The Magazine for Customers of the Turck Group Issue 1 | 2018

more@TURCK

Five Steps to the Smart Factory

Turck Cloud Solutions offer the right implementation for users to pursue Industry 4.0 development – tailored for industrial applications

New Era of Simplicity

Turck's Beep protocol enables Ethernet networks with up to 33 I/O modules via just one IP address

Light-Controlled Assembly

SmartFactoryOWL works with pick-to-light solutions for light-controlled operator guidance in manual assembly processes

Space in the Control Cabinet

Chevron Phillips Chemicals replaces previous I/O level and Ex isolation with excom – and saves a lot of space in the I&C rooms

»Making Industry 4.0 Come Alive«

If you are an avid reader of your more@TURCK customer magazine, you would not have overlooked the fact that the title of this issue is not a new product – at least none that we could have photographed. The graphic designers were asked to illustrate what the photographer would otherwise have taken in front of the camera. You see the digital transformation is fully under way, and we hardware manufacturers also have to adapt to it if we want to support you as a customer on your journey toward the smart factory.

Whilst we are naturally working continually on the further development of our hardware, we are also working more and more on increasingly more powerful software. This not only goes for the hardware-based software directly on the devices but also for new solutions that really make the approach to Industry 4.0 come alive. If this cannot be implemented on one's own within a reasonable time, then new ways also have to be adopted. This is what Turck did in December with the technology buyout of Beck IPC's cloud software. Since then we are both jointly further developing the solution into the Turck Cloud Services, which we can present to you for the first time at the Hannover Messe.

What it is and how you can benefit from this new offering is described in the title story on page 8. However, we will also be pleased to show this to you at our fair stand in Hannover. A large touch monitor has been set up there so that you can experience Industry 4.0 live. For this we will be sending the live data produced on several exhibits directly to the cloud for you to see partially pre-processed and evaluated on the monitor screen. A key benefit of cloud services is that it provides you with worldwide access when you are not at the particular location. Take a look at www.turck.de/cloud. At any time during the trade fair this will be showing live data.

We will be pleased if the articles in this issue of more@TURCK give you one or two ideas, or if you wish to speak with our specialists about your specific requirements for efficient automation. Visit us at fair stand H55 in Hall 9 or contact your Turck sales specialist.

Yours sincerely,

Christian Wolf, Managing Director

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Turck Takes Over Cloud Software

Turck has acquired the cloud software of IoT specialists Beck IPC as part of a technology buyout. The fully developed software solution provides the foundation for the development of the in-house industrial cloud solutions of the Mülheim automation specialists. "The acquisition of the well thought-out cloud software from Beck IPC will enable Turck to take one more step along the path of becoming automation partner for Industry 4.0. Using this software as a basis, we will already in the near future be able to offer our customers a mature and future-proof industrial cloud solution, which we will continually further develop together," explains Turck managing director Christian Wolf (l.)at the signing of the contract. "In the collaboration with Turck we are seeing for the first time in automation a genuine sensor-to-cloud platform for all industrial sectors," says Thomas Schumacher, CEO of Beck IPC. Oliver Merget, director of Turck's Automation Systems business unit, adds: "We don't want to unsettle our customers with Big Data, but offer them Smart Data, i.e. only data with useful value, such as for use in predictive maintenance in order to reduce unplanned plant downtimes."

Beep Simplifies Communication

Turck's new Backplane Ethernet Extension Protocol, or Beep for short, is simplifying the use of its TBEN and FEN20 multiprotocol block I/O modules. Beep makes it possible to connect networks with up to 33 TBEN modules (1 master, 32 slaves) and up to 480 bytes of data to the PLC via a single IP address in Profinet, Ethernet/IP and Modbus TCP networks. More information on page 22

Cloud Solution for Industrial Applications

Turck is presenting its Turck Cloud Solutions service at the Hannover Messe. The data is transferred directly from Turck's controller and I/O components to the cloud. For this, Turck is using the Kolibri protocol recently purchased from Beck IPC, which guarantees encrypted communication. Users can thus save and evaluate production data in the cloud – either just for monitoring tasks or for optimizing their processes and plants. The benefit compared to other systems is the fact that the relevant data can be simply selected in the controller at the click of a mouse. The cloud user interface can then arrange this data directly in clusters and logically organize it in charts without any additional configuration.

more info on page 8

Passive Junctions with an M8 Design

M8 connector variants are completing Turcks offering of multiple passive junctions. The fully encapsulated TB-4M8 and TB-8M8 comply with IP67 protection requirements and are ideal for applications with space restrictions. The fastening holes in the front and at the sides enable the customer to fit the junctions flexibly and suitably for the particular mounting requirement. Turck's offering of compact passive junctions is in response to the growing use of M8 connection technology – particularly in special machine construction and other sectors in which space is restricted. The new product generation is similar after adaptions in design and construction to the already updated M12 junctions. The M8 boxes are available as 4 and 8 connector variants with pluggable M8 connectors and metal threads.

Ultrasonic Sensors for the OEM Business

Especially for price sensitive OEM projects Turck is expanding its range of ultrasonic sensors with the RU50 Eco series. The company was able to develop an ultrasonic sensor based on the latest sonic transducer technology, which does not make any compromises in quality in spite of its economy-based design. The devices in the plastic threaded barrel are made of highly resistant liquid crystal polymer (LCP), and the translucent end caps with an M12 connector output from Ultem. Both plastics have already proved their strength over long periods of use in other Turck products. The RU50 Eco sensor series is currently vailable with a switch output. The customer can choose here between a variant with an M12 connector output and a variant with a cable output.

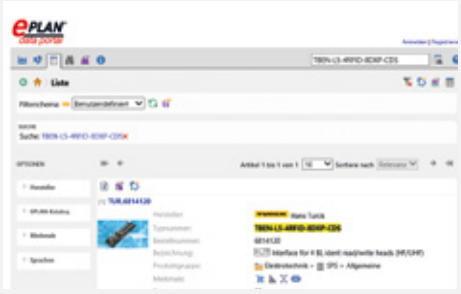
Joint Venture in Malaysia

Turck and Banner Engineering have founded an additional joint venture in Southeast Asia (SEA). After the regional headquarters in Singapore, Turck Banner Malaysia is the second joint venture in the region. Both partners agreed to cover specific markets in joint ventures as part of their internationalization strategy. On March 15, 2018, managing director Darren Chan officially opened the business premises of the new company in Petaling Jaya. Turck and Banner Engineering have successfully worked together in Europe for many years with joint ventures in England, France and Italy. Turck is the regional sales partner for Banner products in many other regions.

Top Employer

Turck is one of the top employers in Germany. This is the result of a ranking that Focus Business published in collaboration with Xing and Kununu. Of the 1000 candidates Turck took 83rd place in the overall ranking for Germany. The family-owned company was placed even higher in the ranking for the "Electronics and electrical engineering" sector. Here Turck took 5th place. "The prize confirms that our continuous commitment to keeping Turck an attractive employer and making it even more attractive is bearing fruit," says Turck managing director, Christian Pauli. Daniela Leppler, director human resources at Turck headquarters in Mülheim, is particularly pleased "that so many co-workers recommend Turck as an employer."

Eplan Data for Turck Fieldbus Technology



Turck has recently published electronic construction data on the Eplan data portal for its most important product series for fieldbus and interface technology. This consists of 105 data sets of the TBEN-L and TBEN-S modular block I/O series as well as Eplan data for the IM12 and IMX12 interface technology series. Turck will publish other data sets during the year, particularly for sensor technology products.

RFID Modules Enhanced with FLC

The functionality of the TBEN-S-RFID compact Ethernet/RFID interfaces has been expanded. The block I/O modules with protection to IP67 come with a new free of charge firmware update, offering many new functions, including the license-free ARGEE programming environment. This Field Logic Controller function (FLC) enables users to implement low to medium complexity control tasks directly on the block I/O module so that these tasks can be decentralized. This reduces the load on the central controller so that only the relevant data has to be transferred. The TBEN-S-RFID can be linked easily to PLC systems without the use of a special function block being necessary. Another new feature is the automatic addressing of the bus-capable HF-RFID read/write heads.

LED Strip Light

The new WLS15 from Banner Enginering is a professional grade LED strip light that makes it easy and very cost-effective to illuminate machines, work spaces, and mobile equipment for improved efficiency, productivity, and safety. Featuring high-efficiency LEDs and a diffuse window, the WLS15 provides bright, even illumination with no hot spots. The strip light is sealed in a shatter resistant, UV-stabilized shell.

IP67 RFID Interface with OPC UA Server

At the Hannover Messe Turck is presenting an IP67 RFID interface with an integrated OPC UA server. The platform-independent OPC UA communication standard enables the TBEN-L OPC-UA to simplify the integration of RFID systems in systems such as ERP, MES or cloud systems, as well as in controllers. Authentication and integrated security protocols protect communication between the systems from unauthorized access and manipulation. The TBEN-L5-4RFID-8DXP-OPC-UA module is compliant with the companion specification for Auto-ID devices. This standard enables the customer to replace devices between the Auto-ID systems of different manufacturers.

Frequency Transducer/ Pulse Counter up to 20 kHz

Turck has added the IMX12-FI frequency transducer to its range of IMX interface devices. Users can not only use the devices as rotational speed monitors but also as pulse counters. In both modes, the single-channel and two-channel variants can transfer input frequencies of up to 20,000 Hz. Besides transmitting the input frequency to the analog output, the single-channel IMX12-FI can also monitor slippage, clockwise/anticlockwise rotation as well as overspeed and underspeed. The user can also define a speed window for monitoring. The two-channel variant transmits the particular input pulses to the corresponding analog outputs. The device can also transfer the difference between two frequencies to an output.

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Five Steps to the Smart Factory

With its wide range of possibilities, Turck Cloud Solutions offers the right implementation for users to pursue Industry 4.0 development – including encrypted data transmission, consistent data retention and the option for hosting by Turck or in the private cloud

It is said that data is the oil of th 21st century. Many companies have understood that data has a value that they can monetize, just like a raw material. Facebook, Google and Co. provide their services free of charge but they are in no way without cost. Today users now know that their data is the currency by which they pay for the services of these Internet giants.

Only someone who collects data can also use it
Not only end consumers produce data today. Large amounts of data are produced every day in industry – data that can have a high usage value when evaluated properly. Machines and plants are continuously producing data that today largely remains unused.

This does not have to continue as Turck has now developed a cloud solution that can put an end to this situation. The cloud saves production data both for monitoring and remote maintenance tasks, as well as for optimizing and analyzing the production processes. The special feature here is that users decide themselves where the data is to be stored and whether it is to be transferred to the internet. The data is also encrypted for communication. To put it another way, customers can thus ensure that nobody steals their oil.

Five steps to smart production
The proprietary cloud platform offering is another step for Turck and its customers on the way to an intelligent, integrated and self-learning production process in line with Industry 4.0. The flexible offer is divided up into five steps.

Step 1: Supply of pure user data for the operation of machines and plants
The digital and analog sensor data enable a PLC or other controller to operate a machine or plant.

QUICK READ

Whilst there are wide range of cloud services available for private and business users, the special requirements of industrial customers in the automation sector have hardly been covered by these services so far: Turck's Cloud Solutions now provides automation specialists with a cloud solution precisely tailored to these requirements and other locally or externally. The encrypted communication maximizes data security, and additional functions such as data analysis or the monitoring of production processes provide the user directly with real benefits. The new offering represents another consistent step by Turck on its journey toward Industry 4.0.

Step 2: Generation of additional data in the sensors and fieldbus modules
The second step covers the generation of additional data no longer required for the actual control of a machine. Sensors, for example, and many other devices supply additional data as well as the process data, such as temperature, degree of contamination, operating hours or other values containing meta information about a device. With the increasing spread of IO-Link in particular, a channel was created to transfer additional acyclical data to the controller. This data has recently been used increasingly for diagnostic tasks or for predictive maintenance. In this way, users can determine the degree of contamination on their ultrasonic sensor, or whether a shaft monitored by a rotary encoder is no longer running smoothly.

Step 3: Integration in the systems of established cloud suppliers
Major IT, telecommunication and technology companies, such as Telekom or Amazon, as well as major software specialists like SAP, IBM or Microsoft, are already offering cloud services on the market. The transfer of data to these clouds from production is now already possible using edge gateways and other solutions, such as Turck's multiprotocol fieldbus devices. Thanks to the multiprotocol Ethernet technology, Turck's I/O modules and systems can send data to edge gateways in parallel with user data (via Profinet, Ethernet/IP and Modbus TCP), which in turn either evaluate it themselves or send it to the cloud systems of the established suppliers.

Turck intends to equip its product portfolio gradually with OPC UA and MQTT communication options. These standard protocols allow components to be integrated flexibly, quickly and easily in any cloud. Beside block I/O modules and modular I/O systems, these protocols will also be available in Turck HMIs and PLCs.

The cloud systems of the major IT suppliers have given little consideration so far to the special requirements of industrial production and automation. Although a lot can be configured and adapted, this can be inflexible, tedious and difficult in particular cases, as well as ultimately being expensive. The communication routes to the major suppliers are also often not encrypted. Turck provides an answer here with its cloud solution that is tailored to automation requirements.

Step 4: Tailor-made for industrial automation
At this year's Hannover Messe, the Mülheim automation specialists are presenting for the first time the Turck Cloud Solutions, its own proprietary cloud solution tailored to meet the requirements of automation and industrial requirements. The benefit of this solution is the fact that Turck with its Kolibri protocol, which is

Turck Cloud Solotions offer tailored solutions for users in the automation sector

»The cloud systems of the major IT suppliers have given little consideration so far to the special requirements of industrial production and automation – Turck's answer to this is a cloud solution tailored to automation requirements.«

part the technology buyout of Beck IPC, offers fully encrypted communication with the cloud. In comparison, communication via MQTT for example is often not encrypted and can therefore be more easily read when the line is tapped.
Kolibri is also a slim-line protocol that can be integrated easily in any standard industrial hardware without causing any performance bottlenecks. Unlike the cloud services of IT suppliers, the Turck cloud automatically shows additional information on the particular devices, without any additional configuration information being necessary. The configuration of other relevant data for transfer to the cloud can be carried out simply in the Turck solution by placing a tick at the relevant device. The function is supported by all Codesys 3-based Turck controllers: Turck will first implement the cloud on its IP67 compact PLC, the TBEN-L-PLC, and later also in the TBEN-S and TBEN-L I/O modules, as well as the HMIs of the TX series.

Where is the data stored?
Turck Cloud Solutions enables the user currently to choose between four different cloud storage options: The right solutions are provided for the customer to enable hosting either by Turck or by the users themselves. Turck also offers solution options specially tailored to customer requirements.

OPC UA AND MQTT

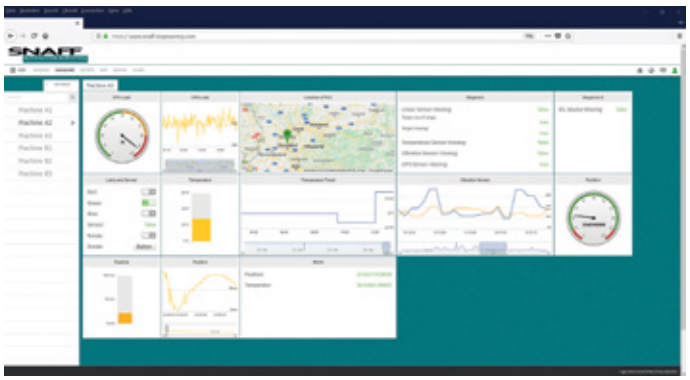
OPC UA is a global standard for integrative communication across all levels of the automation pyramid. The standard was developed in close collaboration between science and industrial companies – including Turck. MQTT stands for Message Queuing Telemetry Transport. The protocol was developed for communication between machines and is also suitable for connections with delays or with a limited bandwidth. MQTT servers store the entire data content of the clients – in industrial automation this is mostly from sensors or actuators.

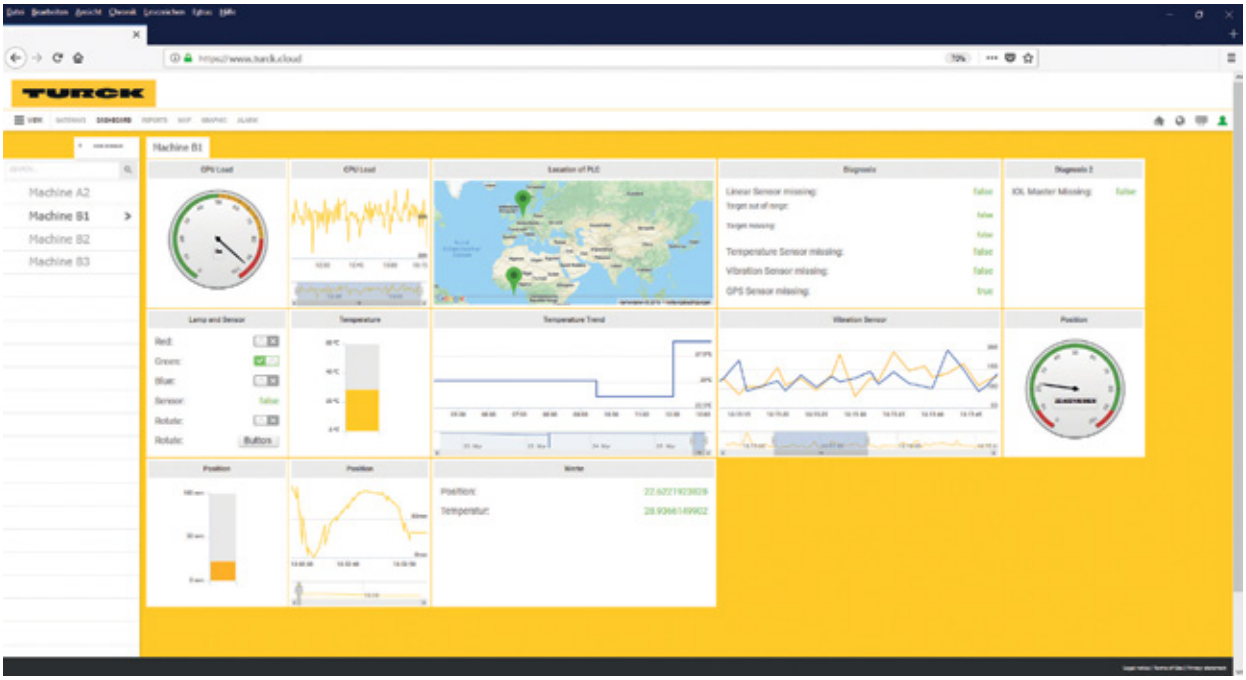
The most convenient variant is to have the cloud hosted by Turck. For this, the company works together with major IT center operators, who can ensure the necessary 24/7 support and also the appropriate data security and system performance. This saves the customer from having to think about the necessary infrastructure and support. Turck takes care of this for the customer as a service provider and thus reduces the initial investment in terms of time and costs. As Turck's cloud solution is primarily hosted on servers in Germany, data security is guaranteed in accordance with German and European data protection laws. On request, customers can also use a server site of their choice, such as in Asia or in the USA.

Flexibly adapted
The customer can also use the cloud hosted by Turck in two versions: Firstly as a cloud with a Turck look – particularly suitable for smaller OEMs and end customers wishing to use the cloud service themselves. Alternatively, the cloud can also be implemented in the corporate design of the customer. This customer portal can also be functionally adapted to the needs of the customer. The customer portal is primarily designed for OEMs wishing to offer their customers a machine with a cloud option, which is required to be recognizable as a product of the OEM.

Turck cloud on-premises
The on-premises variant of the cloud is hosted directly on the customer's site, so that they have complete physical control of all data and processes. This solution can be implemented on the customer's hardware if the appropriate server landscape can be provided and the IT department can provide the necessary support. This installation is normally carried out in a suitable IT environment with air-conditioned server rooms and cannot be carried out directly in the production environment.

The benefit of this solution is the fact that customers do not have to connect their private cloud to the internet, but can establish a local connection to their





Smart data, clearly organized: The dashboard of Turck Cloud Solutions shows the actual machine data and states at a glance; the user-interface can also be customized if required

servers from the production area. This solution can be a way for customers with security concerns to enjoy the benefits of cloud-based intelligence without having to store the data externally.

For customers who require the on-premises solution but do not have their own IT center, Turck has developed state-of-the-art industrial on-premises server solutions. These do not require fans or moving data carriers and can therefore be installed as IP20 versions directly in the control cabinet or as a future IP67 variant directly at the machine in the field. The on-premises cloud can also be opened for worldwide access in order to open them, for example for other customers or other corporate sites.

Step 5: Cloud applications tailored to industrial processes

Turck will gradually expand the applications and functions implemented on its cloud platform. Frequently required analytics functions such as long-term evaluations, sensor behavior or log book functions can then be used without having to configure them manually.

Self-learning algorithms will also have a role as part of the further development of functions. The machine will then learn on its own what is correct (normal) and incorrect (deviant). This estimation will become increasingly more precise the longer operation continues. If the machine registers, for example, a higher temperature value at a sensor, it will know if this is due to the weather or seasonal sunlight, or another reason such as wear.

If the solution to the problem is documented by the software, it will be one day possible to suggest a remedy in addition to the diagnostics or notify the right technician directly via smartphone.

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»For global companies we are the ideal partners for a worldwide rollout of asset tracking, supply chain projects or other applications in the field of RFID.«

Oliver Merget | Head of the Automation Systems business unit

On the journey towards Industry 4.0, Turck promises its customers solutions for the acquisition, conditioning and transmission of production and maintenance data. Erik Schäfer, chief editor of the technical journal Konstruktion & Entwicklung (design and development), talked to Oliver Merget about this.

With Turck Vilant Systems in the Turck Group, the company now has a fully-fledged RFID turnkey solution supplier which provides your portfolio with additional software, systems and services for the RFID sector. How do you intend to integrate the corresponding Turck RFID hardware here?
Our primary aim is to offer customers suitable RFID solutions to improve their processes. For this, Turck Vilant Systems offers 15 years of know-how in this area, as well as the resulting knowledge in the field of software and applications. Turck naturally wants to give preference to its hardware here, but we are not going to turn down projects in which this is not possible. Turck Vilant Systems always has the freedom to use products that guarantee the best solution for the customer.

You are thus now able to operate at a deeper level in the system business.

What can Turck Vilant Systems offer your customers?
Turck Vilant Systems offers customers many years of experience in the implementation of RFID applications in UHF environments, and the company is a pioneer in this area. With over 1000 system installations, Turck now has one of the largest installed bases in the field of industrial automation. Our global network of branches now enables Turck Vilant Systems to provide its customers with the infrastructure, service and support required for worldwide installations. For global companies we are therefore the ideal partners for a worldwide rollout of asset tracking, supply chain projects or other applications in the RFID field.

You recently presented new IP67 I/O solutions such as the spanner block I/O module. What are its main features?
The IP67 spanner module enables us to network different worlds. With its two separate and electrically isolated Ethernet interfaces, the module supports bidirectional data exchange between two Ethernet networks with up to 256 bytes. The use of our multiprotocol technology makes it possible to convert between Profinet, Ethernet/IP and Modbus TCP. The trend towards Industry 4.0 and the increasing modular design of systems and machinery also calls for effective possibilities for networking and linking these plant sections. The spanner module supports users in connecting the production lines of different manufacturers. The bidirectional exchange of transfer signals, product and manufacturing data directly in the field is a critical benefit for the engineering.

You have also added a module with serial interfaces, the TBEN-S-2COM IP67 I/O module, to the portfolio. Why are you still offering serial interfaces?
Even if serial interfaces have long been superseded in the IT sector by USB, they still play an important role today in automation. Ethernet is often too powerful and too expensive for small devices. IO-Link as a point-to-point connection with up to 32 bytes per cycle is not ideal for every application. It is precisely this gap that the serial interfaces can cover. For example, handheld scanners for basic identification tasks

thus still often use RS232 for communication. Our TBEN-S-2COM block I/O module allows the connection directly in the field with only one cable for data and power supply. The EZArray Series light curtains and K50 Series pick-2-light systems of our partner Banner Engineering are other examples. The Modbus RTU function is a specially integrated feature, which considerably simplifies controller programming. The integration of serial devices in industrial Ethernet networks is naturally a major issue in the retrofit sector.

You have also added new functions to your RFID block I/O modules. Which customers are you targeting here?
The integration of our ARGEE programming environment directly in the TBEN-S RFID module enables customers to implement evaluations and commands in the module directly in the field. This makes the implementation of decentralized intelligence possible whilst reducing the amount of unnecessary data processed in the network. Machines can then also be fitted with an RFID solution at a later time, and the data processed directly in the module.

What is the importance of software for Turck?
At Turck we are increasingly using software as well. This is also necessary if we want to support our customer with their migration to Industry 4.0. This firstly includes integrated engineering tools which make the management and exchange of engineering data easier for customers. Turck will therefore combine its current software tools in a software suite and adapt them for the latest usability requirements. Secondly, we will increasingly provide additional functions in our products that will be made available through regular software updates. We will increasingly prepare our products here for sending relevant information directly to higher-level systems and bypassing a conventional PLC.

Author | Interview by Erik Schäfer, chief editor of technical journal Konstruktion & Entwicklung
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Oliver Merget sees Turck well equipped for the challenges of Industry 4.0

What? Where? How?

Wireless-based identification using RFID is one of the key technologies for smart production processes suitable for Industry 4.0. Turck provides a powerful tool for this with its BL ident RFID solution

Today, RFID is already one of the key technologies for the smart factory of the future

A highly automated, highly flexible and closely networked industrial production requires efficient technologies for identifying systems, tools, workpieces and products. Due to its specific benefits, wireless-based RFID identification technology stands out in comparison to alternative solutions such as optical identification, and is therefore without doubt one of the core technologies for Industry 4.0.

In many places today the implementation of RFID in production processes is often still complicated and time consuming. HF technology is relatively easy to integrate due to the insignificant effect of the spatial and physical environment. However, HF technology has a limited range, so that the UHF band is used in applications requiring greater flexibility and larger ranges. UHF technology is particularly used in cases when the tags are fitted to the product and not to the workpiece holder, remain in place there, are difficult to reach or even leave the production site. Bulk reads are another benefit of UHF technology. Whilst the simultaneous reading of several tags is also possible with HF technology, this is limited to only approx. 20 per read operation. UHF can handle 200 tags here and even more, depending on the number of antennas. UHF technology is therefore particularly used in logistics applications requiring the simultaneous reading of several tags.

UHF RFID: Large ranges and high complexity

Users accept the trade-off between the greater complexity involved with UHF systems and the greater flexibility and larger ranges achieved with UHF technology. Unlike HF technology, UHF communication is not based on inductive coupling in the magnetic near field, but the radiated electromagnetic waves. This enables longer ranges but also results in side effects such as interference caused by the interaction between read/write heads or tags. The reflections of waves on walls, metal objects or objects containing water also present the user with particular challenges. UHF read/write heads are provided with some variables which can be set in order keep these effects in check. For example, the output power of most devices can thus be variably controlled. However, users must also set RSSI filters and other parameters to suit the application.

Do several tags have to be read at the same time? Are the read/write heads or the tags moving? Are read and write operations required, and if so, how fast do the processes have to be? These questions are the basics of a UHF installation and must be answered early on when designing a system. This is also the reason why UHF projects mostly require the involvement of system integrators. The integrators take care of the installation of a middleware that filters, transfers and if required presents the usable information from the RFID for the customer's ERP, SCADA or MES system.

UHF requires integration know-how

The integration business is mostly unfamiliar territory for conventional manufacturers – at least in Germany. The software know-how as well as the IT system and programming knowledge required are not necessarily part of the core expertise of typical automation companies. This is why Turck has for a long time maintained partnerships with system integrators throughout Germany, who have provided the support for the successful implementation of several UHF projects.

The strategic importance of integration for UHF RFID systems was for Turck one of the reasons it acquired the majority share of an RFID integration partner. The right partner in Vilant was found in 2017. With four subsidiary companies, Vilant has implemented over 1000 RFID system installations in 35 countries in the 15 years of its existence, and is thus a major player in the industrial RFID system business. The company itself was aiming to expand further internationally and is now able to make use of Turck's well established global sales network, which offers access to many international projects. The RFID turnkey solution supplier has been operating under the name Turck Vilant Systems as an independent RFID integrator within the Turck Group since January 2018.

Versatile software portfolio

Turck Vilant Systems is today already serving the typical focus sectors for RFID system solutions, such as asset tracking, rail, supply chain as well as pulp and paper. The company has software as one of its main focuses. The portfolio contains different software solutions that are suitable for devices with or without a user interface.

QUICK READ

RFID is a key technology for Industry 4.0. Intelligent production processes are only possible if products, workpiece holders or tools can be identified or located unambiguously. This data can not only be used to optimize the process but also traceability or quality assurance. Optical identification is limited in many application fields where only RFID solutions can still operate effectively, such as Turck's BL ident HF/UHF RFID system.

New at the Hannover Messe: Turck's TBEN-L-RFID module with an integrated OPC UA server simplifies the connection of factory automation to the IT world

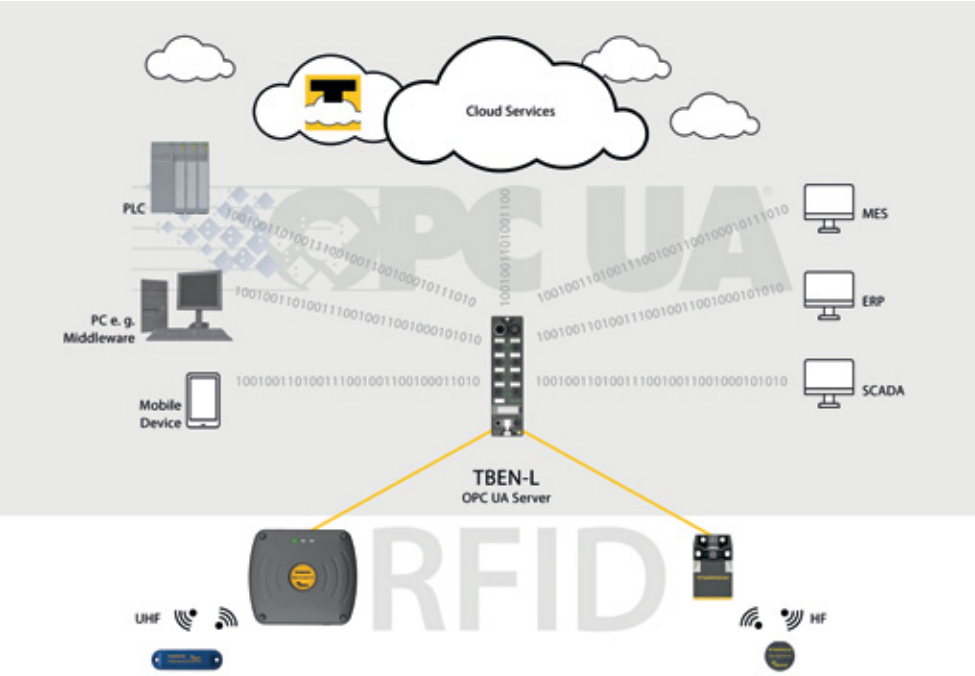
While the Vilant Engine is the right choice for devices without a user interface, the Vilant clients, Gate Client, Handheld Client or Forklift Client, are designed for devices with a user interface. The Handheld Clients, for example, are suitable for RFID handheld devices for the manual reading or writing of the RFID tags, Gate Clients are used for automatic tag detection and Forklift Clients on the operator terminals of forklift trucks. Each device software also features direction detection and stray read filtering.

This kind of specific software cannot simply be done in passing – not even by Vilant. The Finns had already gathered a lot of experience in UHF RFID when there weren't even any international standards for the technology. Vilant incorporated these many years of experience from several projects into its solutions. The software was continually further optimized and refined – so that their logistics expertise is now condensed in program code.

The company shows several examples of its expertise in different sectors on its website www.turckvilant.com. For example, Vilant helped to increase the productivity at the Finnish ABB plant in Vaas by 60 percent by switching the internal logistics to RFID. Vilant could also contribute its know-how in major projects for Migros, the biggest retail chain in Switzerland, car rental company Sixt, and for several other customers. Its contribution always led to significant performance increases for the customer.

HF irreplaceable in automation

While UHF is primarily gaining ground in logistics applications, the development of digital production in factory automation will also in future continue to be supported by the installation of HF solutions – partly in combination with UHF technology. Turck's BL ident RFID system is specially suited for these kinds of hybrid applications, as it allows the connection of HF and UHF read/write heads on the same interface modules. The fitting of the interfaces to the controllers is now very easy in many cases. Especially with the new RFID interfaces in the TBEN-S or TBEN-L IP67 block modules, which are fitted with the Universal Interface (UI



OPC UA offers a standard language for communication with controllers and IT systems, including authentication and other definitions such as the companion standard for AutoID devices

Interface). The UI interface enables a controller to use the RFID channels as simple inputs. The programming of a user-defined function block for the controller is unnecessary here.

OPC UA standardized communication

If RFID interfaces are required to communicate with middleware, SCADA, ERP or MES solutions, the users largely have to accept proprietary solutions or even write their own programs. The platform independent standard OPC UA provides a solution here. OPC UA offers a standard language for communication with controllers and IT systems. Turck has now integrated an OPC UA interface directly on its IP67 RFID interface, the TBEN-L4-RFID-OPC-UA. This enables the interfaces to communicate directly with MES or ERP, or other Ethernet-based systems. Many cloud services also support OPC UA and thus allow the transfer of production data to clouds for monitoring or analysis tasks.

OPC UA also contains an additional specification by which the communication of AutoID devices in particular, such as barcode readers or RFID readers, is standardized. If devices support the companion standard for AutoID devices, the relevant systems can exchange between each other. The companion specification for the AutoID devices also provides the so-called Report mode, which is supported by Turck's read/write heads. The customer can thus start the continuous or time-limited scanning of tags and obtain the read data as event notifications as soon as a tag is located in the field of the read/write head. The customer consequently no longer requires any additional trigger signal, and the read/write head operates autonomously when reporting any new tag to the clients or higher-level systems.

Secure communication

Another benefit of OPC UA is the fact that the standard supports security mechanisms for encryption and authentication and thus protects data from unauthorized access, particularly when transferring to ERP and cloud systems. The customer is thus ensured secure data access from any location worldwide. The security of communication via OPC UA was also tested and confirmed by the BSI, the German Federal Office for Information Security. The TBEN-L4-RFID-OPC-UA already offer the necessary data encryption and required support for security certificates and the configuration of access rights via the web server with a suitable secure HTTPS connection.

Both frequency bands, HF and UHF, will continue to have greater importance as Industry 4.0 further evolves. Whatever the case, customers who come to Turck for their RFID project are in good hands as Turck has one thing in common with its BL ident RFID system: It can work superbly with both HF and UHF – also at the same time.

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Trailblazers

Whilst magnetostrictive measuring systems are ideal for detecting the position of the piston rods in hydraulic cylinders, the requirements for industrial use are different to those for mobile hydraulics

Trends have a sell-by date. Initially only a few "early adopters" have the new product. Bystanders continue to look on and some ask a few questions. People in the business world are invited to congresses and podium discussions about the new subject. After some time and depending on the area, the trend becomes standard, main stream or state of the art, or it dies the quiet death of the few good ideas.

Magnetostrictive linear position sensors already have the transition from trend to standard in the fluid sector behind them. The devices are just as often used for the high-speed detection of the piston position of

The magnetostrictive measuring system is the simplest system for mounting inside hydraulic cylinders

The stainless steel LTX is particularly popular in heavy industry applications

hydraulic axes as for the slow but high-precision positioning of a roller inside a roll stand. As the positioning is carried out directly in the cylinder, it is not affected by external influences and thus excludes from the start any possible inaccuracies caused by transmission elements such as play.

Linear position detection: inductive or magnetostrictive

Inductive and magnetostrictive measuring systems are widely used for the detection of linear movements. The different features of the two systems make them suitable for different applications. The magnetostrictive sensor is normally installed in a fluid cylinder while inductive sensors measure paths directly on linear axes or moving parts.

Inductive linear positioning systems, such as the Li sensor from Turck, are based on a so-called resonance coupling which enables non-contact and wear free detection of the positioning element moving above the sensor. The sensor's high degree of protection ensures safe and trouble-free operation at any time, even in the most adverse conditions. Its excellent dynamic characteristics, coupled with its high shock resistance, enable it to operate high-speed closed-loop control circuits without any significant dead times.

Magnetostrictive linear positioning systems on the other hand are based on a physical torsion effect. The sensor sends an electrical start signal along a so-called waveguide. This pulse causes a magnetic positioning element to generate a torsional wave on the waveguide, which runs from the positioning element towards the sensor unit. The elapsed time measured from the pulse to the detected torsional wave enables the distance from the positioning element to be calculated precisely. The key benefit is the fact that the measuring length of magnetostrictive sensors is almost unrestricted, since the extension of the waveguide is virtually unlimited.

The magnetostrictive measuring system also offered by Turck has two inherent benefits. Firstly, magnetostrictive measuring processes are absolutely contactless and wear-free. Important sensor characteristics, such as accuracy and linearity, are retained for the entire lifespan and guarantee perfect sensor operation all the time. The second benefit comes from the first: Thanks to the contactless waveguide measuring principle, magnetostrictive sensors can be produced with a rod design and thus enable straightforward mounting in hydraulic cylinders. For this the piston rod is hollowed out in order to house the sensor measuring rod. A magnet is fastened at the head of the piston in the cylinder. This acts as a positioning element, which moves when the hydraulic cylinder moves in along the measuring rod. By integrating the measuring rod in the cylinder, it is reliably protected from external influences and mechanical damage. Only the sensor unit protrudes externally at the end of the cylinder. Magnetostrictive positioning is standard in hydraulic applications. Hydraulic system manufacturers only have to use alternative measuring methods when very long strokes or telescopic cylinders are involved.

One of the latest alternative systems for detecting the position of a hydraulic piston consists of an optical reading device, which is mounted externally on the hydraulic cylinder and a laser barcoded piston rod. The reader unit reads the barcode when the piston moves in and out, and determines from this code the current position and thus the stroke of the piston. This system provides the user with absolute position information. The system is relatively inexpensive since the lasering of the piston cost less than the longitudinal drilling of the piston rod, as required by magnetostrictive sensors. One disadvantage of the barcode system is the susceptibility of the optical unit to contamination. The piston rod furthermore has to be protected from twisting, so that the reader head can detect the code precisely.

Absolute position measurement with linear position sensors

Magnetostrictive linear position sensors that measure an absolute position and do not require referencing after machine stops are therefore used far more often. However, the sensors not only have to supply absolute

QUICK READ

Linear position sensors are highly popular in the automation industry. Different sensor designs are used here for different sectors. The design of magnetostrictive sensors makes them particularly easy to integrate in hydraulic cylinders – both in industrial applications and in mobile hydraulic equipment. Turck, the Mülheim automation specialists, has the LTX and LTE linear position sensors in its portfolio. Two sensor series, which operate completely wear free and meet the particular sector requirements thanks to their non-contact design.

Turck's Embedded LTE is specially optimized for use in mobile hydraulics applications

signals but also have to allow simple setup. They must also allow problem-free connection to the standard machine control interfaces of the particular sector.

Not all types of linear position sensors are equally suitable for each sector and application. Manufacturers therefore offer linear position sensors for the different sectors. In addition to magnetostrictive sensors for use in factory automation, Turck also offers devices for use in mobile equipment.

Linear position sensors for industrial applications

Turck's LTX linear position sensor is a pressure resistant rod-type sensor that was specially developed for use in industrial hydraulic cylinders. The sensors of the LTX sensor series have a compact housing with IP68 protection and are thus resistant to humidity and dust. The measuring rod is made from stainless steel and offers optimum protection for the internal measuring system. Unlike many other manufacturers, the Mülheim automation specialist also offers a fully stainless steel version of the LTX linear position sensor. This version is highly popular in the heavy industry. The sensor can be ordered in any length up to 7600 mm. It is also resistant to severe vibration up to 30 g and severe shock up to 100 g. The LTX thus prevents malfunctions and machine downtimes even in extreme load conditions in mechanically demanding applications.

Rapid commissioning and simple handling

The autotuning system of the Turck LTX devices ensures straightforward commissioning for the user. The sensor adjusts itself automatically to the positioning element used and thus enables commissioning to be carried out simply, quickly and safely. An optional teach adapter enables the blind zones of the sensor to be adapted in the field to the application. Alternatively, the sensor can be ordered directly as a variant.

Handling when a sensor is replaced or for sensor troubleshooting couldn't be easier. The electronics housing together with the measuring system can be removed easily. This simply requires the removal of two screws to detach the actual sensor from the pressure pipe. The cylinder here remains hydraulically sealed while the actual sensor can be removed safely. Sensor status diagnostics are provided by a multicolor LED integrated on the sensor housing. The diagnostic LED indicates the status of the position signal as well as other operating states. The actual status is therefore visible at a glance without the need for any complex diagnostic procedures or additional electronics.

All Turck magnetostrictive sensors can be programmed simply and precisely for the measuring range required. This can also be adjusted without any additional tools if a different measuring range is required. This simplifies mounting by enabling the zero point to be set at a later time, and also reduces the number of device variants that have to be kept in reserve since several measuring paths can be covered with only a few devices.

Linear position sensors for mobile hydraulics

Due to their protruding sensor unit, the linear position sensors used in industrial applications are not suitable for the mobile hydraulics market. The sensors used in the mobile market are required to have a space saving design. Turck therefore developed the robust LTE linear position sensor specifically for this purpose. Additional standards also meet the requirements of the mobile equipment sector in addition to the design. Thanks to the integration in the hydraulic cylinder, the sensor is protected from extreme ambient conditions and is therefore unaffected by external influences. The device is resistant to shock up to 100 g and vibration up to 30 g, as is required for routine tasks in agricultural and forestry machinery. The LTE is even suitable for use in hydraulic cylinders for heavy construction machinery in particularly severe environments.

Like the LTX, the LTE also guarantees a high degree of precision, linearity and repeatability thanks to the field proven magnetostrictive technology. The sensor has an internal 16-bit resolution and also offers three signal ranges for mobile equipment (0…5 V, 0.25…4.75 V, or 0.5…4.5 V) in addition to the standard analog output signals of 0…10 V and 4…20 mA.

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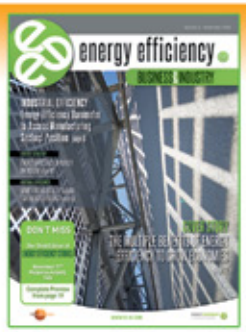

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Beep!

Turck's Backplane Ethernet Extension Protocol, or Beep for short, connects up to 33 I/O modules with just one IP address in Profinet, Ethernet/IP and Modbus TCP networks

Language connects worlds together. Particularly if different nations can communicate in a common language. This process is not only limited to communication between people but is also the case in industry. Controllers and fieldbus devices used to use different protocols in different markets and regions. Besides the preferences of different regions, application requirements also determine the choice of protocol. Due to the fact that a uniform global standard is unrealistic, Turck presented its multiprotocol technology launched in 2012 as a unique and pragmatic way of handling different languages. Devices with multiprotocol Ethernet technology are able to communicate with the three most common Ethernet protocols worldwide – Profinet, Ethernet/IP and Modbus TCP. They combine three protocols in one device.

Thanks to Beep only one IP address is required to connect up to 33 I/O modules in Ethernet networks

Problem solver

Every day, industry is faced with new challenges. The solving of a problem mostly involves the discovery of new requirements that have to be met. The development of Turck's Beep technology is based precisely on this principle. With the launching of its TBEN-S and TBEN-L device series, Turck has offered autonomous fieldbus modules that can each be accessed individually with a single IP address in the network. A useful innovation, since the customer saves costs for additional fieldbus couplers and can manage without the use of proprietary sub-bus structures. There is no other more efficient I/O solution, particularly for applications with a medium to low I/O density, such as on robots.

In very large networks containing many stations, however, a direct fieldbus connection can be a disad-

QUICK READ

With the launch of its multiprotocol technology six years ago, Turck introduced a new "era of simplicity" in fieldbus technology: Under the maxim "One device – three protocols", Turck's I/O modules have been able since then to operate in Profinet, Ethernet/IP and Modbus TCP networks, reducing the number of devices that users have to keep in reserve. Turck's Backplane Ethernet Extension Protocol now allows another milestone to be reached. The new protocol enables the connection of up to 33 I/O modules in a network via a single IP address.

vantage. In these kinds of installations, IP addresses can be rare. The number of connections that controllers can manage is also limited. In order to solve this problem, Turck developed the new Backplane Ethernet Extension Protocol. Beep enables up to 33 block I/O modules and up to 480 bytes of process data to be combined as an Ethernet subnet. This type of subnet only needs one IP address and communicates via a single connection with the controller. Irrespective of whether it is a Profinet, Ethernet/IP or Modbus TCP network.

Beep simplifies communication

In this kind of Beep network one module acts as a master while a maximum of 32 additional modules act as slaves. Users thus benefit twice over: They firstly do not have to purchase any special gateways with proprietary cabling in order to establish the subnets and reduce IP addresses. This is because each block I/O module can either be used as a Beep master or slave. Secondly, through the reduction of the IP addresses, the user can create I/O networks with a high density and connect them with low cost controllers via a smaller number of supported connections.

Another benefit is the fact that Beep operates with all standard Ethernet components. Furthermore, configuration couldn't be easier thanks to the integrated web server. The user defines here the first device on the line as the Beep master and the others are automatically assigned as slaves. The master saves here all the parameters of the device configuration.

If a slave has to be replaced due to a fault or any other reason, this can be performed simply by drop-in replacement. This not only reduces the downtimes required but also the associated costs. The new slave used is automatically detected by the Beep master and

Turck's TBEN-S block I/O modules are particularly suitable for applications in restricted space

Turck TBEN-S offers unbeatable efficiency in medium to low I/O density networks, such as in robot applications

ETHERNET MULTIPROTOCOL

Under the name Multiprotocol, Turck offers fieldbus gateways and block I/O modules that combine the three Ethernet protocols – Profinet, Modbus TCP and Ethernet/IP – in a single device. The multiprotocol devices can be operated automatically in each of the three Ethernet systems. Turck's multiprotocol I/O devices detect the master after startup and adjust themselves automatically to the protocol. Read access via Modbus TCP is a special highlight, also when the controller is connected via Profinet or Ethernet/IP. In this way, HMIs as well as edge gateways and cloud systems can access all process values in parallel with the PLC.

The multiprotocol technology offers users of Ethernet protocols many benefits:

Profinet
- Profinet Real Time (RT) Conformance Class B with topology detection and automatic address assignment
- Fast startup (FSU), best in class with < 150ms
- Ring redundancy (MRP)

Ethernet/IP
- Fast startup (QuickConnect), best in class with < 150ms
- Ring redundancy (DLR)
- Different configuration options for different controller environments

Modbus TCP
- All standard Modbus function codes supported
- Simple integration in Schneider and Mitsubishi controllers, industry PCs and control systems for process automation

supplied with the necessary parameters. A new manual configuration is unnecessary.

The configuration must ensure that the Beep network is installed in a linear topology. The Beep master here always has a static IP address whereas the Beep slaves are not assigned any IP addresses. Several Beep networks can also be operated in sequence along a line. They are configured according to the same principle: Master – Slave – … – Master – Slave. Mixed operation consisting of Beep networks and the devices of other manufacturers is possible without any problem.

Users benefit from the large product portfolio

Beep is available as a firmware update for all Turck multiprotocol modules of the TBEN-S and TBEN-L series as well as on the FEN20 modules. Turck's TBEN-L modules are some of the classics of the IP67 block I/O modules. Besides modules with normal I/O interfaces, the TBEN-L series also includes IO-Link masters, Profisafe and Ethernet/IP, CIP safety, as well as RFID interfaces. Turck's TBEN-L-PLC also offers a full-featured IP67 controller based on Codesys-3. Thanks to their robust housing and high degree of protection, this

Beep is available as standard on all TBEN-L, TBEN-S and FEN20 modules

product series is particularly suitable for the automobile sector as well as for logistics and machine building. While the TBEN-L is used in applications requiring extremely robust devices with high degrees of protection, the FEN20 module stands out for precisely the opposite reasons. With the FEN20, Turck is offering its customers one of the smallest block I/O modules for installation in control cabinets. It offers impressive performance particularly in decentralized applications with a small number of I/O points. Thanks to its extremely compact dimensions, the FEN20 is also ideal for retrofitting Ethernet functions in existing control cabinets and small switch boxes.

Extensive application range: TBEN-S series

Turck's TBEN-S product series combines the benefits of TBEN-L and FEN20. Thanks to the fully potted housing and the extended protection range, it offers a robust design in protection classes IP65/67 and IP69K. These certified protection classes for the TBEN-S series are the result of Turck's "Out of the cabinet" strategy. The ultra-compact I/O module series is also suitable for applications in restricted space.

Like the other Beep-compatible block modules, the modules of the TBEN-S series are multiprotocol-capable and thus support the three standard Ethernet protocols. The specific protocol is detected entirely automatically. In this way, customers can connect the modules to different controller systems without any problems. This feature is particularly useful for globally operating companies.

The many modules of the TBEN-S series offer outstanding flexibility compared to the competition. The universal channels of the DXP modules can, for example, be used as inputs or outputs without any configuration. The universal analog modules can process thermocouple and RTD signals as well as current and voltage signals. In this way, these modules also help to reduce the number of device variants that the customer has to keep in stock. Turck gives special consideration to IO-Link technology, which is a universal digital interface for the sensor/actuator level. TBEN-S modules are therefore also available as I/O-Link masters.

Turck has dedicated itself to making the commissioning and maintenance of modules as easy as possible for engineers; in terms of design as well as in terms electrical circuitry and engineering. In line with this approach, the wiring of the TBEN-S series in the field couldn't be easier – just like the direct integration in industrial Ethernet networks. While problems in installations can never be totally avoided, the TBEN-S offers users comprehensive diagnostic functions for overvoltage, current and short circuit. If a device has to be replaced, this can be performed easily and without any complicated configuration.

Turck's I/O modules already support today read access via Modbus TCP parallel to the controller connection. This approach enables HMIs and control systems, as well as edge gateways and cloud systems to access all process values. The latest protocols such as OPC UA and MQTT are naturally being worked on in the background. Turck is also an active participant in the standardization of appropriate profiles in the IO-Link community.

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Continuous further development: The key indicator cockpit (right) was recently added to Turck's pick-to-light system

Assembly Helper

Turck shows system solutions for light-controlled worker guidance in manual assembly processes in the SmartFactoryOWL manufacturer-independent demonstration platform

A product is never launched in industry that was not previously thoroughly tested. This absolutely essential – just in order to meet the relevant safety standards. However, it is never possible to take into account all eventualities even through intensive testing. Company employees responsible for buying have to rely on the information given by the manufacturers. It is seldom possible for the customer to see new systems in action before they purchase. However, this is where the SmartFactoryOWL provides a solution.

Manufacturer-independent solutions for hands-on testing

The SmartFactoryOWL model factory was founded in Lemgo in April 2016 by the University of Applied Sciences East Westphalia-Lippe and the Fraunhofer Institute. "One aim of the SmartFactoryOWL is to develop different assembly concepts and use the different assistance system technologies or also combine these together," says professor Sven Hinrichsen, who represents the industrial engineering area in the SmartFactoryOWL. The professors, employees and students work there in small teams on the optimization of production processes with the help of new technologies.

Pick-to-light for every requirement

Hinrichsen and his team have been working with the pick-to-light system developed by Turck and its optical sensor partners Banner engineering for two years. The initial aim was to optimize a manual assembly process with a wide range of variants for a machine builder. The first version of the light-controlled worker guidance system was completed in the same year that the factory was founded, and has been continuously further developed up to today.

The Turck portfolio provides an optimum range of solutions for extensively optimizing the manual assembly process. The worker first of all reads in a 2D

QUICK READ

The SmartFactoryOWL is a demonstration platform that provides support in intelligent automation for small to medium-sized companies on the way to digitized production. As a partner of the SmartFactoryOWL, Turck has been represented since 2016 with a pick-to-light system, to which researchers and students of the OWL University of Applied Science have now added a put-to-light system and a key indicator cockpit. The put-to-light system optimizes the supply of materials, while the key indicator cockpit provides guidance for the worker during the assembly process. The cooperation between Turck, the SmartFactoryOWL and Assembly Solutions enabled the development of a projection-based assistance system using Easy Array light curtains from Banner Engineering.

code via the iVu vision sensor from Banner Engineering. The connected TX513 HMI then shows the assembly process on the start screen. A programmable gateway for the IP67-rated BL67 I/O system acts here as the controller. Turck programmed the pick-to-light application on the gateway with Codesys 3, which contains TargetVisu as an additional program for the visualization of the individual assembly steps. The system was implemented so that users can enter new product configurations themselves without any programming required. The K50, K30 and PVD sensor lights from Banner show the worker the next part to be assembled and thus provide guidance through the entire assembly process. Workers acknowledge that the required part has been picked by triggering the integrated sensor when their hand is placed in the indicated container.

Extension with put-to-light and RFID

In practice, a logistics worker has to go through the different assembly workstations and check whether containers are empty, bring these to the warehouse, fill them and take them back to the workstation. Containers can also be forgotten here or placed in the wrong picking shelf, thus leading to interruptions in the assembly process. Sven Hinrichsen and some of his students took up this challenge in the SmartFactoryOWL model system and developed a put-to-light solution for optimizing material logistics. The system notifies the warehouse automatically of any empty containers.

If a container is emptied during the assembly process, the worker places this on a transport trolley located next to the workstation. An RFID read/write head in the front of the trolley ready the to the warehouse. New containers are filled with the required components in the warehouse.

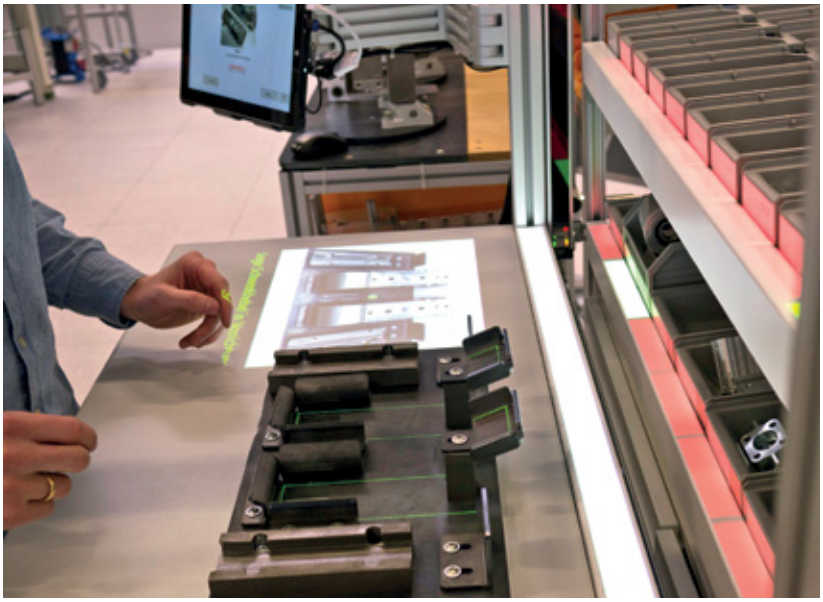
"Unlike labeled containers, this RFID system enables the actual content of the containers to be written to the tag. Thanks to the fast information transfer, we are able to reduce the number of required containers and therefore also reduce stock levels in the plant," explains Sven Hinrichsen.

The actual put-to-light process is used back at the workstation. The picking shelf equipped with the pick-to-light system at the front has the corresponding put-to-light system at the back. The logistics worker holds the filled container in front of a read/write head. Depending on the transferred data, the light for the appropriate track on the shelf in which the container is to be inserted turns green. The worker acknowledges the placing of the container in the appropriate track by pressing the lamp. This goes out as a result, and turns red if the worker acknowledges the wrong one.

Overview thanks to key indicator cockpit

After students thoroughly tested the assembly system, it was decided to provide the ability to display the actual progress of the assembly process. This information is shown to the worker in real time by the key indicator cockpit next to the workstation. It can also show the produced batch size, the order list and other key indicators. The cockpit acquires its data directly

The picking shelves are fitted with RFID read/write heads from Turck, which identify the inserted containers



Showing the next step: projection-based assistance systems with measuring light curtains from Banner Engineering

from the TX513 of the pick-to-light system via OPC-UA. "Each individual step is logged so that we have continuous status information," Hinrichsen explains the decision. The individual values are calculated in Turck's programmable BL67 gateway. This provides information via Ethernet to the TX513 HMI, which sends the information via OPC-UA to the large display above the workstation.

Key indicator cockpit used for process monitoring

The key indicator cockpit can also be used in industrial applications to identify problems. If the time required for an operation fluctuates considerably, this process step has to be checked. A component may have got stuck at this particular position. However, it is also possible to make inferences about the ergonomics of the workstation or the tool.

Image processing in manual assembly processes

A master's degree project completed by Alexander Nikolenko demonstrated once more the benefits of SmartFactoryOWL. In his master's study, Nikolenko made an in-depth examination of the possibilities for image processing in manual assembly processes. "This is actually an area that was not previously a focus of the system suppliers. Image processing now particularly makes a contribution to ensuring production quality in highly automated processes. As manual assembly processes are becoming more complex and thus more susceptible to errors due to the increasing number of variants and small batch sizes, image processing systems also offer considerable potential in this application field," explains Nikolenko, who now works as a researcher in SmartFactoryOWL. Nikolenko's work focused on the requirements of image processing and documented the necessary optimizations. In his studies he used the VE camera from Banner Engineering.

The camera is not yet a permanent part of the pick-to-light workstation in the SmartFactoryOWL. However, the VE camera will look over the shoulder of the operator and check whether the components are being correctly used and assembled. If this is not the case, the camera detects this and does not enable the next assembly step.

Projection-based assistance systems from Assembly Solutions

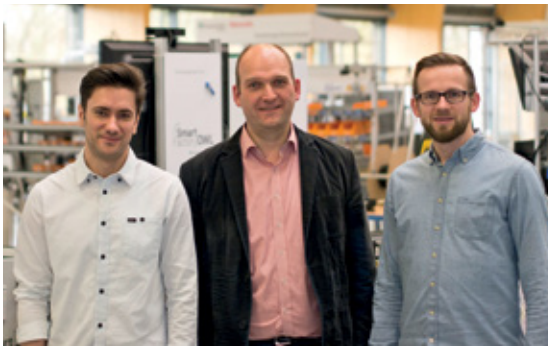
The University of Applied Sciences East Westphalia-Lippe presented a demonstrator projection-based assistance system at the Hannover Messe 2016. The prototype presented at the fair attracted considerable interest. It was this success that caused Daniel Riediger and other colleagues to found Assembly Solutions, a company that develops assistance systems for manual assembly processes.

Assembly Solutions developed a system that projects the current work instructions and the components directly onto the workbench by means of a projector. The projection shows the necessary information for correct assembly using images, symbols and plain text. Light beams, arrows or other markings indicate which component currently has to be fitted and how. This guides the operator continuously through the process, thus reducing the error rate and boosting productivity.

Measuring light curtains detect tool compartments

The projection-based assistance system was implemented at an assembly workstation at which assemblies for an edge milling machine are to be completed manually in different variants. The assistance system also directs the fitter of the edge milling machines with instructions to access the correct component compartments. Two pairs of measuring light curtains from the Turck portfolio, which are fitted horizontally and vertically in front of the picking shelf with the component containers, check whether the correct component has been picked. Banner Engineering's Easy Arrays form a 2D coordinate system, in which the container positions and sizes can be defined and adjusted easily. They

The put-to-light system indicates the row in which the newly filled container has to be inserted



Researchers at the SmartFactoryOWL: Alexander Nikolenko, professor Sven Hinrichsen, Daniel Riediger, CEO of Assembly Solutions (from left)

are therefore independent of the material trolley storing the containers. Easy Arrays communicate via Modbus RTU with Turck's TBEN-S-2COM module, which in turn communicates with the PC-based controller of the application via Modbus TCP.

"The actual communication runs autonomously via the 2Com modules which we have only set via their web servers; no other settings were required," Riediger explains the setup. Unlike many other I/O modules, the TBEN-S-2COM comes with a pre-installed Modbus-RTU client (master) on board. Users of the module do not have to program the module client or purchase an additional Modbus license.

If the operator picks from the wrong container, the Easy Arrays register the hand position and transfer the position data to the 2Com module, which sends it to the controller via Profinet, Ethernet/IP or Modbus TCP. As a result, the "Incorrect container" text is projected onto the work surface and the corresponding container is lit in red. As a specialist for customer solutions, the Turck subsidiary Mechatec also offers this system as a single sourced complete solution.

Partnership

The starting signal for the lasting partnership between Turck, the laboratory for industrial engineering of the OWL University of Applied Sciences and the SmartFactoryOWL was the introduction of the pick-to-light workstation in 2016. The further developments achieved to date and the know-how acquired are testimony to the reliability of the partnership. For Turck, the cooperatation with its Lemgo colleagues provides the opportunity to test new complete systems under realistic conditions and to show what is possible today in the field of digitized production.

The cooperation also gives students, lecturers and companies the opportunity to exchange views and thus also the testing of unusual ideas without any time or cost pressure. Visitors to Lemgo are presented with realistic applications on neutral ground without any sales pressure. The SmartFactoryOWL and the Laboratory for Industrial Engineering have found in Turck a partner that can offer single-sourced complete solutions as well as its wide range of components. The company also has extensive know-how on all levels of the automation pyramid.

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Video |

The safety light curtain Easy Array moves along the machine according to the length of the produced cross braces

Ladder Production with Safety

QING, the Dutch engineering consultants, designed and built a new machine for a ladder manufacturer – using the system know-how and safety solutions of Turck and Banner Engineering

"Qing is an engineering consultant with a difference." – After all, anyone wishing to present themselves on the Internet has to be slightly different to the rest. The consultants at Qing – project managers and engineers offer innovative and sustainable solutions in the fields of industrial automation, special machine construction and energy, primarily for the food and packaging industry. They also believe that work should be fun and that this should be reflected in relations with customers. "There are now around 80 Qings," says Marc Salemink and laughs. The project manager jokes here about the growing number of Qing employees working at their Arnhem headquarters and at other offices in Utrecht, Wageningen and Borne.

Over the past 20 weeks Salemink had worked with his team on a machine for a Dutch manufacturer of ladders and scaffolding. The machine produces cross braces that stabilize the scaffolding. These consist of hollow aluminum bars provided with hooked end caps at both ends, which later interlock with the other scaffold bars. The ladder manufacturer also wanted to use Turck sensors in the new machine because it wanted the number of spare parts required in stock to be kept to a minimum. This was how the initial contact for the collaboration in the project came about.

Qing's previous company had already built a similar machine ten years earlier. This was still connected up with point-to-point wiring and had virtually no safety features. "Today's technology has moved on considerably and so the new machine had to have the latest state-of-the-art technology," Salemink explains. The mechanical construction of the first machine could largely be used again. However, some points had to be reworked because the quality of the cross braces from the first machine was not 100 percent.

Qing approached Turck already during the planning stage for the machine at the customer's request. "We initially only spoke about Turck sensors for our previously used equipment. However, we soon started to talk about the right automation concept we wanted to use for the machine. Turck worked out three scenarios for us and compared them: a point-to-point wiring of the machine, an Ethernet-based option and an IO-Link based variant," Salemink describes the consulting process. "We decided to use the Ethernet-based wiring as this represented the optimum combination of modernity, price and performance for our planned machine."

Time saving Ethernet connection

Today, all conventional sensors and actuators are connected directly in the field with Turck's ultra-compact TBEN-S I/O modules. Only two cables have to be run to the control cabinet for the sensors and actuators – one for signals and one for the power supply. The old machine had a point-to-point connection throughout. Qing previously used passive junctions but these had to be wired individually at the control cabinet. This took up a great deal of time and would take even longer in the new machine due to the increased number of sensors.

"Although the active I/O modules are more expensive than the passive ones, the costs for the input cards at the PLC are considerably reduced since the modules can simply be connected to the Profibus port of the Siemens controller. Integration in the TiA Portal, the controller programming environment, couldn't be simpler. This stores the devices in the catalog, from where they just have to be selected. Other module parameters can be set without the need for programming," Salemink adds.

Machine concept

The machine produced the cross braces in three production steps which are run in parallel. In the first step, the pipes are deburred in order to guarantee the uniform quality and alignment of the pipe ends. In the second step, they are engraved with a serial number. In the third step, the machine positions aluminum brackets from the left and right and presses these at a pressure of 80 bar into the aluminum. The machine

QUICK READ

Turck demonstrates genuine solution expertise at QING in Arnhem with an extensive automation system. Through the early engagement of Turck specialists in a development project, Turck was able to advise the customer on the right automation concept already during the design stage. Once an Ethernet-based concept was chosen, Turck supplied the right sensor, fieldbus and connectivity components as well as safety light curtains from Banner.

»When developing prototypes, it is important to listen carefully and correctly understand the requirements of customers. It's great for us to have a supplier that thinks exactly the same way.«

Bram de Vrught | Business unit manager at QING

produces five pipes a minute and a finished cross brace rolls out of the machine every twelve seconds. The machine can process pipes of just under a meter up to four meters in length.

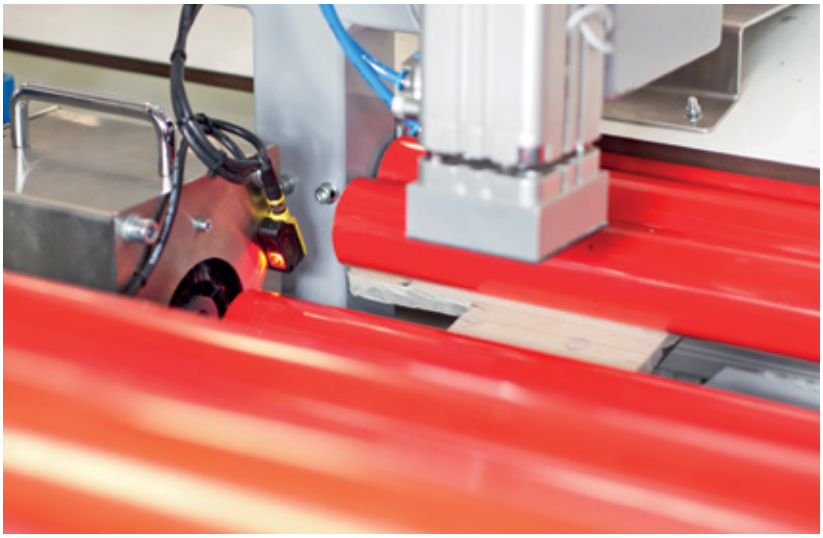
In step one, optical sensors detect the location of the join between two pipes in order to guide just one of the two pipes to the next station. For this Qing uses the Q20EQ7 infra-red sensors from Turck's optical sensor partners Banner Engineering. The switch window on these sensors makes it possible to detect the gap between two pipes and switch accordingly.

System solution

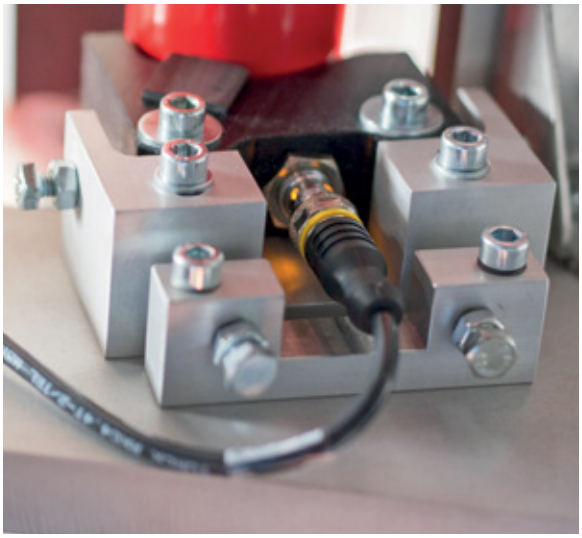
By being involved in the project early on, Turck was able to provide a complete system solution. "We experienced a kind of snowball effect," Salemink explains. "We started out with the sensors. However, as talks continued we used other products: the signal lights, the cables, the I/O modules and then also the safety controller."

The use of the SC26-2 safety controller from Turck's optoelectronics partners Banner Engineering was new for Qing. Previously, the machine builder had been able to implement many safety requirements with relays. However, the requirements of the new machine were too complex for this. In all, seven safety door switches are installed, as well as a light curtain and an emergency stop button from Banner Engineering. When the finished product comes out of the machine, the light curtain must be temporarily deactivated and therefore "muted". This and other conditions can be configured in the safety controllers.

The TBEN-S I/O modules route all the signals to the controller via Profinet



The Q20EQ7 infra-red sensor detects the join between two pipes



The Bi4-M12-AP6X sensor switches if an aluminum pipe is present

Safety controller controls safety devices

"This was the first safety controller I ever programmed," stated Enrico van de Vliert, responsible for safety and PLC programming in the project. "If you have programmed a normal PLC, a safety PLC is no problem at all." These have a simple design and also use function blocks to connect the safety inputs with the safety outputs. The function blocks enable the selection of Boolean operators to precisely define particular conditions.

The modules also have a certain degree of intelligence to verify the logic of the safety application. "However, this does not prevent unsafe settings to be programmed," van de Vliert notes. A safety specialist has to make the final settings and check them. "The software is quite simple, but you nevertheless have to develop a coherent safety concept. However, it shortens the time required to implement this concept in a controller."

Optimized machine with fewer rejects

Although the machine operates considerably faster than its predecessor, it runs more reliably and error-free. In future the manufacturer will produce fewer rejects in the production of scaffolding cross braces. This is also due to the optimizations that Qing could implement due to its experience with the first generation of the machine. In the first generation the pipes were positioned hydraulically in order to then slide out of the machine via two guide rails. This resulted in damage to the pipes occasionally because the hydraulic system cannot accelerate and decelerate as smoothly as an electric motor. Today Qing is meeting this challenge with an electric linear drive that can be controlled more precisely.

Benefit of the overall concept

The scope of Turck's portfolio is rare to find in the automation market. "We appreciate having a one-stop shop," says project manager Salemink. "We really prefer it if we can cover our requirements with just one manufacturer instead of two or three." The consulting provided by Turck impressed Qing, and since Salemink and his colleagues are satisfied, the project manager expects potential for other joint projects in the future. "Unless the customer specifies something else, we will look forward to working more with Turck."

Banner's SC26-2 safety controller controls the safety functions of the machine

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Fast Reader

Turck's BL ident RFID system reduces the reading time for the tool turret of a CNC machine from 130 to 10 seconds

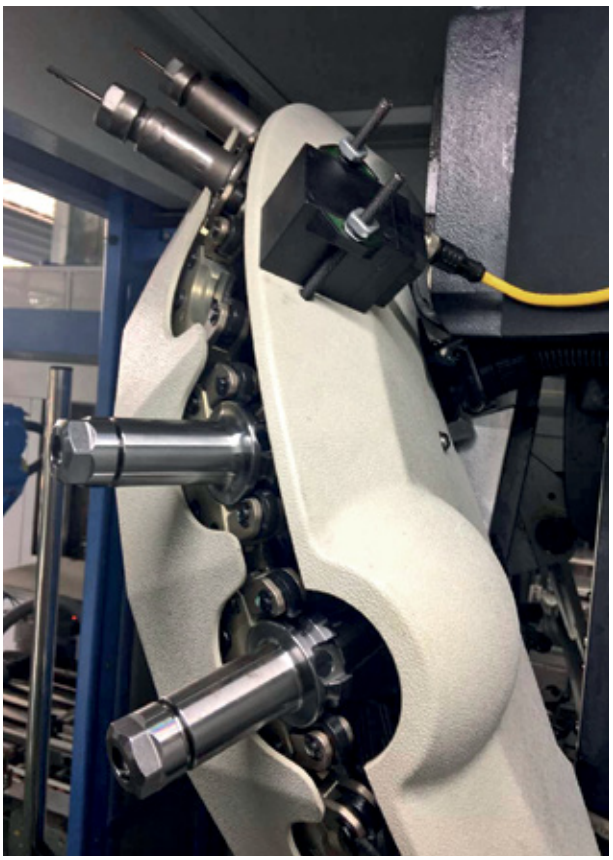
Intelligent RFID systems for tool identification can considerably boost the production efficiency of CNC machines

The requirements of more flexible production are increasing the demand for automated solutions for tool management. Cutting tools are changed more frequently today than ever before. As a result, it has become more difficult for conventional visual identification methods using serial numbers and manual data maintenance to manage the tasks involved. These methods are prone to errors, the tool life cycle can only be managed with considerable effort and tool data is often disorganized. A growing number of processing and manufacturing companies are consequently seeking to improve existing tool management methods. Through efficient tool management, they intend to considerably increase tool performance and lifespan, lowering production costs while boosting machining quality.

The requirements placed on tool management systems are constantly increasing

Tool management systems are required to process different operations, such as different types of supplies, huge quantities and frequent check-out and check-in operations. Without a reliable identification technology, these kinds of management systems can easily become disorganized. Additionally, a poor environment or improper operation can lead to disorganization and loss of data. If this happens frequently during tool usage, this will significantly impact on production

Cutting tool holder with embedded RFID tag



The RFID read/write head is fitted to the back of the tool turret and reliably detects the tag in the tool holder thanks to its extended range through the paneling

efficiency and may even give rise to quality issues, such as products being rejected or returned. As machining continues to develop, particularly when it comes to the mass use of CNC machine tools and machining centers, machining accessories have also become more complex. The requirements placed on production and machining have increased to the extent that previous tool management methods are no longer satisfactory.

Past solutions in need of improvement

Conventional tool management systems have primarily used optical identification technologies such as laser engraving in order to record tool data. This method laser engraves tool-related data onto the cutting tool surface. Whilst this method allows for more long-term recording of data and more efficient tool management, there are obvious disadvantages. The data that can be engraved on the surface of a cutting tool is limited. In the worst case, laser engraving may damage the structure of the cutting tool, impacting its product lifetime. Additionally, the procurement of most engraving equipment comes at a higher cost. Wireless RFID technology is another possibility for identification solutions. The first systems of this kind are already in use, although they are not yet really efficient. Conventional systems of this kind use a read/write head on a cylinder, which moves it back and forth to read data

QUICK READ

Barcodes and laser engraving have for a long time no longer met the identification requirements of cutting tools in CNC machines. Although wireless RFID systems are already used, the short range of the existing solutions require time consuming compromises in practical applications. Together with Turck, a Chinese manufacturer of CNC machines has now implemented an RFID solution for tool management that is Industry 4.0 compliant. Thanks to the extended read/write range, the read time for a tool turret is reduced from 130 to 10 seconds, thus considerably increasing production efficiency for the end customer.

»Turck's modular design makes selecting the right RFID system easy and straightforward. If the required protocol is Profinet, Ethernet/IP or Modbus TCP, a single multiprotocol gateway is all that is needed to support all three.«

Gao Xianghui | project manager at Qingdao Mesnac

Tool turret with cutting tools

from the RFID tag on the tool. The tag is embedded in the tool holder. To identify or change a tool, the tool turret with the relevant tool first has to move to the lowest position. The cylinder with the read/write head has to move the entire way to the turret and back again. This increases the total read time for a single cutting tool to 6.5 seconds. It would take more than two minutes to identify all 20 cutting tools of a turret on a single CNC machine. The production efficiency of the CNC machine would thus be significantly lowered. Frequent mechanical operation also results in wear and tear on the device. If the read/write head cannot promptly retract due to cylinder malfunction or for another reason, this may lead to the read/write head colliding against the cutting tool, which will impair machining accuracy.

Optimized tool identification with Turck's RFID system

Turck's BL ident RFID solution tackles this problem precisely: Read/write heads with an extended detection range can be mounted directly on the back plate of the tool turret. Data from the RFID tags on the tool holder can be read directly through the non-metal backplate, without the need for a cylinder which moves the head forward and backward. One simple rotation of the turret is all that is needed to identify all of the cutting tools on a CNC machine tool. All of the information related to the cutting tools can be read in around just ten seconds. Turck's read/write heads have a protection rating of IP69K, and the RFID tags have a protection rating of IP68. This makes the system resistant to moisture and water, making them also suitable for use in damp environments. The tags have a freely usable 128 byte memory. This enables large amounts of data to be stored, virtually turning the tool into a mobile database.

BL ident with an impressive modular design

"Turck's modular design makes selection of the RFID system easy and convenient. All you need to do for different protocols is change the gateway. If the required protocol is Profinet, Ethernet/IP or Modbus TCP, a single multiprotocol gateway is all that is needed to support all three," says Gao Xianghui, project manager at Qingdao Mesnac, the Chinese system integrator, about Turck's BL ident system.

"The straightforward design of the RFID modules simplifies program development, eliminating the need for function blocks. Read/write operations can be controlled directly via the I/O points." The 44-millimeter detection range meets the on-site installation requirements and prevents read/write heads from sustaining damage due to collisions. The in-metal tags have a protection rating of IP68 so they are ideal for the installation requirements of tool management systems.

Conclusion

The implementation of RFID technology in the HF range fully capitalizes on its benefits for tool identification and management: rapid identification, solid anti-interference capabilities and tags that offer high storage capacity. Adding RFID read/write heads to automated tool-changing systems allows for rapid reading of data from RFID tags on tool holders, making features such as automated tool identification, automated mounting, and total life cycle tracking a reality.

This, in turn, boosts production efficiency and tool utilization while lowering production costs and product rejection rates. As RFID technology continues to be perfected and become more popular worldwide, RFID tool management systems that incorporate Internet technology will increasingly become the system of choice for processing and manufacturing companies.

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Make Space!

At Chevron Phillips Chemicals International NV, Turck's excom system is replacing the I/O level with Ex isolation and is consequently saving a lot of space in the I&C rooms

Ready to connect: Turck Mechatec prewired the control cabinets with excom to special marshalling panels

CPChem plant in Beringen, Belgium

Anyone who avidly follows the technology and IT press would have already read the swansongs to the smartphone that went around a few years ago. Even well-respected CEOs from Silicon Valley have recently predicted that its time had come. Data glasses, smartwatches and digital assistants, such as Amazon's Echo as well as similar devices are often mentioned as successors. Technology migration makes space for new innovations – one characteristic that the consumer and industrial B2B business have in common. When existing device types are discontinued or become unnecessary, their function, i.e. what they performed for a plant or machine, has to be taken over by a different device.

Brownfield projects in the chemical industry can also be considered in the same way. At petrochemical company Chevron Phillips Chemicals International NV, Turck's excom today replaces the previous I/O system and the Ex isolation in the same housing. This creates space in the I&C room for plant expansions and for innovative technologies. The plant in Beringen belongs to Chevron Phillips Chemicals International NV (CPChem) since the end of 2011. It was founded in 1991 by the Finnish refinery Neste. The Beringen plant focuses on the manufacture of polyalphaolefins (PAO), which are used in synthetic oils and lubricants. These oils are primarily used in the automobile industry and other industrial sectors.

When the Finnish manufacturer discontinued in 2013 the I/O system used in the control cabinets in Beringen for the Honeywell control systems, the engineers in charge at Chevron Phillips International NV looked for alternatives for the I/O system used. They looked for a system that could be linked to the Honeywell control system via Profibus DP and provide the Ex isolation of the signals, i.e. supply both intrinsically safe and non-intrinsically safe devices. It also had to be a flexible system that supported the latest in diagnostic functions and open standards. The new I/O level also had to take up as little space as possible and not affect the availability of the plant.

CPChem first of all asked Honeywell whether they could recommend suitable I/O systems to replace the existing system. Honeywell gave its recommendations, which included excom. Several projects worldwide already testify to the excellent collaboration between Honeywell and Turck – equally in terms of the collaboration between their employees and the interaction between systems used.

Pilot project

CPChem first of all rolled out a pilot project with one control panel, in which the I/O cards were replaced with an excom rack. This was for the intrinsically safe signals for field devices in Zone 1 or 2.... As the pilot project proved to be successful, follow-on projects with excom were planned. Initial finding of the pilot project: Excom saves a lot of space. Other systems require a separately located Ex isolation for the signals in Zone 1. With excom, signal processing and Ex isolation are integrated in a single housing. After the pilot project, it was clear to CPC that they only required three control cabinets with excom to replace five control cabinets with devices of the old system.

After the successful pilot project, CPChem replaced a total of 172 I/Os in 2015. This time, the space benefits of excom were fully utilized. The replacement of the I/O cards was planned so that entire control cabinets became unnecessary. This space is now available for plant expansions or the installation of additional technology. In the follow-on project in 2017 other I/O

QUICK READ

The I/O system used on the Honeywell control system in Chevron Phillips Chemicals International NV (CPChem) Belgian plant in Beringen had been discontinued by the manufacturer. CPChem identified Turck's excom as the I/O system best suited to replacing the previous system. Turck Mechatec prepared the fully prewired control cabinets with excom racks und special marshalling panels for CPS, which could be commissioned on site very quickly. Today, excom saves considerable space in the I&C room because it integrates the separate Ex isolation that previously took up a lot of space. The fact that all I/Os are operated in the same way, regardless of whether they are in Zone 1, 2 or the safe area, is another benefit.

»A lot of preparation work could be done in advance. This was a considerable benefit. We were able to work by plug and play as we did not have a lot of time. The actual installation only took one to two days.«

Sarah Gyssels | Chevron Phillips Chemicals International NV

cards for 720 signals were connected via excom.

Fast connection to the existing control system

The time available for installing the I/O technology was short. Although the Beringen plant has a turnaround with a length of maximum 14 days every two years, more than just the physical installation had to be completed within this time frame. The new devices also had to be commissioned and their interaction with the overall system thoroughly tested.

It was a great advantage that Turck could supply fully prewired control cabinets, which were fitted with both excom and special marshalling panels that CPChem had previously used. Turck's own service provider for custom solutions, Turck Mechatec, assembled the control cabinets prewired and ready to connect with the marshalling panels. This considerably shortened the installation time for CPChem since it was possible to retain all the field cabling.

A service provider for CPChem just had to erect the control cabinets and connect the cables to the correct terminals. "A lot of preparation work could be done in advance. This was a considerable benefit. We were able to work by plug and play as we did not have a lot of time. The actual installation only took one to two days. However, the tests still had to be carried out afterwards," explained engineer Sarah Gyssels, who also described the site acceptance test (SAT) and factory acceptance test. While the FAT was carried out at Turck Mechatec prior to installation, the site acceptance test had to be carried out in the plant after the installation. This often takes longer than the actual installation itself.

One system for all signals

The entire migration of the I/O cards for the non-intrinsically safe signal has to be completed by 2019. By then, all the 2000 I/Os will be connected through excom. The fact that all signals, whether intrinsically safe or not, are connected via the same system also makes it simpler for operators. Excom for Zone 1, 2 or the safe area use the same GSD file and the same DTM. Employees therefore only have to become acquainted with one logic and user interface to operate the system. Although HART communication is not currently used by CPChem, the HART capability of excom is important in order to be equipped for later innovations.

Galvanic isolation also between channels of one module

Unlike many other systems, the individual channels of a module are galvanically isolated. In the event of external interference, such as through electromagnetic waves, this ensures that this interference is not also transferred to neighboring channels. This makes measuring ultimately more reliable. Short circuits on a module channel also do not have any negative effects on the other channels of the same module.

Good support

Anyone who has ever been involved in a retrofit project of this magnitude knows that problems will always occur. The important question for CPChem was therefore how Turck deals with these problems. "Turck swiftly solved any difficulties that occurred," Sarah Gyssels reflected. "We always had a customer contact that really looked after us. The training at the local Turck office was also very useful for us, as everyone now has the same level of knowledge, even the new colleagues."

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Trade Shows

At numerous national and international trade shows, Turck will introduce you to current product innovations and reliable solutions for factory and process automation. Be our guest and see for yourself.

Date	Trade Show	City, Country
23.04. – 27.04.2018	Hannover Messe	Hanover, Germany
25.04. – 26.04.2018	ISA/AEC Automation Expo & Conference	Edmonton, Canada
02.05. – 04.05.2018	Fabtech	Mexico City, Mexico
15.05. – 17.05.2018	Smart Automation Austria	Wien, Austria
15.05. – 18.05.2018	Industry Days	Budapest, Hungary
22.05. – 24.05.2018	SPS IPC Drives Italia	Parma, Italy
22.05. – 25.25.2018	Gas.Oil.Technologies	Ufa, Russia
29.05. – 31.05.2018	Eliaden	Lillestrom, Norway
05.06. – 08.06.2018	Expo Pack	Mexico City, Mexico
28.08. – 30.08.2018	Sindex	Bern, Switzerland
02.10. – 05.10.2018	World of Technology & Science	Utrecht, Netherlands
23.10. – 26.10.2018	Congreso Minero Sonora 2018	Hermosillo, Mexico
13.11. – 16.11.2018	Adipec	Abu Dabi, United Arab Emirates
20.11. – 22.11.2018	Automation	St. Petersburg, Russia
21.11. – 24.11.2018	EMAF	Matosinhos, Portugal
27.11. – 29.11.2018	SPS IPC Drives	Nuremberg, Germany

The Net

On the Turck website and product database you will find all the relevant information about Turck's products and technologies, systems and industry solutions – from success stories to data sheets right through to the download of CAD data.

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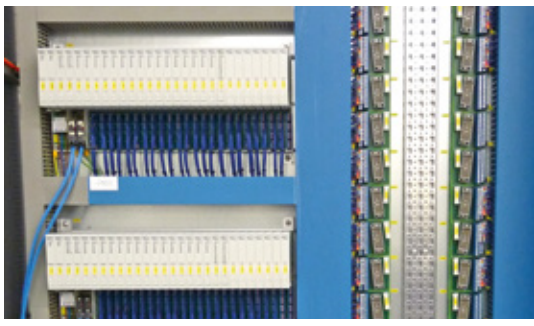

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