SICK insight MAGAZINE

: FOCUS **ELECTRONICS INDUSTRY**

UPGRADE TO THE NEXT LEVEL

AUTOMATION IN ELECTRONICS

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Dear Readers,

The electronics industry is one of the driving forces behind industrial progress and therefore always experiences market changes very early on and very clearly. Product life cycles are becoming ever shorter and the quality requirements ever higher, which currently poses extraordinary challenges to the industry. Added to this are topics such as electromobility and energy efficiency, but also the increasing demand for virtual networking. This is why we must drive forward innovation – quickly, reliably, and economically. High-tech machines and production sites need to be equipped with state-of-the-art sensors in order to be able to satisfy the market requirements for quality and cost-effectiveness. At the same time, the electronics industry itself is spearheading digital transformation and delivering innovative concepts and solutions for smart production.

Regardless of the automation level of upgrades or modifications, sensor technology from SICK ensures investment security as it is backwardly compatible: Our Industry-4.0-enabled sensor technology can therefore be used in existing automation architectures and is able to communicate with all levels up to the cloud.

For years now, SICK has aligned its sales channels with the industries it serves. Across the world, our application specialists are therefore true industry insiders and are deeply familiar with the processes and requirements of the electronics industry. In our application centers in Europe, Asia, and North America, we test and optimize system solutions in accordance with customer specifications. Custom solutions are thus developed in close cooperation with our customers. These solutions offer real added value – and provide answers to the challenges of digital networking. This issue of our customer magazine is full of exciting examples.

I hope you enjoy reading this issue of SICKinsight.

Reinhard Bösl
Member of the Executive Board of SICK AG

SENSOR INTELLIGENCE FOR ADAPTING PERFORMANCE ON EVERY AUTOMATION LEVEL

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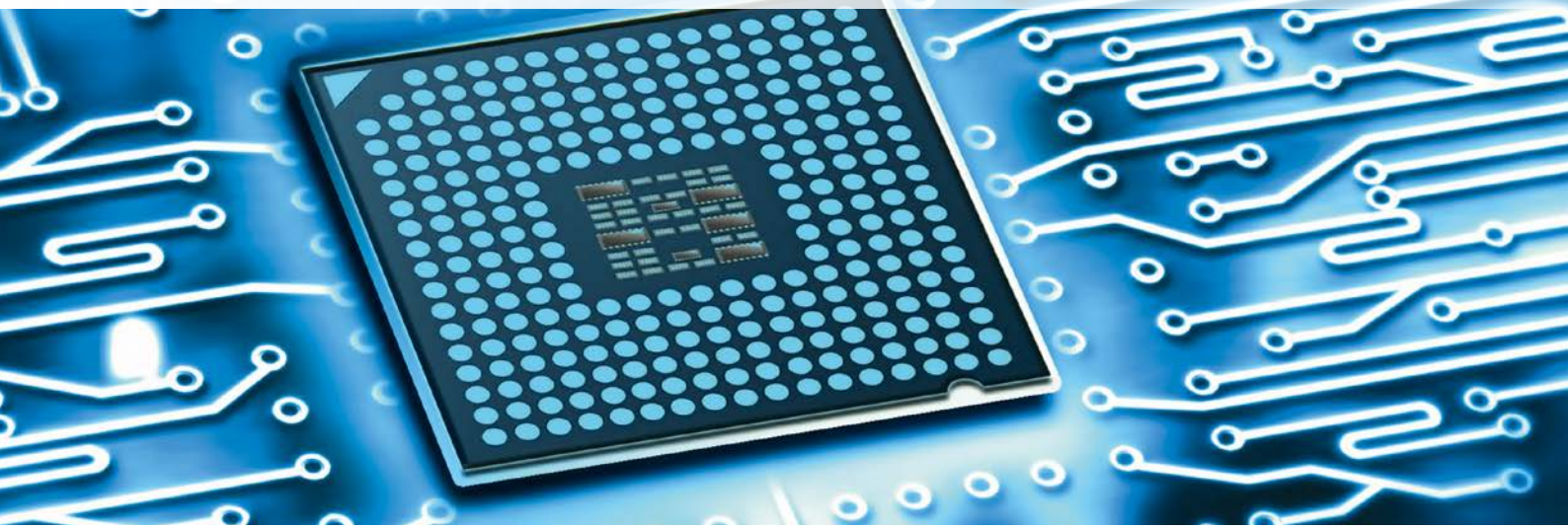
SENSOR SOLUTIONS FOR UPGRADING TO A HIGHER LEVEL OF AUTOMATION

GLOBALIZATION AND DIGITIZATION – THE PRESSURE TO AUTOMATE IN THE ELECTRONICS INDUSTRY



All over the world, the electronics production industry is having to balance shorter product life cycles with higher quality requirements – from consumer goods such as smartphones, TV sets, and household appliances right through to electronic components for various industries. At the same time, the electronics industry is itself spearheading digital transformation and delivering innovative concepts and solutions for smart production.

>> Although electromobility, energy efficiency, and the growing demand for virtual networking offer huge potential for growth, the electrical and electronics industry is also facing new challenges. Firstly, demand for electronic products is increasing (in turn, fueling demand for the electronic products required to produce them). Secondly, new suppliers (e.g., in the area of communications and entertainment electronics) are generating greater competitive pressure. Even in Asia, where – until recently – companies were largely able to rely on manual production processes, major electronics groups are already announcing extensive automation measures to make their production facilities smarter. They are turning away from partially automated lines and moving towards fully automated ones. This change is being driven by pressure from the market, the demand for larger quantities but also greater product variety, and also the need for quality data management. In addition, continuous consolidation of the market is leading to domination by just a handful of Asian and American giants.

When it comes to the performance of the machines and systems used in electronics production, the changing requirements faced by system manufacturers, component suppliers, and system operators can be addressed through various levels of industrial automation.

And sensors play a key role in its implementation. The suitability of the sensor solution affects the plant's profitability and depends on various factors, namely, on the kinds of sensor technologies that can be selected from what is available, whether these technologies can be used intelligently and – above all – on how reliable the sensors are. By drawing on its industrial experience, and technological and industry expertise as well as its broad product portfolio, SICK is playing a key role in optimizing production.

To an extent, retrofits are also being used to optimize electronics production and gradually bring it into line with Industry 4.0 standards. In the future, many electronic devices – such as smartphones – will still have to be efficiently mass-produced. Consequently, sensors and systems that support this type of production and are capable of processing sensor signals intelligently will still be required. However, at the same time, some subareas of electronics production are aban-

doning rigid production lines altogether and are starting to use robots and automated guided carts (AGCs) instead.

Sensors are setting the pace

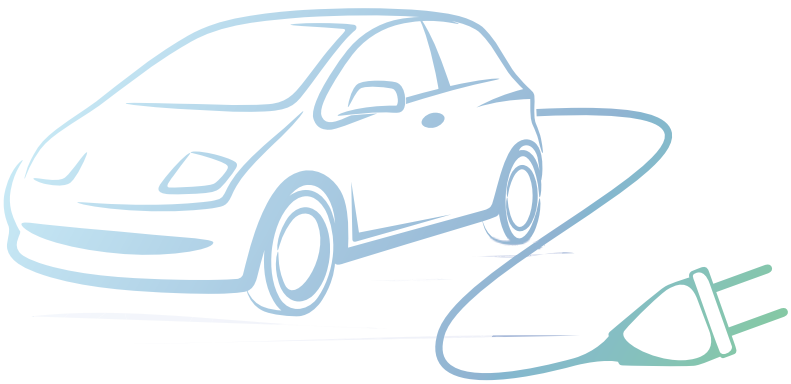
The performance capabilities of intelligent sensors are a key driver of market requirements and of performance-related adjustments within production plants.

Over recent years, traceability has become an increasingly important topic for the electronics industry. Many end customers, particularly purchasers of electronic consumer goods, now expect their suppliers to have systems in place that will enable any electronic component to be uniquely identified and traced. In this way, potential sources of defects can be narrowed down more quickly and product recalls can be carefully targeted.

Image-based code readers are capable of identifying tiny Data Matrix codes on components, thereby ensuring the traceability of items such as PCBs or battery cells throughout the entire production process. The components can be identified while they are moving.

Increasingly, quality assurance inspections are also having to be documented and the evidence retained for years. Take, for example, a situation in which a hand lever press is used to press in electronic components. Up until now, there was no way of obtaining physical values for creating a digital profile in a database. By upgrading systems such as these, the missing data can be made available and, if the system is equipped with appropriate safety technology, the safety of the worker and the process can be increased in PSDI mode. Data management, communication, and networking are all coming to play an increasingly important role in the context of manufacturing – and using – smartphones, TV sets, household appliances, or electronic components for various industries. And that applies whether we are talking about track and trace systems, quality control, or condition monitoring.

Intelligent and rugged sensor technology is opening up new horizons in production quality. This technology makes it possible to collect reliable data in real time – an opportunity to optimize machines and systems that has barely been touched. In relation to this, sensors from SICK are already able to communicate reliably with PLCs as well as with the world of data. Also in the context of reliable detection under the most difficult conditions, reliability and durability are the key to optimizing processes and thus increasing efficiency. The key features of the electronics industry are short product life cycles, a high demand for innovation, and global supply chains that are strongly networked. Where the demands for quality and productivity rise in parallel, profound knowledge and expertise in the relevant industries are an advantage. SICK knows the industries and their processes inside out, with hundreds of thousands of installations and implemented applications all around the world to prove it. In application centers in Europe, Asia, and North America, sensors and system solutions are set up, tested, and optimized in accordance with customer specifications. In addition, the company's agile project teams are constantly working on solutions to enable flexible automation at every stage of production. Thanks to "Sensor Intelligence.", products can perform so many more tasks in combination than they could alone. *(as)*



The megatrends electromobility and virtual networking: an opportunity for growth but also a challenge for the electronics industry.

PCB IDENTIFICATION AND INSPECTION

SCALABLE SOLUTIONS FROM SICK

Vertical integration – that is the keyword for track and trace. The traceability of products during complex production processes is a priority here. Production and logistics require a transparent material flow so that production decisions can be made faster and processes and devices can be traced.

>> The automotive industry in particular was one of the pioneers of this quality strategy regarding safety-relevant devices, together with the pharmaceutical industry concerning intellectual property and health protection (serialization and anti-manipulation measures for pharmaceutical products). The topic of traceability is gaining more and more importance in the electronics industry as well. The challenge lies in ensuring full traceability of all components even many years after installation and being able to map out the entire production process.

Basic prerequisite: a unique code, as individual as a finger print

Most PCB assembly plants now use a wide variety of monitoring technologies. PCBs, fitted devices, and process data are identified and systematically documented. Clear identification with Data Matrix codes has therefore become an established industry standard. Each PCB bears a code containing a unique number. This code is identified by image-based code readers as part of the assembly process. All the necessary information is therefore assigned to the respective PCB in the system. If a problem arises, the traceability system can be used to find out which PCBs are affected or which are fitted with defective devices. This clear traceability has the considerable advantage that , e.g., in case of any complaints, products can be filtered quickly and efficiently. Product returns can then be processed in a targeted manner and with minimal effort. Costs and damage to a company's image can be reduced to a minimum.

SICK products support the implementation of traceability – modular solutions for maximum efficiency

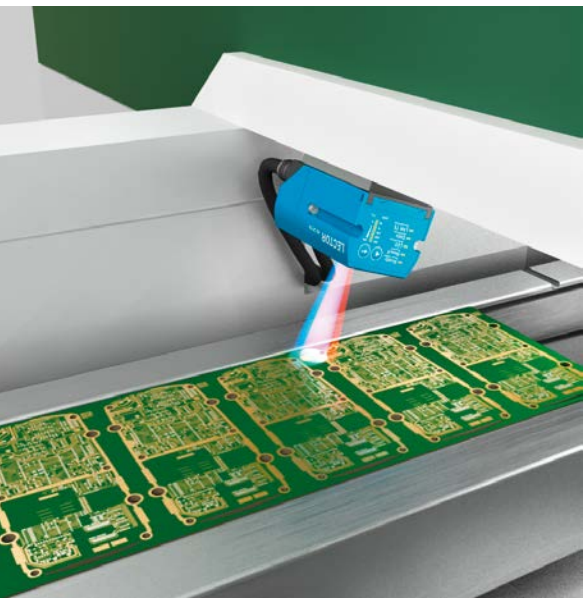
SICK offers a broad range of image-based code readers and image processing systems. Maximum cost efficiency with optimal performance are in focus when selecting a suitable product.

The compact Lector620 image-based code reader is recommended for identification tasks involving large quantities with consistent PCB layout and the same code position. This code reader is installed in the position designated for the code and reliably identifies each code in the field of view.

However, small batch sizes, extremely variable PCB designs, and constantly changing code positions are typical requirements of highly flexible production processes in the electronics industry. Added to this are the demands for a decrease in downtime, short installation processes, and highly flexible plants. SICK therefore offers the multi-code reading system, which is based on code readers of the Lector63x product family. The system can map high variances without modifications by capturing large PCBs as a whole. The position of the code reader does not need to be adjusted.

The Lector620 image-based code reader reads more than 10,000 PCB codes every day

When testing the wireless radio modules of a world-renowned manufacturer, the Lector620 image-based code readers from SICK reliably identify even poorly printed Data Matrix codes on PCBs.



Lector620: Its highly compact design ensures flexible integration even where space is at a premium.

On virtually no other market is miniaturization gaining ground as quickly as it is on the market for electronic devices. The reduction in outer dimensions is being accompanied by a marked decrease in the sizes of the electronic components and assemblies inside. At the same time, the production volume of wireless radio modules, e.g., is constantly increasing and production and testing processes are more and more speeding up. As a result, the identification and tracking technologies used for electronic assemblies have to meet specific requirements because markings – usually two-dimensional Data Matrix codes – are also getting smaller and smaller.

One of the world's biggest electronics groups therefore relies on the Lector620 from SICK: Even when faced with short reading times and small codes with a resolution of only 0.15 mm, the image-based code reader delivers reading rates of more than 99 percent – even when the code and contrast quality of the miniature labels or direct markings leaves much to be desired. Its compact design, integration into various IT environments in accordance with industrial requirements, intuitive operation, and excellent reading performance for reliable tracking and tracing make it an efficient solution for demanding code readings.

Thanks to its convenient functionalities, the Lector620 is very easy to commission. Laser points visualize the center of the image, thereby enabling quick alignment. By the push of a button the auto setup can be initiated, i.e., an autonomous teach-in process. The Lector620 therefore configures itself to identify the relevant code. Moreover, thanks to red and blue LEDs which illuminate the reading field, external light sources are no longer required. In addition, the integrated microSD memory card allows images as well as backup copies of parameters to be saved. In the event that a code reader is replaced, this data cloning feature ensures that all the operational settings are written directly into the new device.

Lector63x multi-code reading – multi-panel serialization, even en bloc

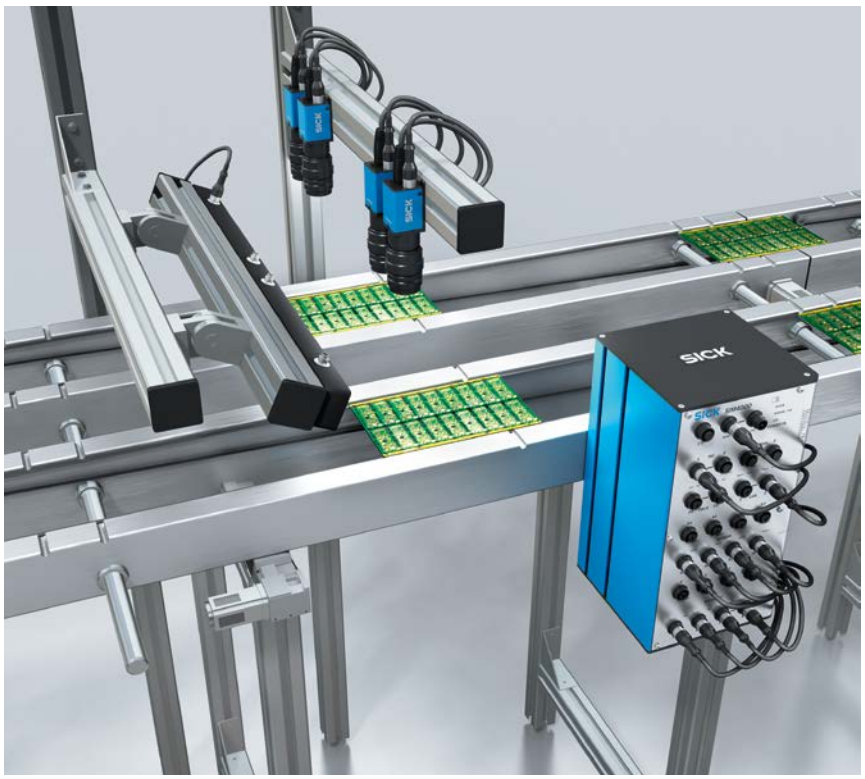
When manufacturing PCBs, smaller individual boards are combined on one PCB panel in order to make better use of production facilities. This panel is then produced in the same way as a single, large PCB. As a result, circuits can be produced in which a single PCB is smaller than the minimum dimensions required for machine assembly. More and more consumers are demanding end-to-end traceability of these single PCBs. Thanks to the multi-code reading function of the Lector63x image-based code readers, the code of each individual PCB in the panel can be clearly identified. By intelligent pre-processing of the images collected during passage of a PCB, codes can be clearly assigned based on their position on the panel. In addition, missing or unidentifiable codes on a panel are also signaled. Moreover, due to the multi-code reading function, the field of view of the image-based code reader is considerably wider as multiple images and therefore multiple fields of view in the direction of passage of the PCB are used for an overall evaluation. Modifications are therefore no longer necessary.

The Lector® series supports all conceivable code reading applications and offers the right solution even for extremely demanding reading tasks.

PCB inspection and identification with SIM4000 and picoCam304x

In combination with the picoCam or midiCam streaming cameras and other sensor technology, the SIM4000 Sensor Integration Machine offers maximum flexibility. The various SICK sensors provide data which is analyzed and evaluated in the SIM4000. This makes it possible to identify codes and carry out additional quality checks in just one step.

In addition to identification tasks, there are various inspection tasks in the PCB industry. The SIM4000 Sensor Integration Machine is fully in control of assuring the required product quality as well as the consistent traceability along all production steps. Sensors like the industrial picoCam304x streaming cameras are connected to this central evaluation unit. Due to their high resolution of up to four megapixels, the cameras are suitable for inspection tasks, including the quality control of devices, as well as for identification tasks such as Data Matrix code reading on PCBs. The SIM4000 performs both applications as part of the SICK AppSpace eco-system and transfers the results to the higher-level ERP system via fieldbus. SICK AppStudio is recommended for programming these applications.



Code identification and quality check in one process step.

This solution is easily scalable. It is expandable with other lanes by adding more cameras to the SIM4000 and extending the sensor app or adding another app. The SIM4000 also controls illumination directly and without additional components. Thus all of the components required for the solution come from a single source.

From small image-based code readers for quick identification of PCBs in one lane through flexible identification of PCB panels of various formats to multi-camera systems in connection with the Sensor Integration Machine for quality inspections, traceability, and object detection – sensor technology from SICK can be relied upon to deliver the required performance. *(as)*

FLEXIBLE SOLUTIONS FOR ANY APPLICATION

DETECTION WHATEVER THE CIRCUMSTANCES

Within the electronics industry, the optimization of products and processes is vital to creating the intelligent solutions of the future. End products are entering new dimensions in terms of their performance capabilities – by becoming smaller, flatter, and lighter. Automation solutions are becoming leaner so that their optimization potential can be fully tapped from a quality assurance and cost perspective. As industrial applications become more complex, detection requirements are increasing. But SICK has the answer: the right technology for any challenge – all in an ultra-compact housing.

>> In the electronics industry, objects can be small, black, perforated, transparent, or shiny. This rich variety of optical properties makes detecting them equally complex: Photoelectric sensors from SICK rely on many different factors so that universal object detection can be achieved reliably.

It is the technology that makes the difference

Reliable detection from SICK can be summed up in one phrase: red laser light. A tiny laser beam provides the ideal starting point for detecting objects and their features, no matter how small they are. The light spot supports switching with maximum accuracy, thus providing the basis not only for optimum product quality but also for greater machine availability, as there are fewer switching errors.

When conventional red-light sensors reach their limits, SICK uses blue light instead. For instance, the WTB2S-2 Blue miniature photoelectric sensor can even detect highly light-absorbing objects, such as dark-blue solar wafers, perfectly.

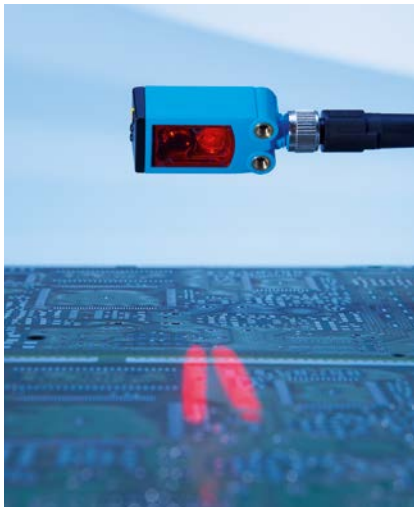
Meanwhile, the PinPoint 2.0 LED is the ideal way to “enlighten” your industry if you want to be able to detect the very deepest of blacks. This emits more than twice as much light as the first-generation PinPoint LED. Of course, the new generation of sensors from the W2S-2 product family are not only capable of “seeing” ultra black. Rather, they guarantee reliable detection of any kind of object and are, for example, able to recognize housings for battery cells or modules in the smartphone industry. On top of that, they offer optimum performance with an ultra-compact design. The WT2-S sensor variant with v-optics supplements the range with its reliable detection of flat, highly transparent, or reflective objects such as monitors or smartphone displays.

Quality made to measure

Detection has to adapt and grow in response to its tasks: Rapid developments within the electronics industry are setting a new pace and new standards, posing challenges for sensors in terms of optimizing production and costs. Adapted sensor technology is always the answer to the challenges of shorter innovation cycles, object miniaturization, or the demand for smaller and more intelligent automation solutions. This manifests itself directly within the sensor solution – e.g., different technologies can be combined in a single platform. And it is exactly this kind of technology platform that SICK has managed to create with its W4 miniature photoelectric sensors, UC4 ultrasonic sensors, and CQ4 capacitive proximity sensor – the housing is barely as big as a lump of sugar. The compact dimensions make it easy to incorporate into the machine design; as a result, the sensors can be used flexibly, even under difficult installation conditions. These sensors demonstrate their high capacity for detection by offering a variety of detection properties combined with full mechanical compatibility. This opens up numerous potential applications within the electronics industry. The CQ4 capacitive proximity sensor can be used to detect light-absorbing wafers in the electronics and solar industries while the UC4 relies on ultrasonic technology to identify

Miniature trio: W4, UC4, and CQ4.

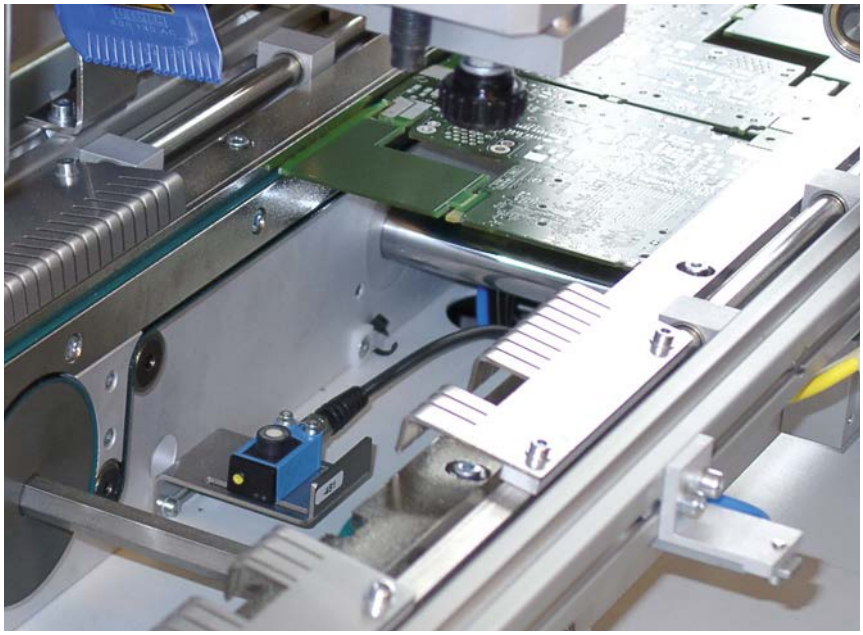
dark, shiny, and even very fast objects. The MultiLine is the high-end member of the W4 miniature photoelectric sensor family. With its linear light spot, it detects PCBs very reliably and so sits nicely side by side with the product that is best in class: the WTV4-3 featuring v-optics, a linear light spot, infrared LEDs, and Pin-Point LEDs for the high-precision detection of perforated PCBs.



Detection of PCBs with recesses – no problem at all for the WTV4-3 photoelectric proximity sensor with its linear light spot.

Smart detection: playing a functional role in open networks

While photoelectric sensors from SICK are able to plug the gap at the micro level, IO-Link performs a similar function at the macro level. By acting as a bridge to the lowest field level and linking all the process participants, IO-Link enables complete transparency – and opens up new dimensions for detecting what is really happening inside machines. The ability to mirror production data retrospectively and diagnose faults and statuses in advance also redefines the role of sensors,



Reliable edge detection with ultrasonic technology.

and paves the way for Smart Sensor technology in the context of Industry 4.0. The new SIRIC® ASIC technology is an example of how Smart Sensor technology from SICK can be applied concretely. Photoelectric sensors featuring this optical technology can be seamlessly incorporated into the automation network as Smart Sensor Solutions in accordance with the concept of "integrated intelligence." As well as supporting diagnostic and remote configuration functions, they are also capable of performing various automation functions, such as counting, time measurement, remote interference suppression, or position determination based on a "time stamp." All of these developments make things easier at the control level and increase machine productivity. Even if there is a burgeoning of technological quality as a result of Smart Sensor technology, the format will remain the same: intelligent sensor technology in an ultra-compact housing.

The entire performance range in one product family

Recently, the SICK miniaturization strategy has culminated in a solution that brings together all the advantages of time-of-flight technology in the world's smallest housing and boasts an impressive sensing range: the PowerProx Small MultiTask photoelectric sensor. Here, reliable detection takes the form of six different sensor variants, which are designed for various tasks and offer compatibility even in the context of robot-assisted production automation. Object presence monitoring must be able to cope with a situation that is highly dynamic. For this reason, the sensors attached to the grippers must be as small and light as possible. With its miniature dimensions, 800 mm sensing range, and ability to support Smart Sensor functions, the PowerProx Small is an innovation that can solve one of the key tasks of the future industrial landscape. *(fg)*

THE MINIATURE ANSWER TO MAXIMUM REQUIREMENTS

OBJECT DETECTION WITH MINIATURE HEADS

Confined spaces, tiny objects, and tailored component designs – these are some of the challenges faced when producing electronic components and devices. Intelligent solutions from SICK are exactly the right combination of fiber-optic sensors and fibers – for flexible and reliable object detection that can cope with the smallest nook and cranny.

>> To keep pace with the flexibility demands of the electronics industry, sensor technology has to be adaptable. What is required – in terms of integration, adjustment, and logical adaptation – is “adapted intelligence,” which must be geared toward and tailored to the relevant application and task.

The journey itself is the destination

The search for an application-specific sensor solution starts with the selection of a suitable fiber and its specific design: plastic or glass fiber, the shape and size of the end sleeve, the protective sheath material, and optical heads that are tiny but still have a wide detection angle. Optical fibers from SICK will fit seamlessly into virtually any application context.

Getting to the heart of detection

The fiber-optic sensors from the WLL180T product family take this solution to the next level – by adapting it to the detection task concerned. The extremely small light spot is the ideal starting point for precise object and feature detection in automation. Consequently, reliable presence monitoring is no trouble at all, even with tiny objects in the micrometer range.

Thanks to the wide range of fibers for different applications, the WLL180T sensors can also be used in confined installation spaces. For example, they can be used to inspect the smallest pins in integrated circuits. The sensors are capable of detecting the tiniest changes in an object's dimensions even from a greater distance – and even in areas of machines and plants that are difficult to access. Up to 16 sensors can be synchronized in bus mode. This prevents mutual interference when fiber-optic heads are mounted very close to one another (anti-interference). In addition, the bus technology makes for easy handling and reduces wiring overheads. This also speeds up commissioning: Thanks to the bus link, all the settings for a sensor can be copied to other sensors within the bus network using a single teach-in cable.

Up to 16 sensors can be synchronized in bus mode.

Rapid switching is the priority

Within the electronics industry, high-tech process automation and object monitoring go hand in hand with reliable and stable sensors for the benefit of the application. For example, wire-break monitoring in the context of wire bonding calls for pinpoint accuracy when detecting fast-moving objects. WLL180T fiber-optic sensors meet this challenge by providing high-resolution signal processing and extremely short response times for lightning-fast processes. LL3-DT01 optical fibers are able to compensate for minor vibrations in the bonding wire thanks to their large detection angle.

Everywhere and nowhere

Many applications within the electronics industry involve detecting what is there – and also what is not. PCBs often have recesses, quite large drilled holes, or curves, which means that the object detection system has to cope with the challenge of a "blueprint." Also with regard to this, WLLT180T fiber-optic sensors score with the proven combination of performance and setting options of the fiber-optic amplifiers together with the specific optical properties of the selected optical fiber. *(fg)*

HIGH-PRECISION PIN INSPECTION OPTIMIZES PRESS-FIT OPERATIONS DURING FINAL ASSEMBLY OF ELECTRONIC MODULES

PRESS-FIT CONNECTORS THAT GO EXACTLY WHERE YOU WANT THEM TO

Demand for electronic components is constantly growing, in turn increasing the quantities involved in PCB production. To ensure that the connections to the periphery are secure, wire connections are no longer soldered onto PCBs. Instead, a procedure called the “press-fit method” is used. This involves pressing the connectors through holes on the PCB at high pressure. The quality of each individual connection can be monitored by the Pinspector quality control system from SICK, which is already being successfully used in the automotive electronics industry.

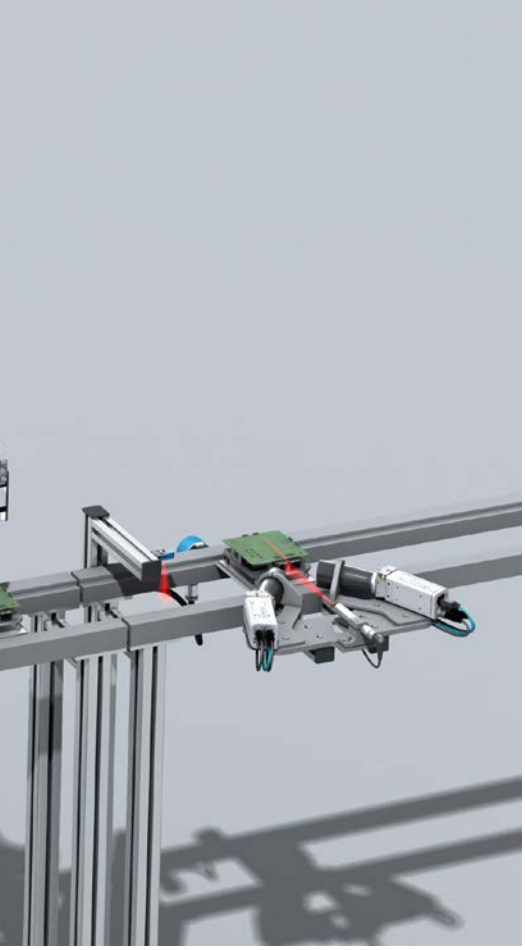
>> As a substrate for electronic components, the PCB is an essential component in industrial production. Despite the high production rate involved, consistent quality must be ensured for the pin connectors. And that is where the Pinspector quality control system comes in. Its 3D streaming camera from the Ranger product family and laser technology are optimally aligned with one another. As a result, whenever pins deviate from the defined quality standard, the system is able to detect the problem.

Maximum precision for reliable connections

Press-fit pin connections dramatically increase efficiency during the final assembly of electronic modules. Not only is the press-fit method faster than conventional soldering; it also results in connections that are more reliable. These are highly valued, particularly in the automotive electronics industry. However, this method calls for maximum precision.

Pin connections for electronic modules are often left until near the end of the final assembly process. If faults occur at this stage, the PCB has to undergo laborious rework or, in a worst-case scenario, has to be scrapped altogether. In turn, this makes the production line less efficient, resulting in higher production costs.

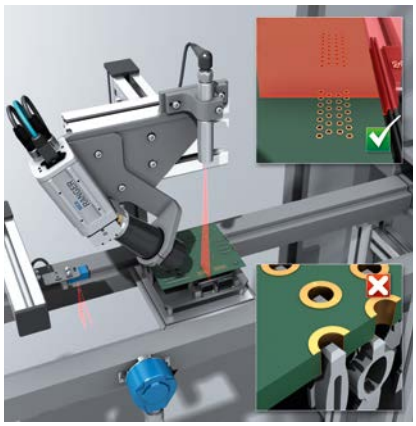
Process precision is also vital to safety when the end product is actually used: If a pin within a multi-pin plug connector is affected by contacting problems due to poor quality, the electronic connections may be interrupted. This can have serious consequences, e.g., by affecting the ABS system or other electronic functions of a



car. The Pinspector quality control system is suitable for checking pin connectors at three different stages of the process.

Position inspection before the press-fit process

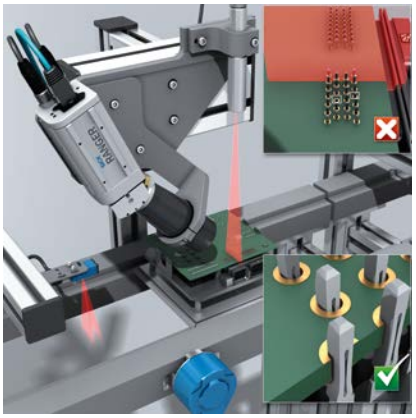
Before the press-fit process is even started, Pinspector uses a non-contact, three-dimensional position measurement function to check that the pins are correctly aligned with the designated through holes in the PCB. Pinspector only gives the go-ahead for the press-fit operation once it knows that all the pins are correctly positioned.



Checking the PCB before the press-fit process.

Position inspection after the press-fit process

After the press-fit process, Pinspector checks the positions of the fitted pins on the PCB to make sure they are correct. For this, the system relies on three methods: It checks that the pins are present, it checks the coplanarity of the pins, and it compares the result against a reference value. None of the pins must be bent or deformed as a result of the press-fit process. Nor are they allowed to exceed or fall short of a defined height. If all pins are within the permitted tolerance range for the height, Pinspector releases the entire assembly for further processing.



Pin inspection after the press-fit process.

Checking the pin connectors

Aside from verifying the press-fit process, Pinspector also checks the pins in the pin connector. With its special lens, the system can provide a precise image of the entire length of the pin. This means that even the smallest of defects can be captured. Depending on the model, the connector shaft or connector housing subsections can interfere with the view. For these cases, Pinspector is available with two cameras, allowing to complete the image from various perspectives. In this way, shadowing on the base can be avoided. On the user interface, various colors are used to differentiate between the 3D measured values.

The Pinspector quality control system reliably checks whether all the pins of a pin connector are present and intact.

Perfectly coordinated software and hardware

The Pinspector quality control system can be integrated into any production environment. SICK optimally aligns the camera and scanning technology in advance, and mounts the devices on a bracket accordingly. Once installed in the application environment, the devices can then be precisely readjusted by the customer. As a result, the system can be easily integrated into existing plants with a rugged screw connection.

And because the accompanying software supports the storage of customer-specific parameters, Pinspector can then be configured perfectly for the inspection task concerned. These parameters define specific reference values for various inspection tasks so that the individual pins can be checked for deviations. If necessary, several areas can also be defined within one pin connector. This makes sense, for example, if the pins are of different heights or widths. In this way, Pinspector is able to inspect the entire plug connector reliably in a single pass. Operation is highly intuitive: After receiving initial training from SICK, customers will find that they can set up the software themselves and customize the guide values to suit the task at hand. *(hs)*

DISPLACEMENT MEASUREMENT SENSORS: THE ULTIMATE INSPECTION AUTHORITY AND GUARANTOR OF QUALITY FOR EVERY STAGE OF THE PROCESS

CUSTOM QUALITY

Within the electronics industry, quality and precision are key factors when it comes to intelligent production concepts: The only way to ensure high levels of quality – from the individual components right through to the end product – is to keep tabs on the value creation process by continuously evaluating measurement results. Optical measurement technology from SICK combines precision and quality in one – by offering measuring instruments that are integrated directly into the production process. In an industry where high measurement accuracy is required in conjunction with short sensing ranges and the tiniest of objects, displacement measurement sensors are really able to show their strengths.

>> They are better at detecting objects than virtually anything else and have no contact points at all: Optical measuring sensors from SICK are quick, precise – and non-contact. Even delicate materials can be detected with micrometer precision without causing any deformation or damage. Every single measurement sensor expresses its intelligence through the perfect interaction of sensor properties (such as size, technology, and user friendliness) and specific user knowledge – all tailored to the requirements of the application concerned. In particular, displacement measurement sensors precisely detect even the tiniest material faults and micro-cracks. Because they are able to measure distances as well as workpiece and production tolerances with micrometer precision, they can monitor whether components are correctly aligned during the assembly process, for example.

Object measurement made easy

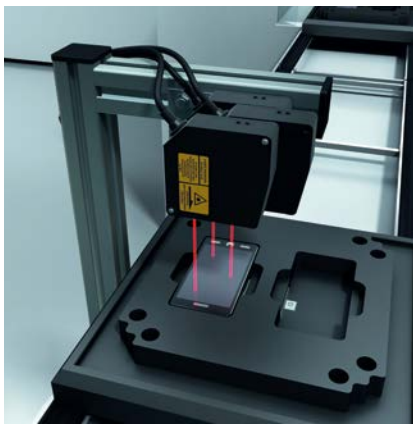
With its compact housing measuring just 18 mm x 31 mm x 41 mm, the OD Mini displacement measurement sensor is the smallest in its class and can identify the exact positions of PCB components. The measurement method is based on the triangulation principle, which makes the sensor highly sensitive. As a result, it can even be used to detect complex surface profiles – including in the context of dynamic gripping or positioning tasks.

OD Mini: distance measurement as part of robot-assisted production automation.

The OD Mini is able to handle the complexity of these applications thanks to its rugged miniature housing, and minimal weight of just 40 g in the aluminum design. Other advantages of the sensor, which ensure a high level of machine availability, are: the intuitive operating concept, the integrated evaluation electronics, and remote programming via the external teaching input.

Quality ties everything together

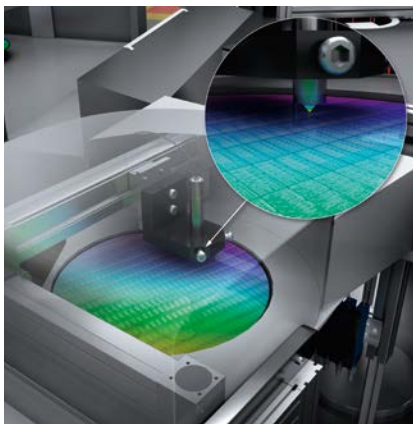
In many areas of the electronics industry, the real challenge lies in the detail, or rather in the structure of the end products. At this level, functionality depends on all the components working in unison and starts at the quality assurance stage of production. Assembly errors can be prevented by checking that the individual components (such as PCBs) have been installed in the correct positions. This is incredibly important when inserting components such as smartphone displays. The OD Precision displacement measurement sensor can identify assembly errors of this kind with micrometer precision and can be functionally expanded by using up to three sensor heads per evaluation unit.



OD Precision: position detection for device assemblies

Absolutely reliable

Quality assurance within the electronics industry also involves measuring the layer thicknesses of lead frames and components. The OC Sharp relies on a chromatic confocal measurement method, allowing it to identify transparent semiconductor substrate layers starting from a thickness of just 0.3 micrometers and with resolutions of no more than a few nanometers. By checking the thickness and suitability of film coatings before the drying process is even performed, the OD Precision ensures the quality of rechargeable battery cells in advance. This laser-based distance sensor also shows its strengths when used to measure the thickness of glass on displays. Thanks to the triangulation technology, these thicknesses can be measured with high accuracy using just a single sensor head.



OC Sharp: measuring layer thicknesses on semiconductor wafers.

Special circumstances call for special “measures”

The wafer-thin glass and layers found in mobile communication devices are clear signs of miniaturization within the electronics industry and are the driving force behind new standards for intelligent measurement technology. The OD5000 is the innovative response. This high-performance sensor can measure even more quickly and precisely – and to an even greater depth of up to 8 peaks. This ensures maximum measurement certainty for thin/ultrathin glass substrates and layers, as well as for curved glass and surfaces. In addition, the sensor can be configured via a SOPAS web server, which means that quality can be optimized within the actual process. This is because production data can be fed back during operation so that tolerances can be adjusted as appropriate further down the line.

OD5000: able to measure up to 8 peaks precisely.

A team of networkers

With its extensive array of optical measuring sensors, SICK has the perfect answer for a highly demanding industry where measurement technology is expected to keep pace with end product flexibility and life cycles while also optimizing production and costs. Coupled with the relevant application knowledge, the technology makes custom applications accessible and can respond to all kinds of requirements.

One huge area of potential lies in the way displacement measurement sensors can be combined with other sensors. Sometimes, assembly involves detecting quantities such as height or contrast in addition to taking distance and planarity measurements with short sensing ranges. And that is where intelligent vision solutions come into play.

In this case, displacement measurement sensors can be used to check that PCBs are positioned correctly inside the device housing, for example. 2D vision sensors detect the mounting holes and indicate their positions ready for the subsequent screwing process. Meanwhile, 3D vision sensors are used in quality control systems, where they perform a wide range of additional quality checks at every stage of the assembly process. For instance, Pinspector can be used for 3D pin inspections. This diverse range of solutions makes SICK a highly competent partner for electronics companies who are looking for optical measurement technology. *(fg)*

LEVEL MEASUREMENT FOR CORROSIVE CHEMICALS IN SOLAR WAFER PROCESS PLANTS

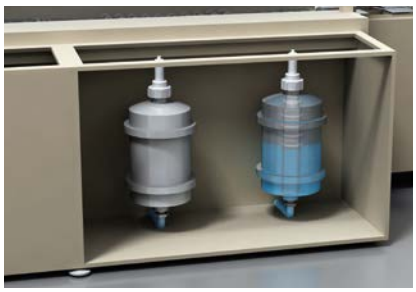
GOOD PROTECTION MEANS GOOD MEASUREMENT RESULTS

In many industries, challenging ambient conditions of all kinds are part of everyday production. The systems and sensors that are responsible for keeping the production process safe have to be specially protected against severe contamination or aggressive chemicals. For instance, chemicals are an unavoidable part of solar cell production, where they are central to core processes such as solar wafer surface finishing and cleaning. The levels in the chemical tanks have to be constantly monitored by sensors. The Teflon®-coatedUP56 Pure ultrasonic level sensors deliver precise results on a non-stop basis.

>> Chemicals for semiconductor and solar cell production are stored close to where they are needed inside storage and mixing tanks on wet processing machines. However, this makes them difficult to access. A common method of determining the level is to use capacitive sensors. The sensors are placed externally on the wall of the tank or on a bypass pipe and are thus protected from the chemicals. Usually, several sensors are mounted on the tank at different heights and are aligned manually. Although they signal limit levels, they are not capable of continuous level measurement.

Ultrasonic technology inside the tank

Nevertheless, precise and continuous level measurement is an absolute necessity when working with aggressive chemicals to ensure the safety and reliability of the process. And that is why SICK has developed a solution based on ultrasonic technology that allows continuous level measurement



Chemicals being stored in hard-to-access tanks.

between the switching points. The non-contact ultrasonic level sensors of the UP56 Pure product family are a range of specialized products for wet chemical processes in the electronics and solar industries. Their PTFE materials protect the ultrasonic sensor from aggressive liquids. Polytetrafluoroethylene (PTFE) – also known as Teflon® – is a special type of plastic that is frequently used in wet processing machines. The transducer of the level sensor has a PTFE coating while the connection flange is made from solid PTFE. As a result, the UP56 Pure can be placed directly inside the immersion pipe at the top of the tank's interior. Using ultrasonic waves, it measures the distance between the sensor and the liquid and signals levels continuously. Any changes in the level of the liquid are detected by the sensor immediately. In plants with confined installation spaces the UP56 Pure Mini is the perfect solution thanks to its very compact design.

Precise, efficient, and maintenance-friendly

Due to its PTFE-protected transducer, the UP56 Pure is very hardwearing and durable, making it ideal for use in highly concentrated acids and alkalis. Once installed directly inside the tank, the UP56 eliminates the need for additional accessories such as external bypass pipes or measuring shafts. Also, because only one sensor is required, it is no longer necessary to position several capacitive sensors mechanically (a process that is prone to errors). UP56 Pure fits seamlessly into the machine sequences, and its digital and analog outputs make light work of the electrical connections. The ultrasonic sensor features a standard flange and is fixed in place with a coupling nut. This means it is mechanically compatible with all the connections that are typically encountered within the industry.

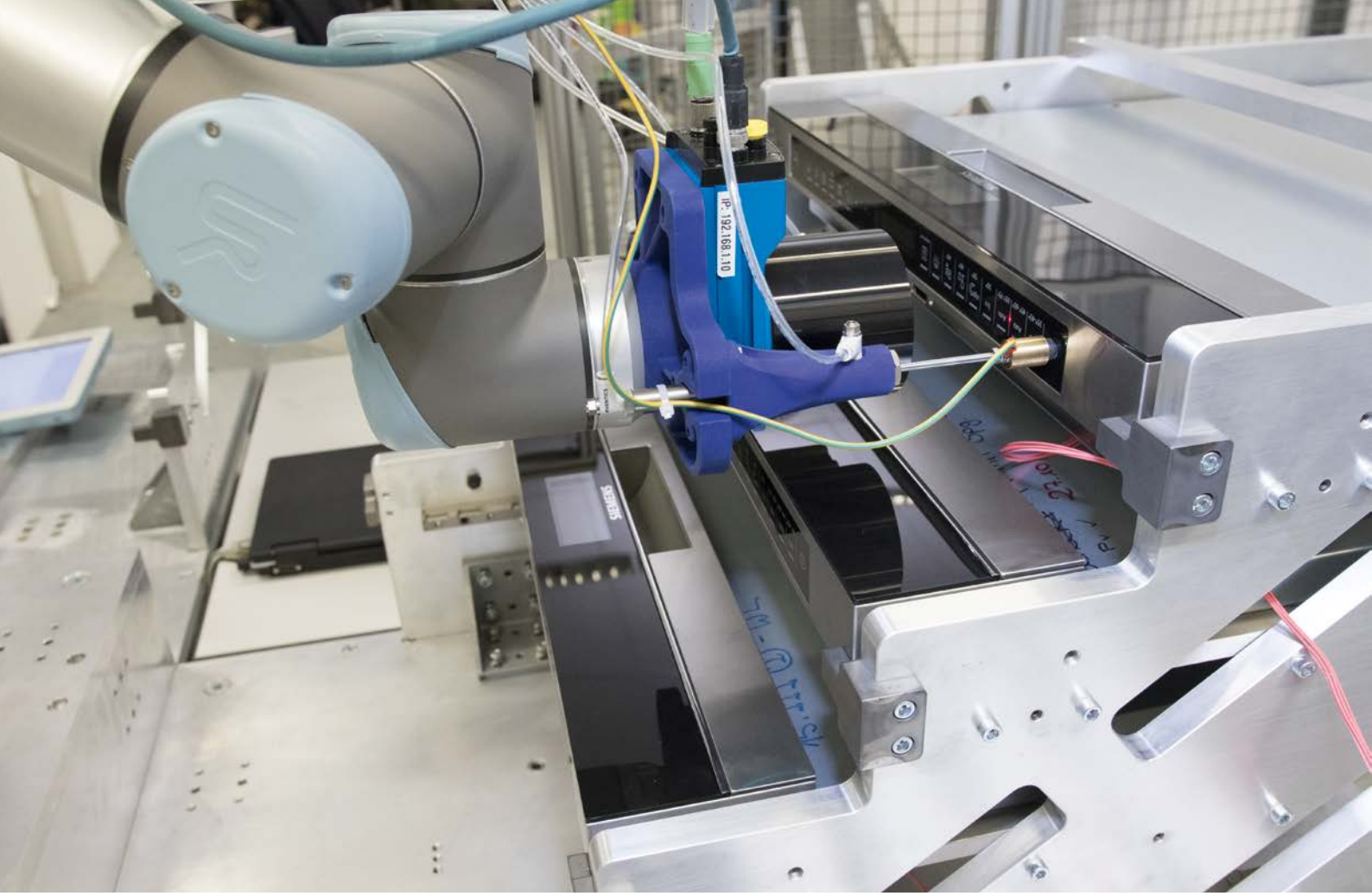
Software is included so that the sensor can be programmed to suit the specific customer and application. The responsible employee can use the software to adjust the parameters in line with the production situation and can optimize the refill times. This increases process safety and reliability, helps to ensure the sustainable use of resources, and minimizes production costs: Not only does the accurate measurement of chemical consumption prevent production downtime due to empty tanks; it also avoids wasting chemicals by refilling the tanks unnecessarily.

Ruggedness on demand

Working in conjunction with its customers, SICK checks exactly what operating conditions the UP56 Pure is going to face once it is installed in the respective production environment. The resulting combination of extensive sensor expertise and optimum knowledge of the process enables a customized approach to sensor implementation with a minimum of effort and expense. Moreover, rugged products from SICK can be used to secure wet chemical processes in other locations as well.

For example, Teflon®-coated capacitive proximity sensors from the CM18 PTFE product family are able to detect leaks in the safety collecting basin underneath the chemical tank. If any leaks occur or if chemicals flow into the safety sump trays, the sensors detect the problem and signal it via the machine controller so that it can be immediately remedied by service personnel. *(hs)*

UP56 Pure and UP56 Pure Mini ultrasonic level sensors.



ROBOT GUIDANCE AND EVEN MORE BESIDES

ROBOTS IN THE ELECTRONICS INDUSTRY: FAST, PRECISE, AND FLEXIBLE – THANKS TO INTELLIGENT SENSOR TECHNOLOGY

In virtually every country, quality requirements are increasing, innovation cycles are getting shorter, and wage costs are rising. As a result, demand for robot-based automation solutions is growing within the electronics industry. Easier collaboration (e.g., thanks to compact and lightweight robots) is opening up additional applications for the market and offers huge potential for new customized automation solutions.

>> Until now, the possibilities for automation within electronics production have been limited. Conventional robots have often proven inflexible, been too expensive to buy, and have been too big and bulky. Now all that is changing with the advent of new and lighter robot arms. As well as being lightweight, compact, and flexible – and easy to program and operate – these robots are becoming suitable for more and more applications. Without any need for laborious installation work, they can take care of monotonous tasks and increase the efficiency of production processes.
And if the robot works side by side with workers instead of operating on its own or if it functions as mobile robot station, SICK offers perfectly aligned sensor solutions from a single source to help ensure safe collaboration and movement.

When what counts is maximum repeatability and precision

To enable the robots to see, sensors have to take them by the hand so to speak. Robot guidance that uses 2D or 3D image processing to locate objects plays a key role in optimizing industrial production processes.
If a robot is forced to work in an environment where the conditions do not remain constant, it cannot manage without a camera system. The robot has to be told how a component is positioned or whether its position has changed so that it can adapt to product variations. This enables it to assemble components that previously had to be put together by hand because they could not be processed by automatic placement machines (such as smartphone enclosures or electronic components for the automotive industry). And it can do this with maximum repeatability and precision. Without any need for laborious installation work, robots can take care of monotonous tasks and increase the efficiency of production processes. They can compensate for mechanical inaccuracies and can – within certain limits – cope with unknown situa-

tions while still delivering highly accurate measured values.

Not just a question of visual judgement and mechanics

The Inspector PIM60 2D camera from SICK is already a proven component for robot guidance applications. The robot uses the camera (which can be stationary or mounted directly on the robot) to detect the positions of predefined objects and can decide for itself how to grip the part. This does away with the need for mechanical attachments such as object guides. In addition, the system relieves employees of non-value creating tasks such as resorting parts on a vibrating table. The system can also be used for measurements and quality inspections, e.g., monitoring of adhesive beads. Using a pattern, optical monitoring systems compare the position, gaps in, and quality of the adhesive used in the joining process and document any errors. The camera sensor allows complete contour inspection and workpiece monitoring immediately after the adhesive is applied.
The components are adaptable, resulting in maximum flexibility. Thanks to the open platform, many robot systems are easy to reconfigure and adjust for new production tasks. If specific techniques and processes are required, they can be added with ease.

The robot detects the positions of predefined objects using the Inspector PIM60 2D camera, which can be mounted on the robot itself.

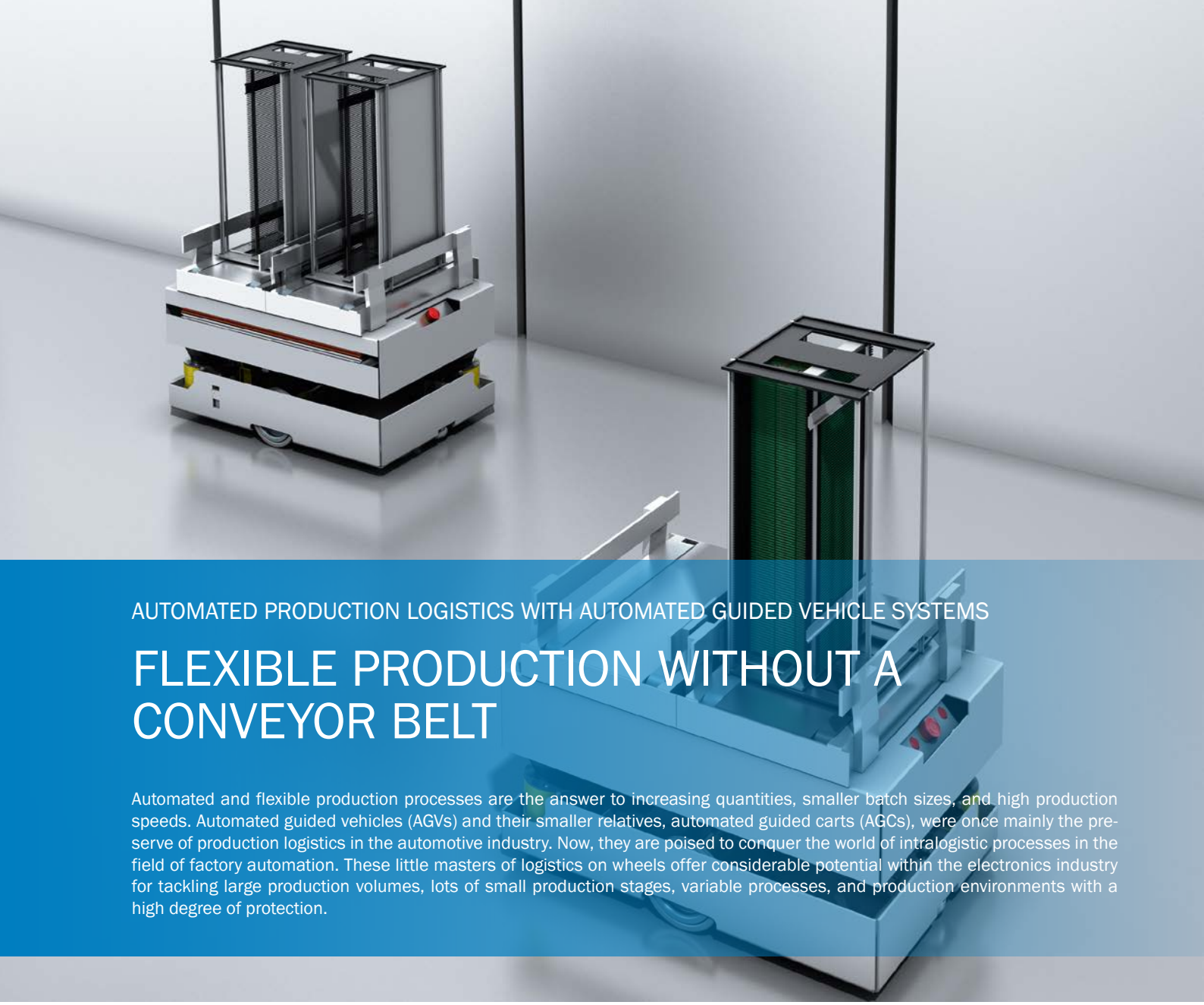
SICK AppSpace for tailor-made application solutions

The new InspectorP65x programmable 2D camera from SICK can be used in TFT display test cycles and quality tests. For instance, the operating buttons can be pressed by a robot finger to test the operating performance. And if the layout of the touch screen changes, the customer-specific app of the programmable camera can be easily adjusted to accommodate this. The InspectorP65x camera is part of the innovative SICK AppSpace eco-system, which is made up of programmable sensors, cameras, other programmable products, and a software platform. The shared development environment needed to create a wide range of SICK products provides a high level of investment security. Because the sensor apps can be reused on various programmable sensors, less development work is required. Furthermore, existing solutions can be adjusted to future tasks on site at a later date. *(as)*

Inspector PIM60 2D camera.

INDUSTRY 4.0

SICK AppSpace brings together software and hardware, and consists of two elements: the programmable SICK sensors and SICK AppStudio, a development system for applications. The flexible architecture and the programmable devices make it possible to generate data for cloud services in the context of Industry 4.0. The software sits in the sensor and can transmit information directly from it. As a result, SICK AppSpace provides users with optimum support in the areas of quality control, traceability, and predictive maintenance.



AUTOMATED PRODUCTION LOGISTICS WITH AUTOMATED GUIDED VEHICLE SYSTEMS

FLEXIBLE PRODUCTION WITHOUT A CONVEYOR BELT

Automated and flexible production processes are the answer to increasing quantities, smaller batch sizes, and high production speeds. Automated guided vehicles (AGVs) and their smaller relatives, automated guided carts (AGCs), were once mainly the preserve of production logistics in the automotive industry. Now, they are poised to conquer the world of intralogistic processes in the field of factory automation. These little masters of logistics on wheels offer considerable potential within the electronics industry for tackling large production volumes, lots of small production stages, variable processes, and production environments with a high degree of protection.

>> The automotive industry is showing how it's done: Automakers are abandoning inflexible conveyor belt systems in favor of production islands. These islands are replacing conveyor belts at factories and making production processes more flexible. By using them, companies are able to respond efficiently to a variety of production specifications. For example, they can accommodate the kinds of custom-made products that are increasingly becoming the norm. As a result, further processing can be individually tailored to workpieces and holdups at individual stations can be avoided (because the order of the production steps can be varied, for example). Automated transport systems are responsible for transferring the bodyparts between the assembly islands – a scenario that would also work well in the electronics industry.

Automated guided vehicle systems for automated production

Regardless of the industry in which it operates, any company that wishes to remain internationally competitive must increase its degree of production automation. This also applies to the electronics industry, which has a vital role to play in shaping what production looks like in the future: The technologies on which sensors and systems are based are key technologies for many future markets with a strong focus on automation. And it is in the production halls of the electronics industry that the hardware is being created for the networked processes that make flexible production possible in the first place. But it is not just sectors such as communications and entertainment that are constantly fueling demand for electronic components. As digitization continues, the electronics industry will also have to contend with growing demand from the industrial production environment as well. Another area that is generating increased demand is the smart living sector, which calls for progressive networking solutions that weave together communications, transport, and living. In order to accommodate these requirements successfully, the electronics industry must rise to the challenge of flexible production automation itself.

Wherever there are lots of small production stages with lots of variety (e.g., smartphone production), automated guided vehicle systems release companies from their dependence on conveyor belt throughput capacity and station processing rates. Automated production systems constantly record where the

products are and what state they are in when they leave the individual production islands. Seamless quality control can be ensured between the production islands thanks to the operational profile of the AGVs.

In situations where deploying workers would be difficult or harmful to health, there are even more application possibilities for AGVs. For instance, they are already being used as rugged transport vehicles in cleanrooms or solar cell/display production, as well as for transporting heavy battery packs in the battery making industry.

Nevertheless, AGVs are often too large for the electronics industry, where there tend to be lots of small production stages that are geared toward economic and spatial efficiency. These settings call for smaller solutions that are better adapted to the specific application. AGCs are a more cost-efficient form of transport but are still customizable. As a result, they are the main contender when it comes to finding a flexible method of automating production.

Sensor solutions for precise navigation

SICK has spent years helping its customers to develop production and logistics processes that are more flexible and more highly automated. The result? – Comprehensive solutions based on intelligent sensor technology and consulting capabilities that bring together mechanical engineering know-how with expertise in electronics. The company has successfully implemented a number of automated guided vehicle systems. These are already showing how an extensive range of sensor functions can be combined for the purpose of transporting products safely in all kinds of processes. SICK offers solutions for all navigation, safety, and detection tasks with its perfectly coordinated sensor products, which are all available from a single source. Code readers and RFID technology automatically detect what an AGC is carrying, laser scanners guide the vehicle, and encoders monitor the speed and direction of travel. However, the sensors are not limited to the vehicle itself. Rather, they also represent the link between the automated guided carts and the production control system.

AGCs usually still rely on a ready-made route network to travel between the production islands, which typically involves using magnetic or optical lane guidance. However, free navigation based on reflectors or even just contour detection is gaining ground – and not just among conventional AGVs, but increasingly among their smaller relatives. The ability to create travel routes with absolute flexibility using SLAM methods (Simultaneous Localization and Mapping) is already becoming a reality. This means specific requirements or a particular system can be accommodated flexibly by making the necessary changes to them. In the not too distant future, they will even be able to organize themselves. It is not just the customizable functions of the AGCs that are worth noting, but also the energy efficiency of these little racers: The “on-board electronics” only consume as much energy as is actually required so that these agile navigators do not end up spending most of their time at the charging station.

Industry 4.0 is on the way

The success of tomorrow’s smart factories will largely depend on what kinds of foundations are laid today: Intelligent and high-performance AGVs and AGCs are already helping to perform complex production processes reliably and efficiently. As precursors to Industry 4.0, they will make barriers come tumbling down in production halls across the globe and will make processes much more flexible. And to ensure they are up to the demands of this promising job, they will need cost-efficient sensor and navigation systems that are individually tailored to requirements.

COMPETENT SENSORS INSTEAD OF DRIVERS – AGVS IN BATTERY PRODUCTION

SICK has long been active in the area of AGVs and has demonstrated that its in-depth understanding of production conditions and logistical knowledge are an unbeatable combination. AGVs featuring sensor technology from SICK are used in the production of batteries, for example. Battery packs for the automotive industry consist of several individual battery modules that have to be fitted inside the vehicle in a particular way. A complete pack is too heavy to move manually. Consequently, AGVs are used to transport the packs from one loading station to the next. They then drive directly to the station where the installation process is performed. SICK ensures the safety of the AGVs by installing its S300 Mini Remote safety laser scanner in combination with the Flexi Soft safety controller, motion control module, DFS60S Pro safety encoder, and emergency stop safety command devices for the protection of humans and machines.

With its experience of successful AGV projects, comprehensive understanding of overall intralogistic and industrial processes, and extensive technical knowledge, SICK is the obvious choice for solutions that are able to meet the growing demand for AGCs. At the center of all this lie its individually tailored advice services and customer-specific complete solutions for navigation, safety, and traceability. *(hs)*

Using AGVs to produce battery packs for the automotive industry.

OPERATOR SAFETY AND PROCESS RELIABILITY IN ELECTRONICS PRODUCTION

THE SIMPLE AND SAFE WAY TO INCREASE PRODUCTIVITY – SIGNIFICANTLY HIGHER MACHINE CAPACITY UTILIZATION

Over the last few decades, we have seen increasingly sophisticated safety concepts being incorporated into production plants, and this has resulted in a dramatic fall in accident rates. At the same time, plant productivity has increased. This is a clear sign that installing the right safety solution makes a machine not only safe, but also productive – and that in some cases, the machine may even end up being more productive than if there were no safety technology at all.

>> When using a conventional two-hand control device on a manual insertion press, 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 – has been completed. 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.

Control in PSDI mode: press cycle on manual insertion presses.

Thanks to the PSDI (Presence Sensing Device Initiation) function from SICK, it is possible to control the press cycle in manual insertion presses or pneumatic presses using a safety solution 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. 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 fully completed first. 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.

Quality data management

Large consumers of entertainment and communications electronics are increasingly expecting their suppliers to provide evidence of documented quality data for the production process. Take, for example, a situation in which a hand lever press is used to press in electronic components. Up until now, there was no way of obtaining physical values for creating a digital profile in a database. Now, the missing data can be made available simply by upgrading these kinds of plants.

Semi-automated workstations

Linking automated production equipment with semi-automated assembly cells requires intelligent and flexible safety concepts. SICK safety solutions ensure the protection of operating personnel, optimize production, and reduce the machine footprint and downtime.

Using the V300 Work Station Extended safety camera system to make a handling robot safe.

Handling robots work at high speeds. In the past, it was necessary to shield personnel from these robots using tall, expensive protective enclosures to prevent injuries. With the V300 Work Station Extended safety camera system, operator safety is maintained while using smaller enclosures. This simplifies access for material loading and maintenance work considerably. Consisting of a camera and reflective tape, the V300 Work Station Extended offers various layout options for the machine design and access area. The safety camera system is the quick and easy way to achieve access protection. If changes to the assembly opening are required as part of process optimizations, the system can be adapted to the new geometry at any time.

Safety down to the smallest detail

Opto-electronic protective devices such as safety light curtains enable productivity to be increased, as there is no longer any need for doors to serve as physical guards. The miniTwin4 light curtain with its compact cross-section, cascading capability, and other intelligent functions is ideally suited to the protection of assembly stations. Miniaturized electronic products require sensor systems that are equally small. Consequently, mini light curtains are the perfect solution in such cases. There are other advantages as well. A single type of light curtain functions as both sender and receiver in a single stick (reducing the number of different variants), and features such as the built-in alignment LEDs make the product very easy to use. By combining it with safety controllers or safety switches, SICK offers complete machine safety solutions.

More productivity at every stage

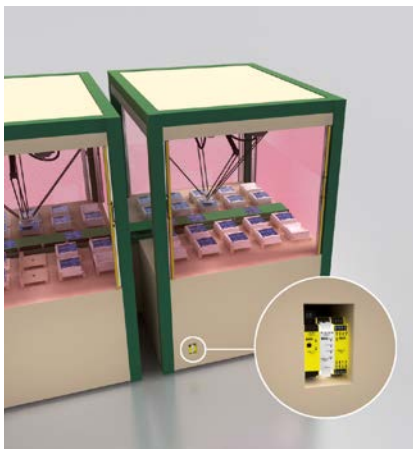
On certain types of assembly machines, operators must intervene in processes to introduce material or correct a problem. Typically, individual machines are connected together and synchronized to form an overall system. The Flexi Soft safety controller monitors everything remotely, allowing adjacent machines to continue working while still protecting the operator because the safety technology triggers any necessary stops. The safe signals from the individual machines can be connected using the Flexi Line expansion concept, and cascaded and diagnosed with the Flexi Loop safe sensor cascade.

Upgrading to the next level of automation

Safety solutions for today's machines and plants have to do more than "just" protect against accidents – because they are increasingly expected to provide added value in terms of automation technology. Extensive application knowledge, a broad-ranging product portfolio, and the right advice from the very start of the project are the key to creating new automation solutions that are tailored to the task.

Any company within the electronics production industry that has immediate plans to upgrade to the next level of automation would benefit from working with SICK. By drawing on its cross-industry application knowledge for flexible safety concepts, companies can protect their investments, processes, and workers – regardless of whether they are looking for semi-automated custom solutions or for integrated safety concepts with convenient diagnostics options. When modifying plants or replacing components, retrofit solutions from SICK can extend the service life of the plant and so often represent a cost-effective alternative to purchasing new equipment. The experienced technicians at SICK are able to integrate upgrade kits into the plant that are specifically tailored to the application – quickly and easily, and with minimum plant downtime. Relying on SICK experts to modify plants safeguards high performance and increases the efficiency of existing plants. *(as)*

Intelligent access protection for maximum productivity thanks to the miniTwin4 light curtain.



The Flexi Soft safety controller monitors everything remotely, allowing adjacent robots to continue working.

ELECTROMOBILITY AS A DRIVER OF INNOVATION

ELECTRICITY DRIVES MOBILITY

More and more vehicles are relying on electric motors instead of combustion engines and “intelligence” is increasingly being built into vehicles. Developments in the area of electromobility are having a massive impact on industry as a whole. It is not only automakers and suppliers that are calling for new production concepts and processes. They are also being demanded by machine tool manufacturers, the handling and assembly technology, and the battery making industry. Sensor intelligence is playing its part in response to this.

EXAMPLES OF THE KINDS OF CHALLENGES ASSOCIATED WITH THE GROWTH OF ELECTROMOBILITY

Multimedia, communications, intelligence

The task:
Seamless traceability for electronic parts, components, and batches

The solution:
Compatible identification solutions such as bar code scanners, image-based code readers, and RFID

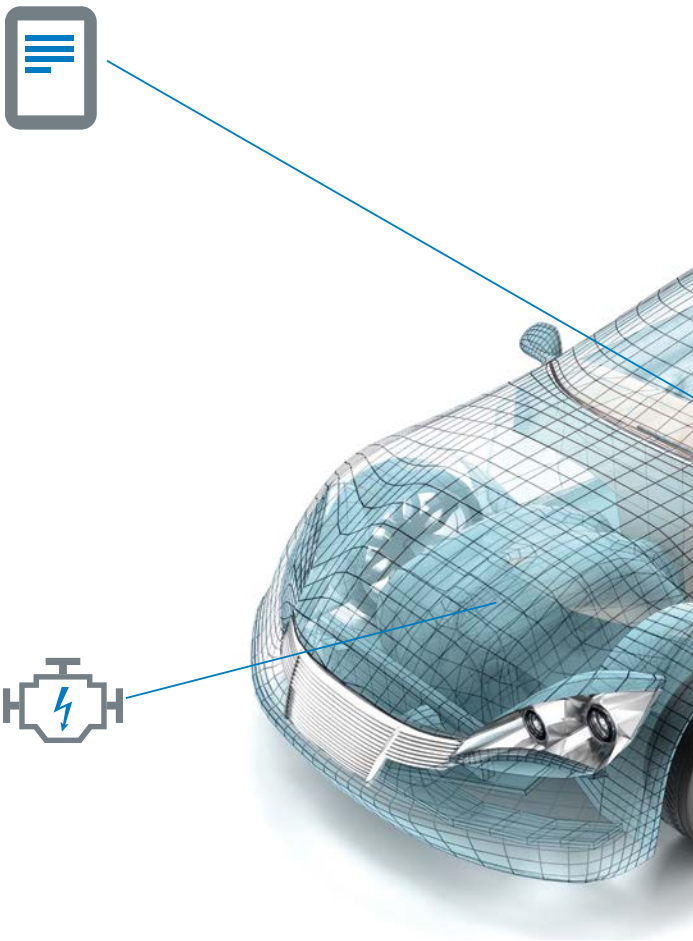
The task:
Automated and efficient quality control during the final assembly of electronic modules

The solution:
Quality control systems such as Pinspector for optimizing PCB production

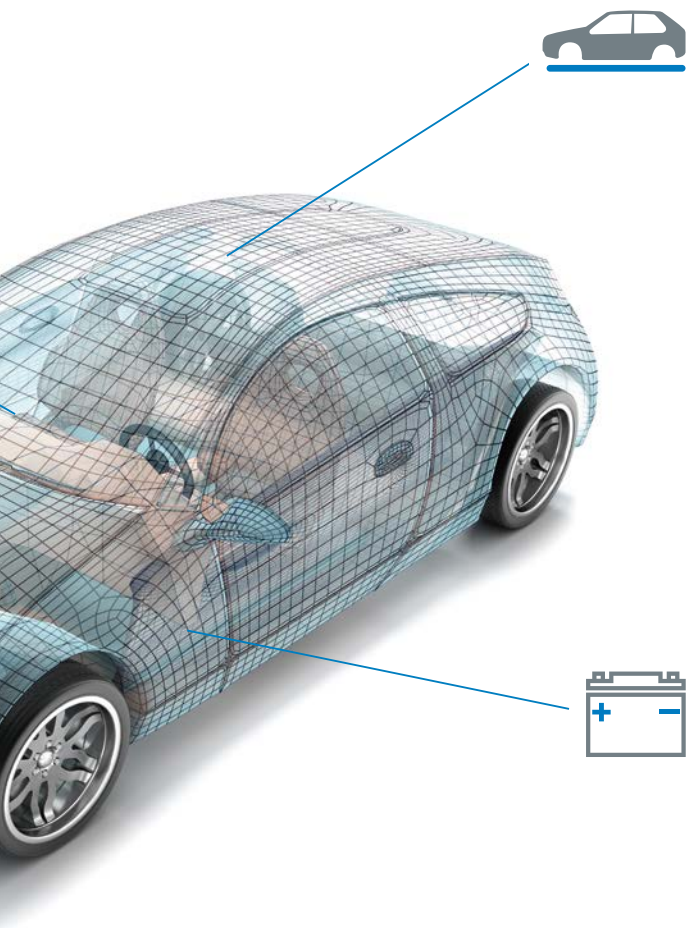
Engine production (electric and hybrid)

The task:
Safe and efficient human-robot collaboration at a robot-based handling workstation

The solution:
A safety laser scanner (such as the microScan3) combined with a safety controller



>> Alternatives to the conventional combustion engine are now available – whether in the form of a fully electric solution, a hybrid drive, or a fuel cell. The economic and ecological advantages (particularly in terms of zero local emissions) are obvious. The population growth we are seeing in megacities, the problems of climate change and a scarcity of resources, and – on top of that – changes in user habits are also revealing that the mobility solutions of the future will have to be more sustainable, more flexible, and more efficient. As a viable alternative, electromobility is proving to be a driver of innovation.



Design engineering, handling, robotics

The task:
Reliable detection of all kinds of materials (carbon, transparent materials)

The solution:
MultiTask photoelectric sensors such as PowerProx

The task:
Inline quality assurance testing of adhesive beads in CFRP body construction

The solution:
A complete solution comprising the Inspector PIM60 Bead 2D vision sensor, the illumination, and the brackets

Battery production

The task:
Automated checking of the battery module (from a straightforward presence check right through to inspection of the weld seam and contact)

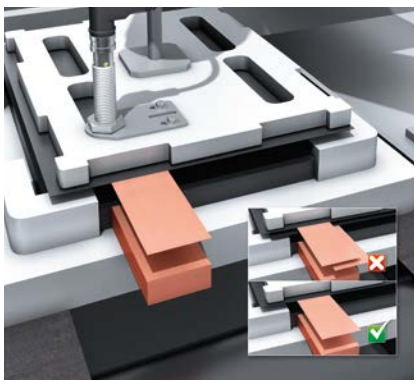
The solution:
3D vision sensors such as the TriSpector and IVC-3D

FROM CHALLENGES TO INNOVATIONS

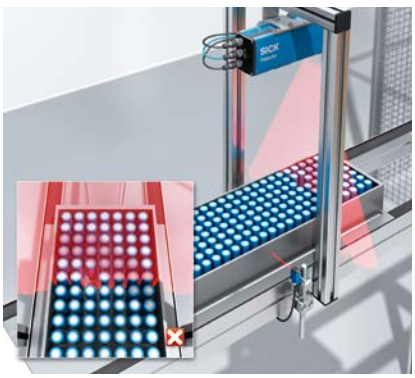
Automakers and their suppliers are having to develop new knowledge and capabilities in addition to their established areas of expertise (such as interiors, tires, or body construction). New components – such as powerful batteries, electric motors, and the corresponding power electronics – are making their way into vehicles and have to be produced and assembled using a high degree of automation. At the same time, we are seeing a rise in the number of different components per car. However, this increase in components and parts also means that they have to be reliably detected, checked, and identified in larger quantities.

Efficiency and high process quality in demand

The ability to produce high-quality parts efficiently in large quantities calls for a high degree of automation in the production process. As the significance of electromobility continues to grow, more and more is being demanded from one of the key components: the energy storage unit. Battery manufacturers have to make sure that their products meet stringent requirements concerning safety, performance, and service life. This demands the utmost reliability in production processes and imposes strict requirements on quality control. However, cost-effectiveness also has a role to play. A broad technology portfolio and the respective application knowledge are keys to implementing appropriate solutions for an efficient production process. For example, it is absolutely crucial to stack the electrode and separator sheets correctly during battery cell production. If, as a result of adhesion, several identical sheets are added at the same time, the resulting cell will be defective. A double-layer sensor can reliably detect any electrode sheets that are stuck together – thereby helping to minimize rejects. Depending on the application, vision sensors can also assist with quality control in addition to displacement measurement sensors. For instance, a straightforward check can be performed to see if the components are present within the battery module or a sophisticated 3D inspection can be carried out on weld seams or plug connectors. When combined in exactly the right way, the vision sensors, illumination, and bracket form an efficient complete solution that is easy to integrate, e.g., for the inline quality control of adhesive beads in CFRP body construction.



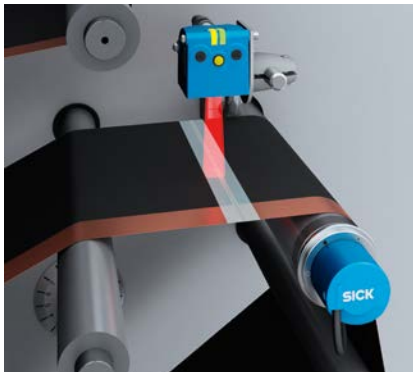
Battery cell production: The IMC12 double-layer sensor reliably detects any electrode sheets that are hanging onto one another, thereby minimizing rejects.



Battery module: As a stand-alone solution, the TriSpector1000 enables reliable 3D inspection of individual components in the battery module.

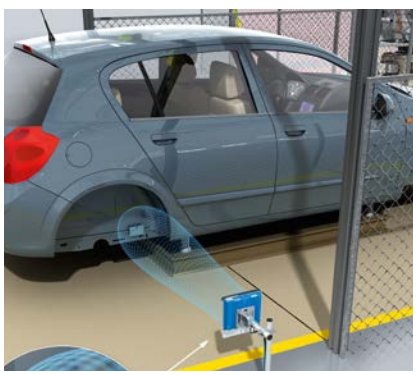
Flexible management of all kinds of components

Reliable identification of objects is a prerequisite for a smooth production flow, and forms the basis for traceability and – in turn – continuous quality improvements. The properties of the objects being detected can vary significantly. As a result, flexibility and precision are required. Miniature photoelectric sensors have an important role to play in this regard. They can reliably detect shiny jet-black objects or hard-to-detect materials such as carbon, and can communicate the resulting information.

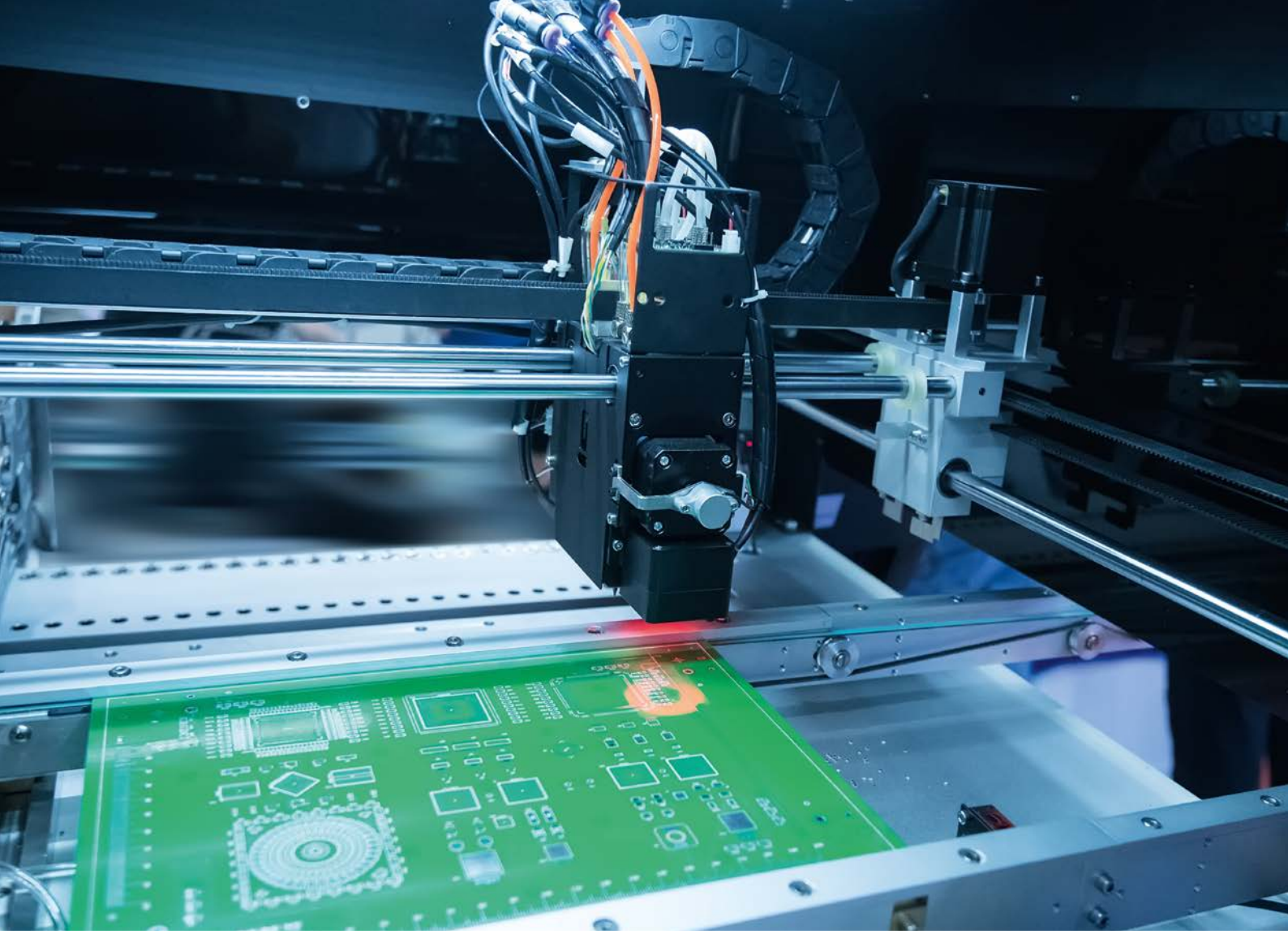


Always the right solution: Thanks to the broad technology portfolio, luminescent, colored, or partly transparent splicing tape can always be detected reliably according to the requirements.

The ability to offer exactly the right identification solution for every stage of the production cycle is absolutely essential if the traceability of products, components, and batches is to be ensured. Not only is reliable data management an absolute necessity for potential product recalls; it also opens up new potential for optimizing processes. As a result, efficient detection of production data provides a major competitive edge. To cater for these requirements, SICK offers a wide range of both permanently installed and mobile readers for bar codes, 2D codes, and RFID technology. Because connectivity, the user interface, and the accessories are all standardized, customers can switch flexibly between the various technologies – a real advantage when it comes to security of investment and sustainability. *(tm)*



Whether you need 1D, 2D, or RFID technology, SICK can offer identification solutions that are fit for the future.



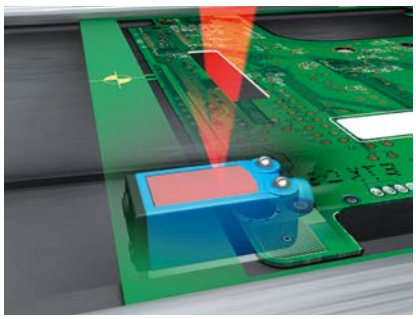
TRAVEL JOURNAL OF A PCB: EXCITING ENCOUNTERS WITH SENSOR TECHNOLOGY

Allow me to introduce myself: My name is PCB. At one time, my unsymmetrical shape with all its openings and recesses would have been unusual, but nowadays many other PCBs look just like me. One day, I will end up living and working inside an electronic device. But first I must have lots of components fitted and be inspected to make sure that everything is present and correct, and to check that I am functioning properly. To this end, I am about to embark on a voyage through the world of electronics production. It should be a very exciting trip: I have to be scanned, detected, monitored, identified, and counted – all in a non-contacting way by sensors. These are either blue or yellow, are manufactured by SICK, and are meant to be highly reliable. I cannot wait to discover what adventures lie ahead.

>> Like me, most PCBs start life as a green, six-layered circuit carrier – 1.6 mm thick and made from an electrically insulating base material and conductive copper.

Along with seven other individual circuits, I've been placed in a manufacturing panel with dimensions of around 280 x 150 mm. I have been labeled with a Data Matrix code – with cells measuring between 125 µm and 250 µm – containing a serial number, and (where applicable) the production order number, material number, change status, and manufacturing date. In addition, I am adorned with several cruciform or round fiducial marks and bad marks.

I am still sitting inside a magazine along with lots of fellow travelers, but soon I will be off on my trip, in the course of which I will be fitted with around 60 components. A magazine loader suddenly removes me and pushes me onto a transport module that takes me to my first destination: a screen printing machine that covers me in a beautiful pattern made from solder paste. I can already see a few of the devices that I am going to meet on my travels. They are blue and I can even read their type labels: WTB4-3 MultiLine and UC4. The WTB4-3 MultiLine MultiTask photoelectric sensor is the perfect choice for me because of my recesses, drilled holes, and cutouts. That is because the



First destination: WTB4-3 MultiLine MultiTask photoelectric sensor used for PCB detection.

sensor has two light beams to make sure I am always picked up by at least one of them. As a result, it can detect me with pinpoint accuracy and can keep a correct count of me and my fellow travelers throughout the entire detection period because although there are several gaps in my surface, only one switching signal is generated. However, there are other PCBs that do not look quite as strange as I do. Instead, they have a conventional quadrangular shape without any special recesses. The UC4 offers advantages when dealing with these. Not only does this small ultrasonic sensor fit beautifully into the system – it also has a very high resolution that enables it to detect ordinary PCBs reliably. It is also very clever in that its integrated time-of-flight measurement prevents interference from objects in the background or from movements by reflective machine parts. However, there are also supposed to be transfer modules or conveyor belts that can obtain the position data for me and my fellow travelers in an alternative way. For instance, I've heard people talk about rotary incremental encoders (such as the DFS60) and linear motor feedback systems from the TTK product family for positioning gantries in the x and y directions. Naturally, all designers have their own ideas about how they want us to be precisely detected – they will be delighted to discover that the SICK portfolio has everything they could possibly need. It is sometimes even possible to adjust the trackwidth of the conveyor systems to accommodate PCBs of different sizes. In such cases, inductive proximity sensors from the IQ10 product family are ideal whenever the conveyor width has to be adjusted because the special SICK ASIC ensures precise and repeatable switching behavior.

The DFS60 rotative incremental encoder transmits the position of the conveyor belt.

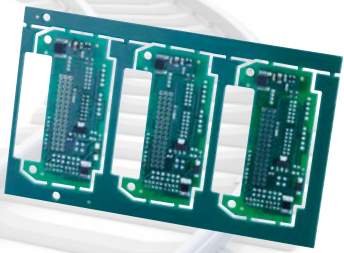
Oh look! – Over there, I can see the machine that is about to apply the solder paste print. Let's see what kind of sensors are waiting for me there.

Precise positioning

I have now arrived at the screen printing machine via conveyor belt and am finding out what it looks like on the inside. This is the place where electronic functional materials are applied to my surface in liquid or paste form. However, I have also heard that some of my fellow travelers are undergoing inkjet printing. To ensure that the solder paste print is applied with the necessary precision, I first have to be detected reliably so that the machine knows where to place the print. To take care of this, there are two vision sensors from the Inspector product family. They look for my fiducial marks and emit a signal to ensure that I am correctly aligned with the printing template before the process starts. It is getting very bright in here as the dome light of the vision sensors floods my surface with light. Well, that solder paste printing didn't take long at all. And it actually looks great. But just to make sure that the functional material has been correctly applied, I'd better let the IVC-3D programmable camera take another quick look. It is so accurate that it can detect any gap and any fault in the solder paste print. Ah, look! – The green light has come on, which means that everything is OK and I can continue with my journey as planned. The next stop on the itinerary is the main station, by which I mean the component placement machine.

The camera code reader acts as a ticket inspector

Next stop "component placement machine" – that's what it says here. Now that the print has been correctly applied to me I can finally be populated with electronic components. I am also keen to find out whether the MES system has forwarded the details of where I have already been (i.e., the process data that the system has been collecting about me the whole time) to the automatic placement machine. That's because the machine needs to know whether everything is OK and which SMDs should be mounted now. Actually, the people who intend to put us PCBs to work inside their devices and machines will also be very interested in our journey further down the line. Within this context, I've often heard people using terms such as "traceability." And now I also know why a tiny mark was placed directly on my surface right at the start. I always suspected that this Data Matrix code would have to be read somehow. But how on earth is that supposed to happen given that the code modules are almost microscopic, my surface has some rather tricky properties, and that (in my opinion) the contrast is so weak? Ah, I can already see the answer to that question up ahead. The blue sensor labeled "Lector620" is an image-based code reader. Thanks to its intelligent decoding algorithms, this offers extraordinarily high reading performance. In any case, it certainly manages to read my code and the codes of the other PCBs very quickly and reliably. As a result, there are no unnecessary delays or – even



worse – cancellations inside the automatic placement machine. The compact sensor can even be installed in confined spaces. And, thanks to the intuitive setup process with the aiming laser, it can be easily integrated and operated with minimal training and installation effort. In cases where the contrast poses major difficulties, the Lector620 can be provided with external illumination. The auto-setup function minimizes installation effort and the versatile on-board interfaces mean that the code reader is perfectly at home in all the networks that are typical of the electronics production industry.

However, I am not just identified inside the automatic placement machine; I am also detected. And because things are so tight in here, the machine designers have come up with something really special to help me on my journey: To detect me, they are using WLL180T fiber-optic sensors in conjunction with LL3 fibers. The optical heads take up barely any space at all – and the sensor is not affected by challenging ambient influences, such as placement head reflections. What's more, the fiber-optic sensors adapt their transmitting power to suit the trackwidth of the conveyor belt, which varies according to the panel size. Cleverly integrated into the side panels of the transfer module and with their master/slave configuration, they also reduce cabling dramatically.

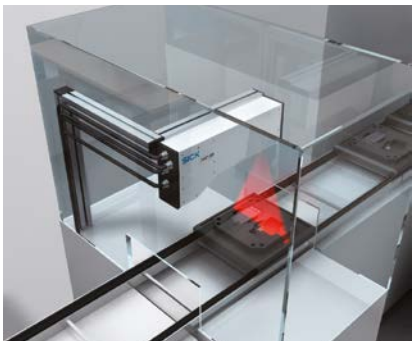
Identification: Who goes there?

Occasionally, I peek over the edge of my printed circuit board and whenever I do I see people hurrying around and working at various machines. Who is it that protects them from danger when, for example, they reach inside a machine inadvertently or have to intervene to deal with a fault? Oh I see, there are some safety doors and transparent covers to keep them safe – and lots of yellow switches. Shouldn't they be blue if they are from SICK? They are safety sensors – and they are yellow. Now I can also read what is written on them: i14 Lock. Those are the electro-mechanical safety switches (also known as "safety locking devices") that keep the flap locked so that no one can open it unchecked. And when I look more carefully, I can see that they are virtually everywhere – even on the transfer equipment that links the various placement stations. And yet, I can hardly see any cabling – and that's probably because the switches are somehow all interconnected. "Well spotted," yells the PCB in front of me, "SICK offers a Flexi Soft safety controller that allows up to 32 of these safety switches or other safety sensors to be cascaded safely with the help of the Flexi Loop integration module – up to performance level PL e according to DIN EN ISO 13849-1." Of course, a safe cascade like this is bound to result in massive cable savings. But it gets even better than that: Because a Flexi Loop line monitors each sensor individually, the "masked" consequential errors that sometimes occur with conventional series connections are completely eliminated. Another clever feature of the solution is that Flexi Loop provides comprehensive diagnostic information during actual operation. This keeps the automatic placement machines "in the loop" and means that no PCB is abandoned in the transfer modules.

Device assembly: This is where my journey ends

I have changed a lot since I started my journey. Before embarking on my trip, I had to be checked by OD Mini displacement measurement sensors to make sure I was strong and flat enough. And then I went from being a bare circuit carrier to a perfectly populated PCB. At least that is what the programmable cameras from the IVC-3D product family are saying as they check me one last time to make sure that the placing is fully completed.

Now I am ready to be integrated into an electronic device. The assembly machines responsible for that process are also equipped with sensor technology from SICK. On manually operated semi-automatic machines, miniTwin safety light curtains provide user-friendly and barrier-free monitoring solutions – which are even available in L- or U-shaped versions. V300 safety camera systems are often used as well, e.g., for flexible protective field geometries or to accommodate special installation requirements.



Everything in place? Final inspection with the 3D camera.

Now that I have been installed in an electronic device my journey through the world of sensors for electronics production has come to an end. Once I have been neatly packed, I will be sent to the end customer. *(as)*

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