more@ TURCK

Efficient and Safe

EAE Solutions optimizes intralogistics solutions with flexibly configurable block I/O and safety modules for the myriad of sensor and actuator signals

Track and Trace: Knowing Where

RFID makes production and logistics processes highly transparent, from incoming goods to production and warehousing right through to shipping

IIoT on Construction Sites

Users of Hüdig's dewatering solutions can now access device status information at any time via Turck's TX700 HMI controller and clouds

»Innovation Accelerator«

A pandemic, a shortage in raw materials, massive disruptions in lobal supply chains, and last but not least a war in Europe – what we have had to go through in the last two years we would previously never have thought possible. But despite all the negative news, we have grown from the challenges: digitalization and remote work have changed our working world permanently, and we are making up for missing materials and delivery problems as best we can with innovative ideas. In this respect, crises are accelerating our ability to innovate, so that together we are becoming ever more efficient.

A look at the news section on the next pages of this issue of your customer magazine illustrates the innovations that Turck has launched on the market in recent months. Starting on page 20, you will learn in six application stories why customers chose Turck and how we were able to meet their requirements. For example, we have developed flexibly configurable block I/O and safety modules for the system solution provider EAE Solutions, which can be used to efficiently transmit the large number of sensor and actuator signals in EAE›s intralogistics solutions. Krups Automation relies on our robust IP67 controllers for its conveyor modules, which provide

decentralized control of each module, communicating to the periphery via CAN and to the plant control via Profinet or Ethernet/IP. We were able to implement another intralogistics solution at KEB Automation. The specialist for drive and control technology has upgraded its assistance system for C-parts management with WLS15 strip lights to create an error-proof pick-to-light system.

The fact that IIoT can also play a role on construction sites is demonstrated by the Hüdig company with its dewatering systems: via the Turck Cloud, users now have access to the current device status of each pump. We also use the cloud ourselves, for the climatic monitoring of solder paste storage in SMT electronics production at our Beierfeld site. Last but not least, we have taken a look at China: in the stainless steel-dominated production environment of a food manufacturer, Turck implemented an RFID-based track and trace solution that today enables traceability across all process steps.

We have put together an exciting topic page for you on the subject of track and trace. At www.turck.com/tat together with our RFID turnkey partner Turck Vilant Systems, we will show you how seamless identification with RFID can provide you with decision-relevant information in real time, giving you the transparency you need for lean processes and supply chains – from incoming goods to production to warehouse and shipping.

We are delighted to finally be able to talk to you in person again about smart automation solutions and innovations for production and logistics, and to present these directly live – at one of the automation trade fairs that can now take place again.

Yours sincerely

Christian Wolf, Managing Director

Content

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Compact 4-I/O Module for Intralogistics

Specifically designed for use in applications with a low I/O requirement, such as in logistics applications, is Turck's TBEN-S1-4DXP Ethernet I/O module. The compact block module provides four channels that can be used flexibly as inputs or outputs, and in the design of the TBEN-S, which comes as standard with eight channels. With a temperature range from -40 to 70 °C and protection to IP65/IP67/IP69K, the new I/O module has a wide range of uses.

Factor 1 Sensor for Logistics Applications

With the inductive proximity switch NI40UE-QV40, Turck is expanding the proven uprox sensor series. This rectangular Efficiency Line variant has been optimized with a focus on flexibility, short commissioning times and price-sensitive applications in logistics and material handling tasks. The Factor 1 sensor also detects smaller metal targets very well when approached from the side, as is common in target applications. The sensor is magnetic field resistant up to 300 mT and meets the protection type IP68. With these characteristic values and a temperature resistance of -30 to +85 °C, it meets the most demanding requirements with regard to availability and operational reliability.

IP67 Power Supply Units with IO-Link for Field Installation

Turck is adding compact power supply units with protection to IP67 to its portfolio of flexible power supply units for 1- and 3-phase applications in modular machine building. The robust PSU67 power supply units operate in temperatures from -25 to 70 °C and can be installed directly at the machine without any protective measures needed. This makes it possible to dispense with switch cabinets or switch boxes completely. The PSU67 power supply units are available with 15, 20 or 25 A as well as with M12, 7/8" or HAN-Q4 terminals. The decentralized power supply units supply 24 to 28 VDC directly in the field without any loss and offer high fail safety thanks to its electronic no load, overload and short circuit protection. Its high efficiency of over 95% ensures an optimum energy balance. The output voltage can be configured directly on the device via an LED interface or remotely via IO-Link.

Fast Strain Gauge Transducer for Hazardous Areas

New in Turck's interface portfolio is a fast strain gauge transducer for force measurement applications in hazardous areas. The IMX12-SG has a repeater function and can be used for signal conversion when the resistance changes on strain gauge bridges. A unique selling point on the market – as well a response time of less than 10 ms, combined with a flexible output circuit configurable with DIP switches and galvanic isolation in a slimline 12.5 mm housing. With its slimline design, the IMX12-SG is ideal for applications with limited space available. Turck's IMX12-SG provides galvanic isolation between the hazardous and safe areas.
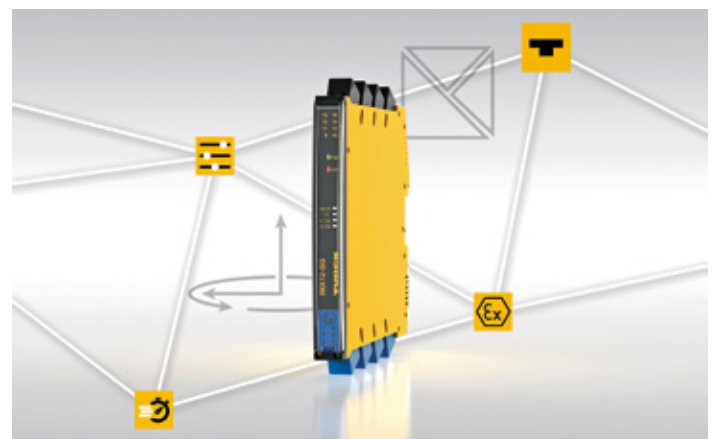
Decentralized I/O Solutions for the Ex Area

The IP67 block I/O modules for the TBEN-S and TBEN-L versions are now approved for use in Zone 2. Turck is thus the first supplier to enable cabinet-free decentralized automation solutions with ATEX and IEC Ex approval, and thus considerably reduce the required mechanical labor, wiring and also commissioning times. In conjunction with the devices of the IP67-rated IMC interface series, it is even possible to implement the cabinet-free connection of intrinsically safe signals from Zone 0 or 1. Users can also implement cabinet-free safety, RFID, IO-Link, controller or cloud solutions directly in Zone 2 since virtually the entire Turck IIoT eco system is offered in these designs. Users must only install the TBSG-L, TBSG-S or IMC-SG protective housings when implementing the I/O solutions in Zone 2.

IIoT Functions for excom Ethernet I/O System

The FW 1.6.0 firmware update for Turck's GEN-3G and GEN-N Ethernet gateways for the excom I/O system improves the IIoT capabilities and simplifies system maintenance as well as commissioning. HCiR (Hot Configuration in Run) now also allows device replacement, expansions or maintenance during operation in hazardous areas and high-availability applications. Changing configurations during operation is possible with Ethernet/IP (CIP) or Modbus TCP. Turck's new firmware also simplifies the handling of the system via the gateway's integrated web server.

Smart Radar Sensors for Rugged Environments

Ideal for harsh applications in factory automation as well as for outdoor or mobile applications are the DR radar sensors for distance measurement up to 15 meters. The rugged 122 GHz devices with protection to IP67/69K are shock resistant up to 100 g and are therefore suitable for distance measurement in application areas such as in port logistics, in which optical or ultrasonic sensors are unsuitable due to their limited range or disturbance factors such as dust, wind or light. The browser-based Turck Radar Monitor parameter user interface simplifies the setup of the DR sensors by means of the real-time display of the signal curve – especially when setting filters to suppress interfering signals or in complicated mounting situations. If several devices are mounted next to each other, the FMCW measuring principle prevents any mutual interference between the signals.

Capacitive Sensors

Turck is presenting new capacitive sensors in the M8 and M12 metal housing for flush or non-flush mounting. The robust IO-Link devices with protection to IP67 are compact and offer versatile use, particularly for detecting objects in production, logistics or pharmaceutical applications. Their dynamic teach function simplifies setup during the ongoing process. The sensors can thus detect the extreme values of passing objects on convey- or lines and independently determine the ideal switch point. An integrated counter function enables the implementation of autonomous counting applications without the need for a PLC.

EtherCAT Block I/O with Eight IO-Link Masters

With the TBEC-LL-8IOL EtherCAT IO-Link master in IP67/69K, Turck is enabling its entire IO-Link portfolio for EtherCAT-based applications. The block I/O module in the robust TBEN-L housing offers eight IO-Link master ports, with four Class A and four Class B ports enabling flexible configurations. Full galvanic insulation between the power supplies makes it possible to implement safety disconnections. Actuators such as IO-Link valve blocks, robot grippers or motors can be powered with up to 4 amperes. The power supply is implemented with future-proof M12-L coded connectors.

New IP67 Switches
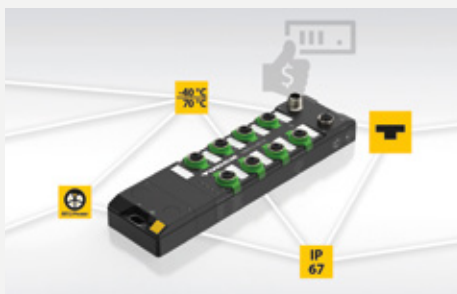
Three IP67 switches expand Turck's portfolio – two unmanaged variants and one managed switch. The two TBEN-Lx-SE-U1 feature eight 100 Mbit ports for the efficient networking of cells that don't require managed functions. Short commissioning times are guaranteed since no configuration is required and the power supply is easily implemented with M12 or 7/8 inch connectors. The new managed IP67 switch TBEN-LL-SE-M2 comes with an M12 L-coded power supply. The device offers eight 100Mbit ports and two Gigabit backbone ports.

Inductive Measuring Sensors with IO-Link

Besides offering flush inductive measuring sensors with an IO-Link output, Turck is now also offering three non-flush variants. The NI4-M12, NI7-M18 and NI12-M30 models supply a signal proportional to distance over a 12 millimeter range as an IO-Link process value (2 bytes) or as a voltage signal from 0…10 volts. Their measuring range can be adjusted flexibly so that the entire signal range can be used even within a small measuring window. The sensors set new standards with temperature deviation compensation and a perfectly linearized output signal.

Shock-Resistant Linear Position Sensors with IO-Link

Turck has further developed its Li-Q25 inductive positioning systems and equipped the contactless linear position sensors with IO-Link. COM3 of the new Li-Q25L enables it to support the latest and fastest IO-Link interface. Its inductive measuring principle outperforms alternative systems, particularly in terms of shock resistance and sampling rates. Thanks to the contactless coupling between positioning element and linear position sensor, the device outputs a reliable position signal even with vibrations or shocks of up to 200 g. The sampling rate of 5 kHz reduces position error to a minimum – constant over the entire measuring length. A 16-bit converter also guarantees highly accurate measuring results. With measurements of up to 2,000 mm, the devices particularly outperform magnetostrictive linear position sensors.

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Knowing Where

RFID makes production and logistics processes highly transparent, from incoming goods to production and warehousing right through to shipping – an ideal solution also for the efficient management of returnable transport items (RTIs)

With UHF readers and displays on forklifts, there are no more blind spots even when transporting multiple containers in production or in the warehouse

Complex structures as well as considerable cost pressure present companies in the manufacturing industry and logistics with the same challenge: rapid decision making based on real-time information is becoming increasingly more important in order to stay competitive.

Today, RFID systems are the means of choice to generate decision-critical information. They bridge the gap between the physical world of production (operational technology, OT) and IT-based MES and ERP systems. By linking objects with the data of the IT systems, RFID systems generate the necessary transparency for lean processes and digitalized supply chains. The aggregated information, such as times, locations, users, or processes completed, allow smart functions such as automated production and ordering processes, the identification of error sources or the accurate forecasting of potential bottlenecks. RFID information enables your systems and decision-makers to make the right choices.

Transparency from incoming goods to shipping
RFID based information provides countless processes in production and logistics with transparency, from the incoming goods department to production and warehouse, right through to shipping. The returnable transport items (RTI) such as pallets, grid boxes, plastic boxes or metal tubs play a major role here. Returnable transport items are a key factor for ensuring the quality of production processes.

RFID-based container management ensures that returnable transport items are always present at the right location, in the correct quantity and quality, and at the right time. The costs for an RFID system are therefore paid back very quickly thanks to the enormous savings achieved since no missing contain-

ers need to be procured at short notice and made available at the place of use.

Benefits compared to barcodes
RFID offers key benefits for RTI identification compared to comparable technologies, and compared to barcodes in particular. There are thus hardly any restrictions in the use of RFID-based systems, since a suitable RFID tag is available for virtually every situation and environmental condition. Moreover, the reading of large quantities can be automated easily in an RFID-based system without any tedious and error-prone manual steps.

To ensure a smooth running RFID-based container management system, special management tools make
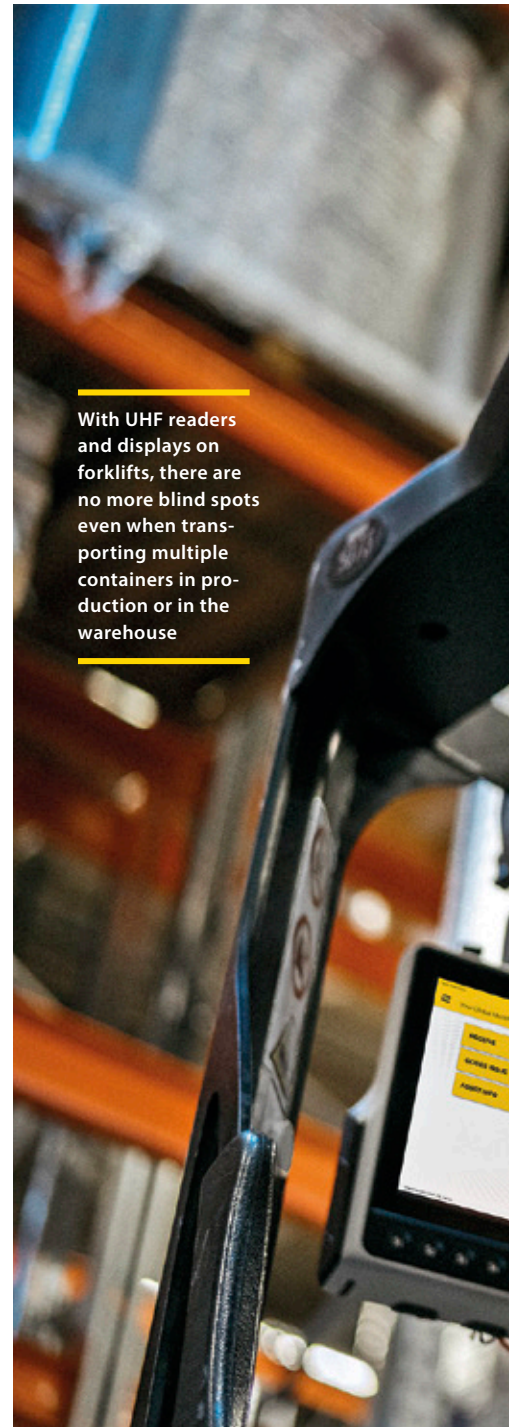
it possible to display all RTI information on a single platform. This therefore bridges the gap between the physical world of production and IT-based MES and ERP systems. By linking objects with the data of the IT systems, RFID systems generate the necessary transparency for lean processes and digitalized supply chains. This information enables both the systems and the decision makers to draw informed conclusions, thus enabling greater efficiency in RTI management and a high level of adaptability in response to seemingly unforeseeable events in the RTI circulation.

Efficient container management saves costs
It goes without saying that reusable containers must not be treated like disposable items. Only efficient pool

QUICK READ

Returnable transport items, such as pallets, grid boxes or plastic boxes are the pack horses of many production and logistics chains. However, logistics systems are not transparent if the movements and positions of RTIs are not continuously recorded. This results in excessive costs due to the buildup of spares and buffer stocks as well as expensive shipping. The use of RFID technology ensures the efficient management of an RTI pool over the entire process chain of production. An end-to-end tracking concept improves transparency and control in load carrier management and thus creates added value in production logistics, which increases pool transparency and minimizes shrinkage and loss.

RFID handheld readers are ideal for reading tags on the move and in processes that cannot be easily automated with conveyor belt, gate or forklift readers

The forklifts equipped with RFID readers allow reliable and fast identification of pallets and containers

management can turn RTIs into a powerful instrument for the creation of sustainable supply chains. Shrinkage, damage or inefficient management often lead to the necessary procurement of additional RTIs in order to prevent bottlenecks and downtimes, so that the actual total stock exceeds the optimum quantity. It is often the case that nobody knows how many RTIs are in use in the entire process chain.

It is therefore particularly important to keep the number of RTIs in circulation as low as possible in order to tie up as little capital as possible. However, a sufficient number must be kept available at the same time in order to avoid breakdowns in the supply chain. The worst case would be the standstill of the just-in-sequence or just-in-time line because of the absence or lack of reusable containers where they are required.

Tracking on the RTI
An investment as large and constantly moving as reusable containers should therefore be efficiently controlled to match supply and demand. Seamless tracking requires the unique identification of each container as well as real-time communication with all participants within the circuit.

For this, it may be useful to capture several containers at the same time. If a pallet contains several containers with RFID tags, for example, multitag reading is required, i.e. the simultaneous reading of several RFID tags. This is usually done via RFID gates, which are equipped with multiple antennas and thus

reliably detect the tags without requiring direct visual contact.

Selecting the right type of reusable container is also an important task. Container sizes range from shoe boxes to pallets for larger goods. They should be reliable, sustainable and durable. However, each industry also has its own requirements for reusable containers, and so the range of variants is very large. To ensure seamless reusable container tracking, all container types must be detectable using RFID. It is therefore important that the RFID tags used can be read consistently and reliably on all base surfaces – for example, on plastic, metal and ESD (electrostatic discharge) materials, as well as on folded reusable containers.

The choice of the appropriate RFID tag is fundamental to the architecture of an RFID solution and depends on the application. If the tags selected are unsuitable for the application, not sufficiently robust or powerful, the read rate of the RFID system will be too low and the entire system may fail. The technical requirements and demands of the process in question must therefore be understood in as much detail as possible.

Turnkey RFID solutions
Besides the RFID tags that can be attached to or embedded in the RTI to be identified, a turnkey RFID solution typically consists of the RFID reader points and their antennas, RFID server applications for data analysis, system monitoring and maintenance, includ-


WHITEPAPER: MANAGING RTIS IN REAL-TIME

The white paper details how enormous potential savings can be achieved by using radio frequency identification (RFID) technology to manage RTI pools. It also discusses the various identification technologies that can be used to uniquely assign RTIs – and which ones are best suited for specific application scenarios.

Barcodes are a relatively inexpensive identification technology, but they are more difficult to automate – especially if several containers are to be read simultaneously
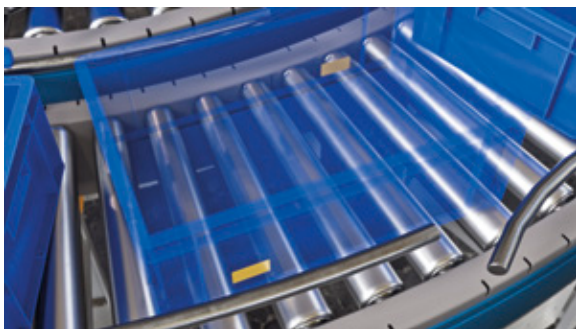
RFID tags stuck diagonally on opposite sides ensure that at least one tag is within range of a reader, resulting in consistently optimal reading results

The RFID readers are designed to read multiple RFID tags simultaneously, for example, a pallet of RTIs moves through a gate

ing an integration layer to support the most common business systems such as ERP and WMS, integration with the customer's back-end system, and an implementation plan.

Turck can cover the complete range for turnkey RFID solutions through its subsidiary Turck Vilant Systems TVS. TVS has been designing and implementing turnkey RFID system solutions including its own middleware and ERP integration for intralogistics, asset tracking and inventory management for 20 years. Coupled with Turck's many years of experience with RFID for production control, both companies offer complete solutions, which cover the entire supply and production chain – from the supplier to production right through to shipping.

Five phases to success
An RFID project with Turck Vilant Systems is divided into five phases. The first phase of the project is about developing an understanding of the customer's needs and familiarizing the customer with RFID. The starting point for customer engagement is the site survey to obtain an expert analysis of the customer's plans and processes. Based on the site survey, the expert prepares a proposal on how RFID technology can be deployed and where the ROI might be. These services are free of charge for the customer.

In the second phase, specific RFID feasibility studies will then be conducted. For customers with no experience with RFID, this starts with a proof of concept. This means that RFID equipment is tested at the customer's

site to ensure that tags, readers or applications will work in the intended application.

In the third phase, everything is prepared for the rollout in a pilot project. Before it is put into operation across the board, the RFID system is tested on a production line or plant. The customer's use of the system can help uncover sources of error that may not have been previously considered.

Rollout and commissioning take place in the fourth phase. The customer installs the RFID readers, with a Turck Vilant Systems technician on site to set up the software and make sure everything works correctly. All processes are tested live and customer employees are trained, optionally in English, French, German, Swedish or Finnish.

The fifth phase is started once the system is ready for operation – the support. Continuous system operation must be guaranteed, around the clock – even during holiday periods. Turck Vilant Systems meets this customer expectation and provides worldwide service and support 24 hours a day, seven days a week.

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Webcode | more12200e

Industry 4.0, The Next Level

Where is the automation industry heading? Wolfgang Kräußlich, chief editor of SPS-Magazin, spoke about this and other topics – from sustainability, Industry 4.0 and the cloud, right through to smart sensors – with Managing Director Christian Wolf, Olaf Ophoff, Director Automation Systems Business Unit, and Oliver Marks, Director Automation Products Business Unit.

Sustainability is currently an important topic: energy efficiency, resource efficiency, the EU Green Deal. To what extent does this affect Turck?
Wolf: As a family business, sustainability has always been an issue for us and is part of our DNA. For a steel producer, however, decarbonization is a formidable challenge. When I look at our own plants, we are already a relatively low-emission company. But we are nevertheless not yet CO2 neutral. Our goal is to achieve CO2 neutrality within the next ten years at the latest. These are certainly also investments, and we are in a competitive environment. The

> »As a family business, sustainability has always been an issue for us and is part of our DNA. We automation engineers are innovators and thus essential pacemakers of progress.«

Christian Wolf | Managing Director

Green Deal should of course therefore be rolled out globally in the end so that it does not become a one-sided burden for our industry compared to competitive markets in North America and China, for example. And the timeline must also remain realistic. Unrealistic goals don't help anyone because they are frustrating and thus also end up thwarting the efforts of companies to become sustainable.

Change, after all, also offers opportunities. What role does the automation industry, and a company like Turck, play when it comes to the Green Deal?
Wolf: You often hear that it's about saving the world. That's a major goal, but if people manage to become CO2-neutral, it won't be because we get catapulted back to the Stone Age, but because industry and automation experts manage to develop new technologies that make it feasible. We automation engineers are innovators and thus essential pacemakers of this progress.

Ophoff: A lot is already being done today: with today's data communication technologies and also in future 5G as the central nervous system for the smart factory, and with cloud services and intelligent components, we can already offer remote services today. Where a service technician previously had to fly halfway round the world, digitalization and automation now offer significant savings potential. And not just financially, but also in terms of conserving resources. Condition monitoring and preventive maintenance are for industry what home office and video conferencing were for office work. This constitutes a major reduction in CO2, and automation is the enabler of this sustainability.

Does Turck have any special green products in its portfolio for this?
Ophoff: Our solutions, sensors, I/Os, gateways, controllers, are generally very compact and require very little energy. But they help to build machines and plants that are

more resource-saving, reduce energy consumption, water consumption and raw material consumption. Think of the woodworking machine as a simple example where an extractor fan runs continuously during the shift. Automation technology makes it possible to identify if someone is standing in front of the machine, and if the machine is not used for several minutes, the fan is also automatically shut down. In the future, entire machine modules will be aligned to demand and thus become more efficient.

Marks: These kinds of ideas hardly played a role in the past, the main thing was more output, faster cycle times, better product, higher quality. This is changing, and we're also noticing it. Energy measurement modules, for example, are becoming increasingly important for us, flow measurement in the field of air, compressed air, energy efficiency in general. Also by the way, in building automation.

Does this mean that Industry 4.0 as a trend is over?

Ophoff: I believe that Industry 4.0 is not over at all. Perhaps the term is a bit worn out because it has so far been overused. It's just a buzzword for which everyone had a different understanding at the beginning. We are now in the implementation phase, in the actual application. Technologies are now being used that were discussed from the beginning, such as RFID. And again, this goes hand in hand with the issue of sustainability: The workpiece not only controls the factory and logistics to produce more efficiently. With RFID, I can track where this product came from and the previous history of the product. I can determine its ecological footprint.

Marks: We have seen in the discussions of recent years that Industry 4.0 or IIoT are indeed a reality. The topic of sensor to cloud and back, the connectivity of sensors, is also being actively discussed today. Sensors produce a lot of data and we want to extract the right essential information from it. This is done via cloud services. We already have many cloud customers today.

Just a few years ago, it was inconceivable that we would sell a pure software product.

How did you come up with the idea of offering cloud services in the first place?

Wolf: Many companies are currently in the process of turning digitalization initiatives into real projects. We started with our own cloud service because we want to understand how a cloud service works and because we want to discuss concrete and economically viable projects with customers. It's about understanding connectivity, but also the business model behind it, and I can't learn that from a few PowerPoint slides. For many customers, such as medium-sized machine builders, the Turck cloud solution is also more attractive than outsourcing their data to an American or Chinese cloud provider. This approach to real projects in order to evaluate them economically and generate added value is exactly what is happening now. And that was different three or four years ago.

Marks: Yes, many companies have seen at the trade shows what is technically possible and now they are considering the eco-

nomic feasibility, looking for the business case. We are focusing on decentralized intelligence in the sensor-to-cloud area because we have IP67 in our DNA. We have smart sensors that can actually deliver data all the way to the cloud. We also see a merging of the IT world and automation in the fact that the data from a smart sensor very rarely ends up in a controller, but almost always in the ERP system, especially when it comes to logistical processes.

Do the old buzzwords of Industry 4.0 still have any validity? Modularity, decentralization, batch size 1?

Ophoff: Absolutely, this is truer than ever. Companies want to produce more flexibly and above all they want to prevent unplanned downtime. There is another aspect to this: The business model of machine builders has been changing for some time, and it will change even faster in the future. In certain industries, it is no longer the case that the machine is built and sold once to the operator, but rather it is distributed ion the basis of a pay-per-use system. When a special machine builder hands over his machine to the customer on

»We support the trend towards modular mechanical engineering. But that means I have to map the intelligence in the machine module.«

Olaf Ophoff | Vice President Business Unit Automation Systems

»But it's no use if the sensors are intelligent, but on the other hand also extremely complex to operate. We offer solutions here to simplify this.«

Oliver Marks | Vice President Business Unit Automation Products

a leasing model, he has a great interest in ensuring that it runs very reliably during this time. The benefit of a cloud solution is on the one hand that you can use it to do all the billing, and on the other hand, you are so close to the machine that you know when a service is necessary, for example, and thus always maintain the availability of the machine. This combination brings benefits to the customer in the end.

What do these changes mean specifically for Turck's product portfolio?
Ophoff: We support the trend towards modular mechanical engineering. A large plant, for example in paper production, used to have one control room with seven control cabinets next to it. Those days are long gone. Modular machine building means smaller and smaller elements that can also operate autonomously as machine parts in the customer's plant. Similar approaches can also be found in the automotive industry. But this means I have to map the intelligence in the machine module. This in turn also requires IP67 technology, because that's the only way to make it efficient. That's where Turck comes in. We have an IP67 strategy, we have products that allow

machine modules to be designed so intelligently that they can be flexibly assembled on site, without complex control cabinet solutions.

Marks: Ultimately, this is also reflected in the smart sensors. When you think about how powerful the devices are today, it is initially very impressive. But it's no use if the sensors are intelligent, but on the other hand also extremely complex to operate. We offer solutions here to simplify this. For example, the multiplexing of radar or ultrasonic sensors: Since ten sensors next to each other could not actually work at all because they would mutually interact with each other, we offer the option for the sensors to multiplex themselves by having one operate as the master and the others to be controlled by it. This also relieves the workload on the PLC and the remote sensors can even perform a level or volume recalculation, even if the tank is conical.

How smart are your products still getting?
Marks: Today, you can pack an incredible amount into the size of a smartphone. If I take the battery out of the equation, I can also integrate quite a lot into an M12

module if I want to. Unlike the smartphone, however, no one pays 1000 euros for an inductive sensor. So the question is what the application requires. We are helped by the consumer industry in that computing power is becoming cheaper, but unlike the consumer sector, we only need micro quantities. Simple usability is more important than pure computing power. We must not get caught up in functionality in the sense of features that basically no one understands anymore, but rather we must consider what the real problems of the user are and how to solve them with our products? That's why, for example, we place great importance on simple and consistent operation with our new Fluid+ sensor platform. The user is given a uniform look and feel across all senso r types in this fluid sensor family. The smart features, such as the multiplexing or pre-processing of data in the sensor mentioned earlier are then the special features.

Modular Means Fast

How machine builders and integrators in the pharmaceutical and biotech industries can shorten time to market with multiprotocol Ethernet

Modularization is a big issue in the biotech and pharma industries; standardized signal transmission and control of the plant modules can significantly shorten the duration of engineering, manufacturing and commissioning

Not only since the Corona pandemic have companies in the pharmaceutical and biopharmaceutical industry been faced with the challenge of developing, approving and producing active ingredients on a large scale as quickly as possible. Speed is required because patent protection for drugs expires after 20 years. However, only some of the time remaining after patenting is available to generate income from patented products, since it usually takes many years from the granting of the patent to the marketable product. Products therefore have to be available on the market as soon as possible after a drug is approved. The entire process from development to the saleable product in the pharmacy usually takes around twelve years. Companies must begin building production capacity before

final approval for a drug has been granted. If approval is not granted, the company is left with the production facilities and has to retrofit them again at a cost of many millions of euros.

Much more common, however, is the situation in which approval has already been granted but the plant is unable to start production immediately due to delays in setting up the production line. The drug then goes into what is called overtime. A situation that is very costly. Integrators and plant manufacturers hope for a way out of this dilemma – or at least a less difficult process – by building up production capacities more quickly. Since each plant is usually designed individually, engineering times as well as commissioning and testing often take too long.

Ethernet facilitates the data connection between the process skids and higher-level control systems

Turck's excom I/O family is available for use in hazardous areas. It promises maximum availability and configuration options during operation, and with the latest Ethernet gateways, also supports the three multiprotocol networks

Standardization shortens engineering, manufacturing and commissioning

Modular plant concepts promise to expedite these project phases and make them easier to plan. This is because many plant components or machines in the biopharmaceutical industry can in principle be standardized – from upstream with bioreactors and filtration units, to midstream with centrifuges, microfiltration and ultrafilter units, to downstream. If all these units are joined together like building blocks with standardized interfaces to form a complete system, both the duration of engineering, the actual production and the commissioning can be significantly shortened.

The different network protocols of the end customers are often the obstacles on the way to standardization and modularization. They usually require the use of different I/O components, actuators and sensors, which in turn requires increased effort in engineering, in e-planning and ultimately also in warehousing. Turck offers efficient solutions with its multiprotocol Ethernet I/O and control modules that can be used in Profinet, Ethernet/IP or Modbus TCP without any intervention by the user. The devices themselves detect which protocol is being used in the network and adjust to it automatically. This therefore enables the machine builder to install devices of this standard independently of the end customer's network.

Offline tests shorten commissioning

Machine builders achieve a further acceleration by testing the machine modules or skids already in their own production facilities. The so-called factory acceptance tests (FAT) can also be performed offline, i.e. without a connection to the subsequent plant control system, using the integrated control functions of the TBEN I/O modules. Turck's I/O components enable the simulation of live operation with their integrated ARGEE logic software, which simulates the inputs of connected machines. If the possibilities of the I/O modules are not sufficient, Turck offers its IP67 TBEN-PLC controller, a fully-fledged Codesys 3 programmable controller, which also supports the three protocols of the multiprotocol standard.

IP67 components and quick connectors minimize wiring and control cabinet construction

The high degree of protection of the TBEN family contributes to the faster commissioning of the plant. Thanks to IP67, the assembly and wiring of large control cabinets can be reduced to a minimum. The use of quick connectors means that in principle only the process connections, power supply and network lines need to be connected on site. In real applications it is rare for all components to be available in IP67, but the assembly of the control cabinet is nevertheless considerably shortened or can be largely pre-assembled. Turck's new IP67 PSU67 power supplies also eliminate the need for control boxes for the power supply.

Multiprotocol I/O systems for all zones, degrees of protection, availability requirements

The multiprotocol family of devices has continued to expand over the years. Customers wanting the flexibility of a modular system will find the BL20 and BL67 system solutions suitable for installation in the control

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In many industries, modularization and standardization are considered target-oriented strategies to reduce costs, production, delivery and development times. This particularly applies to the biotech and pharmaceutical sectors due to the time pressure arising from the process of approvals and patent protection. Components that automatically adapt to the customer's requirements offer a solution to the conflict between customer requirements and the need to standardize. Turck supports this path with its I/O and control components with multiprotocol Ethernet. With their three Ethernet protocols Profinet, Ethernet/IP and Modbus TCP, the devices are suitable for large sections of the control systems used in the market and thus help to establish standards in-house and still meet the preferences of global pharmaceutical manufacturers.

RFID is a simple and reliable solution for the identification and verification of modules, containers or hoses, as shown here

In this application, Turck's IO-Link master module with Profinet S2 system redundancy controls actuators on a bioreactor

cabinet or directly in the field. If, however, I/O blocks are required, Turck offers the devices of the TBEN series for cabinet-free installation directly at the machine, or the FEN20 series I/O block for installation in protective housings.

If an application in hazardous areas requires maximum availability and configuration options during operation, users choose a system from the excom family, which also supports three multiprotocol networks with the latest Ethernet gateways – both as a system for mounting in Zone 2 or as an N series for mounting in the safe area.

Modbus TCP as parallel channel for diagnostic data
The multiprotocol capabilities of the devices offer other advantages besides variant reduction and simple standardization and modularization: The devices can thus also be used via Modbus TCP in parallel to Ethernet communication via Profinet or Ethernet/IP as a channel for data access. In this way, user data and analysis data can be easily branched off to external IT systems and evaluated for diagnosis and monitoring tasks independently of plant operation.

IO-Link and RFID for automatic skid identification
Especially for mobile units that are used at different points in the plant, the documentation of when and where they were used is advisable – and is usually also required by certification guidelines or laws. The use of machine modules can be identified and documented with IO-Link or RFID, simply, reliably and without the risk of manipulation. If the modules use IO-Link components anyway, the entire machine can be identified via the Application Specific Tag of these components. Diagnostic data for predictive maintenance can also be communicated via IO-Link. Many components already offer this option as a standard feature, without the need for complex programming.

Increased internal device temperature or reduced signal strength provide early warning of wear, contamination, or other problems. If no IO-Link components are used, RFID tags can be used to identify the modules via their UID. The UID is a unique one-time identification number of the tags, which cannot be changed after production. For identification in explosion-protected areas, Turck is the only manufacturer on the market to offer RFID read/write devices with Ex-e protection, which can be used directly in Ex zone 1/21 without a protective housing.

Conclusion
The path to a modular biopharma plant is not an easy one. The established routines have to be broken down first of all and investments have to be made in the modified production and development strategy. This is shown by examples from other sectors, such as the automotive industry. However, the cost benefits and synergy effects will only materialize after a certain lead time, which may still be marked by the difficulties of migrating to a modular strategy. Once modularization is ultimately established, benefits can be achieved in all stages of the product life cycle. Manufacturers consequently also decentralize the control capacity and logic of their machine modules. The three Profinet, Ethernet/IP and Modbus TCP protocols cover a large part of the market. End customers who also insist on their desired protocol could possibly be convinced to use one of the three protocols due to the faster production times of the multiprotocol machines.

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Manufacturers of conveying and sorting systems for large logistics centers are faced with the challenge of constructing plants that meet increasingly faster speed requirements and maximum availability since the key requirement of their customers is the optimum throughput of goods. To guarantee this after their receipt has been recorded, articles have to be picked for the order, sorted and presented in a precise sequence so that they can be shipped as quickly as possible.

The optimization of these processes is the core competence of EAE Solutions in Ahrensburg. The company develops innovative control solutions for different applications in the intralogistics industry. The modular EAE Flow software platform for controlling conveying and sorting systems makes it possible to utilize the full potential of existing, new or retrofitted intralogistics systems. The design of the system is based on the latest developments in automation and the highest industrial standards.

EAE Flow consists of the EAE Flow.Master module, which imports sorting and transport parameters and optimally controls the entire material flow. The EAE Flow.Control module handles the real-time control of the electromechanical equipment. It transports goods efficiently and reliably on the basis of the WCS information, I/O signals and scan and image data. The EAE Flow.Commander visualizes the operating status of the systems, statistics and reports. The SCADA-compatible user interface is web-based and can be called up on several authorized (mobile) devices.

EAE Solutions also takes care of the installation and commissioning as well as the engineering and the development of software and hardware. The company relies on Turck's decentralized automation technology, especially Ethernet I/O and safety modules with decentralized controller logic and IO-Link, in order to keep the installation effort to a minimum and make the systems flexible and cost efficient at the same time.

**I/O modules with high-speed counter input
ideal for logistics requirements**
Different sorting systems are used depending on the sorting task, which EAE Solutions implements with specifically optimized control systems: These solutions are for pocket sorters and crossbelt sorters as well as for the conveying technology, in addition to the tray sorter. In EAE's pocket sorter, for example, pinpoint detection of the sorted material is a fundamental requirement for precision timed processes. Progress along the transport section is measured by the teeth of the wheels that transport the pocket holders. These teeth have to be counted quickly in order to determine the exact positions, such as for the guiding of transport pockets.

However, the high speed of the teeth means that the cycle times of standard controllers do not allow them to read in the data. This is where Turck's TBEN-S1 IP67 module comes into its element: the compact multiprotocol I/O module for Ethernet features eight digital inputs. The first input is a high-speed counter – a genuine USP and ideal for use in the pocket sorter. The

The decentralized signal processing by the TBPN hybrid safety I/O module for Profinet/ProfiSafe allows a higher conveying rate of the plant

Efficient and Safe: Flexible I/O and Safety Modules

EAE Solutions optimizes intralogistics solutions with an efficient control system – flexibly configurable block I/O and safety modules from Turck transfer a countless number of sensor and actuator signals

To ensure efficient operation in spite of the large number of sensor and actuator signals in intralogistics systems, Turck has developed a block module with universal channels that can be used as inputs or outputs as required

fast rotating teeth are captured as pulses generated by a proximity switch and counted directly by a decentralized TBEN-S, from which the controller calls the values to thus determine the precise position.

New development and customer request
The control technology for conveying and sorting systems requires the fast reading of signals at many different locations in the system. The large quantity of sensor signals involved requires the fitting of a large number of block I/O modules so that their price is a bigger factor than in other sectors and applications. This means with the pocket sorter that a module with eight inputs would not be an economical solution in an actual application where only three or four signals have to be read. Modules with four inputs and four outputs may also not always cover the actual number of signals required.

On the suggestion of EAE Solutions, Turck therefore developed a module with four universal channels that can be used as required as inputs or outputs. In all, up to four 3-wire PNP sensors or four PNP DC actuators can

be connected. "The new development from Turck suits us very well," Stefan Püttmann, product and project manager at EAE, talks about the flexible module. "With the several hundreds of modules we require, this enables us to offer really cost efficient solutions."

QUICK READ

System solution supplier EAE Solutions also relies on Turck's decentralized I/O and safety modules for shortening commissioning times and increasing the throughput in intralogistics plants. Together, both companies have developed optimum solutions to meet the requirements of EAE Solutions. These include, for example, a flexibly configurable block I/O module or the TBPN hybrid safety I/O module, which combines standard and safety-related inputs/outputs in a single device and controls safety in direct proximity of the hazardous area.

»The new development from Turck suits us very well. With the several hundreds of modules we require, this enables us to offer really cost efficient solutions.«
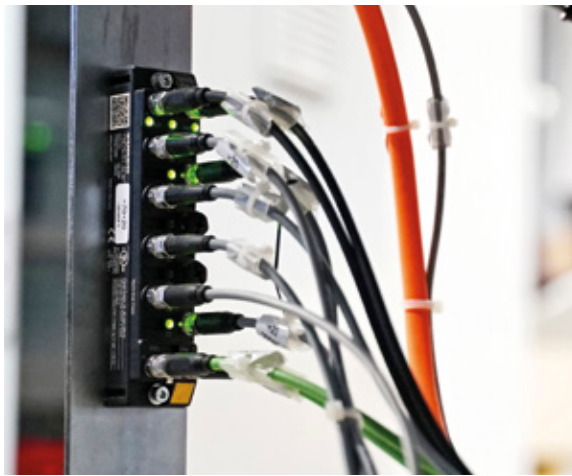
Stefan Püttmann | EAE Solutions

The TBEN-S1 module performs the high speed counting of the teeth and ensures the smooth operation of the pocket sorter

Turck's I/O components with decentralized control logic move the required intelligence to the direct environment of the conveying line

Cabinet-free safety controller in direct proximity to the hazardous area
Turck's decentralized IP67 safety solution also impressed EAE: The core consists of the hybrid TBPN safety I/O module, with which cabinet-free safety functions can be implemented and controlled in direct

proximity to the hazardous area. This decentralized signal processing enables shorter cycle times and therefore a faster conveying rate for the plant. In the event of an unexpected event such as a cable break, the safety functions are also retained, thanks to the consistent decentralized solution in unaffected areas. As the first Profinet/Profisafe block I/O module on the market, Turck's TBPN combines safety and standard I/Os as well as IO-Link. "No-one else offered a safety block I/O module that combines both standard and safety inputs/outputs in a single device," Püttmann recalls. "We recognized that we can also use the standard inputs of the module as well as IO-Link inputs for traffic light indication, signals or normal sensors. With all the features that it has we are thus able to achieve a module utlization of up to 90 percent."

Joint development of individual solutions
"At Turck we can also access ready to use components that are ideal for our applications," project manager Püttmann explains, "starting with the small TBEN module with the high-speed counter on the first input, to the safety module, the RFID readers and the pick-to-light components right through to the service."

Turck's practical solutions developed jointly with EAE Solutions ensure today the optimum throughput and availability of modular plants for the customer. Particular emphasis is placed here on consistent decentralized concepts that have been developed out of the close cooperation between the partners. "Good advisory support and reliable sevice are essential for us in addition to high product quality," Stefan Püttmann emphasizes. "In this respect, we consider Turck to be way ahead. The great thing about our partnership is that we work out solutions together in workshops. There is always someone there who listens and finds solutions for our needs and the requirements of our customers. An extensive service package – for us an important feature."
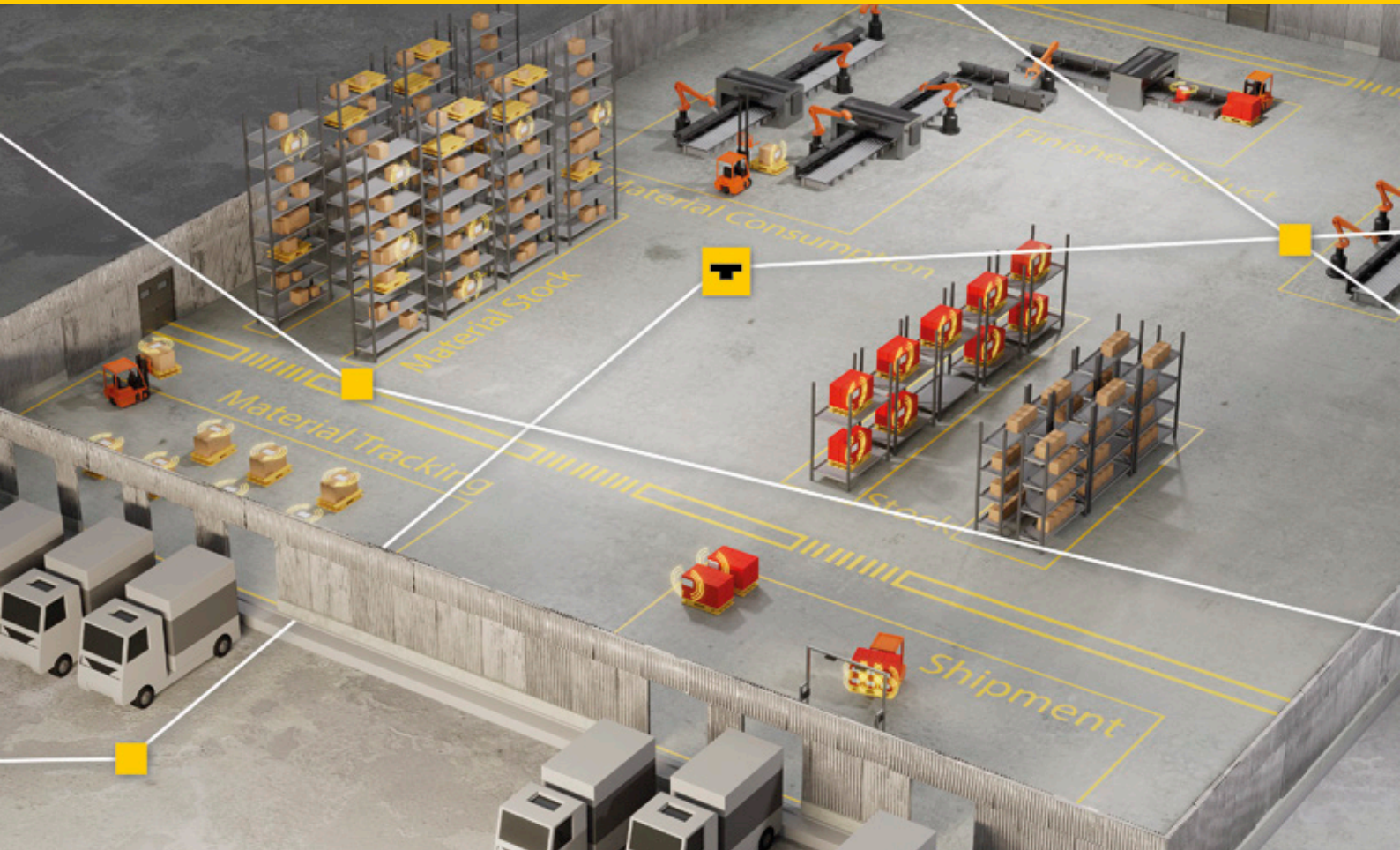
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The eCart system takes the drive and thus also the maintenance away from the conveyor track, thus maximizing its availability

> »In a conventional roller conveyor system the drive is located in the conveyor track. Maintenance is therefore always a problem. That's why we have developed a passive track that is completely maintenance-free.«

Philipp Krups | Krups Automation

IP67 PLCs Control Autonomous Conveyor Modules

Self-driven, electric eCarts from the Krups Group optimize the assembly and testing track in the battery pack production of German car manufacturers - Turck's robust IP67 PLCs provide the decentralized operation control of the individual conveyor modules

Krups Automation, a company with its main plant in Dernbach Rhineland-Palatinate, is one of the market leaders in assembly and test automation. The company specializes in automation systems for the efficient linking of assembly and testing stations. With the "LOGO!MAT eCart", Krups offers a highly available conveyor system that breaks new ground - with actively powered, intelligent workpiece carriers that can rotate, lift, clamp or tilt workpieces.

Philipp Krups, second generation head of the company, explains the basic idea behind it: "In a conventional roller conveyor system the drive is located in the conveyor track. This involves a lot of mechanical parts in the track, and also the associated amount of wear. With permanently installed systems, maintenance is therefore always a problem. That's why we wanted to turn the system round and remove the maintenance from the track. We therefore developed a passive track that is completely maintenance free. The whole technology and electrical system is now located in the carts, the so-called eCarts. These electrically driven carts have a self-diagnostic function and can be discharged from operation if required for preventative maintenance. This means that the downtimes are reduced and the track remains operational. It also makes any later expansions to the conveyor line very easy to implement. The eCart system furthermore makes it possible to implement more flexible produc-

tion processes with smaller batch sizes. It could even be said that it is an Industry 4.0 conveyor."

The system consists of a few standard modules: Rotate modules, shuttle modules, stopper modules and indexers. These units are combined in a layout according to individual customer requirements and connected to the onsite control system of the plant. The conveyor system supplies the customer's production system with report data and enables the implementation of bidirectional communication interfaces. Several large German automobile manufacturers are now using the systems in their battery production for electric vehicles.

QUICK READ

With its eCart system, Krups Automation GmbH serves the increased requirements of modern assembly and test automation in terms of safety, low maintenance and communication. A maintenance-free track and intelligent self-driven carts, bundled with decentrally controlled system components, provide flexible and safe assembly automation. The individual modules of the track are autonomously controlled by Turck's TBEN-L-PLC. With the multibus-capable IP67 PLC, Krups implements standardized and optimized control sequences of the components. Customers benefit from fast commissioning, easy expandability and increased availability.

> »Just routing the 24V cables and signals to the twelve controllers on the stoppers and labeling would be very labor intensive. The price of the TBEN-L-PLC covers this easily.«

Christian Mies | Krups Automation

At the stoppers and other function modules the eCart system communicates with the carts via NFC

Decentralized control for modular conveyor systems
"Previously there was always a main controller, to which all signals were routed. This partly involved point-to-point wiring, but increasingly more often also decentralized I/O units. The problem here was the programming in one sequencer. However, if any condition at switchon or after an emergency startup is present that is not represented in this sequencer, the users must move units by hand in order to restore a known situation," explains Christian Mies, control developer at Krups. "A conveyor system has to be programmed differently in order to eliminate the need for manual interventions. Conditions and appropriate reactions have to be defined that are suitable for all situations." Ideally, every module should be autonomously controlled.

Each module operates externally as a black box, which simply communicates bidirectionally with the central controller in both directions via a bus connection. The module runs its program in order to perform its particular task: Rotating, transferring, traffic monitoring and reporting of module status. Each module is therefore controlled – exactly according to the development – and perfectly implements all possible sequences. A plant controller is installed at the level above this and controls the overall flow. However, the actual positioning sequences and the monitoring of conditions is taken over by each controller at the module.

Krups then no longer has to intervene in the control of the overall plant, neither does the plant operator have to control the conveyor system modules. Only the communication between the general controller and the modules has to be implemented at base level. In-house, Krups calls these conveyor system modules which have their own intelligence smart modules. The company therefore looked for autonomous controllers ten years ago, which can be installed directly on the modules.

Self-built IP67 controller
"At that time we already looked for compact controllers with IP67 protection. However, there was nothing on the market," Christian Mies reports. Krups therefore helped itself first of all: "We had our own controller built on a board, fitted all M12 plug connectors and placed everything in a housing. This housing had to be provided with drill holes plus a pneumatic system and a display. These were very big units and relatively difficult to manufacture. We had to have the boards built, the housings assembled and everything wired up. Although this was successful, it was a laborious task," senior boss Peter Krups explained the journey towards an in-house module controller.

Since Turck launched its TBEN-L-PLC block controller on the market a few years ago, Krups has been able to save the effort required for a self-build. The company is now using the IP67 controller in many machine models – not only in the eCart system. The control system for every conveyor system element was written in Codesys. The communication to the drives or valve blocks and other components of the module is implemented via a bus interface, while the communication to the main controller is mostly implemented via Profinet. "We now have the benefit: The modules can be deployed immediately and without the need for any other field programming device, i.e. replace, insert, data backup. In

Before – after: The controller built in-house by Krups (l.) worked well but, compared to Turck's TBEN-L module (r.), was considerably larger and more complicated to install and only worked in Profinet networks

Turck's TBEN-L-PLC controls the Krups conveyor system modules – communication to the periphery is via CAN and to the main controller via Profinet or Ethernet/IP

the ideal situation: the customer just has to connect the 7/8 inch plug connector for 24 volt and the Ether- net connector for the bus connection," Mies explains the benefits for the users.

For an international company like Krups even the range of protocols offered by the compact controller pays for itself, according to IT manager Mies: "We can serve the US market with Ethernet/IP in exactly the same way as the European and Asian market, where the protocols are mixed. We are currently concentrating on Ethernet/IP and Profinet, but Modbus TCP would also be possible in principle if this is required by a customer. The great thing here is also the fact that all the Codesys licenses are contained in the Turck device. The license is there and we can use it, regardless of the fieldbus the customer uses. We can even use them when we sometimes need a small main controller because the master licenses are also available," Mies describes the different scenarios in which the TBEN-L-PLC can be deployed.

eCart system saves power in battery production
The specifications of the eCart conveyor system in battery production already make it clear that the manufacturer means it with e-mobility. With 130 self-driven carts on approximately one kilometer of conveyor track, the stage of small series production has long been left behind. Krups usually installs around 70 turntables and about 140 stoppers on the track. Ten stoppers and each of the rotary modules each use a TBEN-L PLC as a gateway to the customer's main controller. This considerably reduces the number of bus nodes required for the customer.

To change direction, the carts are moved by transfer units to parallel tracks or their direction is changed by turntables. Unlike most conventional systems it is possible to communicate with the carts of the eCart system. NFC (near field communication) units are

provided at the stoppers in order to use the TBEN-L-PLC as a gateway to implement communication between the main controller and the carts. In this way, carts can be removed depending on their state or the presence of warning messages. Another benefit: When the carts are waiting, they do not consume any power – unlike the conventional roller conveyor systems in which the drives normally continue running – even if no boxes have to be moved.

The sensors and actuators of the modules are connected directly to the TBEN-L-PLC. The block controller provides eight universal channels on four sockets, which can be set automatically to the required configuration as input or output. If other I/Os are required, Krups can expand the number of signals required with the BL compact I/O module via the CAN bus connection. The BL compact modules are likewise designed with IP67 protection and are mounted directly at the units.

IP67 saves wiring
Not only Krups has recognized the labor savings that lie in Turck's IP67 technology, but customers are also convinced by the solution. "Just routing the 24V cables and signals to the twelve controllers on the stoppers and labeling would be very labor intensive. The price of the TBEN-L-PLC covers this easily," IT manager Christian Mies expresses his appreciation. The eCart system is not only energy-saving and fail-safe, it also enables more flexible processes as outlined in Industry 4.0 model scenarios and also already implemented. Through the communication with the workpiece carriers greater product variance can be achieved.

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Hüdig's vacuum units, here the Whisper model, ensure that the excavation pit stays water-free on construction sites

Water Protection 4.0

IIoT on construction sites: Turck's cloud solution enables users and operators of Hüdig's site dewatering solutions to have access to the device status at any time

There seems to be no end to the current construction boom. Since 2011, more apartments have been completed every year than in the previous year. In 2020, the figure in Germany was 306,376, which was another 13,374 apartments more than in the previous year, according to the Federal Statistical Office. The momentum in the construction industry and, as a result, in neighboring sectors and companies is accordingly high.

Among the associated companies benefiting from the construction boom is Hüdig GmbH & Co. KG in Celle. The pump systems specialist manufactures products that include units for irrigation and dewatering. The irrigation pumps are generally used in agriculture. The drainage pumps are mainly used on construction sites where the groundwater has to be lowered during the construction phase. "These pumps have to run around the clock, because considerable financial damage is caused if the building site pit fills up with water," explains Lennart Heers, sales manager at Hüdig.

Technically, the dewatering pumps consist of two installed pumps. An air pump that creates a vacuum and sucks the water out of the ground via lances. In the same way as how you "suck out" a drink with a straw.

QUICK READ

When dewatering pumps fail on construction sites, considerable financial damage can soon be the result. Hüdig, a company based in Celle, therefore offers its customers the possibility to implement remote diagnostics and remote maintenance of units, including direct alarm messages to a cell phone. To achieve this, Hüdig has made its devices fit for the Industrial Internet of Things with the TX700 HMI controller and Turck Cloud Solutions. The integration of the cloud solution with controller, display and edge gateway in a robust device impressed the pump specialists.

»With the Turck solution, we have one programming and one device and no longer three programmings on three devices, which of course saves a lot of time and effort.«

Lennart Heers | Hüdig

This water still has air bubbles in it and is then collected in the unit in an intermediate tank at ground level on the construction site and discharged directly into a stream or other drain via a conventional water pump.

Specialist companies responsible for dewatering on large construction sites
The vacuum units are large metal boxes that can be found on almost every construction site. In large construction projects, dewatering is usually contracted out to specialist subcontractors who are solely responsible for this task. For the developer, this has the advantage that he can concentrate exclusively on the construction activities in the narrower sense. In addition to the actual task of lowering the groundwater, the dewatering companies also take care of the permits and the necessary documentation. "But these companies are usually not on site at all. They install the pump, press the start button and then leave. After that, they come at regular intervals and check whether everything is still in order," says Heers, describing the division of tasks at the site.

Original solution costly for remote information
This is where Hüdig came to offer its customers the possibility of seeing how the pump is doing, even from a distance. The first systems for remote maintenance consisted of three components: a controller, a communication module and a display. However, the system required complex programming: "Our programmers had to program the controller and also the communication between the controller and the modem as well as between the modem and the cloud – and then the visualization on the display," says Heers.

When the manufacturer discontinued the modem, Hüdig looked around for an alternative system for data storage and remote access – and found what they were looking for at Turck. The required functions were a Codesys-based controller so that most of the programming of the original system could be transferred, as

well as a cloud gateway for storing and retrieving data centrally. The system also had to be able to send alarm messages and information.

Control, display and cloud communication in one device
Turck's TX700 HMI controller impressed the decision makers at Hüdig. It meets all the requirements and also has the advantage of integrating the three functions of control, display and cloud communication in a single device. Programming has become much easier with the

The antenna and a signal light are installed on top of the unit

Turck's HMI/PLC TX700 combines control, visualization and edge controller for cloud connection in a single device

I/O expansion modules and the cloud gateway can be fitted to the back of the TX700

The enormous variety of interfaces increases flexibility when using the HMI/PLC TX700

The water from the soil is temporarily stored in the tank and from there pumped into a body of water or the sewerage system

switch to Turck. Today, only one device needs to be programmed, as the logic and visualization are already integrated. The cloud-related variables are then selected with just two or three clicks. "This means that we have one programming and one device and no longer three programmings on three devices, which of course saves a lot of time and effort," says the sales manager about the cloud solution.

Site manager receives info messages on pump status
Customers who use a vacuum unit with a cloud connection can not only include their own service staff but also the site manager in the list of people to be alerted. In this way, those responsible find out directly at the construction site if something is wrong with the pump. "Often these are routine things such as a disconnected hose, a tripped RCD or an interrupted power supply because a plug was pulled out by mistake. This can also be helpful for the companies in relation to legal issues if it is documented that a warning message has been sent. We can even set the mandatory acknowledgement of the message. This has been well thought out," reports Lennart Heers.

Simple documentation function and maintenance planning
Another benefit comes from the cloud's documentation functions. For example, data records can be output as a CSV file. If a flow sensor is integrated in the unit, precise data extracts can be sent to the authorities with the water volumes that have been discharged. Write errors and manipulations are virtually eliminated. The benefit for operators is that they are able to plan maintenance more easily with the operating hours counter. They no longer have to rely on rough estimates of operation or gut feeling, but can specify in detail for each machine

how long it has been in use. Additional parameters for predicting maintenance requirements could also be integrated, for example, to draw conclusions about the condition of the electric motor by combining vibration and temperature values. The sales manager is convinced: "With the cloud connection, we generate real added value for our customers."

Conclusion
"With Turck, the overall concept, from control to modem to cloud solution, fits perfectly. And the touch display of the TX700 enables a more intuitive operation of the units," Heers sums up. "The customers who order our cloud option can now see what's going on much more accurately from a distance – also compared to our previous solution with GSM communication. You don't just get the pressure drop message, but you can see exactly how much the pressure has dropped and evaluate the error accordingly. We've configured the system so that a message is also sent when the error is no longer present, to avoid unnecessary trips."

In Switzerland, remote maintenance systems for dewatering are even mandatory. The idea behind this is that if the construction site is under water, the tax money goes down the drain. In this case, the investment in a remote maintenance solution with a cloud connection quickly pays for itself.

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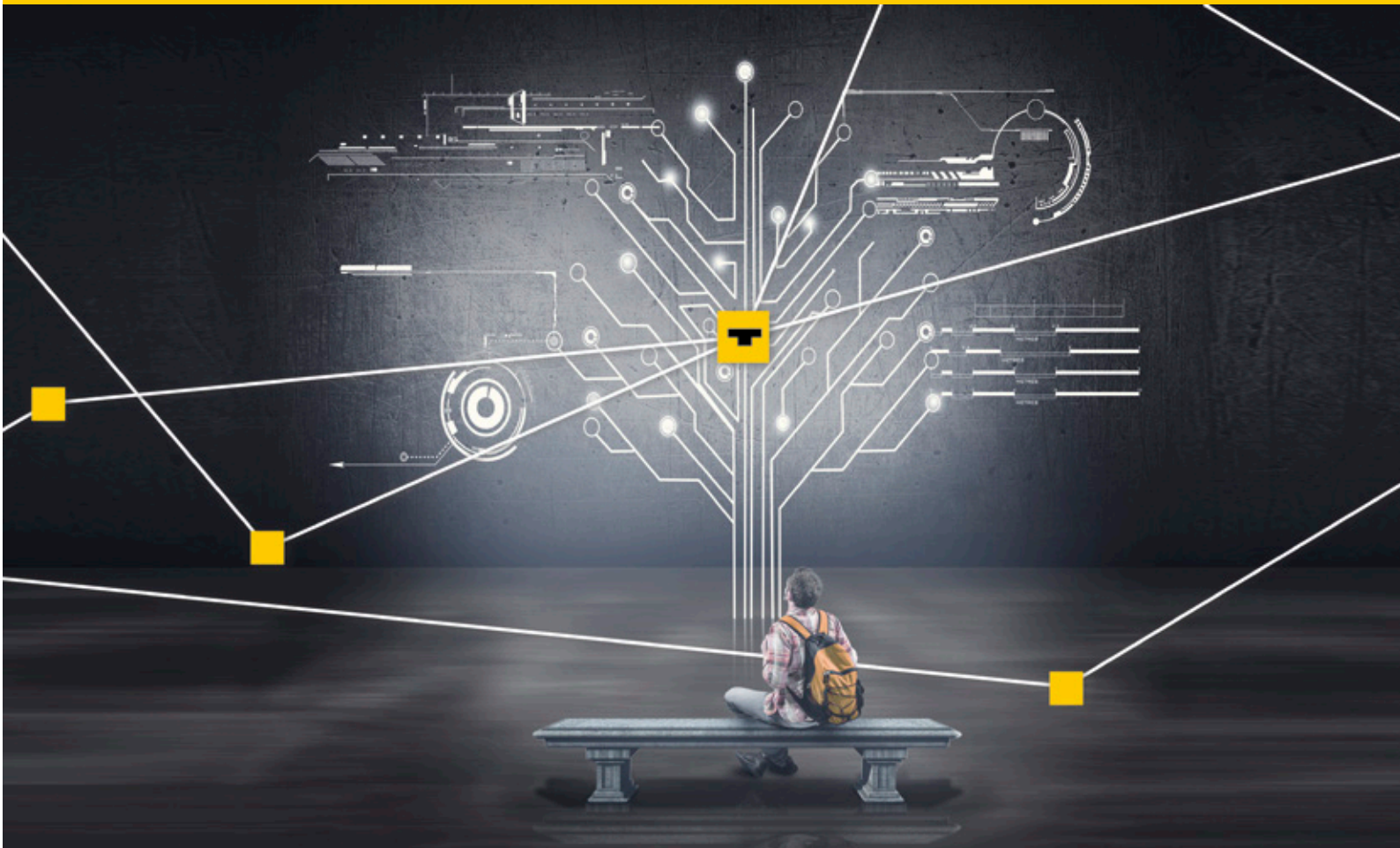
Vision Aid

KEB Automation uses WLS15 strip lights to expand its assistance system for C-parts management into an efficient and fail-safe pick-to-light solution

KEB says goodbye to printed lists on the C-parts shelf: The WLS15 strip lights indicate the compartment in which the searched for item is stored

Whether screws, washers or nuts – C-parts like these are used in a wide variety of sizes and designs in every manufacturing plant and are indispensable for the end product. The large quantity of C-parts involved means it is always difficult to keep track and find the right parts for the next assembly step, because the different designs are often hard to distinguish from each other with the naked eye, such as M4x3 and M4x3.5 threaded bolts. As the number of articles required increases, small parts shelves quickly become confusing, resulting in frequent and often tedious searches for the required item. Besides the large amount of time required, this results in a high error rate and delays in production. In

order to achieve maximum productivity and efficiency, it must be ensured that the required C-parts are not only permanently available but can also be supplied to production at any time and without delay when needed. This was the challenge facing KEB Automation when supplying material to assembly workstations for frequency converters.

Knowing where

The assembly workstations are fitted with tools and production aids. Any required C-parts are ergonomically arranged in small open front storage bins within the employee's reach. Standard labels are attached to the

»The WLS15 strip lights are an elegant and cost-effective solution. This allows the assistance system to be perfectly integrated into the standard C-parts shelf and is practically invisible.«

Phillip Hannesen | KEB Automation

explains Phillip Hannesen, digital transformation manager for production at the company's headquarters in Barntrup. "If you take the same screws off the shelf every day, you know which box they're in. It becomes interesting when new employees have to be trained, new devices have to be assembled, or order picking has

By scanning a QR code on the open fronted storage bin, the iCParts assistance system developed by KEB immediately guides employees to the item they are looking for via a light signal

front of each container, as well as QR codes with information about the material number, warehouse site and storage location. If a storage bin is empty, the assembler refills it at the central C-parts rack, where more than 60 items are stored in their separate containers. It was previously necessary to use a list on paper to determine which small parts were located at which position on the shelf. However, managing small parts on paper is time-consuming, because several hundred C-parts are used in the assembly of high-end frequency converters.

"Experienced employees who assemble a device they are familiar with don't require any support here,"

QUICK READ

As a specialist for drive and control technology, KEB Automation develops, produces and sells drives as well as engines, gearboxes, brakes, clutches and Industrial IoT solutions worldwide. In order to optimize material logistics for assembly, KEB Automation developed the iCParts assistance system – a pick-to-light solution with WLS15 lights from Turck's optical sensor partner Banner Engineering. iCParts shows employees at the central C-parts warehouse the shelf location at which the required screws, washers or nuts are stored. Despite the limited space available, the WLS15 strip lights impressed the company with their easy installation during operation and perfect integration.

The KEB controller developed in-house, runs on a Windows tablet attached to the shelf
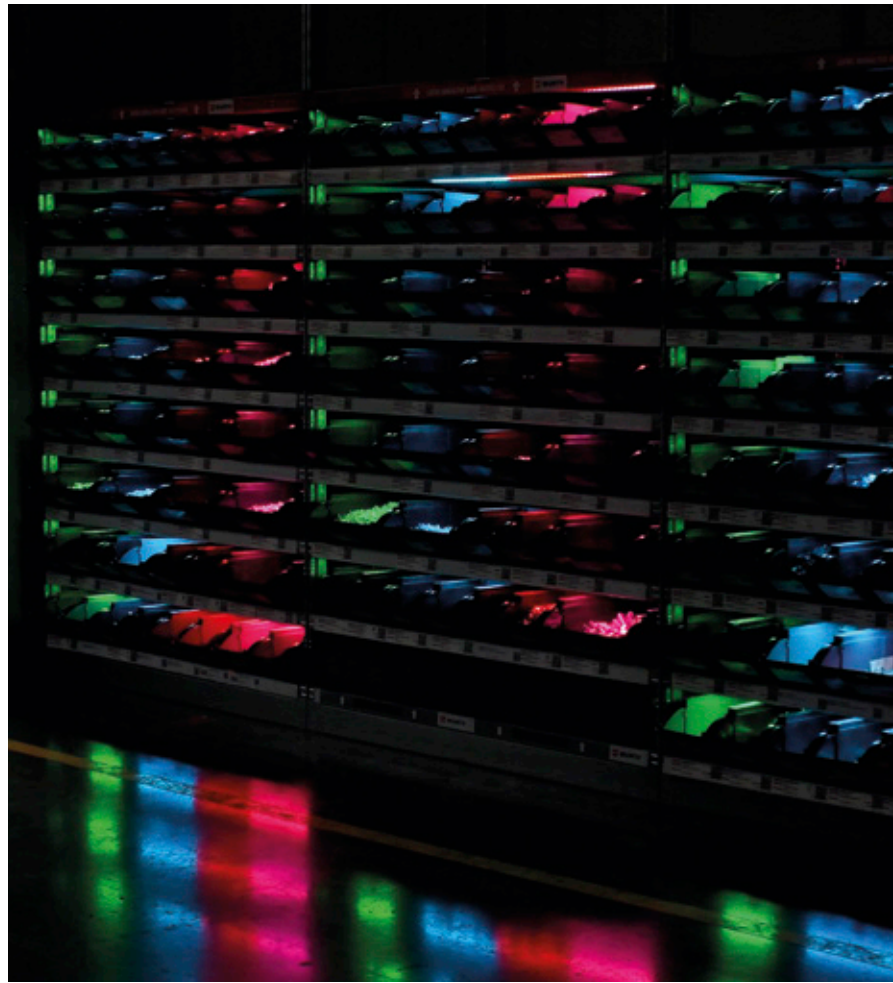
The WLS15 strip lights provide extensive control of LED color indication

to be carried out by employees from other departments. In these cases, there is a lot of searching required at the shelf." By using the iCParts assistance system, every employee should now be able to find the required item immediately without a lengthy search. In this way, the material flow of C-parts in internal logistics is optimized and the manufacturing process becomes leaner and more efficient.

The challenge of limited space
The space between the shelf levels is very restricted in the central C-parts shelf and provides just enough space for the open front storage bins. There is no room for a sensor and the associated cabling. "We thought about how this kind of system could even be implemented on this shelf," says Viktor Derksen, head of production equipment engineering at KEB, describing the initial situation. "A system was needed here that is either positioned externally or concealed within the shelf. These are requirements that we couldn't implement with the components we were using previously."

The launch of the WLS15 strip lights from Turck's optoelectronics partner Banner Engineering was consequently very timely. The WLS15 units are very flat and cascadable LED strip lights that can be installed in tight spaces in an instant, so to speak, with magnetic mounting brackets. The 64 LEDs of each light can be controlled individually as desired. With their 15 mm profile, they are ideal for illuminating areas with limited space. The installation takes place within minutes without any restrictions during operation.

Perfect integration
The in-house KEB control system and software has been optimized for the standard components in production and has already proven itself in other Turck solutions so that it can obviously be used in material logistics. The standard environment, developed in-house, runs on a Windows tablet attached to the shelf. All the required access points already exist in this environment, which is why it is possible to build on what is already in place. "After programming the necessary drivers, the strip lights can be controlled via Modbus RTU 485. The connection to the tablet is provided by a Banner RS485/ USB converter on the shelf levels," Derksen explains. The LED lights are each coupled using T splitters and connection cables. This allows the power supply and communication to be daisy chained from light to light. "The WLS15 strip lights were an elegant and cost-effective solution for us," Hannesen said. "They are located behind the shelf plate, while the wiring is organized through the back. This allows the assistance system to be perfectly integrated into the standard C-parts shelf and is practically invisible."

Ensuring an efficient workflow
The iCParts assistance system optimizes material supply and ensures efficient workflow. When employees need

more supplies, they take their empty storage bin to the central C-parts shelf, where they scan the QR code of the container. The assistance system then detects which material has been requested and controls the corresponding area of the WLS15 strip lights. In this way, iCParts guides each employee directly to the desired item. Without wasting time, they can now refill their empty container.

Replenishment control using RFID technology
The automated reordering of removed C-parts is managed by an RFID-supported Kanban system of the C-part supplier installed in the C-part shelf. Kanban is a process control method that is based on the real consumption of C-parts. The reordering here is triggered by radio in real time. In the shelf itself, the parts are stored in standard KLT boxes. These boxes, as well as the top shelf, are fitted with RFID. Depending on the type of material, there are at least two to three KLT boxes per article in the shelf, so that a full box always follows when an empty box is removed.

Placing the empty KLT box on the top shelf initiates the transfer of the article and container data to the supplier's central warehouse, which triggers the

The required C-parts are illuminated and can be taken immediately, the WLS15 strip lights are mounted behind the fold of the shelf plate

»A system was needed here that is either positioned externally or concealed within the shelf. These are requirements that we couldn't implement with the components we were using before.«

Viktor Derksen | KEB Automation

reordering of a new box with the corresponding C-parts. In this way, early detection of demand is guaranteed and the required parts are automatically reordered. The WLS15 strip lights could be easily and quickly integrated into the central small parts shelf despite the limited space available and complement the existing system. This ensures the optimum material flow of C-parts in internal logistics.

Further application possibilities examined
The WLS15 lights were initially implemented in Barntrup. The fitting out of other storage sites in the plants on site, but also at other sites, is planned and being expedited. "I see the great strength of the assistance system particularly in training activities," says Hannesen. "There is also potential for other types of systems with the WLS15 lights. The lights are available in different lengths and can be mounted in a variety of applications."

Another assistance system based on the WLS15 strip lights is already being developed and additional scenarios for their use are being tested. "An assistance system based on the Banner PTL110 series already supports our employees with the assembly of frequency converters. Together with the WLS15 pick-to-light system at the C-parts shelf, we have an overall process where picking for assembly as well as the replenishing of C-parts is efficiently supported via our assistance systems with Turck components."

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Cool Potting

Turck Beierfeld is monitoring the climatic conditions of the solder paste storage of its SMT electronics production with a system from its own company – with IM18-CCM50 control cabinet guards, CMTH condition monitoring sensors and data dashboards via Turck Cloud Solutions

There is a saying that cobblers have the worst shoes and plumbers have leaking faucets. So what about the automation of an automation technology provider? It is rare for manufacturers to be able to use any innovation immediately in their own production processes. On the one hand, new solutions have to ultimately meet the latest challenges, and on the other hand, the timing has to be right in order to implement them during ongoing operations. At the Beierfeld site, Turck has now been able to directly implement a recently launched innovation and automate the handling of solder pastes in electronics production.

The company in Beierfeld operates an SMT production facility for printed circuit boards, in addition to many other production lines. SMT stands for "surface mounted technology" and refers to a production

An IM18-CCM50 monitors the temperature and door closure in each of the four refrigerators

The solder pastes are inserted in the front area of the printer, and the CMTH sensor directly next to it detects the ambient conditions

process in which components such as resistors or capacitors are soldered directly onto a circuit board – in contrast to the traditional THT ("through hole technology") process, in which components are inserted through holes in the circuit board with small wire pins and then soldered. In the SMT process, solder paste is applied very thinly (<150 micrometers) to the circuit boards with printers. The printed circuit board is then fitted with the components and soldered in the subsequent reflow process.

Climatic conditions of the solder pastes influence quality
To achieve the best possible quality of the solder joint, the solder paste must be stored within a certain temperature range. Moreover, opened containers must not be used for more than 30 days in total. Before processing in the printer, they must be stored at room temperature for at least four hours before the containers can be opened. After this acclimatization stage to prevent condensation, the paste must be mixed for another 60 to 90 seconds – and it must be shaken, not stirred. On average, the paste must only be processed at 23 – 27 degrees Celsius – at a humidity of 40 – 60 percent (depending on the manufacturer). After the printed circuit boards have been printed, no more than eight hours must elapse before the circuit boards are soldered in the oven.

All in all therefore, a number of parameters must be observed, for which any manual control using handwritten notes requires a great deal of attention and care. As with all human processes, there is no such thing as one hundred percent certainty in manual solder paste inspection. There may be a loss in quality if the specified parameters are not observed exactly. The paste does not then optimally fulfill its task of facilitat-

ing the melting process and preventing oxidation, and more scrap is produced. The production managers in Beierfeld wanted to automate and thus optimize the tracking of solder pastes. Last but not least, the ISO 9001 and IATF 16949 certification, with which Turck Beierfeld must comply as a supplier to the automotive industry, stipulates continuous tracking of the processes and preliminary products.

Manual tracking of solder pastes
The storage times in the refrigerator were previously recorded manually by scanning the paste containers. Removal and opening were recorded with notes on the containers or documentation sheets. The refrigerators already had internal temperature monitoring, but it did not record trends, only triggering an email to logistics when the temperature exceeded or fell below the defined range.

Together with his team and project manager Linda Galle, Christian Seliger, responsible for the Research and Development business unit at the Beierfeld site, planned and implemented the automated recording

QUICK READ

For the electronics production at its Beierfeld site, Turck was looking for a solution to automatically monitor the climatic conditions during the storage and processing of solder pastes. In a first phase of the project, the company's own IM18-CCM50 condition monitoring platform was used to continuously monitor temperature, door closure and humidity in the refrigerators and solder paste printers. Today, climatic data during paste processing is continuously recorded, stored in the Turck Cloud and displayed graphically on dashboards.
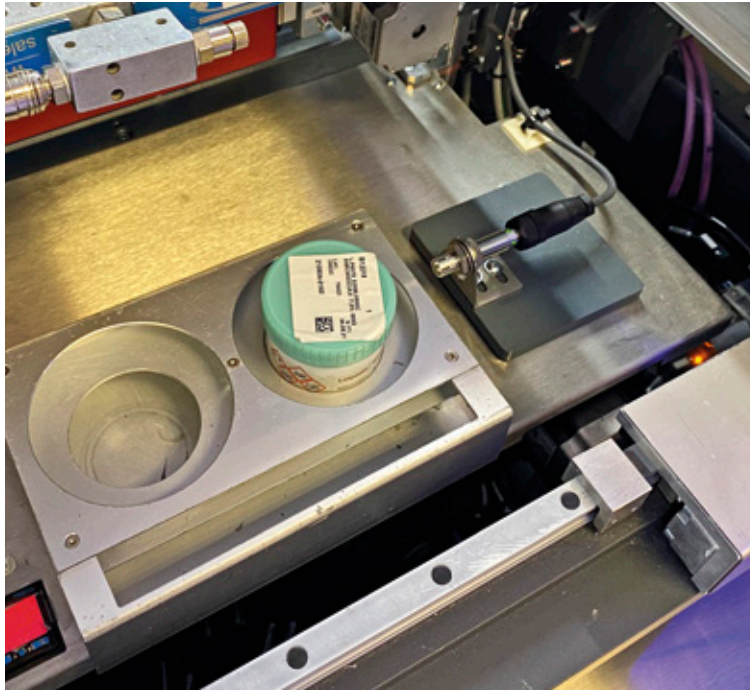
The CMTH sensor transmits the temperature and humidity values to its IO-Link master via IO-Link

Robust and compact: The IP67 power supply unit and the IP67 switch provide a cabinet-free connection between the sensors and the MES

and documentation of paste handling. "In order to be able to achieve rapid project successes even during ongoing operations, we divided the project into several stages," says Linda Galle. "With our Plan-Do-Check-Act approach, we ensure that each stage is successfully completed before starting the next one."

In the first stage, the first task was to monitor and centrally document the climatic conditions in the refrigerators as well as the printers and the workstation for preheating. If there are any critical values, the system must generate appropriate messages or alarms. RFID-supported recording of the solder paste containers and a connection to a Manufacturing Execution System (MES) will be implemented in the next stage of the project.

The monitoring of the climate in the refrigerators was implemented with Turck's IM18-CCM50 condition monitoring system. One of these control cabinet guards with an integrated Linux computer is located in each of the five refrigerators. With their integrated sensors, they detect the distance to the refrigerator door and the temperature in the cabinet. The devices are also able to

measure air humidity, but this is not important in this application, since only closed paste containers are in the refrigerators.

The temperature and humidity in the printers, on the other hand, are very relevant, so the CMTH combined temperature-humidity sensor records these variables there. Each of the three stand-alone solder paste printers has one of these condition monitoring sensors, and another sensor records the conditions at the workstation where the pastes are stored for acclimatization. Each CMTH sensor is connected to a compact TBEN-S IO-Link master, which transmits the data to the production network. The TBEN-L5-SE-M2 managed IP67 switch also integrates all IM18-CCM50s into the production network.

With their open Linux operating system, the IM18-CCM50 devices are designed for the installation of OEM software, allowing users to implement their own software solutions. They form the brain of the system, which handles the storage and the communication – with the sensors, the network and the Turck Cloud. To monitor the refrigerators, only network drivers and

The graphical dashboard makes it possible to see the status of the refrigerators and the other workstations at a glance

Predictive maintenance: The observation of temperature and humidity over long periods of time allows conclusions to be drawn about the wear of seals

The compact TBEN-S IO-Link master brings the sensor's data into the production network – thanks to its cabinet-free IP67 protection

"Brain" of the system: The Linux-based IM18-CCM (CCM stands for Cabinet Condition Monitoring) bridges the gap between OT and IT

scripts for collecting sensor data are installed on the condition monitoring platform. The IM18-CCM50 transmits the data of the integrated sensors as well as the CMTH sensors directly via Ethernet to the Turck Cloud.

Clear dashboards in the Turck Cloud display climatic conditions

Today, this first project phase of solder paste tracking is automated to ensure that the temperatures in the refrigerators, at the acclimatization workstation, and in the printers comply with the specifications. The times when the pastes are stored and removed are currently still documented by hand or recorded by scanning the QR codes on the containers. If humidity or temperature increase, this is indicated to the employees on the dashboard in the Turck Cloud. Long-term trends can also be identified in addition to the current values. In future, it would be possible for the MES to be connected to implement trend detection and analyze correlations between data series.

"The condition monitoring solution based on the IM18-CCM that has now been implemented was only the first step on the way to the fully automated monitoring of the storage and use of solder pastes. In the follow-up project, we will connect our MES and thus complete the digitalization and automation of our production. In this way, we can maintain quality at the

highest level even when operating at maximum capacity, and avoid unnecessary costs due to overlaid solder pastes," Christian Seliger sums up.

Outlook: RFID-supported seamless solder paste tracking

In the second expansion stage, the tracking of pastes will be implemented directly with RFID tags on each container, which at the same time enables the recording of correct acclimatization before opening the containers. Since the IM18-CCM devices then communicate directly with the MES, which controls the production orders for the printers, the system can immediately check whether the paste container used has been correctly stored and acclimatized before the PCBs are printed, or block use if the required conditions have not be maintained. If all data is available in the MES, further information could also be obtained from it, for example, to uncover weak points and sources of errors.

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The RFID tags are well protected in the plastic housing on the two longer sides of the stainless steel basins and are therefore always readable

Process Observer

Turck's BL ident RFID system secures the traceability along the manufacturing and distribution chain of a Chinese food producer

A food manufacturer in China, who sells brine cured products was faced with the challenge of ensuring the traceability of its products at every stage of processing. The company was previously not able to track the

QUICK READ

To optimize its production and delivery processes, ensure product quality and increase operating efficiency, a Chinese food producer made its plant fit for seamless track & trace with RFID support. Today all the relevant data for raw materials, process steps and the storage of cured meat products are continuously recorded and processed. The company decided to use Turck's BL ident RFID system – also because the modular system supports hot swapping, which reduces downtimes and therefore simplifies device maintenance.

production process. When problems occurred with the quality of the food products, whether at the manufacturer of the materials, the operator or in the process, the cause could not be traced and determined with certainty.

The curing time during the production process and the quantity of supplied components varied from coworker to coworker, making standardized, controllable processes impossible. The output of subprocesses was also not quantifiable, so that targeted process control could not be implemented. Uncontrolled manual interventions could cause material bottlenecks, which not infrequently led to quality problems due to production jams. Neither a flexible production process nor an intelligent control could therefore be achieved.

The customer therefore looked for an automated solution for the consistent traceability of its food

products along the manufacturing and distribution chain in order to ensure food safety. All the links in the supply chain had to be interconnected, from production to storage and transportation, right through to retail sales.

### Stable food safety and increased operational efficiency

Turck designed a complete RFID system for the customer according to their requirements and the situation on site. It was thus possible to implement a seamlessly transparent production and full traceability of food products over their entire life cycle.

RFID tags on stainless steel and plastic basins are now used to identify the materials on site. In order to read and write the RFID tags, read/write devices were installed on electronic weighing scales in the defrosting system, on tables in the curing system, on roller conveyors in the rapid cooling system and on cutting machines. The warehouse management system links the information from the production control system (MES) and thus monitors the entire production process in real time.

Cheaper than barcodes

An HF RFID solution is recommended in order to ensure accurate identification in spite of the small distance between the basins in production and in order to avoid frequency interference from other field devices. Read/write devices with IP67 protection and RFID tags with IP68 protection are resistant to humidity and water and therefore ideal for wet environments. The tags are reusable, thus keeping the long-term operating costs of the RFID system considerably lower than the costs of a barcode system. In order to prevent any problems with magnetic or mechanical interference from the metal basins, the plastic coated tags were fitted directly on the two longer sides of the basins in a special metal holder.

The data was transferred via the compact and robust TBEN-S RFID interface modules, which control the field devices and communicate with the higher-level controllers in real time. "The TBEN module has a data buffer range of 16 Kbytes for a large number of operations. This means that the pallet does not have to wait in front of the read/write head until all read and write operations are completed," explains project manager Tao Zhang. "This module also verifies automatically the write operation so that a subsequent
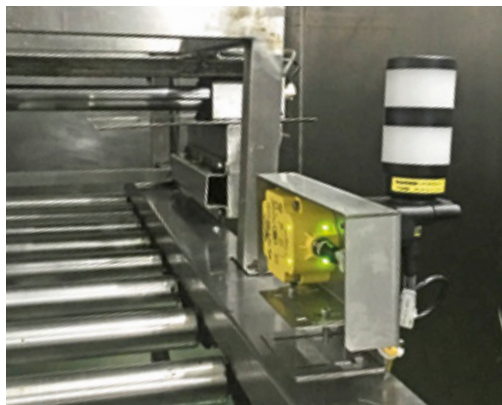
RFID read/write devices were installed at all strategic points of the production process

read option for control purposes is unnecessary. These features of the TBEN modules can considerably expedite production."

LED indicators provide clear information at any time about the operating status of read/write devices and the RFID module. Pre-assembled cables can be installed quickly and guarantee the reliable transfer of data. Read/write devices with a larger range ensure the precise reading of data. "However, the most important feature is the fact that Turck's RFID products can be replaced quickly during operation, thus considerably reducing downtimes and simplifying device repairs," explains Zhang.

Conclusion

The use of RFID technology to create a safe food product supply chain system with the traceability of all processes, from production to the consumer can provide effective solutions for the challenges of conventional food production. The RFID system not only enables the real-time monitoring of production in all phases but also provides process transparency and ensures the improved safety of food products. The analysis of the recorded data also makes it possible to optimize operating efficiency. With the rapid development of Industry 4.0 and IIoT, RFID technology will also play an increasingly more important role in food safety.

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RFID PORTFOLIO ALSO FOR EXTREME APPLICATIONS

With fully encapsulated, robust HF read/write devices in cuboid and cylinder designs in IP67, Turck's RFID system BL ident offers industrial design for all fields of application. The portfolio also includes special cables and read/write devices with IP69K protection for special challenges, such as in hazardous areas or washdown applications in food production. Turck's fieldbus solutions also support users with smart functions such as decentralized pre-processing in IP67 modules or the HF bus mode, which allows 128 read/write devices to be connected to one interface module and thus considerably reduces the wiring effort, costs and commissioning times in applications with many read or write positions.

Digital Innovation Park

Turck promises exciting automation trends and current innovations for Industry 4.0 and IIoT with the new Digital Innovation Park at www.turck.com/dip – from IO-Link to Ethernet in the process industry and condition monitoring. Turck's "digital showcase" offers a quick overview of current automation topics and links to webinars, white papers and more as well as direct contact to your experts.

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