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The Magazine for Customers of the Turck Group



Robust Portfolio

"We are focusing on the mobile equipment market," says vertical market manager Nils Watermann



Safe Identification

Sonplas uses Turck's BL ident RFID system and uprox+ sensors in an assembly plant



Precise Measuring

KRW replaces fault-prone glass scales with Turck's robust LI linear position sensors



Powerful Coupling

Inductive couplers enable the contactless transfer of data with up to 12 Watts of power

Increasing Productivity



Henry Ford once said something that succinctly describes the basis of success: "If you keep on doing what you already can, you'll always be what you already are." If people or organizations want to develop further, they have to break new ground. The same goes for Turck – a company where there's a lot happening at the moment.

Dear readers, you will be able to assess the results of our activities directly at our stand at the Hannover Messe 2014: our new fair stand not only offers an ideal mix of product and solution presentations but also plenty of room for individual discussions with you. The new trade show booth concept is, however, just one of the projects in we are currently working on. In the next few days we will also be activating our new website, enabling you to find solutions for your sector quickly and easily.

Between 2012 and 2015 Turck will also have invested around 45 million euros in new building infrastructure at its German sites in Halver, Detmold, Beierfeld and Mülheim, as well as in Minneapolis in the USA. In this way we are preparing for the challenges of the years to come, particularly in terms of increasing innovation speed and the adaption of processes for new products. The new infrastructure has given us better opportunities to quickly implement product innovations on the market and meet your individual requirements.

A further 15 million euros have been budgeted for IT investments. The worldwide introduction of a new ERP/CRM solution in particular will optimize several processes, from which the company as well as our customers will benefit significantly. The transparency created by this solution will make it possible to implement knowledge management efficiently. In this way, Turck will be able to respond more flexibly and more directly to the increased demands of its customers in the whole world and be better and faster for you.

The investments mentioned will provide us with the conditions that will support us at the core of our activities – the development of automation solutions with which you can increase your productivity. The latest results of these activities are presented in the cover story on page 8: the inductive coupler for contactless data and power transmission.

Yours sincerely,

A handwritten signature in black ink, appearing to be 'C. Wolf', written over a white rectangular background.

Christian Wolf, Managing Director

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Turck's BL ident UHF-RFID system detects the data carriers on the individual car body parts at a Chinese car manufacturer. **Page 18**



Vebe Floorcoverings uses EZ-Array light curtains to measure with ten times greater accuracy the width of carpet runs at a rate of 35 m/min. **Page 26**



Ruthmann has fitted STEIGER® aerial platforms with Turck's Ri360 inductive angle sensor for measuring the swivel angle of the working cage. **Page 28**

Communication in Focus



► At the Hannover Messe 2014 Turck will present its new **stand concept**. For Turck an impressive fair stand has always been an inherent component of corporate communication. Anyone wishing to offer premium products has to ensure the same standard in how customers are approached. The new stand should be a further development in terms of functionality and design. "The result of the competition last year is an impressive stand concept that can be used flexibly for a wide range of different stand areas whilst still maintaining its recognition value", says Christian Wolf, managing director, Turck. Even from a distance, two large multimedia screens at the cor-



ners will attract attention. Supported by visualizations of various exhibits, the new stand concept offers an ideal mix of product and solution representations, associated with a large communication area. The open product presentations on the walkways provide visitors with a direct view of the large communication area in the center.



Inductive Couplers

► Turck is presenting for the first time its contactless inductive couplers for signal and power transmission. The **inductive couplers of the NIC series** consist of a primary and a secondary unit and can be connected as simply as a plug connection. They transmit 12 Watts of power across a 7 millimeter air interface. The diagnostic function detects the presence of the secondary unit as well as any metal objects in the air gap. With a tolerated angle offset up to 15 degrees and a parallel offset up to 5 millimeters, the couplers can also be fitted in restricted and non-standard mounting locations. The standard version of the NIC series transfers two PNP switch signals. If the primary unit is connected to an IO-Link master, data can also be transferred bidirectionally from measuring IO-Link sensors. In combination with Turck's TBIL I/O-Hub it is even possible to identify tool changers, since the junction boxes can transfer their ID to the controller via IO-Link. The combination of Turck's second primary unit that even works as an IO-Link master and the TBIL junction enables the transfer of up to eight switch signals.

[more on page 8](#) ►



Safety Controller

► Banner Engineering, Turck's strategic partner, introduces the **SC26-2 Programmable Safety Controller**. The controllers provide PLC-level capability and control without the programming complexity and steep learning curve of traditional PLCs. Designed to be more flexible and easier to use than other small footprint safety controllers, the SC26-2 uses safety function blocks, Boolean logic functions and a user-friendly programming environment for creating safety control logic. With 26 input terminals and two redundant solid state safety outputs, safety system design engineers are able to easily monitor a variety of input devices, such as e-stop buttons, safety light curtains and other safety and non-safety input devices. The controller's free PC Graphical User Interface configuration software features pre-configured safety function blocks, including two-hand control, muting and enabling device to simplify application programming – and it includes a ladder logic diagram

and a text based summary of the all of the input device and controller output settings. The optional LCD displays IO status and actionable diagnostics like input fault information and device wiring details. This assists users during commissioning and enables faster troubleshooting to minimize machine downtime. The SC26-2 offers eight input terminals that can be configured to monitor input device signals, source 24V dc or serve as I/O status outputs, offering exceptional utility.



Automation Award for QR24

► Voted by the visitors of the SPS IPC Drives, TURCK's contactless **inductive encoder RI360P-QR24** has won the Automation Award 2013 for the most innovative new development in the field of automation technology.



The prize is awarded annually by the magazine elektro Automation. A jury of experts from the congress-committee SPS IPC Drives, VDMA, ZVEI and the editorial office of elektro Automation has first nominated a top-10 list. From these ten proposals the visitors could select their favourite. We would like to thank all the participants, who voted for our new encoder series.

Hans Turck is 90



► On January 9, **Hans Turck**, cofounder of the automation specialist Turck, celebrated his 90th birthday. The birthday celebrant, who has lived alternately in Mülheim an der Ruhr and Cape Town since his retirement from the company in 1998, started the special day together with his wife in South Africa, his adopted country. His outgoing personality and openness, his outstanding sales skills and his ability to enthuse his customers, soon paved the way for Hans Turck to become a successful entrepreneur. After completing his engineering degree in 1950, he first of all gained ten years experience in sales before setting up his own engineering office in Mülheim, from which Hans Turck GmbH & Co. KG later developed. In 1965 Hans Turck sold his first product – an amplifier module.



IO-Link Master Modules

► Turck is extending its portfolio of IO-Link solutions by adding new **master modules** for its **BL20 and BL67 modular I/O systems**. The new IO-Link master modules fully support specification 1.1 with the transmission rates 4.8, 38.4 and 230.4 kBaud (COM 1, COM 2 and COM 3). This provides the user with a wide range of possibilities for implementing IO-Link communication in a large number of fieldbus and Ethernet networks. The BL67 system now provides a modular IO-Link master in IP67 with an operating temperature range of -40...+70 °C for harsh industrial environments. By the product launch in the summer it will be possible to use the 4-channel IO-Link master modules with the gateways for Profibus, CANopen as well as the Ethernet protocols Profinet, EtherNet/IP and Modbus TCP. The EtherCAT, DeviceNet and Modbus RTU protocols will then follow in the second step. All new modules support Turck's multiprotocol technology, which allows the use of the same device in Profinet, EtherNet/IP and Modbus-TCP networks. The multiprotocol devices can be operated automatically in each of the three Ethernet systems and thus reduce inventory and engineering requirements. The devices detect the protocol used by listening to the communication traffic during the startup phase.

Ethernet Multiprotocol I/O Modules with Web Server

► The new Ethernet multiprotocol I/O modules quickly and effectively make standard switching signals bus-capable. Thanks to their multiprotocol plug-and-play functionality, the **FEN20 devices** with digital inputs and outputs can be operated automatically in any of the three Ethernet systems – Profinet, Modbus TCP or EtherNet/IP. The devices detect the protocol used by listening to the communication traffic during the startup phase. The FEN20 devices are available in two different designs: The small FEN20-4DIP-4DXP housing style is designed to be installed in small switch boxes, control consoles or retrofitted in other existing housings, in order to provide fast and effective bus capability to operating elements such as pushbuttons and LED indicators. The large FEN20-16DXP variant is designed for the same type of application with up to 16 I/Os, which in the DXP variant can be used both as inputs and outputs. Both devices are equipped with an integrated web server which for example can be used for displaying diagnostics in plain text.



Turck's automatic small parts warehouse will provide 4,000 more storage places through the expansion



Warehouse Expansion

Turck increases delivery performance and customer satisfaction by adding a third aisle to the automated small parts warehouse

Turck has expanded its automated small parts storage warehouse (AKL) at the Mülheim site by almost 4,000 storage spaces. This enables the company to meet increased goods handling requirements and expand capacity for future growth. The expansion also included the implementation of new functions. For example, it is now possible with the system to consolidate several orders to one consignment for the same recipient automatically. After the required parts are collected, the orders are stored temporarily in

the automated small parts storage warehouse and consolidated until the entire consignment is complete and can be passed on for shipment.

Whilst customers previously received one package for each order, orders are now combined into consignments which considerably reduce the number of packages. "We can now make considerable savings in packaging material and reduce the transportation volume," explains Ulrich vom Bovert, head of purchasing and logistics at Turck. "For the customer this means



lower costs and enables Turck to make a considerable contribution to environmental protection by reducing transportation volume."

The material flow in the incoming goods area was further optimized. The incoming goods places are now close to the automated small parts warehouse and are connected directly via a conveyor system. By establishing short routes and keeping handling requirements down to a minimum, incoming goods can be received even faster, which shortens the lead time in the warehouse and thus the delivery times to the customer. The addition of two places in the shipment area which can be further enlarged as required by means of a materials handling loop is another benefit. "The measures now implemented make us well prepared for future increases in volume. In this way, we can continue to provide our customers with effective logistics," explains vom Bover. ■



The refurbishment of the warehouse now allows the consolidated shipment of several orders to one customer

Even with a parallel or angle offset, the NIC series inductive couplers transfer 12 Watts across an air gap of up to 7 millimeters



Webcode more11400e

Author Sander Makkinga is a product manager for position and proximity sensors at Turck Germany

Powerful Coupling

Turck is providing a solution to wear problems on connections subject to severe stress by using contactless power and data transmission based on inductive coupling

Somehow there is always something magical that happens when a smartphone is placed on a contactless charging station. Power transmission without cables? This is made possible through the principle of inductive coupling. The technology is not really new but its widespread use in the consumer sector is still coming. The charging function for electrical toothbrushes and cordless telephones are as of yet the only mass applications of this technology.

It is in the niche markets where the use of inductive coupling as a means of transmitting power is best leveraged. For example, pacemakers and other medical implants often have to be provided contactless power and signal transmission by necessity. The benefit is obvious: The very idea of a USB port on a rib cage for charging the pacemaker conjures images of horror or science fiction films rather than serious medical technology.

Wear-free operation

In these applications, however, one great benefit of inductive coupling for signal and power transmission is hardly used: Inductive coupling is absolutely wear-free. While in household use this benefit is rarely important, in industrial applications it can be a key factor in choosing a product. The resulting longer maintenance intervals, the shorter downtimes and the increased cycle rates for machines are ultimately powerful arguments for purchasers and for production planners in particular.

Especially in applications where contacts are plugged in and removed very frequently, wear is a major problem – and is therefore a key cost driver. When manufacturers of terminal and connectivity solutions start gold plating contacts, it becomes clear that there is a genuine need for

▶ Quick read

Robots with tool changers or rotary indexing tables place demanding requirements on the connection technology. Contacts and connectors that are subject to wear require short maintenance times or can even cause the machine downtimes. Turck's contactless inductive couplers now offer an alternative to conventional connection technology. The NIC couplers transfer up to eight switch signals with up to 12 Watts of power and therefore provide a wear-free alternative to slip rings or connectors subject to severe mechanical stress.



Solution 1: Two PNP switch signals can be transferred via the secondary unit (right) if a VB2 splitter is connected



Solution 2: If the primary unit (left) is connected to an IO-Link master, data from measuring IO-Link sensors can be transferred bidirectionally



Solution 3: The primary unit operates as an IO-Link master so that up to eight switch signals can be processed via the I/O-Hub (right)

wear-free solutions. Nobody has the idea of using gold just for decorative purposes. Even if the noble metal reduces contact wear, it can't prevent the process. Applications with connections subject to severe stress, whether through vibration or the frequent closing and opening of a connection are therefore an ideal application field for a "contactless plug connection". Robots with tool changers or rotary indexing tables are examples of these kinds of applications.

Inductive couplers as contactless connectors are also impressive on account of the freedom of movement they offer their coupled components, such as robots with rotating tools or shafts from which sensor

signals have to be taken. Here a contactless connection of the interface is a major benefit. Although the slip ring is established in industry as an alternative solution, it is little appreciated due to its wear. Another application area for inductive couplers are overhead conveyor systems as are frequently used in the automotive industry.

Powerful coupler series

Turck's NIC system is a series of inductive couplers that can take on the challenges of the applications mentioned. The coupler sets consist of a primary unit on the controller side and a secondary unit on the sensor/actuator side of the connection. The NIC couplers transfer up to eight PNP switch signals and up to 500 milliamperes of current with an output of 12 Watts.

This enables sensors and actuators such as light curtains, piezo valves or smaller valve terminals to be operated without an additional amplifier being necessary on the secondary side. The primary units are connected via a four-pole M12 male connector or a 30 cm pigtail with a twelve-pole M12 connector. The secondary unit has a 30 cm pigtail with a four-pole M12 connector. With a length of 80 millimeters, the Turck couplers are the most compact devices in the M30 housing.

Three variants – IO-Link included

The inductive couplers can be connected as easily as a plug connection. A sensor or another signal source is connected to the secondary unit (NICS-M30-IOL2P8-0,3-RKC4.4T), the primary unit (NICP-M30-IOL2P8X-H1141) is positioned opposite and connected via a standard four-pole M12 connector to a controller or a fieldbus device. This basic system can transfer without contact two PNP switch signals via a simple VB2 splitter behind the secondary coupler. The air gap here can be up to 7 millimeters apart.

The same system consisting of primary and secondary coupler can also be used to transfer signals from IO-Link-capable measuring sensors. For this the primary coupler only has to be connected to an IO-Link master. On the secondary side the user simply connects an appropriate IO-Link sensor or any other IO-Link-capable device. These combinations even allow bidirectional IO-Link communication including all IO-Link features such as parameter setting and diagnostic data. If the Turck I/O-Hub (TBIL-M1-16DIP for 16 Digital PNP Inputs) is connected on the secondary side, the system can also be used for identification tasks, such as on tool changers, since the hub can transfer a unique ID via IO-Link right into the controller.

The third solution variant is used when more than two signals are to be transferred: In this case, the IO-Link protocol is used to transfer up to eight switch signals. In this way, eight PNP signals can be transferred with a primary and secondary unit as well as an I/O-Hub. The NICP-M30-8P8-0,3-RSC12T twelve-pole primary coupler used here acts as the IO-Link master, and the I/O-Hub as the slave. The primary unit is connected to conventional PNP inputs of a field device using 12-pole M12

connectors so that the fact that the system works internally with the IO-Link technology is not at all noticeable for the user.

Diagnostics with metal detection

Besides the eight PNP sensor signals the system also provides two poles for diagnostic signals. One signal indicates the presence of the secondary unit, the second is used for foreign object detection. If any metal foreign objects such as iron chippings fall between the primary and the secondary coupler and reduce transmission quality, the fault signal is sent to the controller so that the error source can be located immediately. The primary couplers with a 4-pole terminal indicate this diagnostic information directly on the device via the status LEDs which are visible from all sides. If an IO-Link device is connected, the diagnostic data is also available in the controller.

7 millimeter air interface

Turck's inductive couplers differ from other solutions in several aspects: With a maximum air interface of 7 millimeters and 12 Watts of transmitted power they offer the largest distance of all inductive couplers in this housing style. The devices are furthermore immune to shock and twisting of primary and secondary units. If the primary and secondary unit are positioned directly opposite each other at the nominal distance, they can be laterally offset by up to 5 millimeters.

If the application prevents the two coupler sections from being mounted in line, the coupler systems can also be mounted at an angle to each other. With a

4 millimeter gap between each other an angle of up to 15 degrees is possible. The signal is not interrupted directly, even at greater angles. Although the power is progressively weaker, it may still be sufficient, depending on the application.

Operational in 10 milliseconds

In many applications with frequently changing connections, the operational readiness of the secondary unit is also important. With robot tool changer applications in particular, the cycle times that the connection solution allows are a key factor. The secondary unit of the Turck coupler is operational in less than 10 milliseconds. The fixed primary unit is permanently fed with power. With this startup time, the system is one of the fastest on the market. Naturally primary units can be combined with any number of secondary units as required – and vice versa. More complex applications with several primary and secondary units can then be implemented easily with dynamic pairing.

Connection technology and sensors

Customers can draw on the extensive range of Turck connectivity, fieldbus technology and sensor products to ensure the simple mounting and use of the new NIC couplers. Several options are available, from standard four-pole M12 connectors and several different variants of Y splitters, to the I/O-Hub, right through to the appropriate 12-pole adapter cable for the BL67 modular fieldbus system. The automation specialist also offers a broad portfolio of sensors for the many different applications possible. ■



For tool changer applications on robots the NIC coupler offers an impressive performance with a startup time of 10 milliseconds

As a vertical market manager, Nils Watermann coordinates Turck's worldwide strategic direction in the mobile equipment sector



“Contactless Trend”

In an interview with Ines Näther, editor of the technical journal “elektrotechnik”, Nils Watermann, vertical market manager for mobile equipment, describes Turck's involvement in mobile automation

Mr Watermann, why does Turck now have a vertical market manager for mobile equipment?

For around 20 years we have been extremely successful in this sector, with many well-known manufacturers as long-standing customers. The new position was created in order to ensure a more structured operation in the mobile equipment market. A sector manager can coordinate and implement the strategic direction in the entire Turck Group and in international sales.

What are the new target groups that you have in sight?

We have to further penetrate those market segments in which we already have business relations. These are primarily the manufacturers of agricultural and forestry machinery, construction and mining machines, as well as municipal vehicles such as fire engines or refuse trucks. Alongside this we will also approach those market segments that we have not been serving so intensively, such as the field of buses, logistics or rail vehicles.

Harsh operating conditions such as involving dust, dirt, humidity, heat, or mechanical stress are particularly demanding. How is this taken into consideration in your development?

Added to the conditions already stated are requirements for increased EMC immunity, chemical and UV resistance, which go far beyond the demands of industrial automation. However, there are also some industrial applications that have similar requirements. Through the realization of customized solu-

tions in both areas we have been able to gain considerable experience which is fed back into the development of standard products for the mobile market.

What products do you offer in the mobile equipment area?

At present a major part of the sales in this market are inductive proximity switches and connection cables. We offer products from the field of position sensors, particularly rotary sensors as well as inclinometers and angle sensors with special features and approvals such as the e1 certification. However, any of our products can be used in the Mobile Equipment market, as practice has shown.

Which sensor trends in your opinion will gain importance in the mobile automation sector?

Sensors measure states inside and outside machines and thus provide the basis for efficient automation. In order to increase the performance of mobile equipment, for example, the location and position of machine parts must be measured more accurately than before. In mobile automation the trend is moving from the simple detection of end positions to continuous and primarily contactless position sensing. The contactless systems are wear-free and thus increase failsafe performance, particularly in harsh environments. Continuous detection enables the more precise control of operating processes, increasing the efficiency of machines. Besides sensor technology, the fieldbus technology is also an essential element of the Turck portfolio.

Are there any appropriate solutions from Turck for mobile automation in this area?

Yes, for example, our flexible fieldbus I/O block modules in IP69K from the BL compact series. These offer features that are ideal for mobile operation, such as the extended temperature range from -40 to 70 °C or the robust design. These product lines naturally also support CANopen communication.

CAN is the standard in mobile equipment. Up to now, Ethernet has primarily been used here for programming. Does vehicle networking also play a role here?

Currently the vehicles are still being networked with CAN bus, but the sector is already considering concepts involving

high-speed networks. The CAN bus does not provide sufficient resources for the continuously increasing flood of data required on vehicles, so that CAN networks are already being designed in a multiple-layer architecture. The fact that an Ethernet-based high-speed network will ultimately be used by majority is very likely. At present five Ethernet protocols are predominantly used in factory automation, each of them having different strengths and weaknesses. It is difficult to say whether one of these will establish itself in mobile automation, and if so, which one.

Can you give an example of an application that has been implemented?

For one of the largest manufacturers of agricultural machinery we have developed a special inductive sensor for scanning the position of the gears. The customer now has a solution that keeps mounting times to a minimum and excludes the possibility of faults occurring during mounting. The sensor is positioned directly on the gear unit and can withstand the toughest environmental conditions, such as direct contact with oil and ambient temperature up to 125 °C, and has an EMC immunity of up to 200 V/m.

Do you also offer customer solutions as well as standard products?

Yes, we do. The customer-specific business makes up a major part of sales in the ME market. Without the ability to offer customized solutions we would not be able to serve the ME market so effectively since the requirements are often very specialized. The development of customized solutions is already justified by the large unit volumes involved.

What makes the Turck solutions for mobile equipment stand out from the other solutions on the market?

Besides offering a very broad product range we also offer the flexibility and know-how for offering customized solutions. Here we can draw on many years of experience in the ME sector as well as on the standard modular system, and are therefore able to produce the optimum solution quickly and simply. This applies to small changes to the standard product, such as the use of connectors and cables normally found on vehicles, as well as complete new developments, such as customized housing styles and sensor circuit boards. Furthermore we also offer the possibility through Turck mechatec to design and produce completely new subsystems in terms of hardware and software. ■



“For around 20 years we have been extremely successful in this sector, with many well-known manufacturers as our customers. The new position was created in order to ensure a more structured operation in the mobile equipment market.”

Nils Watermann



“In mobile automation the trend is moving from the simple detection of end positions to continuous and primarily contactless position sensing.”

Nils Watermann



Author
Ines Näther is an editor of the technical journal "elektrotechnik"
Web www.elektrotechnik.de
Webcode more11430e

Yellow necklace:
Turck RFID read/write
heads and uprox+
proximity switches
are fitted at each
individual station of
the assembly line



Unique Products on the Conveyor Belt

Sonplas uses Turck's BL ident RFID system and uprox+ sensors in an assembly plant for injector nozzles

Injector nozzles for injection systems basically consist of a nozzle tip, the needle with a spring seat, a spring, sleeve and a type of cover that encloses the entire unit. Mounting them is a complex process since components of each individual injector nozzle are all separate parts. This makes each injector unique. The needle or spring of one nozzle cannot simply be refitted on another nozzle without a loss in quality. Many nozzle components, from the spring seat to the spring, right through to the individual ground needle, have to be measured precisely and matched with each other. The assembly of these unique nozzle products is fully automated on the conveyor belt.

This type of assembly is made possible by special machine builders such as Sonplas GmbH from Straubing. The company specializes in assembly and testing equipment for car parts suppliers. Based in Lower Bavaria they have made a name for themselves in the sector, with machines that assemble or test supplied parts through which fuel later flows in the vehicle. Many international car parts suppliers appreciate this expertise with almost 200 employees with this know-how.

At the end of 2012 Sonplas won the order to design and build two machines for assembling injector nozzles. "The special feature of these machines was the fact that measuring was carried out in front of each assembly station and then the workpiece machined according to this measurement," Sonplas sales manager Hermann Pankofer explains. This is a special challenge for the machine construction. This meant that the spring of the injector was not simply fitted on the needle. The machine firstly measures the force of the spring at a station and then presses the spring seat according to the measuring results. The spring is then placed on the needle and another machine checks the height of the spring at a defined counter force. The height must be measured with a tolerance less than

1 micrometer, since the strength and the seat of the spring later influence the injection action of the injector nozzle in the engine.

Assembly process requires traceability

The complex coordination of measurements and assembly processes requires the relevant measuring data to be tracked and assigned uniquely. "Each component is tracked, not only the injector nozzle in its entirety, but also each individual part itself," says project manager Manuel Lehner. In order to assign the components to a nozzle, they move on the workpiece carrier of the nozzle. The workpiece carrier specially optimized for the plant provides a separate place for each required injector component. RFID readers read the tags that are fitted on each individual workpiece carrier.

For the assembly machines Sonplas looked for an RFID system that can be mounted compactly in the machine. "The problem was not so much the large read/write distances involved but the fact that the tag had to be fitted directly on the aluminum of the workpiece carrier," Lehner describes. The ideal tag could be found in the extensive portfolio of the Turck RFID system: Turck's TW-Q25L12,5-M-B128 tag – not much larger than a thumb nail – meets all the requirements. Eleven TN-M18-H1147 read/write heads in an M18 threaded barrel are fitted in each of the two machines in order to identify the workpiece carriers.

Long switching distance on aluminum

Sonplas looked for inductive sensors as initiators in order to detect the material carriers on the belt and to check the correct position of the workpiece carriers for the tags to be read. This required a compact switch with a long switching distance on aluminum. Only an uprox+ sensor from Turck was ultimately able to meet this set of requirements. Other proximity switches do not manage to guarantee such a large switching on aluminum with the same level of reliability. The four millimeter switching distance of the NI4U-EG08-AP6X used is considerable for a sensor in the M8 housing – and is the same for all metals. Sonplas fitted 56 sensors in each of the



“The fact that the Turck sensor detects aluminum so well was a major benefit for us. This saved us having to implement any labor-intensive alternative solutions.”

Manuel Lehner,
Sonplas



The tag is fitted directly in the aluminum workpiece carrier

Quick read

Special machine builders Sonplas developed and built two machines for assembling high-precision injector nozzles. To meet customer requirements in terms of precision and repetition accuracy, the individual nozzles and their components must be identified accurately in the process. For this Sonplas uses Turck's BL ident RFID system and uprox+ proximity switches which detect aluminum workpiece carriers on the conveyor belt.



Sonplas had to meet high customer requirements in terms of precision and repetition accuracy for the assembly of injector nozzles

two assembly machines. They detect the workpiece carrier on the conveyor belt, control stop and positioning operations, are used for detecting jams and initiate read/write operations.

"The fact that the Turck sensor detects aluminum so well was a major benefit for us. This saved us having to implement any labor-intensive alternative solutions. The machining of a steel workpiece carrier would have been much more complex." Sonplas developed the workpiece carriers on the basis of a standard carrier. With a steel design, the weight of the workpiece carriers on the conveyor belt would also have been too high: "With 30 workpiece carriers for each of the two machines this makes a considerable difference," Lehner says.

The test data at the individual measuring stations is linked with the ID number on the tag via the RFID read/write heads and stored in a database. The data reaches the database of the machine via Profibus using Turck's BL67 gateway. "The challenge with this machine was to maintain a tolerance below one micrometer while coordinating the high-precision measurements and the equally precise assembly operations. This also had to be repeatable in a continuously running production plant. Everything is coordinated here, each cog interlocking with another one," project manager Lehner sums up the particular requirements of the assembly plant and adds: "Here we must be able to rely on each component installed – and naturally on each sensor – one hundred percent." ■



The reader reads the tag on the workpiece carrier in order to identify the individual components



The data of the read/write heads reaches the database using Turck's BL67 gateway with RFID modules



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RFID in the Body Shop

With its UHF-RFID system Turck demonstrates the benefits of its long-range identification solution at an automotive manufacturer in China

At present, the global auto industry is changing dramatically. The emerging market represented by "The BRIC Countries" (Brazil, Russia, India and China) is rising sharply, reforming the pattern of the global auto industry and market. According to incomplete statistics, "The BRIC Countries" have made contributions to over 40% of the growth rate of the global auto market in recent years, and the increase rate of corresponding productivity reaches approximately 55%.

As an important part of the global auto industry, the China auto industry has experienced development and has taken a giant leap. The global auto industry will spread to China and some emerging economies. This is a big historical opportunity for the Chinese auto industry.

At present, the China auto market develops rapidly, and the automobile consumption demands change form flexible production dramatically. In such circumstance, the introduction of the RFID system becomes very important.

Intelligent body shop conveying system

The body shop belongs to line production. The production line is a strip, long and highly automatic, and the production efficiency mainly depends on the conveying line. The conveying line is like a blood vessel that runs through the whole body shop. The body shop is divided into lower body line, side body line, main body line and adjusting line according to production process. A highly intelligent mechanical conveying system is used to connect various parts, forming the equipment system of the entire body shop.

Normal operation of the mechanical conveying system is a prerequisite for production of the entire body shop. Therefore, a highly automatic mechanical conveying system that runs efficiently and continuously is required to link all processes.

In China, Turck is active on the market not only as a manufacturer, but also as a system integrator company. After fully engaging with clients, Turck recommended the use of UHF RFID products in protection class IP67,

The UHF-read/write head TN840/920 reliably captures the data carrier on the car body



Webcode more11451e
Author Zhi Kai is a product manager at Turck China



The body parts on the rail are later reliably captured by UHF-read/write head

successfully meeting long-distance read-write and multi-vehicle type in-line production needs of the clients. The control system includes Turck's BL ident UHF series, a S7 400 PLC and the fieldbus protocol Profinet.

The PLC controls the entire system and ensures continuous operation of the system. The fieldbus is a Profinet network, connecting all RFID substations in the field. Interface modules in the neighborhood can execute all writing and reading processes under control of the control system, and transmit data in carriers into the control system through the bus.

Optimized welding processes

Welding is an important link among four major processes of car production and features in complicated equipment and rapid production. Therefore, improvement of conveyor efficiency of the production line and reduction of waiting time of the production are key factors for ensuring output of a single shift and reducing production cost.

The introduction of the RFID system solves these problems for clients. By mounting UHF labels on the car body and writing related information about the car model, the production line can know the specific location of each car model in real time, so the conveying line can automatically and efficiently classify cars according to models and convey the cars to different production stations.

The ground production line is informed of preparing the corresponding welding parts in advance through reading information on the labels of five to six cars that are going to enter the ground welding line. This method greatly improves continuity of the entire production line and reduces waiting time of the ground welding process.

Moreover, information systems of various shops of the auto manufacturer are relatively independent before, and the exchange of a great amount of information is required when car parts are conveyed among shops. With Turck UHF labels on car bodies, data carriers pass through all shops along with the car bodies, thus ensuring consistent car information in production links, avoiding the step of transmitting information among car bodies, greatly simplifying the operation process and improving production efficiency.



Turck's BL67 gateway transmits the data via Profinet to the PLC

Turck HF (High Frequency) RFID products are suitable for environments requiring read/write in a short distance, while carriers are mounted on conveying tools such as slides, lifting appliances and trays to read/write repeatedly in a closed loop. Turck UHF (Ultra-High Frequency) RFID products are suitable for environments requiring read/write in a long distance, while carriers are mounted on conveying tools, car bodies or products to be produced to read/write.

All in all, aiming at automatic identification systems in the auto industry, the fieldbus technology-based Turck BL ident series of RFID products in IP67 have a broad application scope in processes such as punching, welding, coating, assembly and engine production.

First, Turck owns interface modules of various protection classes (IP69K, IP67, IP20) which are well adapted to various field environments. Second, all BL ident series modules support hot plug and HF and UHF read-write heads can be mounted on the same interface module. Third, a single station supports eight channels and can be also compatible with I/O modules for digital and analog signals. Fourth, Turck supports fieldbus protocols such as Profibus-DP, DeviceNet™, Ethernet Modbus-TCP, Profinet and EtherNet/IP, and matches programmable gateways optically. Fifth, Turck owns various carriers (metal surface mounting, high temperature resistant, etc), meeting mounting requirements of clients in various working circumstances.

In short, profiting from excellent performance and prominent features of Turck's BL ident series of RFID products, the body shop mechanical conveyor system is further optimized and improved in stability, reliability and efficiency during running, beyond the expectations of clients. ■



“Turck's UHF BL ident solution enhances efficiency and implements flexible production.”

Jixue Liu,
Turck (Tianjin) Industrial
Engineering Co., Ltd.

Quick read

If workpieces must be equipped with data carrier, RFID technology in the UHF frequency band is required. Turck has equipped an automotive manufacturer in China with its RFID-system. Since the data carrier is directly attached on the body, the production will not only be optimized in the body shop, but also in subsequent process steps.

Dutch machine building is opening up an enormous export potential for the country, says Frans Brouwer



“Short Routes to Customers”

Inge Hübner, editor of the technical journal “open automation”, spoke to Frans Brouwer, managing director of Turck B.V. about the Dutch automation market

The Netherlands is the partner country of this year's Hannover Messe. What for you is the significance of being selected as partner country?

The fact that the Netherlands has been selected as this year's partner country to the largest industrial fair in the world is an excellent opportunity for Dutch compa-

nies to present themselves and their leading sector solutions to the international public. The Netherlands is an important trading partner with German industry. The Hannover Messe 2014 is therefore particularly important for Turck B.V. because our parent company is German and the two countries collaborate closely together.

Since when has Turck been active in the Netherlands what aim did it have when it started out there?

Turck has been active in the Netherlands since the seventies. In the beginning there was an agency but the separate national subsidiary Turck B.V. was founded in 1991. We have been able to implement the

global strategy in the Dutch market for 23 years. Here we live the corporate philosophy "Think Global – Act Local" every day and we know how important it is to have short routes to the customers and speak their language, especially for the development of specific solutions.

How has the business developed over the years and what are your current sales?

Today Turck B.V. has a team of 23 employees. Since the company's founding, our aim has been to be advisers for our customers in the Netherlands. The market has rewarded this so that we now generate sales in the millions range.

Could you give us a brief overview of the Dutch machine and plant building sector as well as its potential.

There are several companies that are leaders in a specific field. A good example of this is the plant and seed industry. The Netherlands is the world market leader in this sector, and the machine and plant building sector has grown with it so that many suppliers here are market leaders. We also have many innovative machine builders with a worldwide reputation for machinery in the food sector (meat, dairy products, eggs etc.). The semiconductor, offshore and gas industry are other markets in which Dutch companies have a lot of expertise. The Netherlands takes eighth place in the list published each year by the World Economic Forum of the most competitive economies of the world. The Dutch machine building sector makes a significant contribution to this position since it is opening up an enormous export potential for the country.

What potential does the market offer German suppliers of automation technology?

Automation manufacturers like Turck are increasingly being integrated earlier the development of machines and plants. We are increasingly becoming technology partners for our customers. At Turck B.V. we are often the intermediaries between the developers of the Dutch machine builders and our German R&D colleagues. This proximity is a great opportunity for suppliers from Germany. There are a lot of innovative technologies in Germany from which the machine building sector in

the Netherlands can benefit. The distance between the two countries is very small and the cultures are very similar.

What are your main customer sectors in the Netherlands and what product groups do you supply them with?

Our main customer sectors are distributed in the field of manufacturing and process automation. The Dutch government has selected so-called top sectors in which we are particularly strong worldwide. Industry, researchers and government work closely together in these sectors. Two examples of these top sectors are the agricultural & food sector as well as the energy sector. For Turck B.V. these sectors are also important target markets and we can offer a great deal of experience here. When we speak of energy, we also include gas. The Netherlands has an important role in Europe in this area since we have excellent storage facilities and an outstanding gas network. Our products for the process industry have been used successfully in this infrastructure for many years.

What are your objectives in the next five years for the Dutch market?

One of our aims is to generate cost savings and greater customer satisfaction with our intelligent I/O solutions. In the future we will increasingly talk to our customers about solutions, which also involves the issue of software which is becoming increasingly important. There is currently a lot written about the smart factory and Industry 4.0. For us the intelligent connection of components and machines in order to increase the flexibility and efficiency of production is a main focus. However, Turck also has new sectors in its sights such as the mobile equipment market. Although we have been used for a long time in the manufacturing sector for agricultural and building machinery, a new sector management offers us a more structured approach to the market and allows us to bundle our expertise for the customer. The new products and technologies from Germany will also help us to grow further in the Dutch automation market. As with Turck generally, our further development to becoming a complete automation partner for our customers is at the center of all our activities. With this vision we will also develop to become a market leader in the Dutch automation sector. ■



“ At Turck B.V. we are often the intermediaries between the developers of the Dutch machine builders and our German R&D colleagues.”

Frans Brouwer



“ As with Turck generally, our further development to becoming a complete automation partner for our customers is at the center of all our activities. With this vision we will also develop to become a market leader in the Dutch automation sector.”

Frans Brouwer



Author Inge Hübner is an editor of the technical journal open automation
Web www.openautomation.de
Webcode more11431e

32 material carriers
run through the
assembly plant at
Thomas Regout



Quality Slide Production

The telescopic slide manufacturer Thomas Regout International B.V. is automating the quality control of an assembly plant with Turck's BL ident RFID system

Thomas Regout became co-owner of the Nederlandse Spijkerfabriek in Maastricht in 1834. Today, 180 years later, Thomas Regout International B.V. no longer produces nails and spikes but telescopic slides for drawer elements in furniture and other applications. The name of the co-founder has remained, as has the Maastricht site in the heart of Europe. In order to keep production viable in Western Europe this Dutch SME has to manufacture its telescopic slides to the highest quality specification.

Time consuming manual quality control

Previously each product that leaves the company was checked for faults by hand, something that is not always the ideal choice – especially when the financial aspects are considered. “The manual quality control is time consuming. Moreover, a check of the running properties of a slide is always subjective. Results can vary from employee to employee or between days of the week,” says Roy Klaassen, process engineer in charge at Thomas Regout. In order to monitor production quality without manual inspection, Klaassen planned to optimize an assembly plant for telescopic slides from 30 centimeters up to almost one meter in length with an integrated quality control. “Previously we had to stop the plant if a production fault was discovered. This cost a lot of time,” the process engineer describes the situation prior to modernization.

“It was also possible to create new faults in the process by shutting down the machines,” adds Timo Rutten, CEO, consulting engineer and programmer



“We now have considerably less manual interventions in the plant. Production runs more smoothly and we are also achieving a higher level of productivity and quality.”

Roy Klaassen,
Thomas Regout
International B.V.

Quick read

In order to integrate an automatic quality control system, the Dutch telescopic slide manufacturer Thomas Regout International B.V. required an identification system for its material carriers. With Turck's BL ident RFID system, all quality control test results can now be recorded. Manual production stops are no longer necessary and the quality control process is more reliable and efficient.



“In one project for automobile manufacturer BMW, the Turck system could also read tags when they were placed on the inside of carbon components..”

Timo Rutten,
Inofil Besturingstechnologie B.V.

at the system integrators Inofil Besturingstechnologie B.V. The company had already implemented other automation projects with Inofil. The integrator, based in Sittard, Netherlands, advises its customers in finding solutions and product selection. Inofil also integrates the selected solution at the customer as well as taking over the entire programming of the controller.

Quality control by RFID

In order to automate the assembly process for the telescopic slides, Inofil wanted to use RFID to identify the material carriers. This enables Thomas Regout to detect faulty parts during assembly and continue running the plant since the slide concerned doesn't have to run through the production process to the end. Previously you had to complete the production of faulty products if they were not removed from a plant when a machine is shut down. The RFID tracking of the material carriers now enables the faulty parts to be rejected at the end the assembly. The tracking of faults saves resources and energy because the machine no longer carries out any processing steps on these parts.

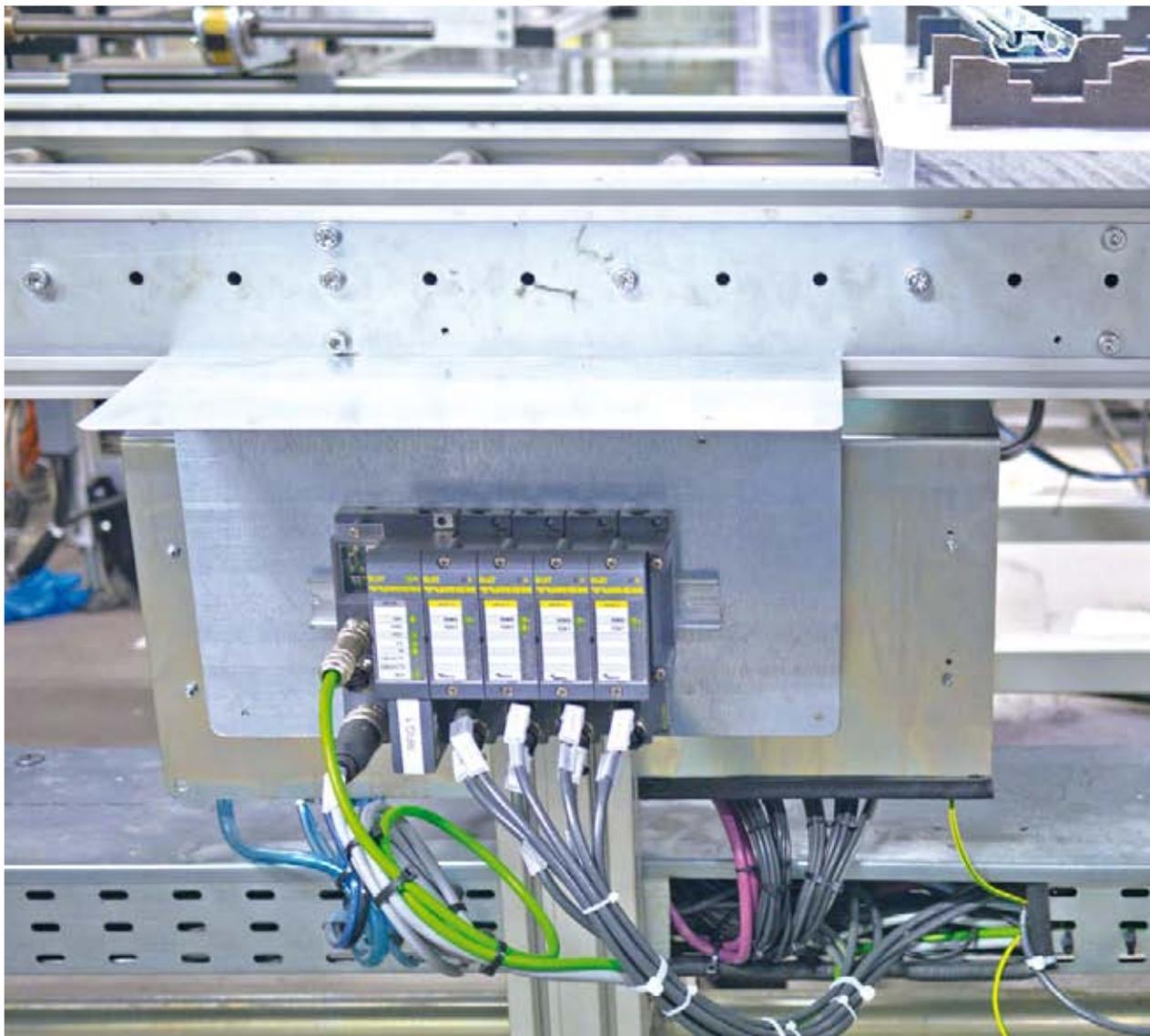
“Another benefit of the RFID solution is the fact that the controller gives us a long-term view. If a material carrier increasingly produces faulty products, this is noticed by the employees, who identify the source of the fault and rectify it. Defects on the material carrier would have previously been discovered much later,” says Rutten.

BL ident: system of choice

Inofil recommended Turck's BL ident RFID system to its customer because the integrator had already had good experiences with it in previous projects. “In one project for automobile manufacturer BMW, the Turck system, unlike those of other manufacturers, could also read tags when they were placed on the inside of carbon components,” Rutten explained.

Trust in the Turck system paid off: In the assembly project, 15 type TB-M30-H1147 read/write heads reliably detect the tags on the 32 workpiece carriers. The data is routed via Profinet to the plant controller via Turck's BL67 Ethernet gateway. Inofil programmed the processing of the data together

Turck's BL67 I/O system brings the system from the sensors and the RFID data to the controller via Profinet



with the visualization in the controller. The Siemens PLC detected the DTM modules of Turck without any problem, which clearly simplified programming.

All tags in view

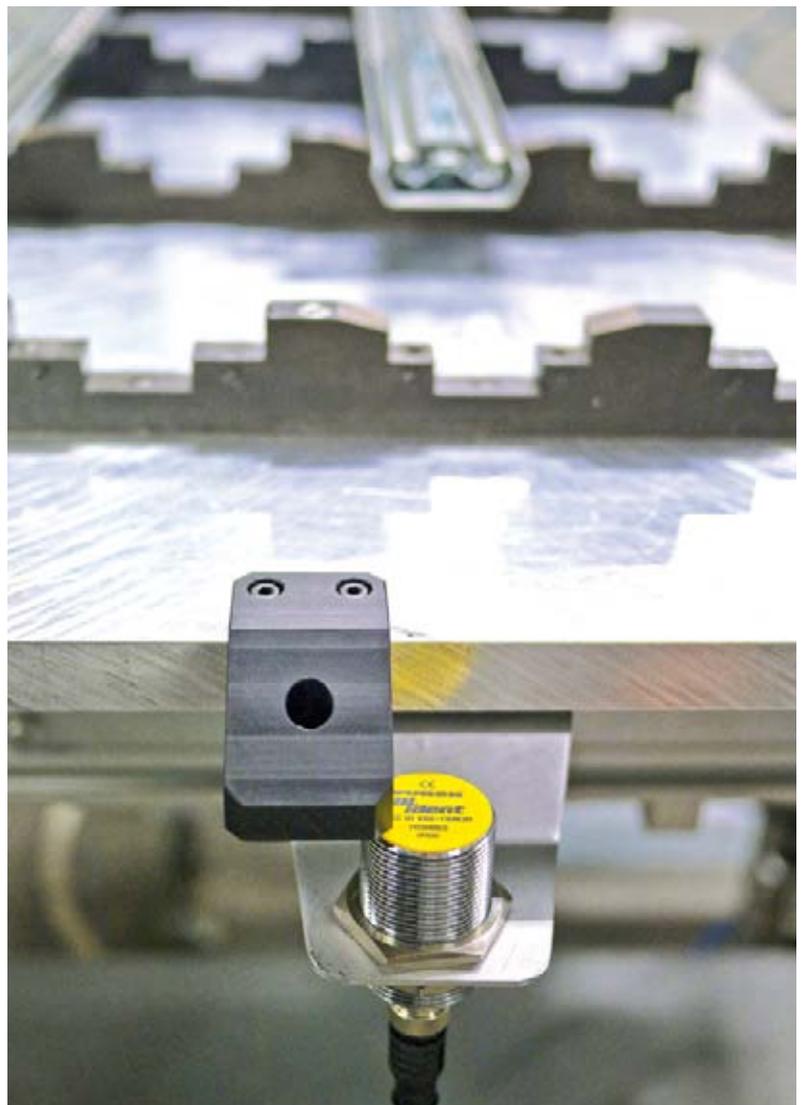
The operator panel gives the plant operator an overview of all stations and the tags that are read there. A history display can also be called up for each individual tag, showing all the faults that have occurred with it. The data itself is stored in a database that assigns it to the individual tags. "The tags do not leave the process. This means that a database solution is more suitable than data storage directly on the tags," Rutten explains.

At Thomas Regout, the RFID system forms the interface between information and production. Design features prevent the tags from being read directly at some of the testing or assembly stations. The controller then calculates from the data of the previous and subsequent RFID reader which tags are currently present at the station and assigns the information in the database to the appropriate data record.

Further RFID projects planned

The modernization of another plant is planned for 2016. This plan involves the optimization of the entire production flow so that it follows the logic of the production chain instead of the historical progression of plant expansions. This would enable the job lists and product parts lists with a long history of use to be replaced with an electronic production data management system based on RFID. RFID tags fitted on the component containers and the corresponding mobile handheld RFID readers will then virtually exclude the possibility of any read or transmission errors. Another optimization feature will enable the identification of punching and cutting tools. This would make it possible to prevent the misuse of tools, and also to permanently monitor the lifespan of the individual tools. Any deteriorating machining results can be detected early on.

The three-month test phase with the current system is very promising: "We now have considerably less manual interventions in the plant. Production runs more smoothly and we are also achieving a higher level of productivity and quality," a satisfied Klaassen states. ■



The tag was fitted to the workpiece carrier with the black plastic holder

Precisely Through the Light Curtain

Dutch carpet market leader increases the precision and production safety through the use of Banner measuring light curtains

G enemuiden, a town in the north of the Netherlands, is known as a center for carpet manufacturing. The largest company located there is Vebe Floorcoverings, which was founded over 80 years ago and is today part of the Condor Group. The family-owned enterprise produces needlefelt carpets, tiles, carpet runners, entrance mats and artificial turf, supplying the building sector, office fit-

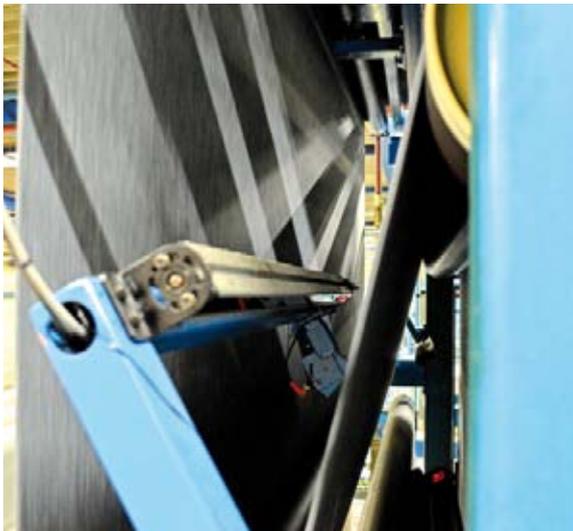
ters, the leisure industry as well as the automobile industry with its products. With 250 employees and a carpet production of 45 million square meters per year in 60 different qualities and designs, the company is the largest supplier in the field of needlefelt carpets worldwide. Last year the company decided to take on an enormous challenge: The precise measurement of carpet width.

The production line for needle felt carpets at Vebe Floorcoverings supplies more than 45 million square meters of carpet a year



Precise measurement data

The production of needlefelt carpets involves precision work and high production quality. Taking into account the fact that the carpet is produced at a speed of up to 35 meters a minute, a tiny fault can quickly lead to a horrible result. "A needlefelt carpet always consists of different layers," explains Freddy Bolt, electrical engineer who accompanied the installation work. "We start with a roll of 4 meters width and a diameter of at least 1.5 meters. We call this roll the master roll. On this several layers of adhesive and carpet are applied in the backing line. Due to gravity and mechanical resistance, the carpet is stretched during production which unavoidably also makes it narrower. In order to maintain a constantly good quality and prevent any rejects, it is extremely important for us to continuously monitor the width of the carpet precisely. Therefore we measure the width of the carpet at the beginning of the job and at the end. This measuring data is used to continuously



EZ-Array light curtains check the carpet width during production with 10 times more accuracy



Turck's block I/O module brings the digital measuring signals to the controller via IO-Link and Profibus

Quick read

A year ago carpet manufacturer Vebe Floorcoverings in Genemuiden, Netherlands, installed two pairs of Banner EZ-Array light curtains for measuring the width of carpet on its production plant which can produce up to 35 meters of carpet a minute. With an accuracy of 2.5 mm, the result of the new measuring procedure is 10 times better than the previous solution. An immediate fault indication also prevents quality losses, rejects and unwanted production downtimes.

monitor the production and correct it if necessary. Although we did have an older width measuring system, it was no longer accurate enough. So we looked around for a better solution."

IO-Link light curtains

This search soon took us to the Dutch branch of Turck located in nearby Zwolle. Turck is familiar with many of the challenges of its customers and delivers more than just standard products. Freddy Bolt commented: "It soon became clear from our talks that the measuring light sensors from Banner could supply the exact precision data we wanted. Furthermore, their terminals are prepared for Profibus networks. We use Profibus as the fieldbus system for controlling the production process. When the signal is received, we don't want to implement any analog to digital conversions. It must be possible for the controller to read in the measuring results of the sensor directly as digital data."

At the start and at the end of the production line, Bolt and his team fitted two EZ-Array light curtains for the measured values. The digital signals of these devices are routed via IO-Link to two IO-Link block modules. Another connection is implemented from the block modules to the Profibus network so that the signals ultimately reach the controller unchanged.

10 times more accurate measuring result

It is now a year since Vebe installed the EZ-Arrays. "We can now warn employees sooner if anything is going wrong with the production," Bolt says. "This prevents any loss in quality and rejects, as well as any unwanted downtimes which would otherwise have involved losses in time, money and materials. We can ensure a continuously high production quality. We owe this result largely to the precise measuring data that was possible. This is accurate to within 2.5 mm which is 10 times more accurate than the previous solution. Another benefit is the fact that the photoelectric sensors could be connected easily to our bus system via Profibus. The light curtains can also be installed easily on the machine. Only the connection and the precise alignment are necessary. Another practical feature is the fact that the display itself indicates whether the alignment is correct. Here the Banner EZ-Array light curtains stand out from other products. The price-performance ratio is also good. In all, I can only confirm that we are very satisfied with our investment." ■



“We can ensure a continuously high production quality. We owe this result largely to the precise measuring data that was possible. This is accurate to within 2.5 mm and is therefore 10 times more accurate than the previous solution.”

Freddy Bolt,
Vebe Floorcoverings

With an operating height of 27 m and an outreach of 14.8 m the performance of the TB 270 is impressive



Webcode more11454e | **User** www.ruthmann.de
Author Hans-Peter L  er is sales specialist at Turck Germany

Angle Indicator

Turck angle sensors are used in the aerial platforms of Ruthmann to measure the rotation angle of the working cage

In the Ruhr district (Germany) people would be surprised to know that the term "Steiger" is protected by trademark. In the German coal mining industry, the "Steiger" is the term given to a mine overseer or supervisor. However, when the municipal parks commission gets a STEIGER® they usually mean an aerial platform from Ruthmann, a company that defined the features of this type of product in the fifties. It all began when the Duisburg municipal works started looking for a solution that was safer than ladders for maintaining street lights. At that time Ruthmann had already been in existence for around 50 years. The company, headquartered in Gescher-Hochmoor in the Münsterland region of Germany, had already been producing transport solutions since 1901. However, it wasn't until the invention of the aerial platform for the Duisburg municipal works that the Westphalian company became a global player and gained sector leadership.

Higher, more compact, further

The challenge in the sector is to develop mobile aerial platforms that can be extended out from a truck chassis with a defined permissible total weight, that are flexible and which also allow a large lateral outreach. The entire vehicle in its retracted state must be compact in design and easy to maneuver. The weight of the truck chassis and its structure play an important role in the further development of aerial platforms. Manufacturers of aerial platforms benefit from the progress made in material science and the latest shaping and joining technologies such as laser welding. Ten years ago, Ruthmann was able to build the TTS 1000, an aerial platform with a maximum working height of 100 meters. While the lead employees at the Gescher-Hochmoor company admit that the market for these kinds of extreme devices is limited, they appreciate the positive advertising gained from these mammoth plants.

As the aerial platforms carry people, they must meet special safety requirements. The safety-related sensors and the controller in particular must have a redundant design. This is the case with all models from the small K 110 on a 3.5 ton base up to the TTS 1000. Sensors are used to measure the position of the telescopic arm on which the working cage is located. Many STEIGER® machines also feature a jib between the telescopic arm and the working cage. This jib



The compact Ri360-QR14 is reliably protected from mechanical damage by the steel cover

– called the RÜSSEL® at Ruthmann – allows flexible maneuvering over obstacles.

The swiveling of the working cage, whether it is located on the jib or the telescopic arm, is also monitored by a sensor underneath the cage. "Only if the jib is in the correct position can the working cage itself be swiveled fully. If it is too steep, the cage with the control console may hit the jib," Dr.-Ing. Klemens Post, head of electrical control technology at Ruthmann, explains the task of the sensor. "To prevent this, the controller continuously monitors the swivel angle of the jib and ensures that it is only moved as far as the actual posi-

▶ Quick read

The aerial platforms built by Ruthmann are based on quality and innovative technology. To guarantee at any time the safety of the STEIGER® aerial platform with a maximum working height of 100 meters, sensors detect each position change – right through to the swivel angle of the working cage. This task is mastered by Turck's Ri360-Q14 inductive angle sensor, which made a big impression with its compact design, simple teach function for the sensing range and intelligent response at the measuring range end points.



“A major benefit for us is the tolerance provided when the positioning element is offset. This is very helpful because a few millimeters offset frequently occur when mounting the sensor.”

**Dr.-Ing. Klemens Post,
Ruthmann GmbH & Co. KG**

tion allows.” On aerial platforms without a jib, the cage can not be fully swiveled to any position.

Behavior in the limit range

“There had been problems with the angle sensor that we had previously used,” Post explains. The sensor was taught with a sensing range of 180 degrees.” It outputs a 0.5 volt signal at the starting point of the measuring range at -90 degrees, and the maximum value of 4.5 volts at the end point at +90 degrees. If the stop at 4.5 volt was slightly overshoot, the sensor signal jumped to 0.5 volt. This immediately caused the controller to lock the movement of the working cage in the direction of the 0.5 V signal. We had to go on the safe side and teach the old sensor within a safer range, i.e. from -85 to +85 degrees,” Post describes how they dealt with the previously used angle sensor.

Turck's Ri360-QR14 inductive angle sensor is better adapted to this. If a position is reached that is outside of the taught start or end point, the 0.5 volt signal is still output at positions before the start point and the 4.5 volt signal at positions after the end point. The signal does not jump until the intended limit point has moved between the two end points. If therefore – as with Ruthmann – the sensor is taught from the start point at 9 o'clock to the end point at 3 o'clock, and the sensor is at 4 o'clock, it continues to output the maximum signal of 4.5 volts until the limit has been

reached at 6 o'clock. Only then does the signal jump to the start value of 0.5 volts.

Straightforward sensor offset

This behavior was not the only reason for using the Turck sensor. “A major benefit for us is the tolerance provided when the positioning element is offset. Vertically and horizontally, the sensor can be offset by three millimeters. This is very helpful because a few millimeters of offset frequently occur when the sensor is fitted. The teach functionality is also really child's play,” Post describes the benefits of the sensor. “We move to the first position, press the teach adapter button for two seconds, move to the end position, press once more for two seconds and that's it.”

The design of the angle sensor also made an impression: With dimensions of 54 x 50 x 14 millimeters, it is considerably more compact than similar products. The magnetic field immunity of the Ri360-QR-14 was not however a decisive factor in selection. The product previously fitted was an inductive system and was also magnetic field immune.

Ruthmann put the sensor through its paces for over four months in a demonstration model of a TBR 200. With a working temperature range of -40 to +70 degrees Celsius the angle sensor also operated perfectly in winter. After all the tests were successful, Post and his team decided to use the sensor in the series



The angle sensor underneath the working cage measures the swivel angle of the cage



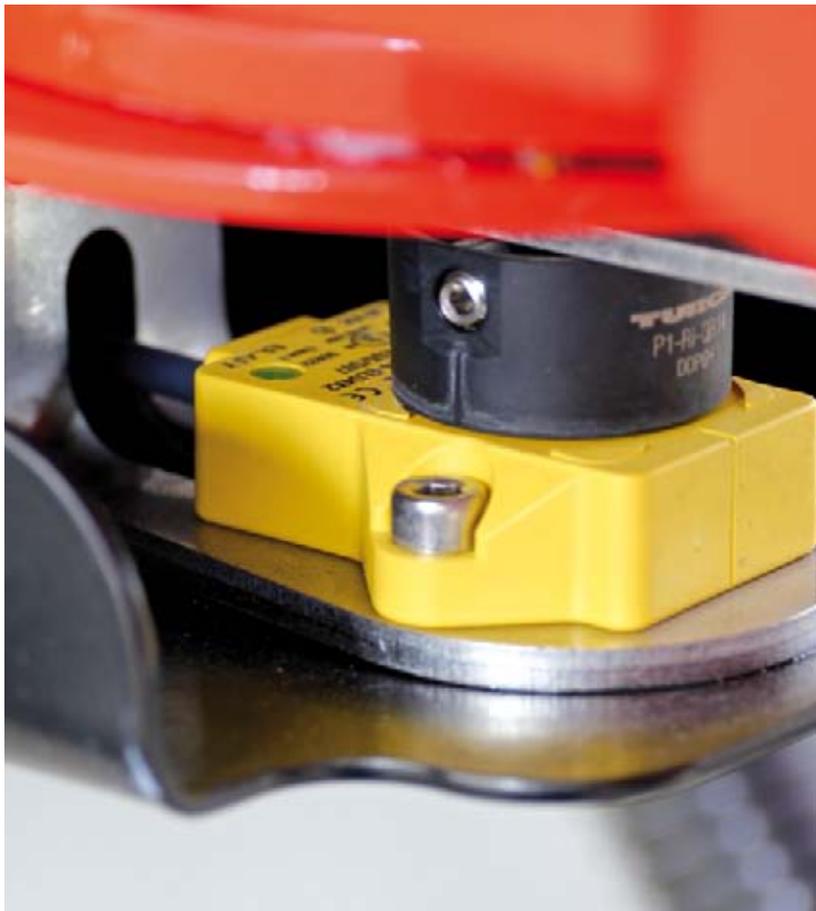
The Bi20-Q20 detects the folded ladder on the outer wall of the working cage

production of the TBR 200 and gradually introduce it as the standard in five other series: The Turck angle sensors now detect the swivel angle of the working cage in the TB 220, TB 270, the T 285, T 300.1 and the T 330. The number in the product name stands for the maximum working height of the particular STEIGER®. The TB 220 therefore allows a working height of 22 meters.

Automatic setup and retraction

Ruthmann provides an automatic system for setting up the aerial platforms. The operator can press a button to bring the device to a safe position. All four side jacks are automatically extended and brought with the necessary movement into a position that secures the entire vehicle in the horizontal position – the controller allowing a five degree tolerance. The automatic retraction of the aerial platform simplifies operation once more. At the push of a button the STEIGER® moves all telescopic booms and the jib from the working position back to the ground or transport position. The working cage is kept vertical during the entire operation.

In order to reduce the risk of accidents, the controller checks whether the ladder for entering the cage is retracted before the working cage can be maneuvered. An inductive proximity switch from Turck is used to detect the retracted ladder. Ruthmann selected Bi20-Q20 primarily due to its small height. At



Turck's angle sensor also tolerates a positioning element offset that is not always avoidable

20 millimeters it fits exactly between the outer wall of the working cage and the ladder. The sensor also has e1 certification for mobile machines.

Klemens Post regards the collaboration with Turck as positive. "We received excellent support from Turck sales. Furthermore, all the Turck sensors that we use are operating to our complete satisfaction. We are gradually fitting the angle sensor in all our machines in which the swivel angle of the working cage has to be measured." ■

► Sensors for mobile machinery

Sensors for mobile machinery must be particularly robust and come with a high degree of protection. Manufacturers often require extended temperature ranges, especially when the sensors are to be installed close to an engine or motor. The standard output signal range in the sector is also 0.5 to 4.5 volt. The special signal range became established when the onboard voltage of the machinery fluctuated far more than it does today. The output signals were therefore previously measured ratiometrically. The signal output by the sensor was not absolute but interpreted in relation to the actual onboard voltage present. In this time 0.5 to 4.5 volts developed into the industry standard for mobile machinery and is therefore still frequently used in the sector.

Precise Problem Solver

Turck's LI-Q25 contactless linear position sensor saves the Kugel- und Rollenlagerwerk Leipzig GmbH having to replace faulty glass measuring scales every six months

You don't see them or hear them, and yet we expect them to provide good service every day. Without roller bearings very little would move in today's world – let alone in industry. In Leipzig, Kugel- und Rollenlagerwerk Leipzig GmbH (KRW) is a company that has successfully dominated its corner of the market. KRW specializes in high-precision roller bearings, special components and small series. Another way with which the Saxony-based company impresses

its customers worldwide is its flexibility and fast delivery performance. "We always have an accuracy within micrometers," says Karl Wolter, director of marketing and sales at KRW, and explains: "If you take a sheet of standard printing paper and divide it into ten layers, each of these layers is one micrometer thick." To achieve this market position, special requirements are placed on the sensors used. The measuring systems at KRW must have a high degree of accuracy.

The cooling lubricant emulsion that was used in the process made the previously used glass scales unusable after six months



Optical systems wear-intensive

KRW normally relies on optical systems since no other measuring systems can achieve the degree of accuracy required. However, the disadvantage of optical systems is their high degree of sensitivity. "In the grinding workshop we have the problem that the lubricating coolant emulsion that we use penetrates into the sensors. When the tool used for grinding is rotated, the medium is atomized and produces a foam that collects on the machines and the sensors in spite of the protective measures and blocking air provided," explains Frank Schubert, head of the grinding shop.

The lubricant, also called slurry, has a very low surface tension. This is required in the process as the slurry can thus penetrate into the smallest crevice. However for glass measuring scales this property is fatal. "Through the movement of the positioning element, some slurry always penetrates on the sealing lip of the sensor. After about six months, the optical sensor at the pregrinder is normally faulty," Holger Lietsch, responsible for maintenance at KRW, describes the disadvantage of the glass scale used previously.

The surfaces of the outer and inner rings of some roller bearings are ground in the pregrinding process. Normally this is the first machining step after hardening. Here an accuracy in the hundredth of a millimeter range is sufficient. The critical precision of the bearings is achieved later in the final grinding and finishing. Depending on the batch, rings of up to 500 millimeters in width can be ground on the pregrinder. For this a strong electromagnet holds the outer rings on the machine table. The tool support moves onto the ring to be machined and the indicator of the LI sensor is set to zero. From this set reference point the machine operator can determine the amount of material removed up to the ground surface.

Magnetic systems unsuitable

"Due to the strong magnetic fields involved it is not possible to use magnetic sensors here. Directly next to the sensor we have the strong electromagnet and also a 30 kW motor which drives the main spindle," Lietsch explains. The only thing that KRW could thus do was to bite the bullet and use the glass scales.

Failed devices were then sent for examination to the manufacturer who could sometimes recondition them. However, this cleaning process is usually only possible once. After that a new sensor has to be purchased. The repair of each item cost several thousand euros, and a new sensor is even more expensive. Furthermore, KRW also had to include the time required by the maintenance personnel in the calculation. Although the grinding machine itself could still be operated, this was only possible using conventional means. Without the sensor, employees would have to adjust the machine using an analog indicator. The scaling is marked on the handwheel and cannot therefore be set precisely to zero.



EMC immune: The 30 kW electric motor of the main spindle fitted behind the bellows does not disturb Turck's LI-Q25 in the slightest

Quick read

High precision roller bearings, as manufactured in the Kugel- und Rollenlagerwerk Leipzig GmbH plant, require extremely precise sensors in the production process. Actually a task for optical measuring systems. The coolant lubricant emulsion required in the grinding process makes it necessary to replace the glass scales at worst every six months – costing thousands of euros in components. As magnetostrictive and other magnetic systems are unsuitable in the proximity of strong magnetic fields, there was for a long time no other alternative – until Turck presented a robust and wear-free solution with its LI-Q25 inductive position sensor.



Large bearings – high precision: The production tolerances in the micrometer range requires precision measuring that must be able to withstand the aggressive lubricant required in the grinding process

Lasting solution with inductive position sensor

“The previous sensor at the pregrinder was normally faulty after six months.”

Holger Lietsch,
KRW

Since autumn 2013 an inductive linear position sensor from Turck has been precisely measuring the grinding depth at the pregrinder at 10 micrometers. The LI sensors operate on the resonant circuit measuring principle, in which the position is not detected with a magnetic positioning element but inductively via an oscillating system created by a capacitor and coil. The contactless system makes it possible to fully encapsulate the sensor housing and thus permanently meet the protection requirements of IP67. No substances can penetrate into the sensor and impair its function, even under the harshest conditions. Compared to magnetostrictive linear position sensors, the performance of the Turck inductive measuring system with its high degree of immunity was impressive: Although the electric motor for the main spindle drive is located very close to the sensor, it does not impair sensor operation at all. The magnetic fixing device on the machine table also has no negative effect on the measuring reliability of the LI-Q25.

KRW maintenance supervisor Lietsch uses a digital signal transmission for the LI-Q25. The SSI signal used works using so-called differential transmission. This prevents any emitted interference source from having the negative effect it could have on an analog signal. KRW therefore does not need to use any costly screened cables. The linear position sensor supplies its signal to a digital display that is fitted to the control console of the grinding machine. Initially the sensor and the display did not operate optimally together. After the firmware of the sensor was adapted for this special display the system works reliably and fault-free. The workers in the grinding workshop can now carry out grinding with precision. The planing and flat grinding provides the base for later machining steps. Faults that occur here can only be corrected with difficulty. ■



The digital display on the control console of the machine shows the measured value of the LI sensor

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Webcode more21490e

Author Markus Ingener is a product manager for fieldbus technology at Turck Germany

Ethernet in Industrial Applications

Our know how series provides you with the most important details of Industrial Ethernet at a glance

Manufacturers are faced with the constant demand to increase productivity and reduce operating costs. A powerful industrial tool being implemented today to streamline production is reliable, enterprise-wide connectivity, providing the highest level of visibility, control and flexibility. To accommodate evolving networking requirements, such as decentralization of control, integrated diagnostics and simplified maintenance, network protocols integrate with industrial equipment and control systems to communicate crucial status updates and pro-

duction data. By understanding the need for enterprise connectivity, the various challenges and considerations associated with implementing network protocols, users can maximize data acquisition and management capabilities.

What is Industrial Ethernet?

Industrial Ethernet (IE) as standard office Ethernet is based on the IEEE 802.3 standard, however several properties of office networks are inappropriate for

industrial applications. Developers had to find solutions for requirements such as real-time communication and determinism. This adaptation is not only an adaptation of the IEEE standard to industrial/automation environments, but also the adaptation of the hardware contained within the devices to withstand harsh environments that may have extreme temperature ranges, humidity and/or vibration that traditional office environment/ IT equipment are not designed to withstand.

Many manufacturing companies maintain separate networks to support their factory floor operations and business operations. For example, the corporate IT network supports traditional administrative functions; the control-level network connects control and monitoring devices and the device-level network links the controllers with the plant floor's I/O devices. Instead of using separate networks, Industrial Ethernet can unite a company's administrative, control level and device-level networks in a single network infrastructure.

OSI reference model

The Open Systems Interconnection (OSI) reference model describes how information from a software application in one computer moves through a network medium to a software application in another computer. The model was developed by the International Organization for Standardization (ISO) in 1984, and is considered the primary architectural model for intercomputer communications. The OSI reference model divides the tasks involved in moving information between networked computers into seven smaller, more manageable task groups.

These tasks are then assigned to seven layers in the OSI model. Each layer is self-contained so that the tasks assigned to it can be implemented independently. The seven layers are divided into two layers: upper

▶ Quick read

Modern industrial Ethernet networks link a variety of machines and devices on the factory floor with IT technology. This enables visibility of all production parameters and diagnoses. Selecting the right Ethernet protocol is key for data management capabilities and the future of the system.

and lower. The lower layers (physical, data link, network and transport) focus on data-transport functions while the upper layers (session, presentation and application) focus on the applications.

TCP/IP

The Internet Protocol (IP) suite is a set of protocols and standards used for the Internet and enterprise networks. It is commonly referred to as TCP/IP because of its most important protocols: Transmission Control Protocol (TCP) and Internet Protocol (IP).

The Internet Protocol is the primary network, defining the address by which the network can transmit the packet from its source to destination. IP provides connectionless delivery of datagrams or packets through a network and provides fragmentation and reassembly of datagrams to support data links with different maximum transmission unit (MTU) sizes.

TCP provides reliable delivery of packets between two devices, relying upon IP. TCP establishes connections between applications, allowing them to send packets to each other. It also maintains the state after the packet is sent, ensuring all packets have arrived. Or if a packet is dropped, lost or corrupted during transmission, TCP can also request re-transmission.

▶ The layers at a glance

OSI layer	Ethernet-Implementation	Examples
7 Application layer – consists of application programs that use the network	Applications	HTTP, UDS, FTP, SMTP, POP, Telnet, OPC UA
6 Presentation layer – standardizes data presentations to the applications		
5 Session layer – manages sessions between applications		
4 Transport layer – provides end-to-end error detection and correction	Transport	TCP, UDP, SCTP
3 Network layer – manages connections across the network for the upper layers	Network Control	IP (IPv4, IPv6), ICMP (über IP)
2 Data Link layer – provides reliable data delivery across the physical link	Network Access	Ethernet, Token Bus, Token Ring, FDDI, IPoAC
1 Physical layer – defines the physical characteristics of the network media		

**Industrial Ethernet
enables seamless
communication
from field devices
to the ERP system**



Standard Ethernet reference model

The standard Ethernet reference model has four layers, each with its own protocols: The link layer (e. g. Ethernet) contains communication technologies for a local network. The internet layer (e. g. IP) connects local networks, establishing internetworking. The transport layer (e. g. TCP) handles host-to-host communication. The application layer (e. g. HTTP) contains all protocols for specific data communications services on a process-to-process level (i. e. how a web browser communicates with a web server)

The industrial Ethernet protocols normally use those four layers of the model. But they differ in the way they use the four layers. While Modbus/TCP™ uses every single layer, especially TCP and the IP layer, EtherNet/IP™ uses the TCP layer only for low priority communication such as administration and diagnosis. For time critical communication data EtherNet/IP uses UDP/IP data transmission. PROFINET® totally bypasses the TCP or UDP layer in order to reach real-time communication.

Selecting networking protocols

When choosing a networking solution, users must understand the individual communication requirements as well as any environmental challenges present in each application. Evaluating the performance capabilities, features and characteristics of EtherNet/IP, Modbus TCP and PROFINET assists manufacturers in selecting the ideal networking solution for their critical communication needs.

EtherNet/IP

EtherNet/IP is a communication protocol supported by the ODVA (Open DeviceNet™ Vendors Association) and is designed for use in industrial automation and process control applications. It takes the Common Industrial Protocol (CIP) and implements it onto the foundation of Ethernet. CIP envelops a wide-ranging suite of messages and services for a variety of applications, including safety, control, configuration and information. EtherNet/IP provides users with tools to deploy standard Ethernet technology for industrial applications.

With EtherNet/IP, the exchange of data is based on the producer/consumer model. This means that a transmitting device produces data on the network and multiple receiving devices consume this data simultaneously. Traffic generated during this data exchange can include input/output data and status updates produced by a remote device for consumption by one or more programmable controllers. Data collected and controlled via EtherNet/IP can use an unacknowledged method of sending information between devices on a network, which means that data delivery is not guaranteed. Therefore, to ensure delivery, a higher layer must be implemented prior to data transfer. For enhanced industrial communication, Transmission Control Protocol/Internet Protocol (TCP/IP) provides a set of services so devices may communicate over an Ethernet network. With the increased prevalence of internet and intranets for internal information distribution, TCP/IP has grown, and has been transported to all major computer operating systems. A typical example of when a manufacturer would implement an EtherNet TCP/IP

IP network is to extend communication plant-wide to connect to a corporation's worldwide network via the internet. EtherNet TCP/IP can take advantage of Ethernet's high capacity for data management to perform a wide variety of tasks, without requiring a high level of determinism or repeatability for message response time. Common TCP/IP applications include program maintenance, data transfer, web page retrieval, supervisory control, connectivity for operator interfaces and events and alarm recording.

Modbus TCP

Modbus TCP is a variant of the Modbus family of simple communication protocols intended for use with automation equipment. It covers the use of Modbus messaging in an environment using the TCP/IP protocols.

When Modbus information is sent using these protocols, the data is passed to TCP where additional information is attached and given to the IP; the data is then placed in a packet and transmits it. TCP must establish a connection before transferring data, since it is a connection-based protocol. The Master (or Client in Modbus TCP) establishes a connection with the Slave (or Server). The Slave waits for an incoming connection from the Master. Once a connection is established, the Slave then responds to the queries from the Master until the connection is closed.

Modbus TCP offers many advantages, including its openness, simplicity, low-cost development and minimum hardware required to support it. Operators can simply use standard PC Ethernet cards to communicate to implemented devices. Further, interoperability among different vendors' devices and compatibility with a large installed base of Modbus-compatible devices makes it an optimal protocol solution.

PROFINET

PROFINET is the open Industrial Ethernet standard of PROFIBUS and PROFINET International (PI) for automation. It uses three different channels to exchange data with the PLS or other devices – the TCP/IP channel for parameterization configuration and acyclic read/write operations, the real-time channel (RT) for cyclic data transmission and alarms. The third channel, the isochronous real-time channel is used as high-speed channel for motion control applications.

For its administration tasks PROFINET uses the standard Ethernet reference model based on TCP/IP channel. But for RT communications it bypasses the standard TCP/IP interface to expedite the data exchange with Programmable Controllers. This makes it ideal for multiple industrial applications. PROFINET satisfies a wide range of requirements, from data-intensive parameter assignment to synchronous I/O signal transmission. Further, PROFINET communication takes place over the same cable in all applications—whether it's a simple control task to highly demanding motion control applications.

PROFINET RT is based entirely on standard Ethernet, operators can easily combine wired and wireless



transmissions. This allows the integration of WLAN communication into the solution. PROFINET offers several advantages in comparison to other protocols, including more flexibility to control automation devices, high-speed operation through real-time communication, simple network structure for easy implementation and cost-efficient technology.

Three protocols, one device

The selection of which Ethernet protocol to use is often driven by the PLC. However, at the I/O level Turck offers multiprotocol solutions that allow the ease of a single device and ease of integration into the higher level system. For a reliable solution across hardware platforms, these three protocols – EtherNet/IP, Modbus TCP and PROFINET – can be deployed in one device to create easier integration with host control systems. This can be applied in any application that uses a host system with Modbus TCP (client), EtherNet/IP (scanner) or PROFINET (master). Upon network power-up, the Ethernet device recognizes the network protocol available to the network, allowing only one Ethernet master to control the outputs while the input and diagnostic data is available to the other two protocols. This technology eliminates the need to configure a device based on the Ethernet host system that will be deployed, ensuring easy device application, minimal maintenance and simplified product specification. ■

Turck's multiprotocol devices automatically recognize whether they are working in an EtherNet/IP, Modbus TCP or PROFINET network

Supplying Success

Turck USA recently was awarded the 2013 Supplier of the Year Award for controls from KUKA Systems North America. We talked with Sandra Harting, Commodity Lead Buyer for Controls from KUKA to learn more about the partnership KUKA and Turck have and what sets Turck apart for our customers.

Sandra Harting: Can you give us a little background on who KUKA is and what you do?

Of course, KUKA Systems is one of the world's leading suppliers of automated production and assembly solutions for sustainable industrial manufacturing. Basically, we build assembly lines that in turn build cars or airplanes. We design, build and integrate the systems for our customers, both on our floor and at the final customer facility.

What kind of Turck products does KUKA use?

We purchase a wide array of solutions from TURCK including sensors, cables, cordsets, RFID products and I/O blocks.

How long has KUKA been working with Turck?

We have been purchasing directly from Turck since May of 2009, but we've been using your materials through distribution for many years.

From left: Larry Drake (CEO – KUKA Systems Group), Sandra Harting (Commodity Lead Buyer – KUKA), Bruce White (Sales – TURCK), Paul Ambros (CFO – KUKA Systems Group) and Jason Hardy (Director of Purchasing/Supply Chain Management – KUKA)



What kind of criteria went into deciding that Turck wins the award?

We look at a variety of factors, including but not limited to on-time delivery status, pricing, and volume of business. For the year 2013, it was greatly due to the work of the outside salesperson, Bruce White, who assisted our engineers in design applications, helped to forecast material and made sure that it would be on the shelf when we needed to order it. Overall in 2013, Turck had a 99% on time delivery rate which is very impressive.

Can you talk a little about the things that make the partnership between KUKA and Turck so successful?

Turck is willing to bring in material based on our forecasts and hold it for us, cutting down lead times when we order large amounts. The Turck team has great people like Duane Marshick and Gary Thomas who go out of their way to solve problems for us to ensure everything

runs smoothly. For example if material is not in stock, they are great at finding alternative products that are in stock and will work for our applications, avoiding late deliveries for our customers.

You mentioned Turck's inside sales team and Duane Marshick and Gary Thomas specifically, is there anything in particular that sets them apart?

They are both extremely knowledgeable from a technical standpoint with the products that they sell, so much so that they are helping to find alternatives for us when the parts we need for urgent kits for our customer are not available. They confirm orders quickly and are just extremely helpful overall. Turck as a whole has been very receptive to our needs, keeping pricing down, helping to keep deliveries running smoothly. All in all the entire team is a pleasure to work with and that is why they were our top Controls supplier for 2013. ■



Turck at Trade Shows

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

Date	Trade Show	City, Country
18.03. – 21.03.2014	Amper	Brno, Czech Republic
19.03. – 22.03.2014	WIN – World of Industry	Istanbul, Turkey
25.03. – 28.03.2014	Automaticon	Warsaw, Poland
07.04. – 11.04.2014	Hannover Messe	Hanover, Germany
08.04. – 10.04.2014	RFID live	Orlando, USA
30.04. – 01.05.2014	ISA	Edmonton, Canada
05.05. – 08.05.2014	OTC	Houston, USA
06.05. – 08.05.2014	Smart Automation Austria	Vienna, Austria
08.05. – 14.05.2014	Interpack	Düsseldorf, Germany
20.05. – 22.05.2014	SPS IPC Drives Italia	Parma, Italy
27.05. – 30.05.2014	Korea Pack	Kyöngju, South Korea
02.06. – 05.06.2014	Eliaden	Lilleström, Norway
02.09. – 04.09.2014	Sindex	Bern, Switzerland
03.09. – 04.09.2014	Euro Expo IndustriMässor	Ålesund, Norway
11.09. – 14.09.2014	Expo1520	Moscow, Russia
30.09. – 03.10.2014	World of Technology & Science	Utrecht, Netherlands
02.11. – 05.11.2014	Pack Expo	Chicago, USA
03.11. – 06.11.2014	Adipec	Abu Dhabi, United Arab Emirates
11.11. – 13.11.2014	Metalform	Atlanta, USA
11.11. – 15.11.2014	IA Shanghai	Shanghai, China
15.09. – 18.09.2014	Rio Oil & Gas	Rio de Janeiro, Brazil
25.11. – 27.11.2014	SPS IPC Drives	Nuremberg, Germany



Turck on the Web

In the product database on www.turck.de/products you will find all relevant information on Turck products and solutions, from data sheets to CAD data in many export formats.

- ▶ **Full Text Search** – Are you looking for a product name, a known identification number or a special feature? Then simply enter it in the above left search field.
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- ▶ **Power Search** – Are you looking for a product that meets very specific technical parameters? Then use the feature search that specifically leads to your solution.
- ▶ **CAD Data** – Simply generate the data record that you need in our product database on the Internet – you can choose from between 80 export formats in 2D and 3D. This service is absolutely free, registration is also not required.

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Publisher

Hans Turck GmbH & Co. KG
Witzlebenstraße 7
45472 Mülheim an der Ruhr, Germany
Tel. +49 208 4952-0
more@turck.com
www.turck.com

Editorial staff

Klaus Albers (responsible)
klaus.albers@turck.com
Simon Dames
simon.dames@turck.com
Paul Gilbertson
paul.gilbertson@turck.com

Contributors to this issue

Don Dale, Jens Gierke, Ronald Heijnemans,
Inge Hübner, Markus Ingenerf, Zhi Kai,
Hans-Peter Löer, Sander Makkinga, Ines Näther,
Helmut Röder, Alfred Steenbergen, Achim Weber

Art Direction / Graphic Design

Arno Kraemer, Britta Fehr (Art design)

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Turck on Site

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GERMANY

Headquarters HANS TURCK GmbH & Co. KG

Witzlebenstraße 7 | Mülheim an der Ruhr | +49 208 4952-0 | more@turck.com

- **ARGENTINA | Aumecon S.A.**
(+54) (11) 47561251 | aumecon@aumecon.com.ar
- **AUSTRALIA | TURCK Australia Pty. Ltd.**
(+61) 3 95609066 | australia@turck.com
- **AUSTRIA | TURCK GmbH**
(+43) (1) 4861587 | austria@turck.com
- **BAHRAIN | TURCK Middle East S.P.C.**
(+973) 77 082882 | bahrain@turck.com
- **BELARUS | FEK Company**
(+375) (17) 2102189 | turck@fek.by
- **BELGIUM | Multiprox N. V. (TURCK)**
(+32) (53) 766566 | mail@multiprox.be
- **BOLIVIA | Control Experto**
(+591) 4 4315262 | conexturck@controlexperto.com
- **BRAZIL | TURCK do Brasil Ltda.**
(+55) (11) 26769600 | brazil@turck.com
- **BRUNEI | TURCK Singapore**
(+65) 65628716 | singapore@turck.com
- **BULGARIA | Sensomat Ltd.**
(+359) (58) 603023 | info@sensomat.info
- **CANADA | Chartwell Automation Inc.**
(+1) (905) 5137100 | sales@chartwell.ca
- **CHILE | Seiman S.A.**
(+56) (32) 2699310 | ventas@seiman.cl
- **CHILE | Intech Analytica E.I.R.L.**
(+56) (2) 2037700 | ricardo.aspe@intechil.cl
- **CHINA | TURCK (Tianjin) Sensor Co. Ltd.**
(+86) (22) 83988188 | china@turck.com
- **COLOMBIA | Dakora S.A.S.**
(+57) 8630669 | ventas@dakora.com.co
- **COSTA RICA | TURCK USA**
(+1) (763) 5539224 | usa@turck.com
- **CROATIA | Tipteh Zagreb d.o.o.**
(+385) (1) 3816574 | tipteh@tipteh.hr
- **CYPRUS | AGF Trading & Engineering Ltd.**
(+357) (22) 313900 | agf@agflect.com
- **CZECH REPUBLIC | TURCK s.r.o.**
(+420) 495 518 766 | czech@turck.com
- **DENMARK | Hans Folsgaard A/S**
(+45) (43) 208600 | hf@hfdk
- **Dominican Republic | TURCK USA**
(+1) (763) 553-7300 | usa@turck.com
- **ECUADOR | Bracero & Bracero Ingenieros**
(+593) (9) 7707610 | bracero@bracero-ingenieros.com
- **EGYPT | TURCK Middle East S.P.C.**
(+973) 77 082882 | bahrain@turck.com
- **EL SALVADOR | Elektro S.A. de C.V.**
(+502) 7952-5640 | info@elektroelsalvador.com
- **ESTONIA | Osauhing "System Test"**
(+37) (2) 6405423 | systemtest@systemtest.eem
- **FINLAND | Sarlin Oy Ab**
(+358) (10) 5504000 | info@sarlin.com
- **FRANCE | TURCK BANNER S.A.S.**
(+33) (1) 60436070 | info@turckbanner.fr
- **GREAT BRITAIN | TURCK BANNER LIMITED**
(+44) (1268) 578888 | enquiries@turckbanner.com
- **GREECE | Athanassios Greg. Manias**
(+30) (210) 9349903 | info@manias.gr
- **GUATEMALA | Prysa**
(+502) 2268-2800 | info@prysaguatemala.com
- **HONDURAS | TURCK USA**
(+1) (763) 5539224 | usa@turck.com
- **HONG KONG | Hilford Trading Ltd.**
(+852) 26245956 | hilford@netvigator.com
- **HUNGARY | TURCK Hungary Kft.**
(+36) (1) 4770740 | hungary@turck.com
- **ICELAND | Km Stal HF**
(+352) 5678939 | kallii@kmstal.is
- **INDIA | TURCK India Automation Pvt. Ltd.**
(+91) (20) 25630039 | india@turck.com
- **INDONESIA | TURCK Singapore Pte. Ltd.**
(+65) 65628716 | singapore@turck.com
- **IRELAND | Tektron Electrical**
(+353) (21) 4313331 | webenquiry@tektron.ie
- **ISRAEL | Robkon Industrial Control & Automation Ltd.**
(+972) (3) 6732821 | robkonfr@inter.net.il
- **ISRAEL | Nisko Electrical Engineering & System Ltd.**
(+972) (8) 9257355 | joseph.shapira@niskoeng.com
- **ITALY | TURCK BANNER S.R.L.**
(+39) 2 90364291 | info@turckbanner.it
- **JAPAN | TURCK Japan Office**
(+81) (3) 57722820 | japan@turck.com
- **JORDAN | TURCK Middle East S.P.C.**
(+973) 77 082882 | bahrain@turck.com
- **KENYA | Westlink Limited**
(+254) (53) 2062372 | sales@westlinkltd.co.ke
- **KOREA | TURCK Korea Co. Ltd.**
(+82) (2) 20831630 | korea@turck.com
- **KUWAIT | TURCK Middle East S.P.C.**
(+973) 77 082882 | bahrain@turck.com
- **LATVIA | Will Sensors**
(+37) (1) 67718678 | info@willsensors.lv
- **LEBANON | TURCK Middle East S.P.C.**
(+973) 77 082882 | bahrain@turck.com
- **LIBYA | TURCK Middle East S.P.C.**
(+973) 77 082882 | bahrain@turck.com
- **LITHUANIA | Hidroteka**
(+370) (37) 352195 | hidroteka@hidroteka.lt
- **LUXEMBOURG | Multiprox N. V. (TURCK)**
(+32) (53) 766566 | mail@multiprox.be
- **MACEDONIA | Tipteh d.o.o. Skopje**
(+389) 70399474 | tipteh@on.net.mk
- **MALAYSIA | TURCK Singapore Pte. Ltd.**
(+65) 65628716 | singapore@turck.com
- **MEXICO | TURCK Comercial, S. de RL de CV**
(+52) 844 4116650 | mexico@turck.com
- **NEW ZEALAND | CSE-W Arthur Fisher Ltd.**
(+64) (9) 2713810 | sales@cse-waf.co.nz
- **NETHERLANDS | TURCK B. V.**
(+31) (38) 4227750 | netherlands@turck.com
- **NICARAGUA | Iprocen S.A.**
(+505) 22442214 | ingenieria@iprocen.com
- **NIGERIA | Milat Nigeria Ltd.**
(+234) (80) 37236262 | commercial@milat.net
- **NORWAY | HF Danyko A/S**
(+47) 37090940 | danyko@hf.net
- **OMAN | TURCK Middle East S.P.C.**
(+973) 77 082882 | bahrain@turck.com
- **PANAMA | TURCK USA**
(+1) (763) 5539224 | usa@turck.com
- **PERU | NPI Peru S.A.C.**
(+51) (1) 2731166 | npiperu@npiiperu.com
- **PHILIPPINES | TURCK Singapore Pte. Ltd.**
(+65) 65628716 | singapore@turck.com
- **POLAND | TURCK sp.z o.o.**
(+48) (77) 4434800 | poland@turck.com
- **PORTUGAL | Bresimar Automação S.A.**
(+351) 234303320 | bresimar@bresimar.pt
- **PUERTO RICO | TURCK USA**
(+1) (763) 5539224 | usa@turck.com
- **QATAR | TURCK Middle East S.P.C.**
(+973) 77 082882 | bahrain@turck.com
- **ROMANIA | TURCK Automation Romania SRL**
(+40) (21) 2300279 | romania@turck.com
- **RUSSIA | O.O.O. TURCK Rus**
(+7) (495) 2342661 | russia@turck.com
- **SAUDI-ARABIA | TURCK Middle East S.P.C.**
(+973) 77 082882 | bahrain@turck.com
- **SERBIA | Tipteh d.o.o. Beograd**
(+381) (11) 3131057 | damir.veckerka@tipteh.rs
- **SINGAPORE | TURCK Singapore Pte. Ltd.**
(+65) 65628716 | singapore@turck.com
- **SLOVAKIA | Marpex s.r.o.**
(+421) (42) 4440010 | marpex@marpex.sk
- **SLOVENIA | Tipteh d.o.o.**
(+386) (1) 2005150 | info@tipteh.si
- **SPAIN | Elion S.A.**
(+34) 932982000 | elion@elion.es
- **SOUTH AFRICA | R.E.T. Automation Controls (Pty.) Ltd.**
(+27) (11) 4532468 | sales@retautomation.com
- **SWEDEN | TURCK Office Sweden**
(+46) 10 4471600 | sweden@turck.com
- **SWITZERLAND | Bachofen AG**
(+41) (44) 9441111 | info@bachofen.ch
- **SYRIA | TURCK Middle East S.P.C.**
(+973) 77 082882 | bahrain@turck.com
- **TAIWAN | Taiwan R.O.C. E-Sensors & Automation Int'l Corp.**
(+886) (7) 7220371 | ez-corp@umail.hinet.net
- **TAIWAN | Jach Yi International Co. Ltd.**
(+886) (2) 27312820 | james.yuan@jachyi.com
- **THAILAND | TURCK Singapore Pte. Ltd.**
(+65) 65628716 | singapore@turck.com
- **TRINIDAD AND TOBAGO | TURCK USA**
(+1) (763) 5539224 | usa@turck.com
- **TURKEY | TURCK Otomasyon Tic. Ltd. Şti.**
(+90) (216) 5722177 | turkey@turck.com
- **Ukraine | SKIF Control Ltd.**
(+380) (44) 5685237 | d.startsew@skifcontrol.com.ua
- **UNITED ARAB EMIRATES | TURCK Middle East S.P.C.**
(+973) 77 082882 | bahrain@turck.com
- **URUGUAY | Fidemar S.A.**
(+598) 2 402 1717 | info@fidemar.com.uy
- **USA | TURCK Inc.**
(+1) (763) 553-7300 | usa@turck.com
- **VENEZUELA | CADECI C.A.**
(+58) (241) 8345667 | cadeci@cantv.net
- **VIETNAM | TURCK Singapore Pte. Ltd.**
(+65) 65628716 | singapore@turck.com



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Hans Turck GmbH & Co. KG
Witzlebenstraße 7
45472 Mülheim an der Ruhr, Germany
more@turck.com | www.turck.com



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