SICKinsight
MAGAZINE

FLEXIBILITY IN LINE WITH PRODUCTIVITY

Visit us online:
www.sickinsight.com

Dear Readers,

Small quantities and individualized mass products are the key words of Industry 4.0. To make this a reality, a machine or plant must be able to handle variable product infeed and adapt to different formats. Sensors and actuators make such an adaptation possible. Any product size and shape can be produced flexibly on one machine.

We are shaping Industry 4.0 together with our customers. Our solutions can be extended to Industry 4.0 functions step by step. Our broad portfolio of products and solutions allows us to offer many different possibilities and methods for creating the foundation for more flexible processes. This involves the concepts of digitization, intelligence, and networking, which will enable production and logistics systems to optimize and control themselves autonomously. Intelligent sensor technology allows for a new standard of quality in flexibility. This technology makes it possible to collect production data in real time – a potential to optimize machines and plants that has barely been tapped.

Increasing market volatility means that production concepts need to be adapted to significantly changing conditions. It is therefore necessary to anticipate volatility.

In this issue of SICKinsight, you will find examples of concepts that improve flexibility. These concepts were developed and are being implemented together with our customers.

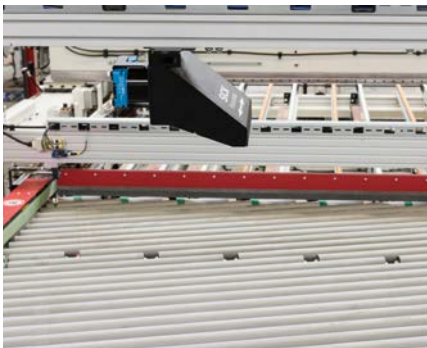We hope you enjoy reading this issue.

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

PRODUCTION CONCEPTS FOR VOLATILE TIMES

CONTENTS

IDEAS GROW WITH SENSOR TECHNOLOGY

In the last few years, the furniture manufacturing industry has started to move away from largely supply-oriented toward demand-oriented production. This presents two challenges to manufacturers of woodworking machines: the need for automated batch-size-1 production for large quantities, and therefore high variance in large quantities, as well as batch-size-1 production for high variance in medium to small quantities.

>> IMA Klessmann GmbH woodworking systems (Lübbecke, Germany) meets both requirements. "Our core business is the concurrent growth of both individualization and automation in production. Within this, the spectrum ranges from standard machines costing EUR 100,000 to systems costing in the region of tens of millions of euros," explains IMA Managing Director Bernhard Berger. "We take the experience we gain with large industrial customers with respect to automation and then apply this to batch-size-1 projects for smaller and medium-sized customers."

The choice of scanner depending on customer requirements

In order to process edges of carcass parts and fronts, IMA commissioned SICK to design the sensor technology for a Performance.one system. "We had it designed by SICK and they came up with just what we wanted. It was important for us to meet customer requirements in terms of sensor technology, or in this case the choice of scanner," adds Marcel Sulewski, Purchasing Team Leader for Electronics at IMA Klessmann GmbH, explaining the approach.

The challenge: When will batch size 1 prove its worth?

The system operator, a manufacturer of high-quality designer furniture, cabinet systems, doors, and kitchens for a discerning private customer base, was looking for an automation solution to process small quantities with high variance. The system had to be in a position to reliably detect and process a highly

diverse range of workpieces. "It is simpler with classic industrial customers – I always have the same workpieces in large quantities," says Ulrich Sievers, Head of Electrical Construction for Throughfeed / Handling & Transport Technology at IMA Klessmann GmbH, describing the starting point. "You can set the sensor technology, a scanner for example, to something and know that it's working. But for this customer, we had to assume that every part looked different. For example, sometimes they are building exhibition stands, sometimes a kitchen, and at others a new wardrobe. In this sense, the installed equipment had to be more flexible."

Performance.one involves an IMA solution for commission-based and small batch production. The highly flexible circulation production system for formatting, gluing together and finishing edges with complete return is designed for flexible batch-size-1 production requiring

virtually no manpower. To identify workpieces and then configure the machine settings, image-based code reading was recommended for this project.

Image-based code readers are characterized by their flexibility in the selection of the code type. In addition to reading 1D bar codes, they employ a range of image processing algorithms to identify 2D codes, such as the frequently used Data Matrix, QR, or MaxiCodes, as well as plain text. They make light work of switching from bar codes to 2D codes.

System optimized with just one camera

For every identification task, the same question is asked: Which technology is best? And as it so often is in life, there is never just one answer for every question. The best possible solution is always tailored to the individual technical and economic conditions of the application. With Performance.one, the challenge was to reliably identify a small code over a large

width. "Normally, we would have had to set up two cameras to cover this width," explains Ulrich Sievers.

Instead, the SICK team recommended using a Lector65x image-based code reader with Panorama mirror hood. The mirror hood helps to widen the field of view and is mounted together with the code reader either for top reading or side reading. In this combination, the code reader can be used for automated, fixed identification and decoding of bar codes on moving objects. It enables an approx. 50% larger field of view with the same code resolution.

Concerning the joint project with SICK, Ulrich Sievers remarks enthusiastically, "Here, we were mostly concerned with scanning reliability. That is what is required again and again. The difficulty lay in reading a small code over a large width. By using this Panorama hood, we didn't need a second camera and simply expanded the field of view."

"We use the code to set the production parameters. Automatically. 'Because I (the workpiece) am passing by here, you (the machine part) have to do this and that with me.' The component is recognized automatically. There are different board widths, different surfaces, and

different contours. The code sets the machine. This is the essence of Industry 4.0," summarizes Ulrich Sievers.

A further challenge for the automation of the system was the presence monitoring concerning the workpieces. Photoelectric proximity sensors operating according to the triangulation principle were quickly pushed to their limits due to the different decors and shiny surfaces of the veneers. With the Dx35 distance sensor, SICK really had an ace up its sleeve, because the Dx35 reliably detects the presence of passing workpieces and can also measure their width.

Dx35 – flexible measurement or switch up to 35 m

The Dx35 product family of distance sensors, based on HDDM™ technology, combines reliability, measuring capabilities, and flexibility in one very compact housing. Depending on the application, subproduct families are available for distance measurement on natural objects (DT35 and DS35) or on reflective tape (DL35 and DR35). The sub-product families also come with different interfaces. In addition to the IO-Link function, which all the devices have, the product family also offers sensors with analog and switching output (DT and DL) or the option of two switching outputs (DS and DR).

Finally, and not without a certain amount of pride, Ulrich Sievers describes the project as being "more ambitious than large-scale production." He adds, "Together with SICK, we have designed a Performance.one in batch size 1 for the customer."

Connected right into the living room

Aspects such as transparency and traceability are playing an ever more important role for manufacturers, because the level of variability in the production lines of furniture manufacturers is constantly increasing and assembly lines are seeing more and more variants being built in parallel. Vertical integration – that is the keyword for track and trace. Traceability of products during complex manufacturing and logistics processes is a priority for this integration. Production and logistics require transparent material flow so that production decisions can be made faster. Transparency of the material flow based on intelligent sensor technology also plays a critical role in delivery.

The Dx35 reliably detects the presence of passing workpieces and measures their widths.

Ideally, furniture manufacturing should now be controlled from behind – optimized for the delivery and construction of the furniture. Complex furniture systems such as kitchens can include over 100 order items. These should be loaded and unloaded according to the structural logic of the system. This works, for example, by reading out information that is already found in a QR code or a RFID tag of the veneer. This is how integrated information flows are established within a company or a company's system. *(as)*

IMA Group

IMA develops, produces, and distributes machines and systems globally for the processing of wood materials, including edge banding machines, CNC machining centers, electric drills, and transport and handling systems. For over 60 years, the company has been recognized in the industry as a technology leader in the planning, development/engineering, and implementation of complex production lines and systems in high-end applications. It offers solutions in both stationary and throughfeed technology, as well as in high-performance, feeding, and stacking systems. The most important manufacturers of kitchen, office, and DIY furniture, as well as of doors and components are loyal IMA customers. IMA has around 900 employees globally and is present in more than 60 countries. Along with the headquarters in Lübbecke, Germany, IMA also has service and sales companies in Western Europe, the USA, Canada, Russia, Singapore, and China.

For optimized processes along the value-added chain for wood

The requirements in the wood industry are diverse and exacting. Fast, safe, and efficient production processes are indispensable for high productivity in the saw mill, wood material, veneer, and furniture industries. SICK offers a variety of perfected products and complete system solutions to achieve optimized production results.

FLEXIBLE ADJUSTMENT IS EVERYTHING

>> With the latest trends for smaller production runs leading to customized mass-produced items and therefore a higher frequency of job-changing, an adaptive packaging machine must be able to cope with an irregular product infeed, while also being able to adjust to different formats. This adaptation is made possible with sensors and actuators. All packaging shapes and sizes are possible with just one machine.

Fast, software-supported format changes can reduce downtime and optimize material utilization and packaging processes.

In packaging machines, it is primarily contrast sensors that are used for recognizing marks. KT contrast sensors from SICK detect even the smallest contrasts at the highest speeds, such as print marks on foils or packaging. They detect minute grayscale variations between the mark and the background on matte, shiny, or transparent surfaces.

Fast format change via IO-Link

To give an example, when the contents of the packaging change from orange to apple flavor, the colors of the packaging materials often change too. This means that the contrast sensor has to be taught-in again for optimal recognition of the marks. If multiple sensors are built into a machine, this will take a lot of time. But if the formats are stored in the sensor as jobs, they can be simply called up when

needed. In this way, all contrast sensors in the machine are given the same setting automatically, e.g., transmission color and switching threshold.

Once parameters have been taught in the contrast sensor, they are stored in the controller as "jobs". Should the format change, the corresponding "job" is simply recalled. This saves time and money.

The IO-Link connection also has other advantages. IO-Link enables constant data diagnostic. The sensor's "quality of teach" function returns a value that is indicative of process reliability. If the value falls below a certain level, a "safety message" can be output via the controller, for example. If the value changes while the process is in progress, the "quality of run" function reports back immediately.

Smart sensor functions offer additional advantages

Along with conventional print mark detection, the sensor will soon be able to provide additional information via IO-Link thanks to new automation functions.

A smart contrast sensor with the additional integrated "print mark counter" function detects and counts the print marks on film rolls. If it is given the number of print marks per roll, the sensor will indicate how much film is still on the roll at any point in time. This signifies that a roll-change will take place at the right

time. The conveyor speed of the packaging material can easily be determined and controlled by using the contrast sensor's "speed monitoring" function.

Additional integrated functions allow you to produce new and higher-quality information beyond print mark detection together with the customer, depending on the desired application. *(as)*

Using the KT at Harro Höfliger

"The integrated IO-Link interface can be used to access the parameter settings for the KT contrast sensor. This speeds up and simplifies format changes. We are able to use the IO-Link functionality flexibly for diagnostic purposes in the preliminary stages to ensure that critical packaging materials are detected reliably," explains Rainer Bauer, Controls Engineering at Harro Höfliger Verpackungsmaschinen GmbH. Harro Höfliger is a leading global manufacturer of high-quality production and packaging lines. It specializes in system solutions for the pharmaceutical and medical industries, with a focus on customer-specific machines.

COMMUNICATION-ENABLED SENSORS WITH ADDITIONAL INTEGRATED FUNCTIONS
OFFER A GREAT DEAL OF POTENTIAL

CONSISTENTLY MORE EFFICIENT

IO-Link is not just gaining increasing acceptance in an ever greater number of applications – the manufacturer-independent communication technology is also a catalyst for innovative sensor solutions and supports the global availability of data and information required by Industry 4.0. Even "smart" sensors are putting this communication channel to good use. Their ability to reliably acquire data, as well as to communicate and run diagnostics, combined with the additional functions integrated into the sensor, offers huge potential in terms of machine productivity. This is especially true when you want to perform certain automation tasks remotely.
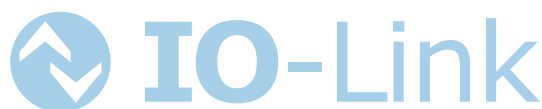
>> Always ready to go: Various parameter settings can be visualized, tested, and optimized as necessary right from the integration and initial commissioning of the smart sensors. You can also store various parameter sets ("formulas") in the automation system and then load them to the sensor during operation without wasting any time. Machines and plants in which product variants have to be replaced frequently are the first to benefit from this functionality. It enables a changeover which is fast and, in addition, offers a high level of process reliability.

Self-diagnostics makes predictive maintenance possible

The components of machines and plants in the production environment are constantly subjected to environmental influences such as dust, material from cardboard abrasion, humidity, or vibrations. Not only are sensors from SICK designed for the harshest application conditions in terms of their mechanical, electrical, and optical properties, they also improve
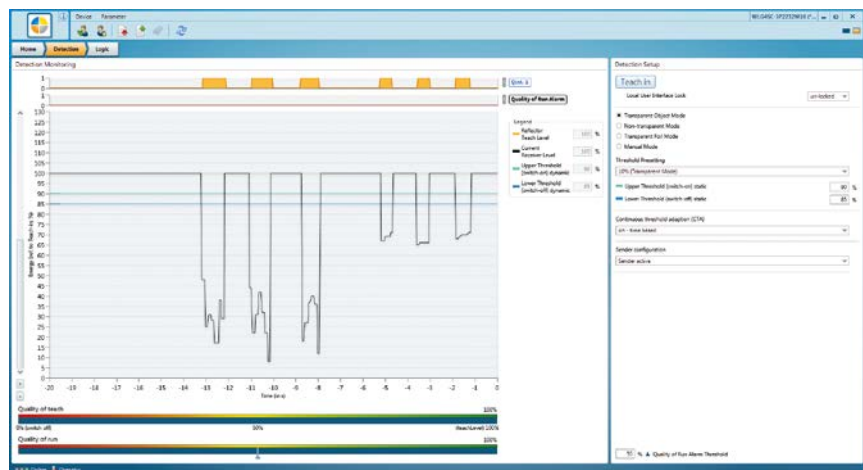
From the eye of the sensor: All the relevant function details of the sensor can be displayed by visualizing the detection processes; for example, on the HMI and soon on mobile devices. This transparency facilitates the ideal configuration of the sensor to the respective application conditions and also provides support for troubleshooting.

the performance and availability of machines when subject to heavy loads and high throughput thanks to their self-monitoring functions. The diagnostic data can be used in machine-level (but also in cloud-based) analysis tools in order to anticipate potential faults in good time and to prevent them from occurring by means of predictive maintenance. Smart sensors from SICK also give the option of displaying their settings and operating data visually for the benefit of the machine operator. With one glance at the HMI terminal, the operator can determine the current operating status of the sensor, which switching thresholds are configured, and the extent to which the sensor might be approaching critical tolerances.

IO-Link ensures continuity – inductive sensors

IO-Link is the communication channel for inductive sensors with smart inner workings. These include the IMC and IQC product families. Both sensor families offer up to four programmable or teachable switching points in a single sensor. As only one sensor is now required for the various switching points, more elegant, space-saving, and cost-effective solutions for applications such as the multi-stage or infinitely variable detection of gripper positions can be provided. Other options that are available via IO-Link include verifying adherence to the secure sensing range and performing basic function diagnostics as part of condition monitoring in order to provide information regarding the output state.

From smart sensors to smart application solutions

On the one hand, the potential of smart sensors is of an incremental character – they are oriented toward step-wise increases in efficiency for the tasks at hand, such as downloading parameters for fast changeover, easy device replacement, formula management, and condition monitoring. But SICK goes even one step further: The additional integrated functions – and therefore the ability to shift computing power from the automation system to the field devices – offer a sustainable approach for building more efficient and better-performing automation networks. The integrated additional function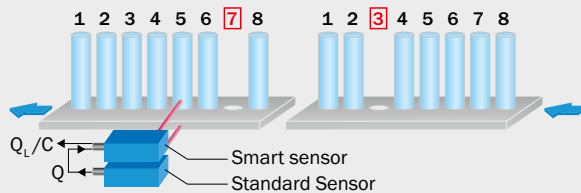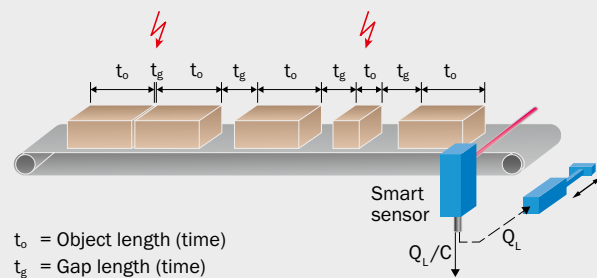s also allow you to generate new, higher-quality information that goes over and beyond object detection, depending on the desired application. This information can be generated in combination with another sensor and then provided for the higher-level systems as necessary (PLC, ERP, the cloud).

EXAMPLES FOR SMART APPLICATION SOLUTIONS (SMART TASKS)

Q_L = Smart-task switching signal (binary)
C = IO-Link communicatio
t = Time

Object and gap monitoring

A photoelectric proximity sensor with the additional integrated function "object and gap monitoring" ensures that faulty products are automatically ejected before the next stage of the process. For example, broken or stuck-together chocolate bars are registered as being "too short" or "too long" prior to the packaging stage. Adherence to the minimum distance between individual bars on the conveyor belt is also ascertained directly by the sensor, with automated ejection being triggered when necessary. The result is a precise and efficient procedure which also relieves the controller of data processing tasks.

t_o = Object length (time)
t_g = Gap length (time)

Smart sensor
Q_L/C Q_L

1 2 3 4 5 6 7 8   1 2 3 4 5 6 7 8

Q_L/C
Q — Smart sensor
— Standard Sensor

Carrier load analysis

A smart sensor with the additional integrated function "carrier load analysis", in combination with another sensor, determines which loading positions are occupied on a particular workpiece carrier passing the sensor and which ones are free. The sensor transmits this information either directly to the next process unit (e.g., a gripping robot) or to the machine controller. The advantage is that monitoring of the correct loading of the workpiece carrier is performed with one smart sensor instead of a complex image-processing system.

Greater transparency, more control

Sensors which monitor themselves; workstations where sensors and actuators coordinate their processes and functions; production structures with autonomous, self-organizing, and self-optimizing units – making the smart factory a reality means a paradigm shift when it comes to implementing manufacturing and intralogistics processes. It requires both intelligence and the ability to communicate at field level. Transparency of the sensor status, the settings, and the information produced in the sensor also mean improved control over entire processes. *(tm)*
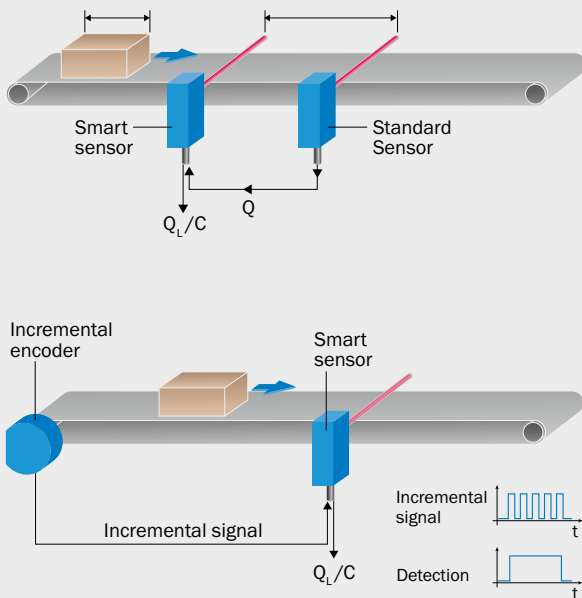
Speed and length monitoring

With the additional integrated function "speed and length monitoring", the absolute length or speed of a passing object is evaluated directly in the sensor. This allows sorting or monitoring tasks to be performed directly by the smart sensor and the results of this evaluation to be sent to the controller. In addition to speed monitoring, this solution offers two modes for object length measurement:

Mode 1: with a smart photoelectric proximity sensor and a directly connected standard photoelectric proximity sensor, for example.
For this mode, the conveyor speed must not increase or stall during the length measurement.

Mode 2: with a smart photoelectric proximity sensor and a directly connected incremental encoder. In this configuration, the measurement is carried out completely independently of the conveyor speed, and therefore also independently of delays or accelerations during the length measurement.

Print mark counter and speed monitoring

A smart contrast sensor with the additional integrated functions "print mark counter" and "speed monitoring" detects and counts the print marks (e.g., on rolls of film). If it is given the number of print marks per film, the sensor will indicate how much film is still on the roll at any point in time. This ensures that the film change is detected in good time and can be signaled. Using the speed monitoring function, the conveyor speed of the packaging material can be determined, controlled, and monitored easily.
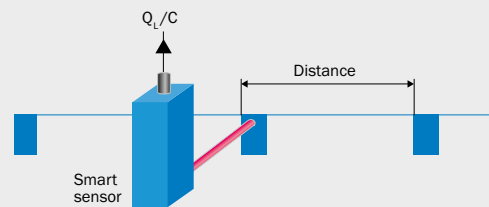
GREATER FLEXIBILITY WITH THE PATTERN SENSOR

The PS30 pattern sensor, with its enormous flexibility, responds to trends in the packaging industry toward ever more complex and unusual labels. Offering unrestricted design freedom, the PS30 impresses not only when used on endless tracks – it also delivers outstanding results when detecting patterns on individual objects. The sensor detects and positions labels and any objects with a distinctive pattern reliably without print marks. Even without this unwanted design factor, the PS30 knows when an endless track needs to be cut into the roll-fed labeling or whether a package or tube is in the right position for sealing.

Exact positioning of endless tracks or individual objects – all without a mark, using the image.

>> The innovative PS30 uses contrast to determine positions. And the best thing about it? In this way, it can also detect two-dimensional patterns. To begin with, the system learns an image using distinctive reference areas with a good recognition factor. The sensor reliably recognizes the patterns by analyzing these significant and distinct areas of the image – analysis of the entire image is not necessary. The PS30 also accurately positions challenging objects or labels with low contrasts or interference from glare – it always decides on the reference area with the best possible contrast. This saves on material and time. It mainly saves time because image determination using pre-defined reference areas reduces the amount of processing power required. The conveyor speed rises as the time needed to retrofit the machines falls – all thanks to the option to store several image profiles.

Furthermore, less material is needed for labels when using the PS30, because significant material overlap is no longer necessary to cover the print mark. The PS30 therefore already offers some features of a vision sensor, which is similar to a contrast sensor when the speed of the material is high at the same time.

Full flexibility also for batch size 1

The device can be commissioned quickly, flexibly, and in a user-friendly way via the control panel or the integrated web server using the convenient human-machine interface (HMI). Various jobs can be stored and managed along with their image and teach-in data. This allows the format to be changed quickly and easily by selecting from the job file. The job data is selected using the job designation or a preview image.

There is also a great deal of flexibility when it comes to defining the switching point. This can be defined visually and directly using the image. The switching point can be defined by the machine operator via the HMI. The sensor operates according to the principle of "what you see is what you get".

A pattern for success in Industry 4.0

The sensor is also already prepared to meet the requirements of Industry 4.0. With its Ethernet interface and integrated web server, it enables direct access to the sensor and its configuration via PC, tablet, or HMI with a standard browser outside of the PLC and without the need to install software as usual.

In addition, the sensor provides a great deal of analysis data, such as the detected object or format length, the current teach-in and process configuration, as well as the teach-in and process quality. The integrated web server enables easy access to sensor data and easy integration into a current visualization via OPC DA or JSON API. *(as)*

Defining the switching point (green line) directly on the image.

INNOVATIVE MEASUREMENT TECHNIQUES

MULTIFUNCTIONAL FLUID SENSORS FOR GREATER FLEXIBILITY

The fluid sensor portfolio from SICK is primarily geared toward the requirements of machinery and plant engineering. The current and future requirements include further optimization of plants in terms of flexibility, productivity, and efficiency, as well as automated level measurement and flows for Industry 4.0 concepts. Using of fluid measurement technology mainly for no-load and overload protection is now a thing of the past. The focus is no longer on preventing the worst-case scenario, but rather on achieving optimal monitoring of relevant process parameters and flexible process control.

Refining conventional measurement methods with innovative measurement techniques

The new fluid sensors from SICK, such as the DOSIC® flow sensor, offer calibration-free measurements no matter which medium they are used in, ensuring a high level of flexibility. Plants do not have to be converted or operated in parallel when the fluid or medium is being changed. The IO-Link digital communication protocol also allows the process data to be integrated into an automation network.

Ultrasonic and time-of-flight measurement

In one sensor, SICK offers complete flow measurement which is flexible for all industries and fluids – even in hygienic conditions. The non-contact DOSIC® flow sensor detects the flow volume of conductive and non-conductive fluids based on ultrasonic technology. With its measurement channel and stainless-steel housing, the ultrasonic flowmeter is suitable for measuring tasks in hygienic conditions. The compact and rugged design offers a wide variety of application possibilities, including those where space

restrictions or aggressive media play a role. Installation is quick and easy, and does not require medium calibration. The seal-free, self-draining measuring tube enhances process reliability. Up to two configurable digital and analog outputs as well as the IO-Link interface to the higher-level control unit ensure the right initial situation. The DOSIC® is EHEDG-certified and FDA-compliant. With the DOSIC®, SICK offers flexible flow measurement and high process quality at an outstanding price/performance ratio.

The IO-Link digital communication protocol has also gained acceptance in fluid technology. The added features in version 1.1 make it possible to fully comply with the demands of Industry 4.0. The opportunity to use a multitude of data to produce and supply goods in a more efficient and flexible way, while also saving resources and achieving better quality, ultimately depends on the reliability of the data input for the process chain – and, therefore, on the sensors that record real-time situations and convert these into digital signals. *(as)*

Reliable flow measurement for all industries with DOSIC®.

SAFETY EXPERTISE + AUTOMATION KNOW-HOW = FLEXIBLE MANUFACTURING

CUSTOMIZED SOLUTIONS FOR FLEXIBLE PRODUCTION

Flexibility and productivity are major trends in the field of industrial automation. However, increasing one needn't mean decreasing the other. There are already some initial approaches, such as flexible production cells and systems, which can help you strike the right balance. These pose new challenges for functional safety if a person interacts directly with the automated environment. To ensure that this does not lead to bottlenecks when implementing this "flexible manufacturing" solution, linking in automation and safety expertise is essential.

>> As a result, flexible safety concepts, which meet the requirements but leave enough scope for flexibility in production processes, are currently being developed in collaboration with customers. The wide range of safety-related sensor and controller solutions from SICK allow you to design protection mechanisms in a flexible manner and adapt them to the situation at hand.

The Flexi Soft safety controller offers a wide variety of options for programming monitoring scenarios and integrating various safety sensors. In addition, Flexi Soft can also process the signals from non-safe sensors from SICK such as cylinder sensors on robotic grippers, thereby simplifying the automation solution as a whole.

With the certified Safeguard Detector functional safety system, the safety and productivity of packaging machines can be increased. The system has a modular structure and consists of a Flexi Soft safety controller and two MultiPulse MultiTask photoelectric sensors. The Safeguard Detector securely detects whether a movable physical guard is located at a previously defined position, e.g., the packaging material in the carton magazine of packaging machines. If there is sufficient packaging in the carton magazine, then it is not possible to reach into the hazardous area while the machine is running. Safeguard Detector provides flexible protection for machines which are constantly adjusting packaging formats and production ranges during operation.

In line with the trend toward modular systems, an ingeniously simple solution for safely connecting system modules in a network was developed together with a system manufacturer: the Global E-Stop. System operators need to be able to replace individual machine modules, integrate new modules into the overall plant, and combine modules in new ways. However, this must work without having to invest huge amounts of time and money in wiring or programming in order to ensure the safe and secure networking of machine modules.

Intelligent hazardous area protection
Robots are already able to operate without being surrounded by a safety fence. Safety laser scanners from SICK monitor the precisely defined robot surroundings and are connected to the safety controller of the robot. The easy-to-program protective field geometries can be easily adapted to the individual layout in question. Countless monitoring scenarios can be set to automation mode at any time. Downtime is also reduced by an automated restart.

Modern robot systems feature safely monitored axles and drives. Safety limits can be set for the robot operation space in the robot's controller. These make sure that the robot reference point (tool center point) does not leave the defined working area under any circumstances. Various protective fields are activated in the safety laser scanner on the basis of these safety limits. The protective field is always larger than the working area

Robots are already able to operate without being surrounded by a safety fence.

of the robot. Stopping/run-down times and approach speeds must also be taken into account. This ensures that any personnel are detected in good time and that the robot is stopped before a hazard arises for the person.

Building flexible production processes with a high level of automation while also protecting personnel, machines, and entire plants, is a challenge which is already giving rise to step-by-step solutions. The new communication options and the functionalities of safe sensors, combined with non-safe sensors, represent beneficial application solutions – reliably and with an increase in productivity. *(as)*
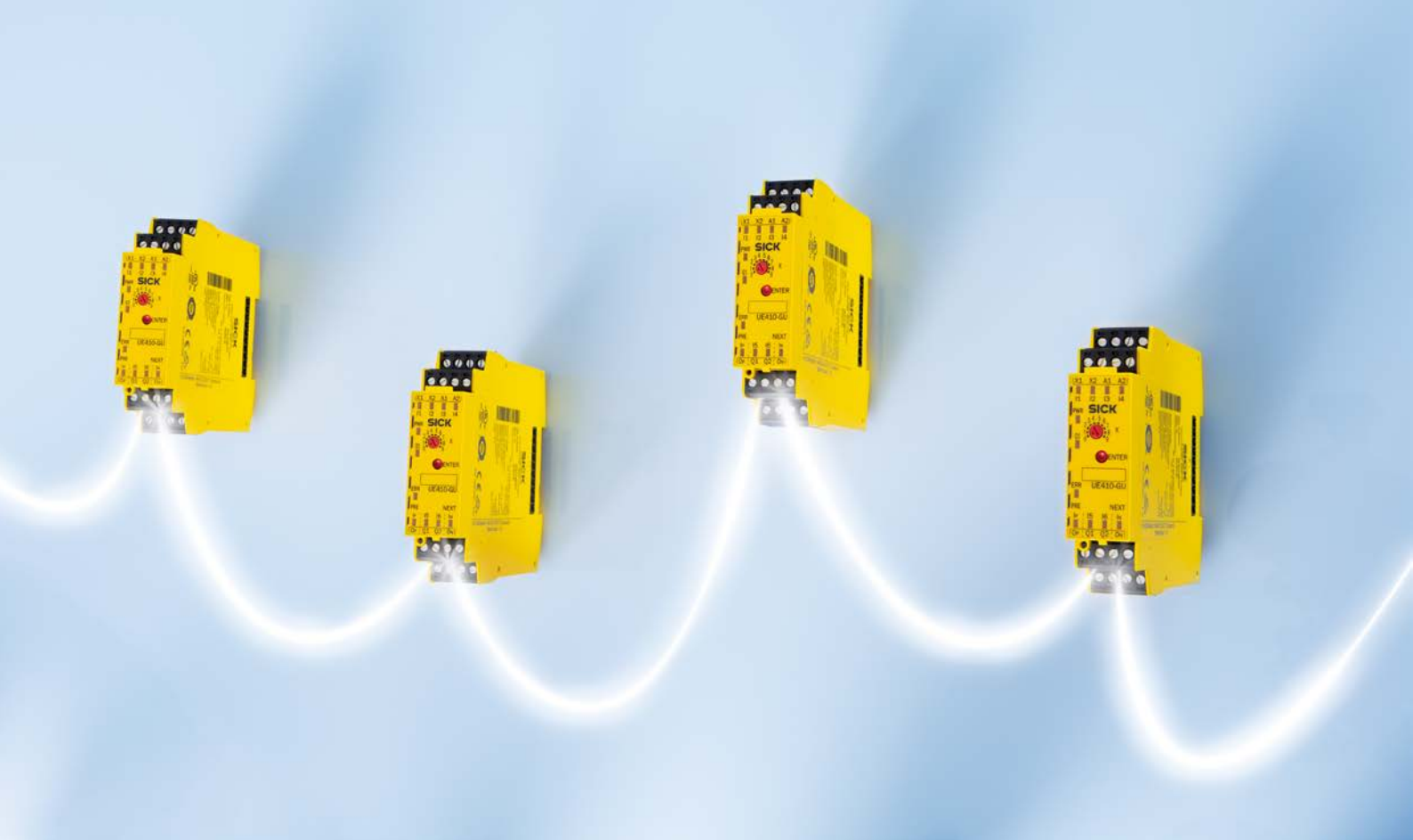
# THE SMALLEST COMMON DENOMINATOR – GLOBAL EMERGENCY STOP

Icelandic company Marel is the world's leading provider of advanced food processing solutions for the fish, meat, and poultry industries. These solutions are provided in the form of modern equipment, systems, and services. From individual system modules through complex processing lines and beyond to portions packaged ready for consumption by end customers, the company supports every aspect of advanced food processing. Marel requires its production lines to deliver flexibility and modularity. System operators need to be able to replace individual machine modules, integrate new modules into the overall plant, and combine modules in new ways. However, this must be achieved without having to invest huge amounts of time and money in wiring or programming in order to ensure the safe and secure networking of machine modules.

It is for this reason that Marel chose to draw on SICK's safety expertise. Working in collaboration, the two companies have created a solution that is simply genius: the Global E-Stop.

Marel uses a variety of machine modules on its processing lines. Simple machines can be protected with relay technology; complex machines require a safety controller. 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 indi-vidual 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, in some cases (continuous material transportation applications is one example) all upstream machine modules have to be shut down too, in order to prevent damage or product losses. It is a question of identifying the right overarching safety function which can also be relied upon to deliver flexibility and safeguard system throughput. Marel uses SICK's Flexi Soft software-programmable safety controller in com-plex machines. The Flexi Line interface is designed to support the safe and secure networking of modular machine elements. This is due primarily to the inclusion of this functionality in the Flexi Soft main module as standard. In modular systems with a small number of complex machine modules, where using a Flexi Soft safety controller for each of them would be too laborious a solution, networking with Flexi Line was one option, but Marel considered this excessive. So the company had to look for a solution that was more straightforward yet still comprehensive.

Test pulse output

Test pulse output

● **Safety inputs**
● **Safety outputs**
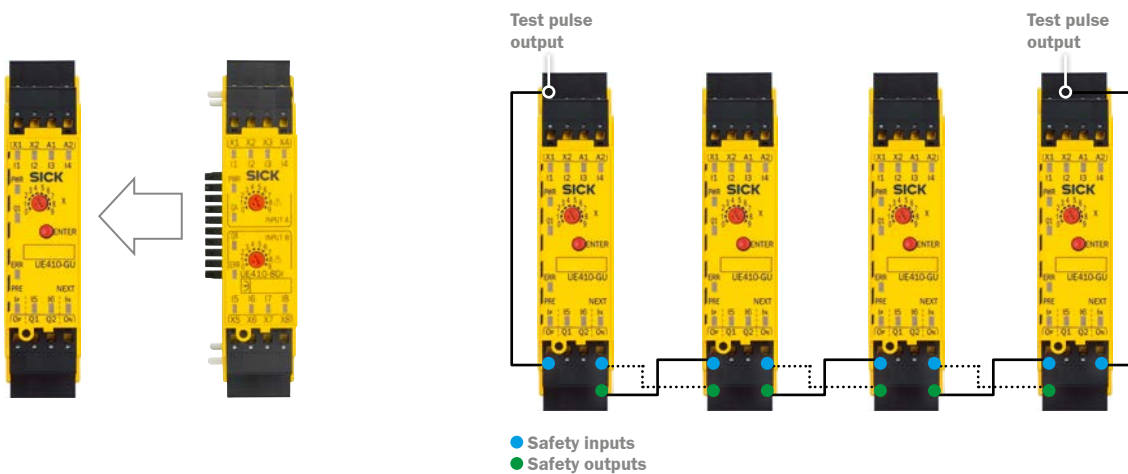
Global E-Stop

It was important that safe controllers used in machine modules which have been manufactured separately can still be combined at their subsequent installation site in as little time – and with as little effort – as possible. Ideally, it should also be possible to do this without the need for addressing – in other words, by simply connecting and then teaching in to confirm. So the developers from SICK integrated a cut-down version of the Flexi Line functionality into a new module for the Flexi Classic safety controller.

The new Global Unit module (GU module) makes provision for a global emergency stop function. Multiple GU modules can be interconnected using a special signal. Each GU module knows its direct colleague, as they have previously been introduced via teach-in. All applications provided by a GU module, each selectable via a rotary switch, have a global emergency stop function. This function acts on all of the safety outputs in the

system. In plain English, this means that pressing an emergency stop push-button on a GU module stops all other safety outputs of the interconnected modules. To reset the global emergency stop (Global E-Stop), the reset function must be activated on the same GU module on which the emergency stop button was triggered (local reset).

Safety is always exciting when it permits flexibility

The concept for Marel makes provision for one GU module for each machine module. The system operator simply interconnects all of the Flexi Classic nodes and Global E-Stop is ready. The signal lamp on a machine module flashes when that machine module triggers a global emergency stop. The lamps on the other modules simply light up but do not flash.

In more complex machines, the Flexi Soft software-programmable safety controller is responsible for the higher-level safety function.

"The market is looking for a way to safely and easily network modular machine modules that might be equipped with their own dedicated safety controller," says the engineering team of Marel, describing the starting point for the collaboration between the two companies. "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. Together with SICK, we have developed a simple, elegant, and customer-focused solution. Safety is always exciting when it permits flexibility." *(as)*

More about the customer at:
www.marel.com

17

THE SAFE SOLUTION FOR HUMAN-ROBOT COLLABORATION

In the factory of the future, humans and robots will collaborate to an increasing extent. Based on this vision, RoboJob develops innovative systems for the automated loading of machine tools. Safety laser scanners from SICK ensure maximum safety.

>> The automated loading of milling machines and lathes has now become standard practice in areas such as metal processing. Once the machine has been programmed for a particular machining stage, it is easy to integrate a robot which feeds in the components in sequence and removes them again. This creates a fully autonomous production cell. "Suppliers in the metal industry must use automation in order to remain competitive," explains the CEO of RoboJob, Helmut De Roovere. "The prices for CNC machining are determined at an international level. Businesses have to deal with growing production costs and the difficulty of finding workers with the right technical qualifications. Automation can be the solution to these problems."

RoboJob is part of the Aluro Group, which also includes Aluro bvba, a high-profile manufacturer of machines for the aluminum industry. This Group also includes Aluro CNC, a supplier active in the machining industry, which was itself faced with the challenge of maintaining its competitiveness ten years ago. As the company could not find any suitable automation solutions on the market, RoboJob was founded. Today, RoboJob is the market leader in this industry and sells its systems both in Belgium and abroad.

Robots and operators working on the machine simultaneously

"One of the main reasons for us developing our own solution was that the CNC machine had to remain accessible," continues Helmut De Roovere. "For supplier companies which produce small ranges of products or even individual items, most of the work is done directly on the machine. The conventional solution of placing the robot in front of the machine with a safety perimeter around it would make this impossible. Our solutions – namely Turn-Assist and Mill-Assist – place the robot adjacent to the machine so that both the robot and the operator can easily work on it."

Another feature of RoboJob's solutions is the flexible tables from which the robot takes the components being machined. These tables feature a system with adjustable clamps and brackets that can be adapted according to the products being manufactured. The height of the tables can be set automatically so that the robot knows exactly where it should take the component from or where it should place the next component.
A third feature of Turn-Assist and Mill-Assist is that the robots are not surrounded by a safety perimeter. Instead, the precisely defined surroundings of the robot are monitored with safety laser scanners from SICK and are connected to the robot's safety controller. RoboJob was one of the first companies to apply this concept to these kinds of applications.

Intelligent hazardous area protection

The principle of operation of a safety laser scanner is simple. Installed at floor level next to the robot, it scans the surroundings. Different areas, which are known as fields, can be taught into the scanner. If the safety laser scanner detects a person in one of the defined fields, it sends a corresponding signal to the robot's controller.

"One of the advantages of the scanner is that two fields or – depending on the scanner version – even more fields can be defined," stresses Helmut De Roovere. If a person enters the outer field – known as the warning field – the safety laser scanner sends a signal to the robot's safety controller. The controller then reduces the speed of the robot and also emits an alarm signal to warn the person that he or she is too close to the robot. At this stage there is no danger to the person and the robot can continue operation. If the person then moves closer and into a further defined field – the protective field – the controller stops the robot.

Safety limits for the robot working area are programmed into the robot's controller. These ensure that the robot does not move outside of the working area necessary to carry out the task at hand under any circumstances. Various protective fields are activated in the safety laser scanner on the basis of these safety limits. The protective field is always somewhat larger than the working area of the robot. This ensures that any personnel are detected in good time and that the

Automated loading of a machine tool with a robot solution from RoboJob.

robot is stopped before a hazard arises for the person.

A system that allows the operator to collaborate with the machine

Helmut De Roovere continues: "Using safety laser scanners is a key part of our efforts toward making the production cell as accessible as possible. We want a system which takes the operator into account and makes adjustments for him or her – not the other way round. With this in mind, we have developed a user-friendly platform which is linked to the robot's controller and is adapted to how the operators use the system."

RoboJob wants to go one step further and make better use of the variety of functions offered by the safety laser scanners.

According to Helmut De Roovere: "Today we have two protective areas which are defined in conjunction with the working range of the robot. We want to improve this by adapting the protective fields dynamically to the operation carried out by the robot at any given moment. With the risk analysis, we can ascertain which areas have to be protected at a given point in time for each position and each movement of the robot. This would give the operators more room to work safely in the vicinity of the robot. In doing this, we are working on the principle that the robot must take the operator into account. Operators can then carry out their duties on the machine and the robot can continue to operate. This increases productivity thanks to the safe collaboration between humans and robots." *(tm)*
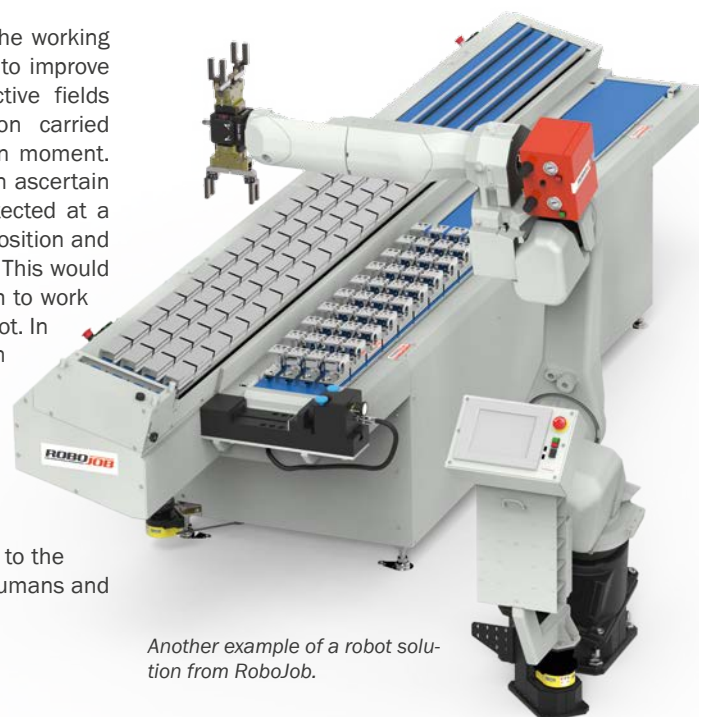
Another example of a robot solution from RoboJob.

NON-STOP ICE CREAM ON A STICK

A sensory check can mean two things in the context of ice cream. Namely, the sensual experience of the chocolate coating cracking as you bite into it, followed by the explosion of flavors; but it can also refer to the quality check carried out by sensors in the manufacturing and packaging process. On the type HK 4 horizontal cartoner of Dienst Verpackungstechnik GmbH, the latter is undertaken by equipment including image-based code readers and vision sensors from SICK.

>> Ice cream on a stick is a matter of taste. Whether you love caramel, chocolate, strawberry, raspberry, or almond, one of every flavor, or maybe even a selected assortment, Unilever satisfies the taste of every ice-cream lover. The company states that it processed 1 billion Magnums on sticks in 2014. Some of these went onto the market as individual portions and some as multipacks.

The correct batch assignment according to size, flavor, and number plays a crucial role in secondary packaging in multipacks. Ice-cream lovers want to be assured that the packaging will contain the type of ice cream they want, that it was processed quickly (cold chain), and that the stamped use-by date provides reliable information about the freshness of the product.

The ice-cream manufacturer and plant operator must also be able to be sure that the packaging machine also correctly packs different boxes with different assortments and seals them properly. The changing designs of folding boxes therefore present a further challenge.

A range of formats on a single machine

The HK 4 horizontal cartoner is a top model from Dienst and automates the packaging process of pre-glued folding boxes, meeting the highest requirements in terms of shape diversity, short set-up times, ergonomics, and reliable machine availability, while also handling the products gently.

The type HK 4 horizontal cartoner has a modular structure. The 6-inch variant is a small and compact machine, which can process up to 300 folding boxes per minute.

The ice cream does not need to be kept in a freezer while it is being packaged into folding boxes. Downstream in the production line, the HK 4 deals with the incoming ice creams, for example, for the six-packs of Magnum Mini White, Almond, and Classic. A Lector620 Professional image-based code reader from SICK reads the QR code on the folding box. If this matches the production plan data, the incoming ice-cream assortment is transported into the folding box by means of a pusher.

"Firstly, we spread the tabs on the box apart, put the products inside, and then we seal the tabs. No later than when the first box reaches the QR code reader, I can check if the data on the box matches the production data," says Roland Kaluza, Construction Manager at Dienst Verpackungstechnik GmbH, explaining the process. "As soon as we have assembled the boxes, the lower tab is pushed upward and, after glue has been applied, the covering tab is pressed down. The box is closed."

If a QR code has been read as incorrect, the machine records this error and automatically separates the folding box concerned from the packaging process without interrupting this process. If three boxes have been read as incorrect using the QR code, the machine stops as the QR data does not match the production control data, thus avoiding packaging errors. "In principle, the entire supply chain can be monitored using the QR code," explains Roland Kaluza. "Food production and packaging are subject to particularly strict quality rules. Ice cream is one of the sensitive food items."

Up to 180 Magnum folding boxes are filled per minute on the HK 4. There are currently seven different box sizes for the different packaging designs. The ice creams are either arranged in one row or two rows, or in two rows of three, four, or five.
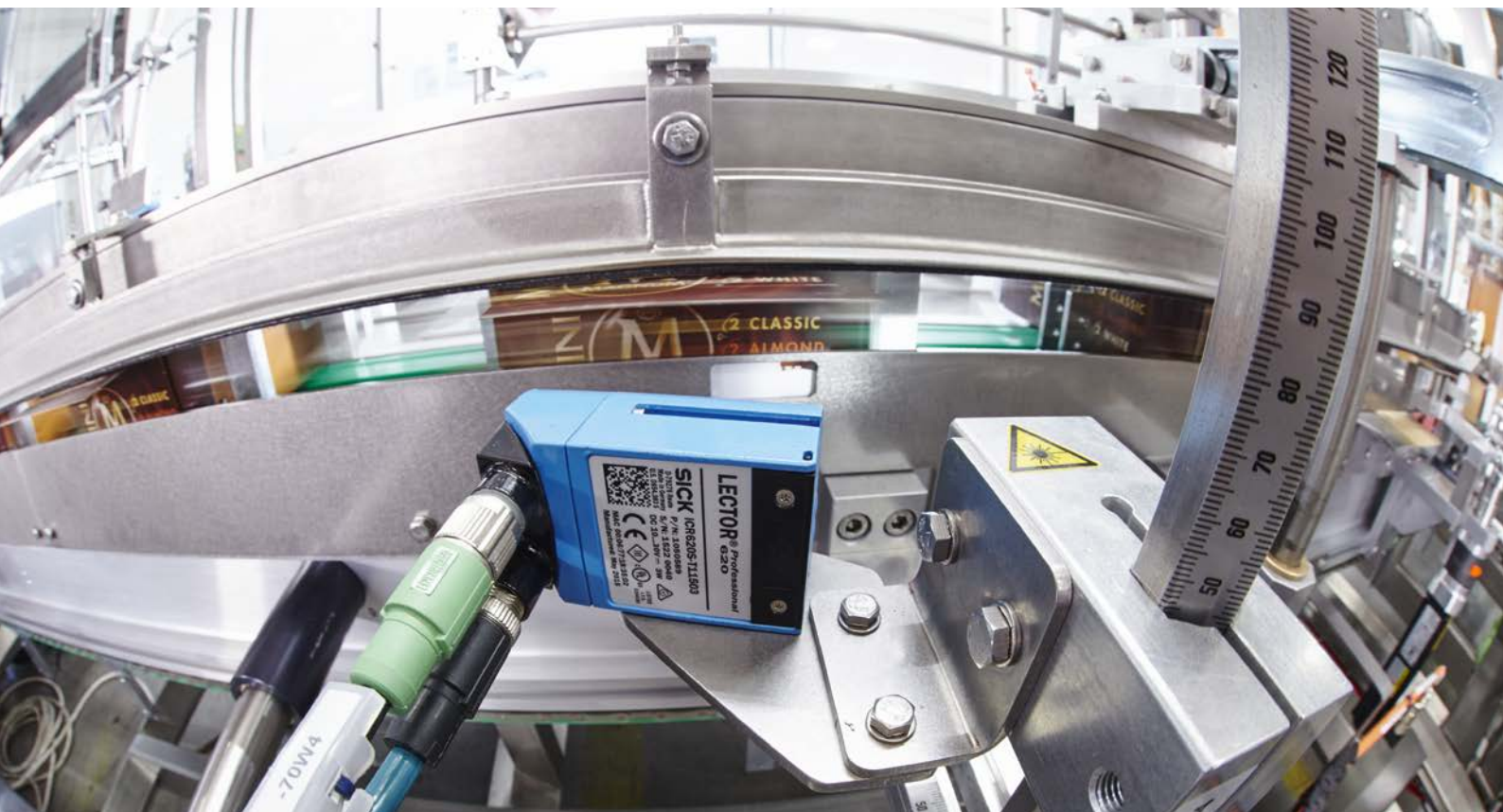
The vision sensor verifies that the use-by date is there.

The folding boxes are only given their use-by date through laser printing at the end of the repackaging process. The Inspector vision sensor from SICK verifies that the date is there. The multipack is complete.

Lector620 Professional image-based code reader

The sensors in the Lector62x product family are compact, image-based code readers, specifically tailored to industrial requirements. Whether items are mobile or stationary, they identify the most commonly used code types with exceptional reliability – even poor quality codes. Its highly compact design ensures flexible integration even where space is at a premium. Lector620 Professional code readers are universal and economical.

Integration

The compact and rugged metal housing with enclosure rating IP 65 – optionally IP 67 – is up to two thirds smaller than in most other industrial 2D code readers. Housing nuts and sliding nuts with variable distances between the holes, as well the M12 swivel connector, ensure safe and quick mounting at any time. There are also diverse options for integrating code readers into your respective IT environment easily and openly. Ethernet TCP/IP, FTP, EtherNet/IP™, PROFINET, CANopen, serial interfaces, digital I/Os – with the Lector62x product family, all the relevant data interfaces are integrated into the relevant device. A USB interface is also integrated into all devices, which enables extensive service and diagnostic functions.

Inspector: intelligent image processing solution in an easy-to-use sensor package

The Inspector vision sensor for image processing applications represents an intelligent solution in a single device, and can be relied upon whatever the task: quality and completeness verification, part position detection, or measuring applications. The rugged IP 67 metal housing is
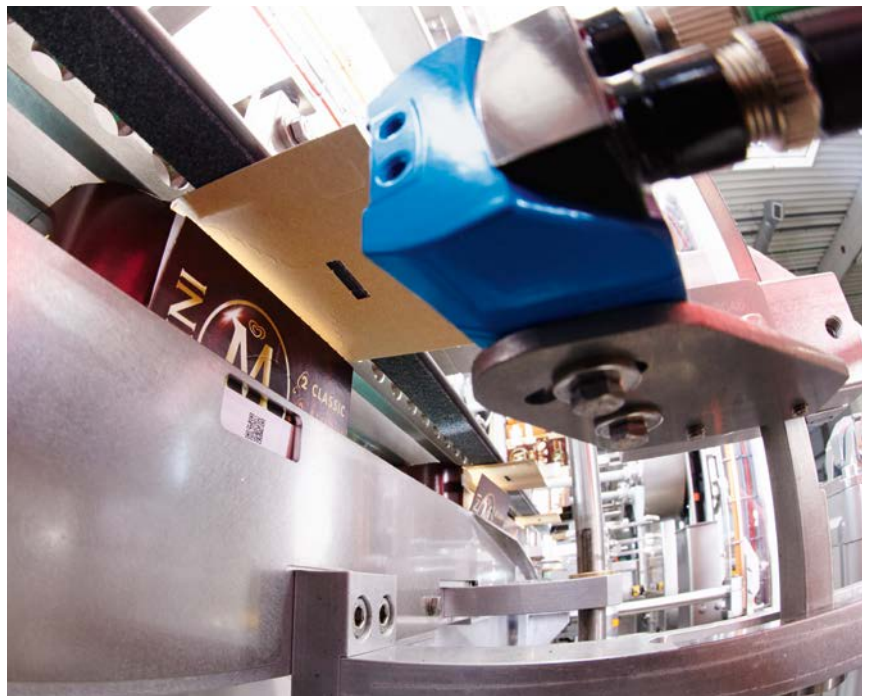
Code reading in a fraction of a second – not a problem for the Lector620 Professional.

adapted for industrial use and, thanks to its intelligent image processing, the Inspector is perfect for applications involving high speeds. The variable mounting options are designed to adapt easily to the optical requirements of the customer's given application. This ensures an excellent inspection, even of objects that are difficult to recognize, such as strongly reflective parts and multi-colored labels. The Inspector product family offers extensive support in control, monitoring, and data collection thanks to numerous interfaces.

A multitude of new ice cream varieties are launched on the market annually. The increase in ice cream varieties also means an increase in the diversity of

The Inspector vision sensor is the intelligent solution for image-processing applications.

folding box designs. For instance, now there is the new Magnum box with round edges and its exclusive eye-catching design, as everyone knows you eat with your eyes too.

The HK 4 horizontal cartoner ensures error-free packaging of different ice cream batches and assortments in diverse folding box designs.

Nothing stands in the way of the sensory check at the end of the supply chain; that is to say, when the ice cream lover gets to taste the ice cream. As we know, there is no accounting for taste. Unless it's the wrong one... *(as)*

More about the customer at:
www.dienst-packsystems.de/en
www.unilever.com

HIPERFACE® DSL

FREE ACCESS TO DIAGNOSTIC DATA

The continuous condition monitoring of electrical drives is growing in prominence. This is because the purely digital HIPERFACE DSL® interface makes it possible to provide status data such as the temperature of servo actuators in a format which can be evaluated by control technology. The fully scalable premo servo actuator platform from WITTENSTEIN motion control GmbH, located at Igersheim, Germany, not only uses the future potential of HIPERFACE DSL®, but also benefits from numerous design and safety advantages.

A premo high line servo actuator from Wittenstein, with the HIPERFACE DSL® One Cable solution.

>> We need digital data and protocols to enable us to "look into" a machine right down to the motor shaft. Thanks to their HIPERFACE DSL® interface, motor feedback systems such as the EKS/EKM36 and EFS/EFM50 product families from SICK fulfill this prerequisite, which is necessary to ensure efficient condition monitoring. An external temperature sensor can be connected to the motor feedback systems and the values from the sensor – together with other process data from the drive such as speed, voltage, mechanical revolutions, or present diode current (for optical EKS/EKM36 and EFS/EFM50) – can be recorded and digitally transmitted to the controller for evaluation. "All of this makes it possible

to derive information about the status and anticipated development of drive and machine conditions," explains Jörg Peters, Head of Product Management at WITTENSTEIN motion control. "Lots of machine manufacturers are becoming more aware of intelligent, future-proof servo technology at the moment because of the influence of Industry 4.0. With the help of their transmission technology, drive solutions incorporating HIPERFACE DSL®-compatible motor feedback systems offer all the options for providing data which can be used for continuous condition monitoring and preventive maintenance."

Fully scalable in performance-based increments: The "premo" servo actuator platform

With the newly developed, fully scalable premo (precise motion) servo actuator platform, WITTENSTEIN motion control GmbH is able to configure motors and gears with application-based performance feature increments from a specific modular system to form customized motor/gear units. "In theory," explains Jörg Peters, "the consistently modular structure can produce over 40 million possible premo variants in total."

premo and HIPERFACE DSL®: Perfectly prepared for condition monitoring

Servo actuators from the premo platform and motor feedback systems with a digital HIPERFACE DSL® interface make it possible – with the aid of the sensor input on the motor feedback system and a sensor (e.g., for temperature measurement) integrated in the drive – to monitor the status and utilization of the machine part and to use this data for condition monitoring where applicable by means of additional evaluation logic in the controller. Motor characteristics, serial and

EFS/EFM50 – high resolution motor feedback system for dynamic servo motors.

part numbers, as well as additional data that provides ready assistance for maintenance and replacement, can also be transmitted via HIPERFACE DSL® with the help of the electronic type label functionality. The second goal associated with condition monitoring is the optimization of machine efficiency in order to

achieve maximum productivity. Continuous condition monitoring is essential for this, in order to achieve need-based maintenance and thus optimal machine operation. *(tm)*

More about the customer at:
www.wittenstein.de/en-en

WITTENSTEIN motion control is counting on a leading standard

For WITTENSTEIN motion control, digital one cable technology offers a lot of potential for many reasons. HIPERFACE DSL® reduces the need for connectors and cables. This not only cuts the number of components in the motor/gear unit, but also reduces the amount of wiring required. Furthermore, when premo servo actuators are integrated in robots, moving axes, or mobile machine structures, the reduction in mass and weight also saves kinetic energy and improves the energy efficiency of the entire powertrain. "In addition, the absence of a second plug connector reduces the risk of fluid ingress in hygienic environments," says Jörg Peters.

THE ROBOT BUTLER THAT MOVES AROUND BY ITSELF

In 2015, the young Danish company Mobile Industrial Robots (MiR) introduced the German market to the MiR100, a mobile transport robot that works like clockwork. Built-in S300 safety laser scanners, 3D cameras, and ultrasound ensure that the robot stops automatically as soon as it encounters a person or a static object.

MiR100 is a user-friendly, efficient, mobile robot which aids the automation of internal transport and logistics solutions. It optimizes work processes and frees up staff resources, thereby increasing productivity and reducing costs. Its technology is able to scan the movement range and surroundings automatically and import 3D plans of the building.

The small, four-wheeled transporter can carry 100 kg or pull loads of 300 kg and transport them through the building. It can be programmed quickly via an app. Using a smartphone as a remote control, it can investigate new terrain; this data can then be used to create a map on the phone with a simple tap. The MiR100 is easy to use and can be controlled using a tablet, cell phone, or PC.

The MiR100 can be controlled using a tablet, cell phone, or PC.

A built-in computer creates a map of the surroundings and sensors are constantly reading the location of the MiR100. As soon as it detects an obstacle, it automatically swerves or stops. This is made possible by two scanners and a 3D camera.

With a scanning angle of 270°, the S300 compact safety laser scanners from SICK ensure all-round surveillance. Multiple protective fields that offer flexible configuration options are especially important in applications that use small, mobile robots – and the 16 freely

The MiR100 mobile robot from Mobile Industrial Robots was developed for applications in the fields of logistics, production, and healthcare. It has already become a popular colleague in hospitals, laboratories, and sorting offices, where it pulls loads back and forth and reduces long transport distances while always remaining courteous – if it detects a person or an obstacle, it responds naturally by braking or swerving out of the way. *(as)*

More about the customer at:
www.mobile-industrial-robots.com/en

configurable protective fields offered by the S300 allow flexible adaptation to a range of traveling situations and environmental conditions. Mobile robotics also require sensors that are as compact and rugged as possible, and have to consider the amount of energy that components consume. Its efficient design with a typical power consumption of just 6 W means that the S300 offers the right technical credentials in this respect too, making it a key component in the solution. Thanks to the EFI interface, S300 safety laser scanners can be integrated into different networks via gateways – ensuring secure SICK device communication. This includes both communication between different robots and between robots and other components within networked production systems.

MiR100: a small transporter on four wheels at a docking station.

DIP switch

Parameters such as resolution, output value, and count direction are set directly on the encoder.

PGT-10-Pro
PGT-12-Pro

Pocket-sized programming unit for self-contained programming in the workplace or on a building site.

PGT-08-S

PC-based programming unit for convenient programming in the workplace or in production.

PROGRAMMING SOLUTIONS AND ADDITIONAL INTELLIGENT FUNCTIONS FOR ENCODERS

QUICKLY ADJUSTED, INTELLIGENTLY EVALUATED

Virtually all system operators need to operate machines efficiently even when batch sizes are small, when products and formats need to be changed frequently, or when packaging varies in terms of design and size. A key part of meeting this requirement is encoders, which can be adapted quickly and easily to the specific requirement at hand. Thanks to additional intelligent functions and the suitable communication interfaces, all relevant data for diagnostics and for monitoring the entire system is also analyzed and transmitted directly in the encoder, including visualization.

>> Those who really want to offer efficient solutions for programming (and therefore changing the parameters of) encoders or inclination sensors must take into account the various target groups and applications: Is programming carried out by developers or service technicians? Is it to be used in a small production series or in a highly automated plant? SICK offers numerous options for programming its encoders, and consequently always has the right solution: from compact, lightweight display units and PC-based tools to integration in controllers and web-based user interfaces.
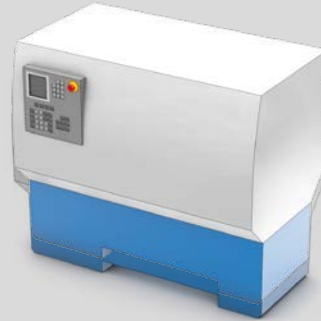
RS-485

Programming via an RS-485 interface using a PC or user-specific controllers.

Ethernet/fieldbus

Programming with user-specific controllers and engineering software from the manufacturer of the PLC via fieldbus/Ethernet.

Ethernet via web server

Programming via an integrated web server.

Programming "on the fly"

Incremental and SSI absolute encoders can be programmed using a PC, industrial PC, or a controller supplied by the customer via the RS-485 interface. The advantage is that programming can be carried out without disconnecting the electrical connection and therefore during the process. This means that a new encoder setting can be selected within seconds and rapid changeover of the machine is guaranteed. No programming software is required as control commands perform the programming process directly. This supports optimal integration into the relevant controller landscape.

Always ready to hand

Ideal for use in customer service and in servicing: The lightweight, mobile PGT-10-Pro programming unit is able to work in a fully self-contained manner thanks to an integrated voltage supply. This means that numerous programming functions are available at any time and without the need for time-consuming installation (plug and play) and regardless of your PC hardware or software. You can run diagnostics on the encoder without having to dismantle it because the encoder output values (position or speed) are shown on the display. In addition, the cloning function saves time and reduces the risk of faulty programming when using multiple encoders with the same configuration.

DUS60 and DUV60: greater and more inclusive flexibility

The new DUS60 incremental encoders and DUV60 measuring wheel encoders offer the possibility of setting parameters such as resolution, output value, and count direction directly in the encoder. Programming via the PC and the corresponding software is not necessary. The settings are made quickly and conveniently using the integrated DIP switch. This means that significantly fewer encoder variants are required.

WEB SERVERS, ADDITIONAL FUNCTIONS, AND VISUALIZATION

Encoders with Ethernet-based fieldbus interfaces offer even more flexibility in terms of commissioning, changeover, and monitoring. If the web server is integrated directly into the encoder, as with the AFS/AFM60 EtherNet/IP™, this allows greater "insight" into the application: Various parameters of the system and potential decisions that can be drawn from it are evaluated and visualized, after which they can be retrieved at any time. This also includes extensive

additional functions which calculate the required data directly in the encoder and where necessary can display it over the web server – all without any loads being applied to the machine controller.

Everything at a glance

The visualization of all encoder features and diagnostic functions on a screen allows the user to change parameters quickly and easily, output data to the controller, and gain an understanding of

diagnostic data via the graphical display. Users can therefore configure and/or analyze encoder data as well as optimize service intervals wherever necessary, regardless of location and with access to LAN or WLAN via Wi-Fi switch. This can be carried out on-site and directly in the application, in a laboratory environment, a warehouse, or an office – even without a controller. *(tm)*

ADDITIONAL FUNCTIONS	OUTPUT VALUE	EXAMPLE OF USE
Speed limit	Above/below speed limit	The encoder outputs the actual speed. It can also emit a signal when this speed exceeds or falls below the set speed limit values.
Cycle counter	Number of cycles	The service life of a wire draw mechanism is reached after one million cycles. In the interests of predictive maintenance, the required signals are transmitted to the controller so that the mechanism is changed in good time.
Motion timer	Number of encoder shaft operating hours	The encoder outputs the number of hours during which the encoder shaft is rotating. Maintenance work on the system, such as lubricating shafts and bearings, can then be carried out according to plan.

Additional integrated functions which can be displayed via web server at a higher level.

SICK AppSpace: GIVING SPACE TO YOUR IDEAS AND SOLUTIONS.

THIS IS **SICK**

Sensor Intelligence.

Break through the boundaries of conventional programming – with SICK AppSpace, SICK's open platform for programmable sensors. The SICK AppSpace eco-system offers system integrators and original equipment manufacturers (OEM) the freedom and space to develop application solutions to fit the specific requirements of application descriptions. From precisely designing the perfect online user interface, through selecting the most suitable programming technique to distributing the software on various hardware platforms, for SICK AppSpace, one thing is of paramount importance: Providing you with flexibility during the development of a customized solution. We think that's intelligent. www.sick.com/SICK_AppSpace

SICK

Sensor Intelligence.

SICK AG

Erwin-Sick-Str. 1 | 79183 Waldkirch | Germany

Phone +49 7681 202-0 | Fax +49 7681 202-3863

www.sick.com

Order No. 8020073