety switch with additional ruggedness as well as enabling a high level of machine availability to be maintained. Three actuators in different sizes, three active sensor surfaces, and up to four actuator configurations open up almost unlimited mounting possibilities and make the STR1 flexible and easy to integrate.

The STR1 and TR10 Lock feature self-monitoring semiconductor outputs (OSSD) which detect any errors that occur and ensure high levels of safety at performance level PL e (EN ISO 13849). The safety switches can be used individually or in series, either directly using T-distributors or with the innovative Flexi Loop safe sensor cascade. Thanks to the available coding types (universal, unique, and permanent), the STR1 and TR10 Lock also offer outstanding protection against manipulation. The outputs detect occurring errors. All this is what makes the STR1 and TR10 Lock from SICK so safe and yet still flexible. *(ro)*

Rugged, flexible, and easy to integrate: The STR1 transponder safety switch.

SICK offers a white paper on the subject of designing and selecting interlocking devices in line with the new EN ISO 14119 standard. It is available to download at: **www.sick.com/whitepaper_id**

SAFETY AND PRODUCTIVITY WORKING IN HARMONY

ADVANCED SERVICE EXPERTISE

SICK offers an extensive selection of machine safety services, ranging from risk assessments to the preparation of generic safety concepts, right through to the specific selection of components, their integration into the plant, and programming or configuration. SICK's 140 safety experts operate in more than 80 countries and are also tasked with validating protective functions. What is more, they provide support for machine and plant conformity assessments all over the world, with the aim of providing evidence that the safety requirements applicable in any given region are being fulfilled. Whether they are used during construction, renovation, or linking machines and plants, SICK's safety services take the strain off your internal resources – and the knowledge and experience of its experts ensure that state-of-the-art safety concepts are implemented in a way that is both efficient and safe. In fact, SICK specialists are already making the necessary preparations to face the safety technology challenges that new work processes will bring in the future.

>> Conventionally, machine safety has always referred to stopping any movements in a working area that could present a hazard to people or other machines. If someone enters the hazardous area of a machine, the drive is disconnected from the power supply and this puts the machine into a safe state. Inevitably, some time will be lost before the process starts running smoothly again – and there may be faults in the process if the workpiece has been damaged or become unusable. This puts safety and productivity at odds with one another, as the operator is blocked from any further access with the work process and direct interaction becomes impossible. State-of-the-art workstations are looking for machines and their operators to do more than simply coexist as they have done in the past. They now require more collaboration – if, for example, an operator is temporarily standing in the working range of a loading robot at a loading station. In cases where direct collaboration may be needed in the future, the interactive movements between humans and machines will actually have to take place simultaneously. Thanks to new technology that makes it possible to perform more complex and more flexible safety functions, there is a growing sense of resolution in this area of conflict.

Smart actions mean more than just shutting down

Nowadays, it is possible to put machines into a safe state without shutting them down altogether. Safety technology solutions for a range of process states enable processes to be not only stopped, but also slowed down, automatically restarted, or accelerated.

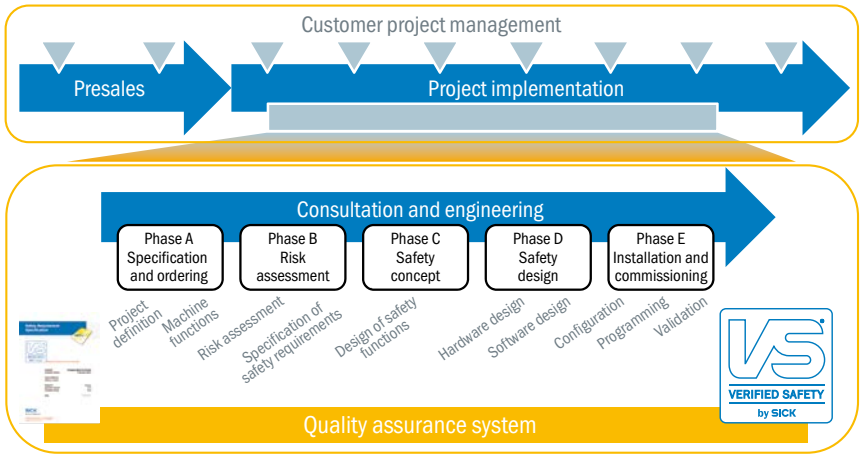
Robots are a standard feature of assembly processes in the automotive industry. If someone accidentally approaches the hazardous area of a robot, for instance, the robot does not necessarily need to shut down entirely – as an initial step, it may be enough for it to reduce the speed safely and warn the person using a noise or light signal. If the person keeps approaching, then shutdown can happen at this stage. The latest systems are also able to detect when a person leaves the hazardous area. As the machine then resumes normal operation of its own accord, this does away with the need for a manual machine reset. Intelligent access protection systems provide presence detection that only becomes active when the safety device associated with them responds. This makes it possible to prevent production-related waste in the protective area from leading to an unintended shutdown.

Adding value: Process analysis data

Safety sensors are able to do more than simply put a machine into a safe state. Statistical evaluations can be used to identify the need for changes in a process or a working environment – if, for example, safety-related shutdowns are starting to happen more and more within a certain period of time. This information creates added value for the machine operator, as it makes it possible for this person to identify problems and introduce corrective measures early on (such as additional operator instructions or changes to processes). Significant periods of downtime or extensive damage can be avoided as a result. What is more, it is possible to monitor how the product is performing in relation to the relevant safety requirement, as a means of assuring quality. Automated rejection of a faulty product may even be triggered at the next stage in some cases.

Expertise from SICK for every case

Safety experts at SICK analyze complex processes on machines and plants by performing risk assessments, selecting the appropriate safety technology, then implementing it and testing it to ensure it is working correctly. To guarantee people's safety, it is also essential to perform a sufficient analysis of the way in which they interact with the machinery before anything is implemented. Every possible way of using the equipment – including any foreseeable misuse – must be taken into account when performing a risk or hazard assessment. This is not a problem for SICK's safety experts, however, as they have proven their qualifications as required and are always up to date with technological developments. They also consider the legislative and standards-based requirements that apply to machine and plant safety at that time, and use all this information to develop perfect-fit solutions without oversizing. Qualifications of the specialists from SICK are regularly checked and documented on the basis of SICK's in-house VERIFIED SAFETY competency management system, applied consistently throughout the globe.



SICK's VERIFIED SAFETY quality assurance system has been tested and certified by the Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA) in accordance with Annex X of the Machinery Directive. This means that SICK is now officially entitled to carry out EC conformity assessments for prefabricated safety systems.

VERIFIED SAFETY – Safe processes ensuring high quality

As part of the VERIFIED SAFETY system, defined processes and competency management ensure that requirements for reducing risks are complied with. The system also offers legal security in that it integrates and demonstrably meets the legal requirements that apply to each region. Maintaining the same procedure worldwide creates a standardized situation in which results, for example, are documented in the same way in China, the USA, Italy, and other countries. This provides a basis for comparing results and a consistent overview – a particular advantage for global companies. The VERIFIED SAFETY competency management system is also an integral part of SICK's comprehensive customer project management (CPM) process, making it applicable as standard. Projects such as the retrofitting of protective measures can therefore be carried out at 16 production plants in 14 countries to the same standard of quality as retrofitting on a single production line in a single country.

What future challenges will safety service providers face?

New work processes are resulting in new hazardous situations and in some cases may even require new standards, regulations, and safety functions in order to keep people and machines protected. Safety experts and service providers need to analyze these new work processes, draw up suitable measures for them and – where necessary – define new standards. This work must concentrate on ensuring safe interaction between humans and machines. We are increasingly seeing machines work autonomously and at the same time as humans, immediately next to them – that is, directly in a hazardous area, as is the case with robots in automotive assembly. As safety functions become more complex, it is not only the engineering aspects that will present more challenges: The subsequent validation processes will too. SICK, however, is up to the challenge, not only in the products it develops, but also in the action it takes as a development partner and service provider – playing its part in shaping the safety solutions of the future. *(ro)*

Operational safety: New requirements for risk assessments

In force since June 1, 2015, Germany's new Ordinance on Industrial Safety and Health (BetrSiV) has required the country's machine operators to fulfill even more stringent requirements with respect to performing and documenting risk assessments:

- Avoiding overlaps with the Ordinance on Hazardous Substances in the area of explosion protection
- Ensuring the risk assessment is made available before the equipment is used for the first time
- Listing risks that may arise when using the equipment in the context of the working environment
- Operating entities are not released from the obligation to perform a risk assessment at the site of use even if CE marking is present
- Aligning the risk assessment with every stage of the life cycle, ensuring greater consideration is given to maintenance and actual accidents
- Standardized definition of the state of the art by the Committee for Operational Safety and expert committees from accident insurers
- Requirement to adapt existing protective measures if the state of the art changes
- Prevention of impermissible operational statuses, particularly during startup, shutdown, and testing stages
- Customer held responsible for ensuring that any external service providers used have the correct specialist knowledge

FUNCTIONAL SAFETY ENGINEER (TÜV RHEINLAND)

TRAINING AT SICK: FUNCTIONAL SAFETY

Even at the development and design stage of a machine, it is important to consider how it will ensure safety – all too often, accidents are the result of a failure to carry out adequate risk assessments in advance. When implementing and commissioning a machine, residual risks can be avoided by installing additional safety technology. Ultimately, the safety of machinery depends on the safety system operating correctly as well as other risk-reducing measures. This is where functional safety comes in. SICK offers the Functional Safety Engineer (TÜV Rheinland) training, designed to provide developers, designers, and operating entities with training in the field of functional safety and help them learn about the ways in which machine safety can be guaranteed.

>> SICK is a recognized course provider under the TÜV Rheinland Functional Safety Training Program. The qualified trainers from SICK appointed by TÜV Rheinland, are experts who are able to provide information on a combination of the necessary theoretical knowledge and the on-site requirements that apply in practice. They also possess – and can demonstrate – at least ten years of experience in the field of functional safety. SICK's training enables engineers, designers, companies working with functional safety, and other parties who have an interest in this field to be trained in the subject and enhance their specialist knowledge of it, up to the level of the internationally recognized FS Engineer qualification. Training can be delivered at a SICK subsidiary or at the customer's premises, and plans are in place to offer the seminar in both English and Spanish in future. This will give companies operating in other regions of the world the opportunity to acquire knowledge about the safety-related requirements and guidelines that apply in the European Union, making it easier for them to comply with goods export specifications.

A comprehensive agenda

SICK's training looks at risk assessment and risk reduction, machine safety, as well as functional safety on machines. A range of protective equipment – such as fences and electro-sensitive protective devices as well as safety-related software – is presented as a toolkit that can be used for reducing risks. The program also addresses potential ways in which protective devices can be positioned. As well as this, participants learn about requirements for developing safety-related control systems, including principles for verifying and validating safety functions, on the basis of the following standards: EN ISO 12100 (Safety of machinery – General principles for design – Risk assessment and risk reduction), EN ISO 13849 (Safety of machinery – Safety-related parts of control systems), and EN/IEC 62061 (Safety of machinery – Functional safety of safety-related electrical, electronic and programmable electronic control systems). The trainers from SICK provide in-depth examples from practice as well as tried-and-tested expert tips in areas such as documentation and functional safety management. They also provide support when it comes to implementing the European Work equipment directive for manufacturers. Other subjects addressed during the training program are based on the EN/IEC 61508 standard (Functional safety of electrical/electronic/programmable electronic safety-related systems) and the Machinery Directive.

Functional safety is an important subject even at the design and development stage of a machine.

Expert qualification through the FS Engineer (TÜV Rheinland) certificate

All participants in the seminar receive detailed training documents and, at the end, have the option of taking an examination concerning the issue of functional safety. Those who are successful are then awarded the globally recognized FS Engineer (TÜV Rheinland) certificate. *(ro)*

Additional information:
www.sick.com/functional-safety-engineer

AVOID EXPLOSIONS – PROTECT PEOPLE – MEASURE RELIABLY

EXPLOSION PROTECTION IN THE MANUFACTURING INDUSTRY

Wherever just a single spark is enough, wherever the safety of people, machines, and the environment are a key consideration, and wherever explosion protection is absolutely essential – this is where SICK safety solutions come into their own. It goes without saying that all protective measures have to work together to ensure maximum safety in Ex areas. Specific directives describe the contents of relevant laws in detail, regulations govern type approvals of measuring devices, and international standards lead to best practice. SICK measuring devices are designed to conform to regulations for Ex areas and facilitate safe measuring activities within industrial processes.

>> Everybody is familiar with the explosion triangle for gas and dust explosions: Oxygen, flammable material, and a source of ignition. As soon as flammable gases, vapors, liquids, and particulate matter are added to the equation, production processes can suddenly find themselves in an explosive environment. But to prevent such explosions from occurring, the oxygen concentration or those of flammable components must be continuously monitored wherever sources of ignition cannot be entirely ruled out. Devices with potential sources of ignition must also be explosion-protected for use in explosion-hazardous areas. This is precisely why system operators rely exclusively on certified device technology and are sure to comply with statutory regulations. SICK is developing measuring technology which has been certified to the appropriate levels for use in these explosion-hazardous areas.

Explosion protection as of 1815

Explosion protection is by no means a new phenomenon. In fact, its origins can be traced back to the mining industry over 200 years ago. In 1815, British chemist Sir Humphry Davy invented an explosion-protected mining lamp – known as the Davy lamp – to significantly reduce the potential for mine explosions triggered by methane. This incorporated a special mesh screen to protect the open flame. The structure of the lamp itself is similar to the principle of a flame arrestor. The source of ignition is insulated from the explosive atmosphere so that the flame cannot escape into the surrounding environment. This flameproof enclosure is still commonly found today in explosion-protection applications, no matter whether the Ex zone involves gas, dust, or even both.

Certified measuring devices

With increased mechanization, automation, and production speed comes the even greater need to adjust explosion protection accordingly. And this does not

just apply on a national level, it also applies globally by means of internationally applicable standards. Here, too, the importance of keeping the explosion risk to a minimum still applies. This also ensures that the use of certified measuring devices is regulated by an appropriate type approval for the relevant ignition protection type.

Sensor technology for Ex areas

SICK is committed to developing sensors for Ex areas which comply with these specifications and are suitable for plants that carry out risk assessments in line with American (NEC), European (ATEX), or international (IEC) standards. With functional device designs and integrated safety features, SICK's extensive product portfolio and experience in providing solutions are always sure to impress. SICK is able to rely on these as early as in the planning phase to demonstrate its experience to customers and offer ideal solutions from an economic perspective. Every task has its own special challenges. From selecting the ideal measurement principle, measuring range, or any other properties essential to the devices being installed, these decisions are all made in line with the relevant applications and with the customer firmly in mind. Car manufacturer Assan Hanil in Turkey, for example, relies on access protection in its paint shop.

Explosion protection: Access protection in the paint shop at automotive supplier Assan Hanil. Full report at: **www.sickinsight.com/access_protection**

Safety light curtain with ATEX rating

Four robots transport bumpers of various sizes into the input and output areas of the explosion-hazardous paint shop area. If a person enters this hazardous area, the robots must cease operation safely and immediately. The solution for this is the C4000 Fusion safety light curtain as an opto-electronic protective device with ATEX II 3G/3D rating. This safety solution relies on the ability to differentiate between people and materials, as the automatic bumper transport must not be negatively affected without clear justification. This serves to keep people safe while also maintaining system performance and process efficiency.

Detecting and protecting, measuring, monitoring and controlling: Whatever it might be, it's all in a day's work for SICK. *(sh)*

TASK	ZONE	CATEGORY	SOLUTION FROM SICK	IGNITION PROTECTION TYPE
DETECTING	1, 2	2G	W24-2 Ex photoelectric sensors	Intrinsic safety
	2, 22	3G, 3D	W18-4 Ex and W27-3 Ex photoelectric sensors	Protection by enclosure
	1, 2	2G	WLL24 Ex fiber-optic sensors	Intrinsic safety, optical beam
	2, 22	3G, 3D	MZT8 ATEX magnetic cylinder sensors	Non-sparking equipment
	0, 1, 2	1G, 2G	IM Namur inductive proximity sensors	Intrinsic safety
	1, 2	2G	MM Namur magnetic proximity sensors	Intrinsic safety
	1, 2	2G	RS25 registration sensors	Intrinsic safety
PROTECTING	1, 2, 21, 22	2G, 2D	deTec4 Core Ex safety light curtain	Protection by enclosure, pressure-resistant casing
	1, 2, 21, 22	2G, 2D	C4000 Advanced Ex safety light curtain	Protection by enclosure, pressure-resistant casing
	2, 22	3G, 3D	C4000 ATEX II 3G/3D safety light curtain	Non-sparking equipment, optical beam
MONITORING AND INSPECTING	1		EuroFID3010 total hydrocarbon analyzer (certified as a gas warning device according to EN 50271:2010)	With industrial housing: pressurized enclosure for Zone 1
	2	3G	S715 Ex modular gas analyzer	Restricted-breathing enclosure
	1, 2	3G, 2G	GMS815P modular gas analyzer	Pressurized enclosure, restricted-breathing enclosure
	1	2G	S720/S721 Ex, GMS820P modular gas analyzer	Pressure-resistant casing
	1, 2	3G, 2G	MCS300P Ex process gas analyzer	Pressurized enclosure, increased safety
	1, 2	3G, 2G	GM32 Ex in-situ UV gas analyzer	Pressurized enclosure, intrinsic safety
	0, 1, 2, 21	1/2G, 2D	TRANSIC151LP and TRANSIC121LP (FM) laser oxygen transmitters	Intrinsic safety, increased safety, protection by enclosure, non-incendive
	1 or 22	2G, 3G	FW101 Ex and FW300 Ex dust measuring devices	Pressure-resistant casing or protection by enclosure
MEASURING (FLOW)	1	2G	FLOWSIC500 gas flow meter	Intrinsic safety
	1, 2	2/3G	FLOWSIC100 Flare mass flow measuring devices FLOWSIC300 and FLOWSIC600 gas flow meters	Intrinsic safety, increased safety, pressure-resistant casing
	2	3G	FLOWSIC100 Process mass flow measuring devices	Ignition protection type "n"
	0	Ga, Ma	FLOWSIC60 flow velocity measuring device	Intrinsic safety
ACCESSORIES	EN2-2 Ex intrinsically safe NAMUR amplifiers			

ROOTS IN OUR REGION, AT HOME THROUGHOUT THE WORLD.

THIS IS SICK

Sensor Intelligence.

From sensors to sensor intelligence: Brilliant ideas and exceptional pioneering spirit have produced automation technology which has changed the world. The work started by Dr. Erwin Sick 70 years ago is being continued by over 7,400 employees all over the world as they embark on a new future with Industry 4.0. With our products and ideas, we protect both people and the environment. We are helping to make processes more efficient and to preserve resources. For us, this is a reason to celebrate. www.sick.com

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