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# Safety in the Block

First hybrid Profinet/Profisafe block I/O combines safety and standard I/Os as well as IO-Link in a robust IP67 module



## IO-Link Addition

Turck is expanding its comprehensive IO-Link series with proximity switches, contactless encoders and laser distance sensors

## Noble Droplets

Arburg's Freeformer uses the Li-Q25 inductive linear position sensor to measure the screw movement in the discharge unit

## Pass Control

The PALC unit image processing systems from ISW use the BL20 Codesys gateway to check data matrix codes and plain text

# Safer Than Ever



By the time the automation sector meets up once more for its annual class reunion at the SPS IPC Drives fair in Nuremberg, most exhibitors will have already done their homework. Sometimes exhibitors only want to impress their visitors with minor innovations, but sometimes they want to announce a real breakthrough.

This year, it's the latter that Turck is aiming to do. Attentive readers of technical journals may have already noticed our advertising campaign entitled "Safer Than Ever". What we are advertising here will also be presented at our fair stand in Nuremberg: The first hybrid I/O module, which provides both standard and safety channels at the same time. The benefits that these hybrid modules

offer you as a user are presented in detail in the title story of this issue of your more@TURCK customer magazine.

The fact that Turck is bringing its Safety I/O series relatively quickly to the market is also due to the close collaboration of two specialists: Turck was thus able to integrate its IP67 I/O know-how with the safety know-how of Bihl+Wiedemann and include a fully developed safety module in its portfolio in a short time. We can also provide the connection technology for your safety-related applications in addition to the appropriate sensors.

At the fair we are presenting several other innovations as well as safety technology, which we are pleased to present on the following pages. We will be pleased if the articles in this magazine give you one or two ideas or if you wish to speak with our specialists either at the fair or onsite about the specific challenges you face.

In the meantime we hope you will find the content of this magazine informative.

Yours sincerely,

**Jürgen Grabow, Vice President Sales Factory Automation**

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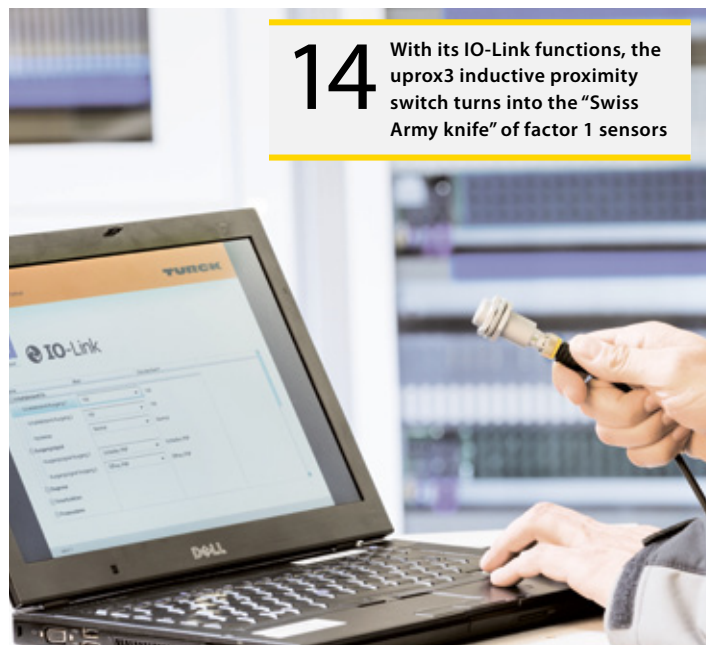
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## Turck Breaks the 500 Million Euro Mark



Turck, the Mülheim automation specialist, is expecting a consolidated group turnover of around 500 million euros for the end of financial year 2015. The consolidated group growth rate has increased by 14 percent compared to the previous year. Allowing for exchange rate adjustments this is an increase of over six percent. "This year, we will exceed the growth target of at least five percent we set in 2014," said Turck managing director Christian Wolf. The number of employees worldwide grew from 3,500 to 4,000. The increase is due to the fact that Turck in Mexico has opened its own production facility and has taken over the employees of its former offshore production site in Saltillo. "This year Turck has also invested in the future, with investments of around 10 million euros just for the new production facilities in Mexico alone," Wolf continued. "The modern production plants in Germany, USA, China and now also in Mexico are enabling us to respond more flexibly to the requirements of global markets and serve the wishes of our customers even faster." As part of its 2020 internationalization strategy, Turck is developing its regional proximity and worldwide solution expertise. According to Wolf, this will be achieved by an extensive focus on further investments in the ASEAN region. This includes the planned development of the subsidiary in Singapore into the regional ASEAN headquarters as well as the intensification of sales activities in Thailand, Malaysia, Indonesia and Vietnam. A manufacturing facility with a complete value creation chain is also planned for Asia. In spite of the continued unstable economic climate Wolf stated a growth target of five percent for 2016.

more info  
about TBPB  
on page 8

## Hybrid Module for Standard and Safety I/Os

With the TBPB safety block I/O module Turck is presenting the first module to combine both standard and safety inputs/outputs in a single device. The IP67 hybrid modules can be adapted flexibly to the specific signal requirement in the machine. They thus help users to implement space saving and inexpensive wiring of their machines. On the safety side of the Profinet/Profisafe module, the user has two safety inputs for connecting different safety sensors such as light curtains or emergency-stop buttons. Two additional safety channels can be used either as inputs or outputs. The four universal inputs/outputs for connecting non-safety-related signals can switch up to 2 A. Two of the I/Os can also be connected as IO-Link masters. In combination with Turck's I/O hubs, users can connect up to 32 additional I/Os to the module in this way.



## First Contactless IO-Link Encoder

At the SPS IPC Drives fair Turck is showcasing the first fully contactless encoder which outputs its measured value via IO-Link. This makes the QR24-IOL an inexpensive alternative to encoders with an analog interface. Users can connect the single turn encoder with a standard M12x1 male connector. Expensive shielded cables become unnecessary through the use of simple three-wire cables. The combination with Turck's contactless measuring principle offers additional benefits. The zero point of the encoder can be selected as required – and can be set simply via IO-Link after mounting.

more info  
about  
IO-Link  
on page 18





## IO-Link-Capable uprox3

The flagship uprox3 sensor is now offered also in an IO-Link-capable version. The intelligent interface makes the factor 1 inductive proximity switch a universal sensor that can be parameterized to suit over 100,000 individual requirements. For example, the two separately adjustable switching distances (each either NC or NO, as well as PNP or NPN) enable early warning functions to be set for targets subject to wear. The user can thus take action already before a failure occurs. Various timer functions can also be set, for example an off-delay for speed monitoring. These options are already possible in I/O mode, in which the sensor can be operated on a conventional digital input. In IO-Link mode, the sensor is operated on an IO-Link master. This enables access to all parameter and evaluation functions.



## Hexagon Nut Simplifies Connector Handling

Turck optimizes the grips of its two TX and TE connectivity series. A new hexagon nut has now been integrated in the knurled grip of the connectors. The improved wrench contact surface simplifies the secure tightening of the plug connectors with screw wrenches. The manual tightening of the coupling nut is also simplified by the broader and rougher grip surface. The optimized coupling nut is introduced for all straight and angled M8 and M12 plug connectors of the black TXL and TEL cable types as well as all other cable colors of the two product series. The connection and extension cordsets of the TXL line combine in a single series the different requirements that previously had to be reserved for special cables.

## Turck Software Manager (TSM)

The Turck Software Manager (TSM) is a program that clearly displays and updates all software components of Turck devices and systems in a single tool. The free software supports users in configuring, parameter setting, programming and commissioning Turck solutions. The TSM eliminates the need for the time-consuming searching and updating of individual files and programs. The program handles the entire update process: It checks for updates of the installed software and indicates new software versions, downloads them on request and installs them. The user thus saves a great deal of time in the engineering and configuration of

hardware, as well as the commissioning and parameterization of his application. The Turck Software Manager can be downloaded free of charge from [www.turck.com/tsm](http://www.turck.com/tsm)



## IMX Interface Series with Worldwide Approvals

The new IMX12 interface series is now suitable for worldwide use thanks to new international approvals. Besides ATEX for Europe, NEPSI for China, Inmetro for Brazil (currently only DI) and IEC-Ex as a worldwide reference standard, the devices for digital input or output signals (DI, DO) now also have North American UL approval. The IMX series is comprehensive and can be used in functional safety circuits up to SIL2. The module for analog output signals (AO) is already available in addition to the DI and DO devices. The device for analog inputs (AI) will follow at the end of 2015. With its slim 12.5 mm housing, the IMX series offers maximum signal density. The speed of the IMX devices is also exceptional. The IMX12-DI Ex-isolating switching amplifier resolves input frequencies of up to 15,000 Hz, which were previously only possible with special frequency transducers. More info on page 38.



## Turck Cooperates with Bihl+Wiedemann



In the field of functionally safe automation Turck is cooperating with safety specialists Bihl+Wiedemann. "Through the close collaboration with Bihl+Wiedemann, Turck can as of now bring mature safety products to the market and ensure a short time to market also for other developments in the safety portfolio," said Turck managing director Christian Wolf. "We are thus able to supply our customers with the right I/O solutions also for safety-related applications from a single source." The collaboration bundles the core expertise of both companies together: "Turck is combining its IP67 expertise with the safety know-how of Bihl+Wiedemann," Wolf continued. "The world's first hybrid TBPN safety/standard block I/O modules are the first result of the cooperation."

## Auerböck Managing Director in Austria



Stephan Auerböck will be the new managing director of Turck GmbH in Austria. Since the takeover of the former Turck agency Intermax and the

founding of Turck GmbH in 2010, the 44-year-old engineer has been responsible as sales manager and authorized company representative for all operative business in Austria. In this position Auerböck will take over from Christian Wolf, who has been responsible up to now for the management of Turck GmbH in addition to his managerial duties at Hans Turck GmbH & Co. KG and the Turck Holding.

## Robust Laser Sensor with IO-Link



Turck introduced a rugged, versatile laser sensor designed for difficult distance-based applications over a range of 25-300 mm. The new Q4X, developed by Turck's optic partner Banner Engineering, reliably detects distance changes as small as 1 mm on such challenging targets as black objects on black backgrounds or reflective items. High excess gain and a 64-element imager combine to minimize errors in detection, counting and validating orientation. Its versatility allows OEMs or end users to reduce inventory of different sensor types. Comprehensive menus are easy to navigate. An angled four-digit, seven-segment LED display with convenient push-buttons allows intuitive setup and easy viewing. A bright output

indicator provides high visibility of operation. Bipolar (PNP and NPN) outputs integrate the sensor with PLC or other control units. Alternatively the sensors IO-Link-interface features easy parameterization and diagnostics.



## UHF/HF Smart Labels Extend RFID Offering

Additional smart labels extend Turck's BL ident complete modular RFID system. This addition enables the automation specialists to provide its customers with a particularly comprehensive selection of tags, offering maximum flexibility in the implementation of customized identification solutions from a single source. Smart labels are RFID tags that are used in open cycles, i.e. tags that normally leave the plant or production cycle. Compared to the rugged tags used in closed cycles, smart labels are less expensive, easier and more flexible to adapt than conventional tags. Customers can select the tag material as required and adjust the size of the tag to their particular application. Customized labeling or programming of the tags is also possible.



**INNOVATION**

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# Safety in the Block

**Turck's first hybrid Profinet/Profisafe block I/O is an IP67 I/O module that can be optimally adapted to the particular signal requirement of any machine**

Anyone wanting to manufacture machines in Europe has to comply with the requirements of the Machinery Directive and the national regulations derived from it. Other large economic areas such as the USA or China also have similar standards and laws. Russia and Brazil have also followed suit with the relevant regulations. Essentially all of these standards stipulate that persons operating a machine must be protected from any risks arising from it.

In order to comply with these mandatory safety requirements for personnel protection, machine and plant builders find different solutions on the market for safety technology. The solutions available range from several safety sensors to safety relay modules, right through to the complete automation solution with integrated safety controller for fieldbus-based systems and related drive systems with a safety function. Regardless of which of these safety architectures is

selected, they all fulfill the same purpose: In an emergency, i.e. in the event of possible danger to persons, who for example open a guard door or press an emergency stop button, the safety architecture ensures the shutdown of the machine with maximum reliability.

## **Few IP67 I/O for safety**

Safety technology has also been part of fieldbus technology for several years. Nowadays, each fieldbus protocol integrates a safety option. However, in spite of the several different fieldbus systems (including Ethernet) with a safety option, the large majority of components for the control cabinet are designed for IP20. This means that the customers of many manufacturers have to route all signals of safety-related sensors and actuators into control cabinets or subdistribution units and wire them there to I/O modules. Only a few

## QUICK READ

Safety or standard? Until now, whoever wanted to fit their machine with a Profinet controller and IP67 Ethernet I/O modules had to make a decision. In most cases this would result in an excess number of safety and reserve channels. Turck is now offering with the TBN-L1-FDIO1, a hybrid Profinet safety module that can be optimally adapted to the specific signal requirements in the field. Besides four safety-related inputs and outputs, up to 32 standard inputs or outputs can be provided via IO-Link on the standard side of the module.







solutions with IP67/69K protection have up to now been available for Profinet/Profisafe.

However, regardless of the protection type, the reality of machine and system building is only covered in a limited way by the range of safety-related products offered from fieldbus manufacturers. The offering consists mainly of either pure safety I/O modules or standard I/O modules. This is the case even though the planning and installation in the field almost always involves a different number of standard and safety signals. Safety signals must be brought to the controller directly next to standard signals. Until now, however, there have been no I/O modules that can bring both safety signals and also standard signals to the controller. For IP67 wiring in the machine, the user could previously only choose between either pure safety or pure standard modules. There were often too many unused channels left over – either on the standard or

the safety I/O modules. The alternatives of a point-to-point wiring or a separate safety controller require extensive wiring.

#### **TBP-N-L1-FDIO1 hybrid safety I/O module**

Turck has closed this gap with its TBP-N-L1-FDIO1 I/O module. The hybrid module combines four safety Profinet/Profisafe channels and four standard I/Os. It offers two safety-related inputs for Profisafe to which two-channel safety components such as mechanical safety switches or also electronic safety sensors with OSSD signals such as light curtains can be connected. Two universal digital channels are also provided as safety-related inputs or outputs.

#### **Flexibility through two IO-Link masters**

On the standard side the new module offers four universal inputs or outputs. Two of them can even be

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**On the standard side two of the ports can be used as IO-Link masters to offer up to 32 standard I/Os via Turck I/O hubs**

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The TBPN-L1-FDIO1 not only offers highly flexible inputs and outputs for safety and standard signals. With its onboard logic function the hybrid module can operate as a remote compact safety controller at the same time.

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defined alternatively as IO-Link masters, which considerably increases the application range of the modules. Through the use of Turck I/O hubs on both IO-Link masters, users can keep the wiring effort required for additional standard signals down to a minimum. With two I/O hubs up to 32 additional digital signals can be connected via IO-Link. This flexibility of the module simplifies the engineering of machines and minimizes the number of unused channels. As more standard I/Os than safety I/Os are required in most cases, the TBPN with its IO-Link option is a clever solution.

**Remote logic speeds up the reaction time**

The TBPN-L1-FDIO1 does more than only offer highly flexible inputs and outputs for safety and standard signals. With its onboard logic function the hybrid module can operate as a remote compact safety controller at the same time. The user benefits from the shorter reaction time of the overall system and allows for this in machine and plant design. Without the

remote logic the triggering signal must first reach the distant safety controller via Profisafe, be processed by it and then sent to the actuators to be controlled. The overall reaction time of the system is thus longer than a local disconnection directly at the device using Turck's hybrid module. This means, for example, that a shorter gap between a light curtain and a hazardous movement can be designed than with a conventional safety PLC solution.

**GSDML file and configuration software**

The logic functions and the properties of the safety-related I/Os are defined using Turck's Safety Configurator for safety channels. This is necessary for every application since different safety components with different behaviors make an individual selection necessary. The Safety Configurator is based on MS Windows and enables rapid configuration of the safety I/Os thanks to its intuitive interface. The standard I/Os are configured using a GSDML file as is customary with

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The picture on the left shows the current situation in many production halls – Turck's hybrid module saves space and unused channels

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all Profinet modules. The web server of the device simplifies its diagnostics and commissioning.

### Memory stick saves repeat configurations

To save the customer having to reconfigure modules in the event of a fault, these are fitted with a pluggable memory stick. The Turck Safety Configurator not only saves the set safety properties in the TBP module but also on the stick. If a replacement is required, you simply pull out the memory stick on the faulty module and fit it in the replacement device. After the power supply is switched on, the configuration data is automatically transferred to the new module and operation can continue safely unchanged.

### Safe shutdown and power supply

Three of the four universal channels can be used as switchable standard outputs. The module reliably disconnects the power supply here. This applies also to the power supply for one of the two IO-Link masters. This enables the safety-related shutdown of auxiliary drives, valve blocks or other actuators, which minimizes the switching and wiring effort required for the actuators. All outputs switch up to two amperes. They can also be used for actuators such as valve blocks or contactors which require higher currents.

Two safety outputs can be configured via the configuration software as two-channel unipolar (P switching) or bipolar (P/N switching) outputs. This enables mechanical contacts of safety contactors as well as electronic safety signals for drive systems to be switched off safely.

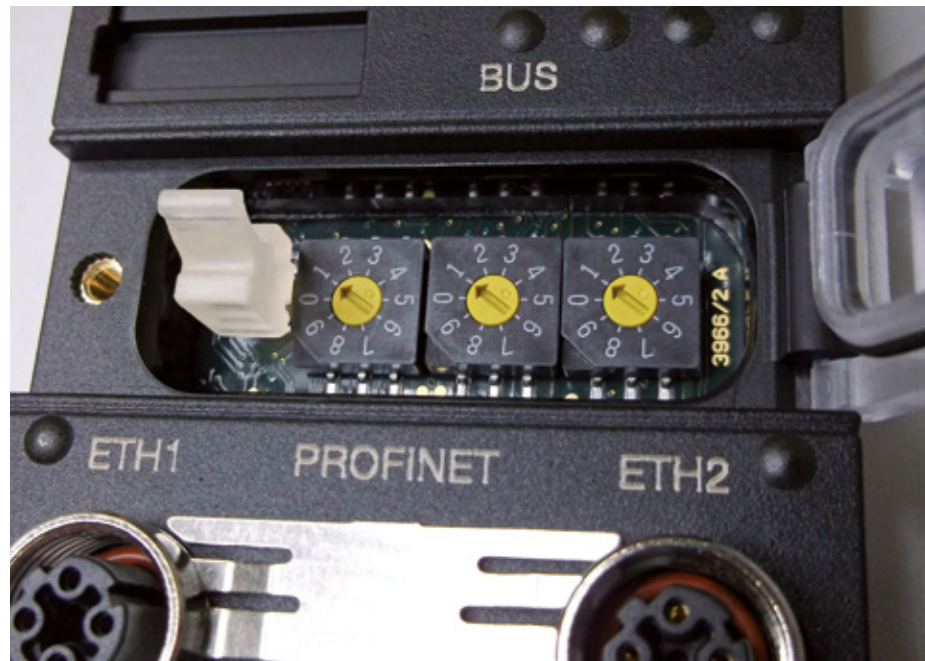
### Extended application range: I69K, PL e, SIL 3

The IP67 Profinet/Profisafe modules are primarily used in the European machine and plant building sector. Their main use is for paper and wood processing machines as well as for conveying and warehouse technology systems. The modules are also suitable for the automation sector, particularly automotive body construction and robot applications. Thanks to the enhanced temperature range between -40 and +70 °C and the protection types IP65, IP67, IP69K, the modules can be used in virtually any application area beyond these sectors. Both the protection types and the wide temperature range are not provided by any other Profisafe module on the market. The robust fully potted design and metal plug connectors underline these features.

In applications requiring functional safety the modules can also be used up to SIL 3 (IEC 61508). If the risk assessment of machines is required, as specified in EN 13849-1, the customer can use the modules up to performance level e/category 4. With its extensive performance range and specifications, the fact that the device also comes with an integrated switch for linear topologies cannot be overlooked.

### Flexible with a hybrid module

There is currently no other supplier on the market that offers this level of flexibility with hybrid IP67 safety standard modules. It is also possible to manage using



To replace the module, the configuration data is automatically transferred to the new one via the memory stick

pure standard and pure safety modules in the control cabinet. All signals come together here anyway and can be distributed accordingly. At the machine, however, signals have to be collected where they occur. Previously the user was forced to either use several different modules in the IP67 area, even if only one additional signal was required, or accept the use of long cable runs to a remote module.

The TBP Profinet/Profisafe module will be available at the beginning of 2016 and will round off Turck's Ethernet offering of TBEN-L and TBEN-S modules. The Ethernet series then offers standard I/Os, IO-Link master and safety I/Os. However, as Turck also has a strong presence in the USA, and the globally exporting machine and system sector in Europe requires safety solutions for the US market, a safety I/O module for Ethernet/IP and CIP Safety will follow. CIP Safety is the safety variant of Ethernet/IP, the most commonly used Ethernet protocol in the USA. This CIP Safety hybrid module will have the same specifications as the TBP apart from the Ethernet protocol. With Profisafe and CIP Safety the automation specialist is covering a large section of the world market for safety automation solutions.

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»IMX is not only useful for the chemical industry, but also for mobile applications or small/medium-sized plants powered from solar panels or batteries.«

Klaus Ebinger

Director Product Management Interface Technology | Turck

In an interview with the Chemanager magazine, Klaus Ebinger, director product management interface technology at Turck, explains the versatility of the IMX series, the »snakes and ladders« game involved in obtaining Ex approval, total performance, and the benefits of a higher switching frequency in process automation.

**Mr Ebinger, Turck is launching the new IMX generation of interface technology at the Achema. Are you relieved that most of this project has been completed?**

Relieved is probably the wrong word. Whatever the case, I am very pleased with the project so far. However, I also know that the work is not over yet. With the launch of the first devices of the new generation we can just about celebrate the halfway stage for IMX. We still have to cover the other half of the way up to the full introduction of the complete product line. It's a well known fact that product management in interface technology is more of a marathon than a sprint.

**What were the factors that led to the development of a completely new product generation? Couldn't Turck have also continued to develop its established product lines?**

Although our IM series is well-established on the market, any further development would have been limited. As we wanted to come down to a 12.5 millimeter width with the IMX, we would have had to completely redesign the housing of the IM devices.

This would have also made it necessary to adapt the electronics. After considering these issues, we therefore decided to develop a completely new generation based on the latest electronic components, which really offers some impressive features and promises the user investment security into the next decade.

**Apart from the size mentioned, what could you then actually improve?**

Virtually everything. Starting with functional safety. IMX can also be used for functional safety circuits up to SIL 2. A SIL process must be covered correctly with safety manuals from development to production, right through to the documentation. That, by the way, would also have been virtually impossible with an existing series. We have also improved the total performance of the devices and improved the switching frequency on the isolating switching amplifier. The entire series is also fully approved from the start for the most important markets worldwide. With older product series this is only partly possible. If components of an established device are discontinued, you have to replace them and possibly

renew the approval of the device. Another consideration is the fact that the standards also change. Obtaining worldwide approvals for devices is like playing snakes and ladders. Once you've successfully obtained one important international approval, another authorization body changes a requirement and the fun starts all over again.

**And how do you avoid this game with IMX?**

While we can't fully avoid it, IMX is a new development that meets the latest technical state of the art: We have already obtained approvals for ATEX and IEC-Ex, which are used as a reference standard for many other Ex approvals, as well as cULus for the North American market. The first devices already got approvals for China (NEPSI) and Brazil (INMETRO). We have currently applied for cFMus, TR CU for Russia and KOSHA for South Korea. We have furthermore completed all preparations for a type approval in accordance with marine and offshore applications. We will naturally be able to easily guarantee these approvals long-term for all devices of the series because the components will still be available in the foreseeable future. This means maximum investment security for customers, even in the long term.

**You said you have improved the switching frequency on the IMX. Is that at all relevant in process automation?**

In particular areas definitely. The standard IMX12-DI can cleanly resolve frequency signals up to 15 KHz and transfer them to the controller. In many cases this is not relevant, but there are application fields where it saves customers having to purchase expensive frequency transducers.

For example, with certain flow sensors which output a digital frequency signal as well as the analog signal. These very accurate flow meters are primarily used with expensive media. Unlike the analog signal, the digital frequency signal is not temperature dependent and is therefore very precise. This is achieved with an optimum total performance.

**What do you mean exactly by total performance?**

Total performance is what we call our overall precision value. This value not only represents the linearity of devices, as is the case with many competitors. This is because the accuracy of an interface device is not shown in the laboratory but in the control cabinet, and there we don't have

20 degrees but rather 40 degrees mostly. There are also voltage fluctuations and changes through the connected load. These are all fault factors that are only found in many data sheets if you know exactly where to look. We have now combined all these in the total performance and always still achieve values that currently no other manufacturer can match.

#### **Where do you see the main application areas with IMX?**

As IMX is used for galvanic or Ex isolation, the series is primarily useful for the chemical industry with its many subsectors. However, there are other applications which we definitely have in mind with IMX: For example, mobile applications where the transport of flammable liquids is involved. These manufacturers must also isolate an Ex area, but mostly have to deal with a fluctuating board voltage around 12 volts. We have therefore extended the voltage range of the devices to 10 to 30 VDC. The series is also useful for small and medium-sized plants that are powered from solar panels or batteries. With the high precision and the switching frequency, IMX even fulfills the requirements of the pharmaceutical sector and even certain factory automation applications. IMX is basically the "Swiss army knife for interface technology".

#### **How will existing customers manage the change to IMX?**

It was clear to us that any migration is a difficult issue. With innovations like this one we therefore approach our customers very early on. This enables several ideas arising out of these discussions to be fed into the development. The customers in turn know in the long term what they can expect long before we announce the new product generation. The contact with our customers is also good because we have built several good relationships over a long time. Interface technology at Turck is ultimately a success story that now already has a 50-year history. Turck's first product was an interface device. We will also use these excellent relationships for the changeover to the new IMX series, which we will prepare and implement jointly with customers over the next five to six years. The new series does after all offer the best in investment security.



# IO-Link Series Growing

**Turck has extended its comprehensive IO-Link portfolio with three new product series featuring the communication interface: inductive proximity switches, contactless encoders and laser distance sensors**

Interest in IO-Link has been gathering pace considerably in the wake of Industry 4.0. This technology has been available since 2006. While there has been a long debate about the pros and cons of this technology, many users today are convinced of its benefits. There are now around 2.2 million IO-Link nodes installed and recently the trend is growing. From 2013 to 2014 alone, the number of nodes virtually doubled. Users today implementing IO-Link have already fulfilled the basic requirements for a fully automated factory. The possibility to implement the forwarding of sensor data to higher-level ERP systems is thus already in place with IO-Link. For a new technology to be established, suppliers must offer in their portfolio components for all levels of the automation pyramid. This has now become the case with IO-Link.

With IO-Link the uprox 3 will be the Swiss Army knife of inductive factor 1 sensors

The IO-Link technology has played a key role in product development at Turck since the very beginning, so that the Mülheim automation specialist can

offer today probably one of the most comprehensive IO-Link portfolios on the market – from the simple programmable fieldbus module right up to the intelligent field device. At the SPS IPC Drives fair Turck will once more be underlining the sensor area by showcasing three of its most innovative new developments now also with IO-Link: The uprox3 inductive proximity switch, the QR24 contactless encoder and the laser distance sensor of its partner Banner Engineering. For all devices, the IO-Link variant now presented is exploding the range of possible applications and considerably simplifying handling. IO-Link turns the simple proximity switch into a multifunction sensor that also includes the possibility of identification

#### **Standard I/O mode: Two adjustable switch points**

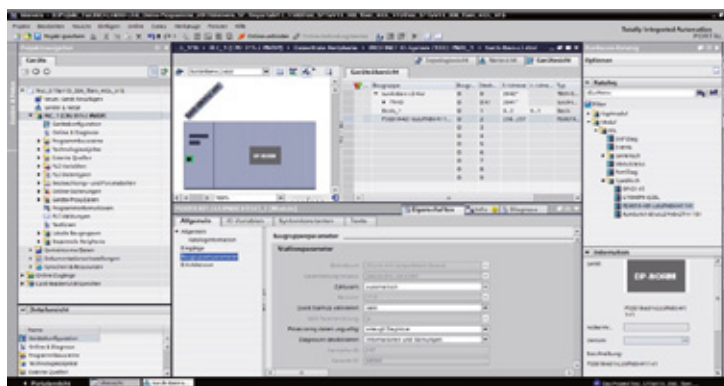
Turck's uprox3-IOL offers two operating modes. In IO-Link mode the sensor is operated on an IO-Link master, and in standard I/O mode on the conventional



digital input of an I/O module or controller. In this case IO-Link is only used for configuration purposes. In standard I/O mode two sensor switch points can be set individually and independently of each other. The actual points can be set in 10% steps from 10 to 100 % of the rated operating distance. If previously you had the choice between a 5 or 8 millimeter switching distance, it is now possible to set the sensor precisely – the switching distance of a BI8U, for example, can be set to 8 mm, 7.2 mm, 6.4 mm down to 0.8 mm. This may be particularly necessary for targets with a large tolerance in order to prevent damage and switching errors at the same time. It also simplifies mounting. The user mounts the sensor to achieve the best possible fit first of all and only then sets the switch point for the target.

The switching behavior of both switch points can be set either as an NC or NO contact as well as an NPN or PNP independently of each other. A startup delay as well as the hysteresis of the sensor can also be set. The M12 variant of uprox3-IOL is factory set with a PNP changeover contact and a switching distance of up to 6 millimeters. This is up to 10 millimeters on the M18 variant.

The second switch point allows customers to monitor wear information in addition to the actual detection task of the sensor. For this a switch point is set at the optimum distance from the target. The user selects the second switch point in order to detect early on if there is any severe wear on the target. This



**User-friendly Turck IO-Link master:** In the TIA Portal all the parameters which are already defined by the selection of the respective devices are grayed out when displaying the extended station parameters

enables you, for example, to replace brake pads before there is a risk of a machine downtime.

The uprox3-IOL can not only be set to IO-Link mode, but also to standard I/O mode for very specific detection tasks. This makes it possible, for example, to implement rotational speed monitoring applications by setting an off delay. With a rotating target, the sensor is switched off for the duration of one revolution. The sensor is then reactivated and the target would have to be located in front of the sensor again. If this is not the case, the sensor switches off and the user knows that the speed is no longer correct. Thanks to its pulse divider function, the sensor can also reduce up to 128 input pulses to just one pulse, which is passed on to the controller.

#### **IO-Link mode for identification tasks**

In IO-Link mode, the uprox3-IOL is operated on an IO-Link master. The second process value byte can even be used here for identification tasks. In this case, the uprox3 writes part of the so-called application specific tag as an identification number to the second byte of the 16-bit IO-Link signal. Workpiece carriers on which a proximity switch checks the correct position of the workpiece can be identified automatically. And this can also be carried out without any additional IO-Link call, but deterministically as part of the cyclic data. If



## QUICK READ

The more talk there is about Industry 4.0, the more IO-Link is also becoming a hot topic. No wonder, since the communication interface brings some real benefits for the user. With the right concept, clever IO-Link devices combine cost efficiency with flexible setting options. Turck is presenting the proof of this with the premiere of three new devices at the SPS IPC Drives fair: With the uprox3 inductive proximity switch, the QR24 contactless encoder and the Q4X laser distance sensor, the IO-Link specialist has added three more product variants to its IO-Link portfolio.

## TREND IO-LINK



IO-Link facilitates parameterization of the laser distance sensor Q4X at hard to reach places

Using the "Application Specific Tag" each uprox3 IO-Link sensor can be individually identified



The QR24 IO-Link works reliably with inexpensive standard three-wire cables

required, the IO-Link call can be used to read out all the characters of the application specific tag in order to use more complex ID information.

### Integrated temperature monitoring

The uprox3 also provides information in the cyclic data about whether the actual temperature is above or below the set temperature range – also according to customer requirements. The precise value of the integrated measuring sensor can be called via the controller as part of the acyclic information. The integrated temperature monitoring thus enables

predictive maintenance, such as for the early detection of faulty cooling or when the motor is running hot.

### Customer benefits

The versatile setting options enable customers to reduce the number of different types required, reduce costs for procurement and inventory levels. In the future they can purchase just one sensor as a universal solution, which can be set as required for specific applications via IO-Link. The IO-Link variant is only negligibly higher in price than the conventional uprox3 sensor. The integrated identification feature



enables anyone wanting an alternative and simple identification solution to save the costs of acquiring an RFID or barcode system. The uprox3-IOL is initially available as an M12 and an M18 variant in two housing designs: both in the chrome brass housing as well as in the PTFE coated variant for welding applications.

#### **First contactless encoder with IO-Link**

Turck's QR24-IOL single-turn encoder offers similar benefits thanks to its IO-Link interface. The new QR24 model is the first contactless encoder with an IO-Link output. Previous IO-Link encoders only used the technology for setting parameters. If IO-Link is also used as a data interface, as it is on both the QR24 and the Q4X laser distance sensor, the user can make some effective cost savings. Expensive shielded or twisted pair cables, as required for conventional analog signal transmission, become a thing of the past. IO-Link works reliably with inexpensive standard three-wire cables. Turck is continuing this approach consistently with the pricing of the QR24-IOL. It is consequently cheaper than the variants with analog, SSI or other digital interfaces.

#### **Freely selectable zero point**

Besides the cost saving benefit, the QR24-IOL boasts some clever parameter options. The user can set the zero point of the encoder as required. It was often necessary before to make compromises in mounting and commissioning. This sometimes meant that the terminals were difficult to reach or the diagnostic LEDs were hardly visible even though the zero point was correct. Alternatively the encoder could also be mounted without a correct zero point alignment. Users nevertheless had to store correction factors in their controller. The freely adjustable zero point of the QR24-IOL eliminates both these disadvantages. The orientation of the encoder can also be selected – either clockwise or counterclockwise (CW or CCW).

#### **LED status indication**

The QR24-IOL encoder variant also enables predictive maintenance. Besides the 16 bits which are output as a position signal, the encoder also transmits 3 bytes of status information. These increase the diagnostic coverage and indicate whether the positioning element is measuring correctly or not, or is being operated in the border area. This information can also be provided early on via the controller, if blows or shocks have caused the encoder or positioning element to become loose prematurely – and before a signal failure occurs. LEDs directly on the encoder show this information also and thus simplify diagnostics in the field and the correct mounting of the positioning element.

#### **Q4X laser distance sensor**

Turck's photoelectric components partner Banner Engineering also supports the IO-Link activities of its Mülheim partner and is launching on the market the Q4X laser distance sensor, another IO-Link device. It is the first device of its kind to combine two operating modes that previously were always used separately:

Contrast sensing and adjustable background suppression. The user can set the mode and other parameters such as switch window and foreground and background suppression, as well as predictive maintenance, directly in the field via the display or via IO-Link. The communication interface here also considerably simplifies parameter setting at locations that are difficult to access.

#### **New parameter sets when replacing devices**

The benefits for parameter setting in particular are also provided since IO-Link version 1.1 is now available and supports all new Turck sensors. When a replacement is necessary, the IO-Link master simply copies all the stored parameters to the identical replacement device. Employees do not require any special training to carry out the replacement and operation can continue without interruption. Particularly in the event of unscheduled machine failures, this intelligent data retention feature can considerably reduce costly downtimes.

#### **System expertise in IO-Link**

Customers continuously using IO-Link as a data interface benefit from Turck's many years of experience with this technology. Turck has now integrated the setting options of all in-house IO-Link devices in the station GSDML file of the TBEN-S master. This considerably simplifies the setting up of a system via the PLC. When the GSDML file is read in by an engineering software (TIA Portal or other) all Turck devices can be selected as a specific port configuration. Both the individual parameter setting of devices via a PC as well as the manual writing of an IO-Link call program block in the controller thus become unnecessary.

This provides a user-friendly solution to the integration of the IO-Link devices. When advanced station parameters are displayed in TIA Portal, all parameters which were previously specified by selecting the particular device are grayed out. The remaining unspecified parameters can then be selected easily via drop-down fields. The integration of the IODDs also simplifies the documentation and commissioning of machinery. If a device is connected to the wrong input, this is detected by the controller – also if the device is replaced at a later time. Any annoying connection faults arising during commissioning and servicing can be detected quickly. The diagnostics of devices during operation is also easier since each individual sensor can be accessed without any programming effort.

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# Sealed with Glass

**The Austrian electroplating specialist Electrovac relies on Turck's BL ident RFID system for its production of glass seals**

Glass is not primarily used as a sealing material. However, it does offer an ideal solution for specific applications. One of these applications is the key specialization of the Electrovac company. "In specific terms, it has to do with so-called glass-to-metal seals," explains Karl Hogl, electroplating specialist at Electrovac in Klosterneuburg near Vienna. These are feedthroughs for hermetically sealed housings, into which the metal pins are inserted. The feedthrough opening is then sealed with a glass ring. "The housings are often subjected to a vacuum. Alternatively, the housings are fitted with pressure sensors which then have to be sealed from the ambient pressure.

These hermetically sealed housings are used in applications such as pressure sensors in the aircraft industry, airbag ignitors in cars, or position sensors for off-road vehicles. They are also used in applications such as aerospace engineering, medical technology or in military equipment. Unlike its considerably larger plant in Germany, the company's head office in Klosterneuburg is primarily responsible for smaller

series or special productions. This site is responsible for manufacturing the housings together with the glass seal. "At this stage we often do not know what the housing will ultimately be used for," said Hogl, indicating the extremely exotic nature of possible applications for this technology.

## Robust sealing

But why is glass used as a seal? Hogl explains: "The seal of the feedthrough has to meet a wide range of different requirements. Whilst obviously being hermetically sealed, it must also be temperature resistant and pressure resistant. With plastics, for example, it is difficult to achieve the right level of temperature resistance. A rubber seal would be unsuitable for providing long-term vacuum sealing. Therefore, the ideal sealing material for these kinds of demanding requirements is glass."

Around one year ago, the Salzburg-based company Schloetter, a plant and control system builder for the electroplating sector, overhauled the electroplating

Small but fine: The electroplating plant at Electrovac is used for electroplating small series of hermetically sealed housings

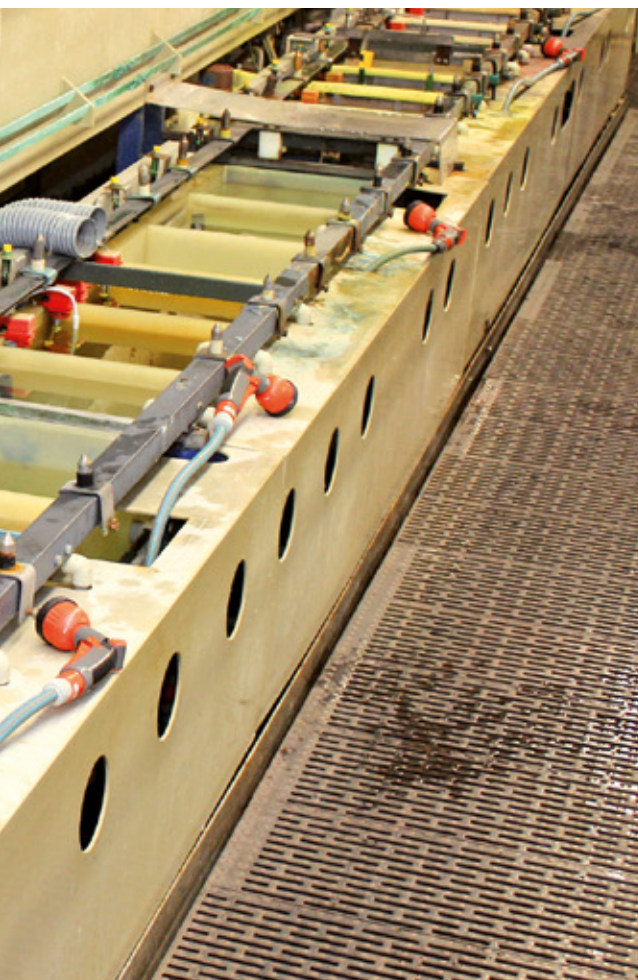




»Our experience with Turck has always been positive. Installation is simple and reliability is high. Giving Turck the job of providing the sensors on this plant was therefore an obvious decision.«

Harald Hraschan | Schloetter Ges.m.b.H

Even severe ambient conditions are not a problem for the read/write head



plant in the Klosterneuburg factory. This is used firstly as a test plant and secondly for electroplating small series housings after the glass seal has been melted into the feedthrough openings. "The plant control system was also renewed as part of this work in order to optimize operating processes," Hogl says. The new controller was required to ensure that the correct process parameters, such as current and time, are always selected for different requirements.

This is where Turck got involved. RFID tags were attached to the workpiece carriers. The only entry now required at the controller is the housing located on the carrier. Sensors installed at the different electroplating baths now enable the controller to identify the workpiece carrier and select the appropriate parameters. "Our experience with Turck has always been positive. Installation is simple and reliability is high. Giving Turck the job of providing the sensors on this

## QUICK READ

The technology in which Electrovac is involved is far from ordinary. After all, who thinks of glass when they think of sealing technology? This article shows what it's all about and the role played here by Turck's RFID solution.



RFID tag on the workpiece carrier

plant was therefore an obvious decision,” said Harald Hraschan, project manager at Schlötter. Karl Hogl adds: “If we didn’t have these sensors, we would have to enter all the parameters by hand, either selected from a list or from memory. You can imagine how easy it is to make a mistake, even when taking the utmost care.”

**Robust system**

“The sensor, or more precisely a type TN-M18-H1147 RFID-enabled read/write head, considerably increases the degree of automation and significantly reduces the error quota,” confirms Stephan Auerböck, the sales manager for Turck in Austria. “In this specific application, it was also necessary to take the ambient conditions of the electroplating plant into account, even though these were not a problem for this sensor.” The sensor components used in the Electrovac application are from Turck’s BL ident series. BL ident is a complete RFID system which particularly shows its special benefits in industrial environments. Whether in production control or distribution, in logistics or automation, with BL ident users can use interference-free HF technology and the wide range UHF technology simultaneously in an identification solution. Even

in industrial conditions and for the data exchange of fast moving tags, very large detection ranges are possible. Each BL ident system can be created flexibly with data carriers, read/write heads, connection technology and interfaces (gateways and RFID electronic modules) to form a tailored RFID solution. In addition to extremely fast FRAM tags that offer a virtually unlimited number of read/write operations, high temperature variants for temperatures up to 210 °C are available, which can be used, for example, in paint lines. Another important feature is that BL ident can be integrated into existing plant configurations without any problems.

Plant maintenance technicians will also be pleased with the other benefits, such as the possibility to hot swap electronic modules during operation, thus eliminating the need for downtime. The LEDs on the read/write heads also provide very straightforward optical fault diagnostics. “A major benefit for the customer is the extensive range of the Turck program,” Auerböck continues. “In other words, we offer a very high level of flexibility to meet particular plant requirements.” This, incidentally, also includes explosion protection.

**COMPONENTS USED**

<b>Read/write head</b>	TN-M18-H1147
<b>Tags</b>	TW-R30-B128
<b>Fieldbus gateway</b>	BL20-E-GW-EC
<b>I/O module for RFID</b>	BL20-2RFID-S

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## User Day, September 20th 2016

RFID in Industry and Maintenance



RFID in Retail and Logistics



Security with NFC and RFID



RFID in Medical Processes



The cartons move on the conveyor belt past the camera, which controls the print quality

# Pass Control

**The PALC unit image processing systems from ISW use Turck's Codesys programmable BL20 gateway to check data matrix codes and plain text**

Imagine that you have a headache, and so you take a conventional acetylsalicylic acid (aspirin) pill, which helps ease the pain. With the aspirin pack in your hand, you could use the data matrix code printed on it and the relevant databases of the manufacturer to find out who was involved in producing your pack, and thank everyone involved personally.

Who supplied the required chemicals and primary products? Who put the pallet with your pack into the warehouse? Which transport company picked up the

pack and when, and what time it arrived at your drugstore? Clearly the possibility to say "thank you" was not a major priority in implementing the comprehensive traceability of medicine, but it really is fascinating nevertheless.

#### **Transparency in the entire process**

There are few sectors in which the processes have the same degree of transparency and traceability as the pharmaceutical sector. As in the food industry, this is

primarily due to the health relevance of the products concerned. People have to eat food and take pharmaceutical products. The comprehensive transparency of the process ensures absolutely fault-free production and thus keeps the risk to consumers down to a minimum.

In the pharmaceutical industry, traceable production is also a requirement of brand protection. The ability to trace every single pack from the drugstore back to the production plant makes the work of any product pirate more difficult. Suppliers selling the goods can be prosecuted more easily. As it stands, most major manufacturers have already implemented security systems for the traceability of their products. The EU Falsified Medicines Directive 2011/62/EC (FMD) requires all pharmaceutical companies in the EU to have implemented the full traceability of their products by the second quarter of 2018.

If a drug company wishes to set up a transparent and traceable production system at the last minute, it may possibly come across Industrielle Sensorysysteme Wichmann GmbH (ISW), a company based in Kölln-Reisiek near Elmshorn. With around twenty employees, the company has grown to become a specialist in optical identification systems. ISW started out as an integration partner focusing on image processing systems and has since developed into a manufacturer of special machines and plants, mostly with image processing solutions as a central task. "ISW customers appreciate the fact that we offer more flexibility than some major companies, and nevertheless still offer an all-round carefree package of image processing machines together with the integration in production as well as in the customer's ERP and MES systems," explained Tobias Wichmann, authorized representative for sales and application.

## QUICK READ

The advanced image processing systems manufactured by the German company Industrielle Sensorysysteme Wichmann GmbH (ISW) are used in all sectors of industry. In the machines of the PALC unit series, Turck's Codesys-programmable BL20 gateway processes the signals of different sensors and devices, operating as a PLC and coordinating the functions of the subsystems. The simple programming and optimum dimensions for this application were some of the key factors in choosing the BL20 system.

### Individual testing systems

The solutions address the needs of the pharmaceutical sector but also other sectors such as the packaging and automotive industry. ISW has in its portfolio a number of standard machines for identification solutions which are adapted to the specific requirements of the customer. These include solutions that offer more than track and trace functionality. For example, systems are available for visually inspecting the workmanship and quality of motor parts.

The PALC unit is mostly used in the pharmaceutical sector, and PALC unit stands for Package Aggregation Line Controller. In its standard application, the machine marks a folded box with a unique serial number, product specific data and a data matrix code. It then checks the quality of the print. This is necessary to guarantee readability at the end customer (i.e., in the drugstore). In extreme cases, illegible medicine packs cannot be sold. The system is designed in different modules for the particular customer in order to



This photoelectric sensor at the reject area of the PALC unit is used to verify the rejection

»Turck’s Codesys programmable BL20 gateway has exactly the right dimensions for this task. Naturally, the PLCs of major manufacturers could also handle this task but would be unnecessarily expensive and complex.«

Tobias Wichmann | ISW

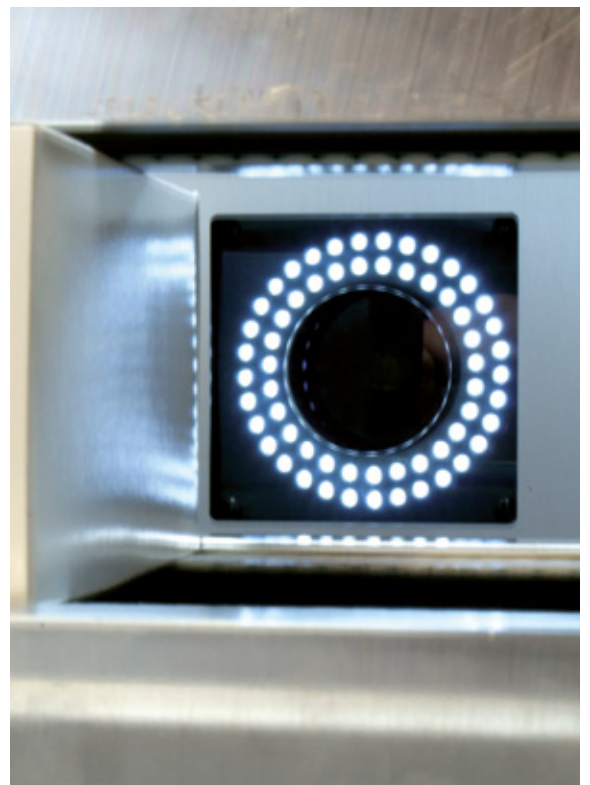
optimize connections at the specific production lines, or to meet the requirements of the different marking processes.

The PALC unit consists of a conveyor belt which feeds the folded boxes to a camera with a lighting system. The read process of the camera is triggered by a reflex sensor. The camera checks the quality of the print on the basis of parameters taught. If the print result does match the target values, a compressed air nozzle blows this folded box from the conveyor belt to a reject chute. All other folded boxes are transported further in the process and if necessary fed to a connected packaging unit. The PALC unit is parameterized via an HMI, which shows a graphical user interface. If production changes to a different box size, this can be changed via the HMI.

**Codesys gateway as PLC**

“The PLC is the core of the system,” says ISW representative Wichmann. In this case, it’s the programmable BL20 gateway from Turck that handles the control task. “All signals come together on the PLC and are processed: the signals of the IPC, the sensors, trigger signals, signals of the camera inspection and compressed air monitor and more,” Wichmann continues. “Turck’s Codesys programmable BL20 gateway has exactly the right dimensions for this task. Naturally, the PLCs of major manufacturers could also handle this task but would be unnecessarily expensive and complex. Another benefit was the fact that we already had experience with Codesys in the company and could program our solution quickly with the BL20. The choice of a suitable controller for the PALC was

ISW programmed the control of the entire PALC on the BL20 gateway with Codesys



The camera checks the quality of the print





therefore easy to make."The communication between the industrial PC and the gateway is implemented via a TCP/IP Ethernet connection.

#### Easy handling

A photoelectric sensor at the entry initiates a start trigger for the printing and measuring process. This is combined with another signal from a rotary encoder at the motor, which triggers the printer and camera at the right time. A photoelectric sensor triggers the compressed air nozzle to blow the bad boxes (NOK) from the belt into the reject chute. Both photoelectric sensors are from Banner Engineering, Turck's partner for optoelectronic solutions. The simplicity of the system is also its strength: "We didn't have to teach the system or do anything similar. The photoelectric sensor is fitted with a reflector to act as a reflex sensor. Any foreground or background rejection is unnecessary here," Wichmann says. The Turck compressed air sensor (M12E-VP44X-H1141), which is located at the maintenance unit of the compressed air nozzle and monitors the compressed air present as required, also offers easy handling.

ISW also uses another Turck product in the PALC unit: The end of the reject chute is monitored with an inductive proximity switch from Turck. The BL20 then processes the signal indicating whether the chute is closed or open. The conveyor belt is stopped if the chute is not opened. "The excellent support from Turck sales was also an important factor in choosing the Turck products," Wichmann says.

The PALC unit marks a folded box with a serial number, product specific data and a data matrix code, and then checks the quality of the print

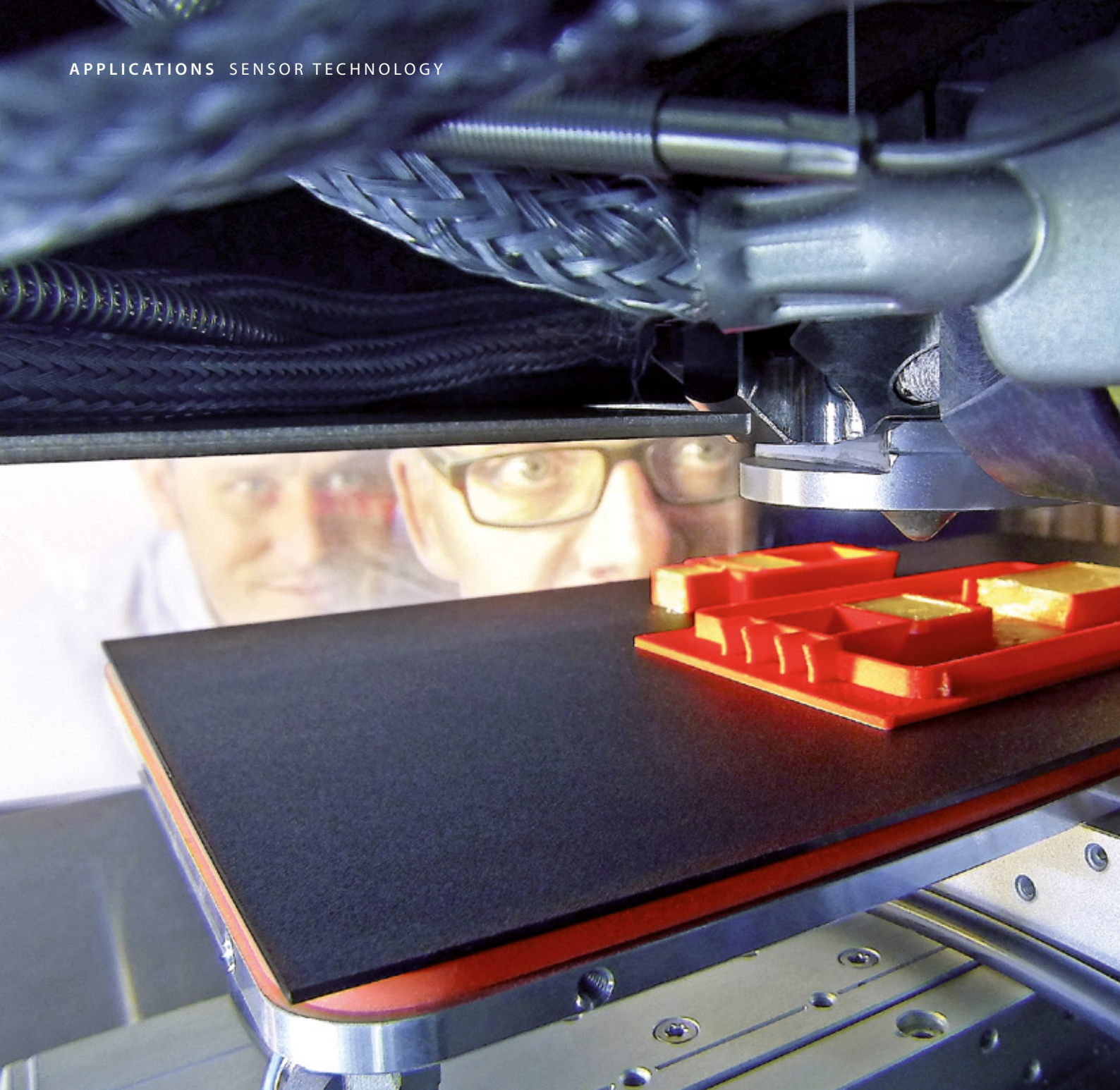
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Webcode | more21551e

## COMPONENTS USED

<b>Programmable gateway</b>	BL20-PG-EN
<b>I/O Module, analog outputs</b>	BL20-E-4AO-U/I
<b>I/O Module, digital inputs</b>	BL20-E-16DI-24VDC-P
<b>I/O Module, digital outputs</b>	BL20-E-16DO-24VDC-0.5A-P
<b>Light barrier</b>	Q20PLP-Q7
<b>Pressure sensor</b>	PK010R-P13-2UP8X-V1141
<b>Proximity switch</b>	BI4U-M12E-VP44X-H1141



Production efficiency – that is the promise that customers have been able to expect from Arburg for several years. Customers are not only supplied with the injection molding machine of choice, but are also supported by the company in implementing their plastic production tasks as efficiently as possible. Arburg's portfolio also includes robot systems, custom turnkey systems and other peripherals. Another product was recently added to the Arburg portfolio which caused a real sensation in the plastics world: The Freeformer, which operates without a mold using standard granulates.

**Efficient production of one-off parts/small batches**

Customers requiring one-off parts or only a few hundred units of a particular component were previ-

ously faced with a difficult choice. For such a small number of parts, the production of an injection mold is not financially justifiable. If the costs here are added to the cost of the individual part, the price becomes unprofitable. Since showcasing the Freeformer for the first time at the K plastics fair in Düsseldorf in 2013, Arburg has thus been offering a solution for the industrial additive manufacturing of one-off parts and customized batches.

The 3D printing sector still appears to be relatively relaxed about the entry of the injection molding specialist in this market. There are two reasons for this: Firstly, 3D printing as a manufacturing process is being strengthened by the entry of one of the world's leading injection molding manufacturers (548 million € turnover in 2014). Secondly, Arburg's Freeformer is



During printing,  
the part carrier moves  
on three axes with  
micrometer precision  
underneath the rigid  
discharge unit

## Noble Droplets

In Arburg's Freeformer for additive production, Turck's Li-Q25 linear position sensor offers very precise measuring of the screw movement in the discharge unit with a high scan rate

aimed in part at different customers to those of typical 3D printer manufacturers.

### 3D printing for industrial requirements

With the usual 3D printing process, 3D printers discharge a plastic strand that cannot be broken during printing. This restricts the freedom in the geometric design of the component. Arburg uses the world's most unique AKF process, which was developed in-house. The Arburg plastic freeforming (AKF) process manufactures components from 3D CAD data without a mold using individual droplets of melted standard granulate. "The Freeformer not only prints prototypes and samples, but manufactures one-off industrial parts and batches that meet industrial requirements in terms of stability as well as component accuracy," explains

### QUICK READ

Arburg has attracted a lot of attention in the world of plastics with its Freeformer. The machine for additive manufacturing produces components that are not only attractive but meet demanding industrial requirements. This is made possible through the very fine application of plastic droplets and a machine actuator and sensor system that is fully connected via high-speed Ethernet. Turck's Li-Q25 contactless linear position sensor measures the movement of the screw in the two discharge units. It offers outstanding performance thanks to its accuracy and high scan rate of 5 kHz.

»We are operating with a 25 micrometer accuracy. The Li sensor offers this over a 500 millimeter distance without any loss in the accuracy of measuring length.«

Werner Faulhaber | Arburg

Dr. Eberhard Duffner, development manager. The machine achieves this by applying the plastic in small 200 to 300 micrometer droplets, depending on the nozzle size. This process also enables complex geometric designs to be implemented.

**Standard plastic granulates can be used**

The Arburg developers also provided the Freeformer with another unique selling point. The machines operate with standard plastic granulates. At present these are polyamides (PA), polycarbonates (PC), thermoplastic elastomers (TPE) and acrylonitrile butadiene styrene (ABS). The standard plastic granulates are much cheaper to purchase than for conventional 3D printers, and the customers normally have these granulates already in stock.

**Two discharge units**

Arburg's Freeformer is fitted as standard with two discharge units and can thus print materials with different colors or properties into one component.

This makes it possible to produce functional components that could have a hard-soft combination.

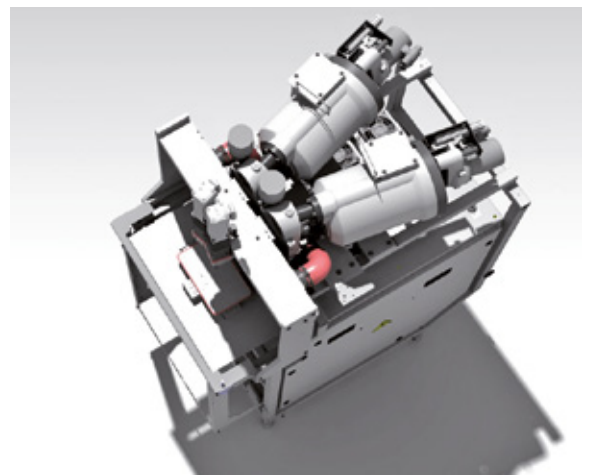
In the AKF process, the droplets make connections in all three dimensions. The components produced offer a particularly high degree of stability and precision. In the tension test, PC components achieve values of around 90 percent. To reach this high level of stability, the plastic has to be discharged as very small droplets with a high density. However, to keep the production time short in spite of the small droplet size, 70 or even 200 droplets are discharged per second – the speed varying according to whether a component contour or filling is being printed.

The discharge unit stays rigid during printing. Instead, the part carrier moves underneath on three axes with micrometer precision to position the component correctly. The carrier must be moved accurately over a short distance in the cycle of the discharge unit. "We have four milliseconds to position the carrier correctly," said Werner Faulhaber, head of the electrical engineering development department at Arburg.



Turck's Li-Q25 sensor meets Arburg's demanding requirements in terms of positioning accuracy and reproducibility

The Li sensors are located at the end of the two cylinders in order to measure the movement of the plasticizing screw



## COMPONENT USED

**Linear position sensor** Li500P0-Q25LM0

### Inductive linear position sensor measures the screw movement

The cycle and the size of the droplets are controlled by a closure at the tip of the discharge unit. The plasticized material is tensioned at 100 bars of pressure in front of the closure. "This pressure is produced and controlled in the plasticizing screw. To keep the droplet size constant in relation to the fluctuating viscosity of the melted material, a correction model is calculated with the extremely slow changing screw movement measured on the Li sensor," Faulhaber says.

If the droplets are too large or too small, this would damage the quality of the component. Although the surface of the printed component is not as smooth as that of an injection molded component, the droplets are in a very regular formation in order to ensure the correct dimensions of the resulting component. This is made possible using Turck's Li-Q5 inductive linear position sensor, which measures the movement of the screw in the Freeformer.

### Li sensor offers impressive accuracy and linearity

"We are operating with a 25 micrometer accuracy. The Li offers this over a 500 millimeter distance without any loss in the accuracy of measuring length. On sensors with a Varan interface, this accuracy is a unique selling point. The positioning accuracy and reproducibility were the key benefits of the Li," said Werner Faulhaber, describing the key reasons for choosing the sensor for the plasticizing screw. Turck's Li sensors are also used on Arburg's injection molding machines.

Although the sensors are also used on the screw in these injection molding machines, different requirements apply here: "In terms of performance, the Li on the injection molding machine is placed under a considerable load," Faulhaber says. On the Freeformer, the speed of the signal output and the rather slow movement of the screw are not critical. "However, it was important to match the scan rate that the servo axes required. Even if the translational movement of the screw itself is not very dynamic, we scan the value very frequently." In both machine types, Arburg uses an inductive linear position sensor from Turck with a maximum scan rate of 5 kHz.

### Actuators and sensors controlled via Varan real-time Ethernet

"The Freeformer is entirely electrically driven. We do not use any pneumatic or hydraulic drives. We control each axis – and this can be up to thirteen servo axes – via real-time Ethernet. We had the vision of connecting the entire actuator system and a considerable part of the sensors via real-time Ethernet," said Faulhaber. This sets an additional criterion in the selection of a



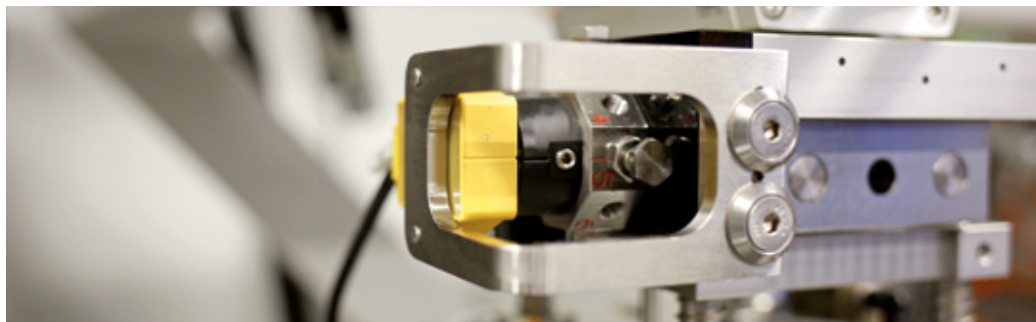
suitable linear position sensor. In 2012, Arburg collaborated in the development of the Varan interface of the Li for use in electrically driven injection molding machines. This development gave Arburg further benefits in the Freeformer. "We have the advantage that we can integrate the Li sensor as easily in this special version as with one of our own actuators or measuring systems," Faulhaber said.

The design of the Freeformer won the prestigious Red Dot Award in 2014

**Author** | Ralf Moder is sales engineer at Turck  
**Photos** | Arburg  
**User** | www.arburg.de  
**Webcode** | more21552e

## QUICK READ

Nothing can stop the high performance grinding machines from the workshop of the Linear Abrasive engineering company. Referred to as Parsifal, Tristan, and Isolde, the machines have made a tremendous impression with customers worldwide. In order for this to continue, the latest machine uses Turck's contactless inductive encoders and angle sensors to ensure precise and reproducible measuring of data.



Turck's RI angle sensor is used for position measuring of a mechanical limit drum over 360°

# Smooth Running

## Swiss abrasive machine builder Linear Abrasive relies on Turck's contactless encoders and angle sensors

The output of machines for high-performance continuous grinding developed by the engineers, designers and technicians at Linear Abrasive Engineering S.A., based in Marin-Epagnier, Switzerland, is as dynamic as the music of Richard Wagner. The company develops and manufactures machines for the high-performance continuous grinding of workpieces in large series. The Linear Abrasive systems are provided with a base made from cast iron and reinforced pre-stressed concrete, thus preventing virtually any vibration, even at high cutting speeds.

The machines are used for the large-volume production of metal workpieces. This requires maximum precision just as much as fast cycle times. The requirements of the customers are quite simple: They want to be able to press the green button so that the machine starts up and continues running; 24 hours a day, 360 days a year. "The machines even have to carry out the cleaning automatically," says Alain Kobel, head of the "Electrical" R & D department.

### Success factors: Precision, reliability, durability

The first machine that was designed 30 years ago by Linear Abrasive was intended for Germany. It was used for processing rare earths, which consist of high quality

metals. Nowadays, Linear Abrasive exports and supplies its grinding machines to customers in Europe and other markets, particularly to manufacturers active in the automotive industry. These manufacturers have been particularly impressed by the precision, reliability and

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»Every machine we develop and construct is a challenge. To be successful, we need the support of technically skilled partners with answers to our questions. Pure sales people are of no use to us.«

Alain Kobel | "Electrical" R & D

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durability of the high performance grinding machines. They also appreciate the fact that this small but fine machine builder is flexible and fast enough to meet the specific needs and requirements of its customers.

### Individual customer requirements as a key objective

The fact that every machine supplied by Linear Abrasive is a unique item developed to meet particular customer specifications goes without saying. In fact, customers actually present the development depart-

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With its inductive measuring principle, the QR24 encoder is particularly robust and precise

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For a customer from the automotive industry, Linear Abrasive built the machine for grinding connecting rods with continuous parts machining on both sides

ment with the prototype of a workpiece and a complex catalog of requirements. The fact that customers' expectations are increasing with each new application is also evident. Keeping up with this demand requires no small amount of inventiveness – and often new technologies as well – not least with regard to the individual components of the machine. For example, in a current project for a demanding customer from the German automotive sector, sensors are an important factor, as they play a key role in ensuring precise processing.

**Precise sensors**

The engineers at Linear Abrasive looked around on the market for innovative products and came upon Bachofen, the agents for Turck in Switzerland. "Every machine we develop and construct is a challenge. To be successful, we need the support of technically skilled

partners with answers to our questions. Pure sales people are of no use to us," Alain Kobel explains.

He and his team decided to use the unique probe sensors of Turck, including a high precision inclinometer with a particularly high EMC performance, an inductive analog QR24 encoder, and an inductive Ri angle sensor. Each component offers outstanding process safety and robustness., enabling the implementation of a new measuring principle based on an innovative resonance coupling, which does not require the use of magnetic positioning elements. As a result, the sensors are not susceptible to electromagnetic interference, which can be emitted, for example, from large motors. Thanks to the completely contactless operating principle, the robust sensors are both maintenance-free and wear-free, as well as offering outstanding reproducibility, resolution and linearity over a large temperature range.

COMPONENTS USED

<b>Encoder</b>	RI360P0-QR24
<b>Angle sensor</b>	RI360P1-QR14
<b>Inclinometer</b>	B2N45H-Q20L60

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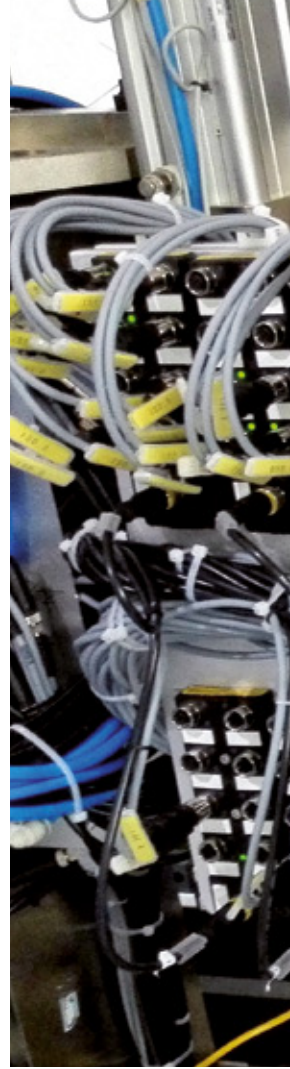
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# Simple Differential Equation

**At the differential gear production plant of a Chinese auto parts supplier, Turck is showing how its IO-Link solution for signal connection is easy, fast and efficient**



The automotive industry is a highly competitive sector. Nowadays, automotive plants in Asia, Europe and America are building very good cars, and the differences in quality between the particular vehicle classes are marginal. This competitive pressure is also felt by the auto parts supplier sector. Some manufacturers are renowned for the tough way in which they handle their suppliers. The positive side of this competitive pressure is the increased production efficiency that it has developed. Suppliers have to keep their production flexible and ensure that setups and modifications can be carried out quickly. To do this, they are increasingly relying on systemic production and products. Modular concepts enable larger quantities of individual components and shorter development and production times.

## QUICK READ

A Chinese manufacturer of differential gears uses Turck's TBIL IO-Link hub to connect hundreds of sensors and actuators in production. Each of these junction boxes connects up to 16 sensors or actuators via IO-Link. The solution saves minutes of the time required for assembling multicore cables while also reducing costs. The solution is completed with Turck's BL20 Profibus gateways with IO-Link master modules. Besides switching signals, they also bring RFID data and analog signals to the PLC.

### Use of differential gears

One example of these developments is the production of axle differential gears for automobiles. Differential gears ensure that the wheels of a vehicle can move at different speeds. When a vehicle is cornering, an axle differential gear is necessary so that the outer wheel can cover a greater distance than the inner wheel. The differential balances out the different speeds of the wheels. For off-road driving, four-wheel drives have the ability to block single differentials or all of them in order to transfer the power from stuck wheels to all wheels. Four-wheel drive vehicles also have a central differential in order to distribute the drive power to the front and rear axles.

### Many sensors in gear production

Several magnetic field sensors on the production line of the differential gears detect the positions of pneumatic cylinders and clamps, while proximity switches detect components of the differentials themselves. There are also many actuators such as air valves, solenoid valves and other devices, which perform the commands of the controller.

### Multicore cables and passive junctions failed

Initially, the customer wanted to connect the signals of sensors and actuators to the fieldbus gateways in the control cabinet using passive junctions and multicore cables. However, this solution didn't meet all of the specified requirements. The costs of the cable lengths and the extensive wiring effort involved had a negative



effect on the overall cost. Many cables for the passive junctions would have had to be prepared manually and then connected again to the I/O modules in the control cabinet. Commissioning would have been particularly prone to errors as well as being time consuming. The solution would also have been very expensive and difficult to maintain.

Troubleshooting during cable inspection would have initially presented a lot of problems: As the types and models of the sensors installed are the same, the cable markings are also identical apart from one or two digits. Assignment errors were therefore bound to happen. The search for and rectification of wiring errors would in turn be very time consuming and complex. The customer recognized this before the solution was chosen and obtained further advice from Turck.

#### **IO-Link solution fast and efficient**

Turck could offer a space saving solution that simplified the wiring of the production workbenches and which nevertheless could be implemented cost effectively. The system also allowed the implementation of diagnostics right down to the sensor level.

The customer used a Siemens controller with Profibus-DP. Turck consequently offered a BL20 Profibus gateway for the control cabinet in conjunction with IO-Link master modules. Turck's IO-Link compatible TBIL junction boxes are ideal for connecting the sensors and actuators in the field. These I/O hubs use IO-Link to bring up to 16 binary signals to the IO-Link master via a standard sensor cable. The 16-bit process signal of the

IO-Link protocol is therefore not used for an analog process value, but for transferring 16 individual switch signals for digital input or output signals. As the TBIL I/O hubs offer protection to IP67, they can be mounted directly in the field as close as possible to the sensors and actuators. IO-Link is a digital protocol that allows the use of standard three-wire cables, which eliminates the need for any expensive shielding and lengthy cable commissioning.

#### **Efficient and transparent network structure**

This network structure, consisting of I/O hubs and Profibus DP gateways with IO-Link master modules, enabled the user to avoid the need for any time consuming wiring in the control cabinet as well as making savings in the terminals, expensive cables, and space required. The solution also provided an outstandingly simple and clear network structure that prevented faults already at the installation stage.

If any faults occurred later, however, maintenance was simple thanks to the use of IO-Link. The location of faults can be identified right down to the individual field device and differentiated between a wire break or a short circuit. The central configuration of the entire system from the controller ensures the central availability of all relevant information. This simplifies both maintenance and documentation.

#### **Space saving and flexible**

An IO-Link module on the BL20 gateway provides four IO-Link masters. This means that up to 64 binary signals

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**Economy program: 26 TBIL I/O hubs means 26x savings on multicore cables and their assembly**

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Besides hundreds of switching signals, two BL20 gateways also bring signals from RFID read/write heads and analog signals to the PLC

can be connected with a single module. The flexibility of the overall solution is always ensured. Additional IO-Link master modules or other I/O modules can be connected easily to the BL20 gateway.

The customer was able to successfully complete the commissioning of the system quickly. As many identical sensors are connected and only TBIL I/O hubs were used as I/O-Link devices, the workload involved was manageable anyway.

**Analog signals via IO-Link**

IO-Link is still unfamiliar territory for many customers. Some were initially skeptical, particularly due to the unusual setup in the controller. However, after an IO-Link installation is completed, most customers are convinced of the benefits. In the application described, the customer realized that he would also be able to connect all measuring sensors for pressure and temperature with IO-Link as long as they have an interface. Special analog input modules are thus just as unnecessary as the expensive shielded cables for analog signals. The analog sensor could be connected directly next to the I/O hub to IO-Link master module of the BL20. The sensor parameters can then be set directly from the controller. The customer intends to examine this option with future projects.

The project engineer for the customer is impressed by IO-Link: "We have good reason to believe that the

IO-Link communication interface will be the top choice for the new generation of intelligent devices. Devices with IO-Link communicate data digitally and can thus exchange process values as well as configuration information and diagnostic data. The information exchange is transparent on the entire section from the sensor right up to the controller."

**Turck benefit: System expertise in IO-Link**

Turck offers one of the most extensive IO-Link portfolios on the market. From measuring and switching sensors, to connection technology and the TBIL I/O hub, right through to IO-Link masters for the most important fieldbuses and Ethernet protocols in IP20 and IP67. This system diversity is virtually unique on the market. Customers benefit from Turck's mature system know-how.

The integration of the IO-Link devices on Turck IO-Link masters via the controller will be even easier in the future. The setting options of the Turck devices are integrated into the GSDML file of the Turck IO-Link master. For the customer, this means it is only necessary to read the GSDML in the controller software in order to set up a device. The devices just have to be selected on the master. The IO-Link device parameters to be set can be selected via drop-down fields instead of having to program IO-Link call function blocks manually.

The time saved means that the installation can be put into production even faster, thus offering an edge in highly competitive markets such as the auto parts supplier industry.

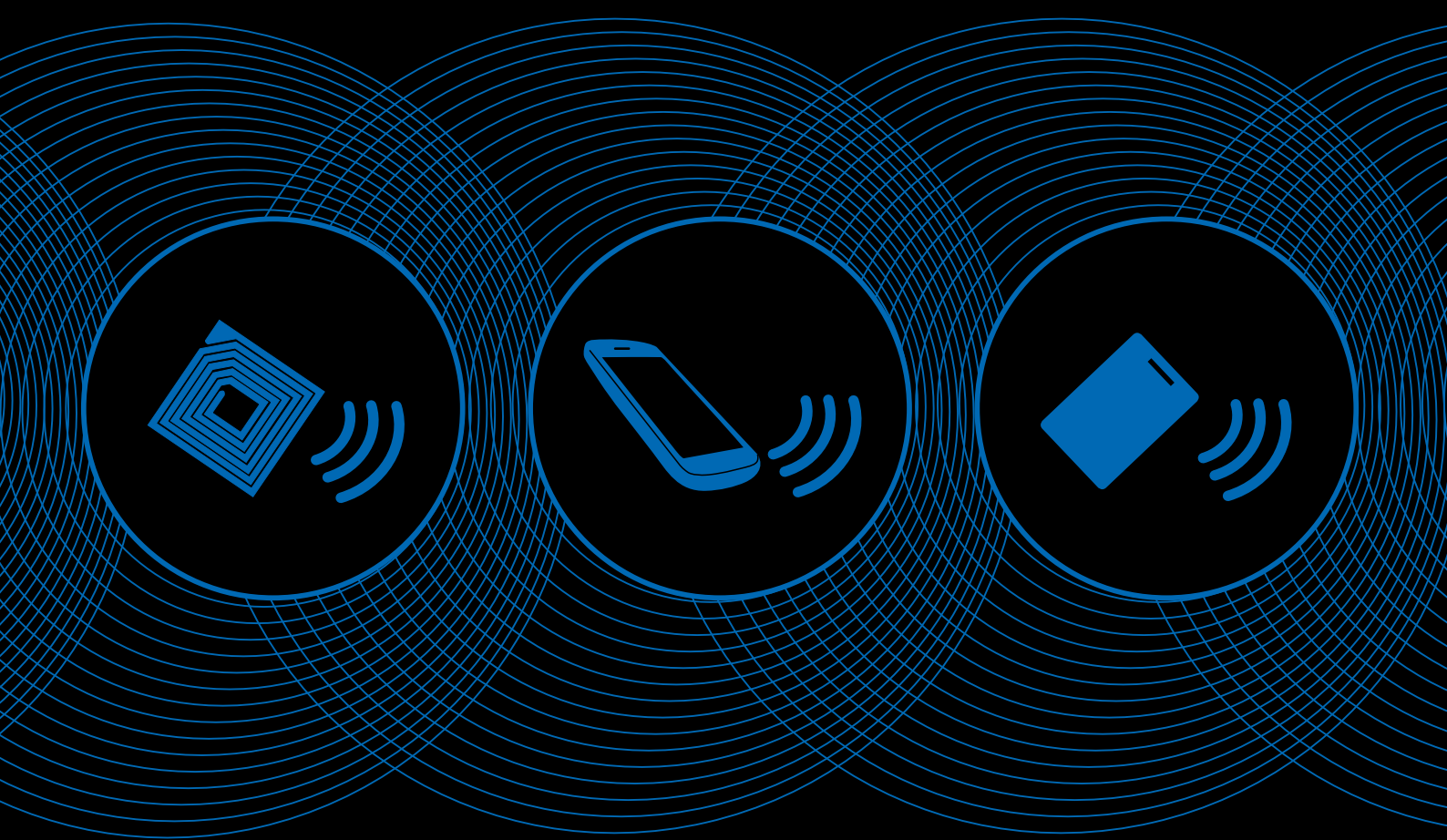
**PRODUCTS USED**

<b>Profibus-DP gateway</b>	BL20-GW-DPV1
<b>IO-Link master</b>	BL20-E-4IOL
<b>I/O hub</b>	TBIL-M1-16DXP

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Turck has now  
launched the first  
interface devices of  
the new IMX12 genera-  
tion on the market

# Pentathlete

**Turck's new IMX interface device platform provides a five-fold innovation leap in the following disciplines: compactness, speed, accuracy, safety and globality**

A look at the development of interface technology will show that manufacturers and customers increasingly have three key requirements: Safety, particularly with regard to Ex separation and functional safety (SIL), the space requirement on the DIN rail, and performance – particularly with regard to the speed and accuracy of the devices. Although existing interface devices can meet these requirements to a certain extent, the possibility of their further development is normally limited.

For many years, Turck has offered a wide range of interface devices on the market which have also been continually adapted to the latest developments. However, it is only with a completely new electronic platform that a manufacturer can offer future-proof innovations based on state-of-the-art technology, which can provide customers with investment security for the next decade. Turck has therefore invested a

great deal of time and money in the development of a completely new generation of interface technology. Having rigorously tested the IMX series and having acquired an extensive range of approvals for it, the Mülheim-based automation specialist has now launched the first devices of the new IMX interface platform. This not only sets new standards in terms of the traditional issues of safety, space and performance already mentioned, but also opens up new markets, such as in mobile equipment, thanks to its 10...30 VDC capability.

## **Functional safety and Ex separation**

The issue of functional safety has grown in importance in recent years. In the beginning, safety integrity levels (SIL) had been equated with quality. However, plant operators have gradually developed a greater understanding of safety in their applications. Manufacturers



have consequently had to meet these resulting challenges. Turck directed its development process for the new IMX series completely in compliance with the requirements of IEC 61508, and recognized independent bodies have certified this process. The comprehensive manuals and commissioning guides support customers in the operation of the devices in functional safety circuits.

#### Global approval portfolio

Ex approvals can also present a challenge, particularly when the same device is required for use in different countries. Unfortunately, Ex approval is not as uniformly harmonized worldwide as in Europe, where the ATEX directive is applicable in all countries. Different continents mean different standards. The challenge of all device manufacturers is to cover the different requirements of all relevant Ex approvals combined – prefer-

## QUICK READ

Proven technology has advantages and disadvantages: Although it may be well-established and fully mature, at some point it cannot be developed any further. If additional performance is required, the only solution is a consistent innovation using the latest technology and providing customers with security for the next decade. Turck is meeting these requirements with its new IMX interface series. With more compact housing dimensions, more accurate and faster devices, SIL2 certification and several international Ex approvals for worldwide use, Turck is raising the standard for interface technology to a new level.

The devices of the IMX12 series can be used seamlessly in a voltage range from 10 to 30 VDC. This opens up the possibility of use in new applications that are supplied from batteries, PV collectors or small wind turbines.



ably in one device. This is what Turck has managed successfully with the IMX series: The devices will be comprehensively approved for Europe, North America, South America, China and Asia, and are provided with UL, FM, ATEX, Nepsi, Kosha, Imetro and IEC-Ex certification. Shipping approvals will also be available in the near future. The global approval portfolio of the IMX series enables the customer to operate the devices reliably at different locations worldwide.

#### Minimum space requirement

While Turck's MK series required almost three centimeters in width for nearly twenty years in order to process one temperature signal, the current IM series only requires 18 millimeters for the same task. The new IMX series now only requires 6.25 millimeters per temperature signal. Thanks to the small 12.5 millimeter housing width, and up to four terminal banks per side, these devices achieve a channel density that is unrivaled on the market. The space requirement on the DIN rail for the isolating switching amplifiers with a relay output (2-channel 4-wire resistance temperature sensors) has even been reduced to half of that required by the IM series. Thanks to the four removable terminal banks, only those terminals concerned have to be removed, even when replacing three-wire sensors.

#### Maximum accuracy

Turck has managed to increase the performance of the new series in spite of the small mounting width – in terms of accuracy as well as in terms of speed. This is highlighted particularly with the IMX12-AI EX analog signal isolator. The new electronic design makes it considerably less sensitive to external factors such as temperature or voltage fluctuations. The effect of the interface device on the overall performance of a complete measuring circuit is thus considerably reduced. The device operates much more accurately



and thus meets the increased demands of the field devices for accuracy.

However, the linearity error of the devices is not the only factor considered with regard to accuracy. Many other error factors, which often only appear in the small print of the manufacturers' data sheets, should not be ignored. Data sheets cannot be used as the sole basis of device comparisons. Ambient influences such as temperature, power supply fluctuations or changes in the connected load can have a considerable effect on the performance of devices. Turck specifies these errors and field conditions, and includes effects such as repeatability and hysteresis in the total error calculation. The so-called total performance is calculated from this together with the temperature coefficient. It does not reflect abstract laboratory conditions but the performance in the field. It has been verified that the analog signal isolators and temperature measuring amplifiers of the IMX series have the best overall performance in terms of accuracy of all 12.5 mm interface devices.

#### 15000 Hz measuring frequency

The IMX12-DI EX isolating switching amplifier also offers maximum values in terms of speed. Input frequencies, which were previously the reserve of special frequency transducers, can be transferred inexpensively, reliably and in a minimum of space. With up to 15,000 Hz, measured values can be optimally resolved, enabling precise measuring without the negative effect of a signal conversion. Thanks to the high measuring frequency, analog measuring values can be transferred with a high resolution and accuracy. The normal temperature coefficient, which usually has a considerable influence with analog measurements, is unnecessary. No other isolating switching amplifier on the market can achieve this to date.

#### Process industry, skids and stand-alone units

The process industry, with the chemical, pharmaceutical and oil and gas sectors in particular, are the principal target sectors for interface devices. A new special feature of the IMX series will enable Turck to also provide solutions that were previously not possible in some applications: The devices of the IMX12 series can be used seamlessly in a voltage range from 10 to 30 VDC. This opens up the possibility of use in new applications that are supplied from batteries, PV collectors or small wind turbines. This possible use in smaller mobile and autonomous installations makes the IMX devices particularly interesting for manufacturers of small to medium-sized plants. Thanks to the international approvals available, manufacturers of centrifuges, decanters or biomass power stations can use the new interface devices in plants for worldwide export.

#### Growing portfolio

Besides devices for standard digital input/output signals and analog input/output signals, the range of the IMX12 product series includes temperature



Up to four 2-pole terminals – each on the Ex and non-Ex side – can now take 2-channel temperature measuring amplifiers in 4-wire PT100 connection technology

measuring amplifiers and speed transducers in different designs. Turck is presenting the first devices of the IMX series at the Achema fair: the IMX12-TI 2-channel temperature measuring amplifier, the IMX12-DI Ex isolating switching amplifier, the IMX12-DO valve control module, as well as the IMX12-AI EX HART analog signal isolator and the IMX12-AO HART output analog signal isolator. The IMX series will later be expanded into a complete interface device series which meets all the requirements of the target markets in the coming years. In other words, long-term investment security for customers is absolutely ensured.

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**Infos** | [www.turck.com/imx](http://www.turck.com/imx)

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# Trade Shows

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

Date	Trade Show	City, Country
27.01. – 29.01.2016	IFAM	Celje, Slovenia
09.02. – 11.02.2016	Automation Technology Expo West	Anaheim, USA
18.02. – 18.02.2016	INE – Indumation Network Event	Brabantal Leuven, Belgium
01.03. – 04.03.2016	Automaticon	Warschau, Poland
08.03. – 10.03.2016	LogiMat	Stuttgart, Germany
08.03. – 10.03.2016	SPS – Industrial Automation	Guangzhou, China
15.03. – 18.03.2016	Amper	Brno, Czech Republic
17.03. – 20.03.2016	WIN Eurasia Automation	Istanbul, Turkey
18.04. – 21.04.2016	Mioge	Moskow, Russia
19.04. – 22.04.2016	Siams	Moutier, Switzerland
21.04. – 22.04.2016	ISA Automation Expo & Conference	Edmonton, Canada
25.04. – 29.04.2016	Hannover Messe	Hanover, Germany
03.05. – 05.05.2016	RFID Live	Orlando, USA
10.05. – 12.05.2016	Smart Automation Austria	Vienna, Austria
10.05. – 13.05.2016	Elmia Automation	Jönköping, Sweden
11.05. – 13.05.2016	Industrial Automation	Beijing, China
17.05. – 20.05.2016	Expo Pack	Mexico City, Mexico
24.05. – 26.05.2016	SPS IPC Drives Italia	Parma, Italy
31.05. – 02.06.2016	Eliaden	Lillestrøm, Norway
12.07. – 14.07.2016	Semicon	San Francisco, USA
06.09. – 08.09.2016	Sindex	Bern, Switzerland
12.09. – 17.09.2016	IMTS	Chicago, USA
13.09. – 15.09.2016	Automatik	Brøndby, Denmark
03.10. – 07.10.2016	MSV	Brno, Czech Republic
04.10. – 07.10.2016	World of Technology & Science	Utrecht, Netherlands
25.10. – 28.10.2016	12 Seminario Internacional de Minería	Hermosillo, Mexico
01.11. – 05.11.2016	China International Industry Fair	Shanghai, China
06.11. – 09.11.2016	Pack Expo	Chicago, USA
07.11. – 10.11.2016	Adipec	Abu Dhabi, United Arab Emirates
16.11. – 18.11.2016	Fabtech	Las Vegas, USA
16.11. – 19.11.2016	Metalex	Bangkok, Thailand
22.11. – 24.11.2016	SPS IPC Drives	Nuremberg, Germany
23.11. – 26.11.2016	EMAF	Porto, Portugal
30.11. – 03.12.2016	Machine Tool Indonesia	Jakarta, Indonesia
08.12. – 10.12.2016	Elektro Vakbeurs	Hardenberg, Netherlands
08.12. – 10.12.2016	New Industries	Gorinchem, Netherlands

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