Industrie 4.0 Forum

VDMA

Industrie 4.0 in practice – Solutions for industrial applications

Industrie 4.0 – Made in Germany
Examples from the mechanical engineering industry

Hartmut Rauen

The German mechanical engineering industry has a key function in the context of Industrie 4.0. As the backbone of German industry, it is a guarantee for growth and prosperity in our society. Almost one million people are involved in producing the future, day after day.

Given this position – and the sector's innovation and market leadership in many areas – the German mechanical engineering industry has an obligation to shape new developments in industrial production. Industrie 4.0 is, without a doubt, one of these new developments.

With the fourth industrial revolution, information technology and Internet technologies are integrated little by little into products and factories. The virtual world of IT draws nearer to the real world of production. The most significant effects are greater flexibility and customisation in manufacturing, improved resource efficiency and cost savings as well as new business models.

Industrie 4.0 is thus not a parallel world, but rather an important trajectory on the way to the future of production. The examples in this brochure show that this development has already begun and implementation is well advanced.

33 VDMA member companies present solutions from the industrial practice that clearly illustrate the specific character of Industrie 4.0. For there is no single blueprint for Industrie 4.0. Rather, each company must consider the topic from its own unique position.

Yet, Industrie 4.0 is a topic for all companies – certainly for small and medium-sized companies, too. It is against this backdrop that the VDMA established the "VDMA Industrie 4.0 Forum".

The forum comprises an interdisciplinary team of VDMA experts, who view themselves as partners of companies and service providers. Together with VDMA members, the key action fields research, norms and standards, IT security, production and business models, legal frameworks and employee qualification are advanced and the sharing of information and experience is stepped up.

Use this network and join in – it really is worth it.

Hartmut Rauen,
Deputy Executive Director of VDMA

Industrie 4.0 at the VDMA

With the Industrie 4.0 Forum, the VDMA is actively involved in developing feasible action recommendations for the German mechanical engineering industry, paying special attention to the user perspective. The goal is to establish a long-term and sustainable network for member companies to share experiences.

The forum comprises an interdisciplinary team of VDMA experts, who view themselves as partners and service providers. They support member companies as well as the VDMA associations and departments in the key fields of action for Industrie 4.0:

Politics & networks

It is not only technological challenges that the German mechanical engineering industry faces on its way to becoming the leading market and provider of Industrie 4.0. Agreement must be found with politics and society about important conditions and frameworks. Strict requirements on research and development, training and qualification, norms and standards, legal and data security must be met in order to lead Germany, as an industrial location, into the future.

Production & business models

Lean management and intelligent production systems aim to achieve greater efficiency in organisation and processes. With the potential of cyber-physical systems, especially customised manufacturing is pushed forward in new dimensions: Automation and a batch size of 1 will no longer be mutually exclusive in the future. Increasingly, what engineering can offer is becoming more hybrid. Industrie 4.0 provides the capital goods industry with the possibility to develop new and innovative business fields – from engineering suppliers through to long-term partners and solution providers.

Research & innovation

When it comes to implementing Industrie 4.0, research results are a key to success in the international contest and in Germany's competitiveness as an industrial location. Reliable funding instruments in production and ICT research are important here. A consideration of the requirements of mechanical and plant engineering, a sector characterised by small and medium-sized companies, is essential too. The networking of all stakeholders and the quick and broad-scale transfer of research results among industrial companies are important success factors.

Norms & standards

Industrie 4.0 makes cross-company networking as well as the integration of different value-added networks possible. Norms and standards are crucial in this respect as they define the way the players cooperate and how the information is exchanged. That is why it is decisive to actively shape standardisation and open standards for reference architecture, and to engage relevant players in an active dialogue.

IT security & legal

In the context of Industrie 4.0, IT security is essential for the safe operation of cross-company production processes. It must be possible to design an automated data exchange of interconnected production systems in a secure and reliable way. Controlling the identification of process actors and protecting the know-how of products, machines and plants is crucial.

Already today, the implications and effects of legal issues in the environment of Industrie 4.0 can be recognised. That is why further developing and redesigning existing laws will be a central task during the implementation of Industrie 4.0 in companies' daily business.

Source: iStock Photo / alengo

IT technologies & software

Software and IT are changing industry at a speed unknown in any other sphere. The development cycles of new technologies are becoming extremely short. These innovations must be adapted and be "industrialised" for the production and automation world. How the material 'software' is dealt with is an important success factor. Modern architectures are the key for modular and flexible systems, which meet today's demands vis-à-vis quality, availability and usability. Such complex, mostly interdisciplinary projects can only be successfully carried out with the right methodological approach and specialist expertise of different experts.

People & work

Industrie 4.0 will lead to a lasting change in work and its processes. Employees in factories of the future will be expected more than ever before to coordinate processes, steer communication and make autonomous decisions. The activities will be more demanding from both a technological and organisational viewpoint, and there will be greater demand for interdisciplinary expertise. The German State, its educational institutions and the companies must meet these challenges.

Industrie 4.0 – a topic for all

Industrie 4.0 is not only a topic for large-scale industry, but must also be feasible for small and medium-sized companies as well. Implementation strategies are necessary that show for example how the harmonisation and integration with existing production technologies, IT systems and databases should occur. In addition, best practice examples can illustrate how production processes in the future should look, which automation solutions can be intelligently introduced or how the IT security of cross-company production can be ensured.

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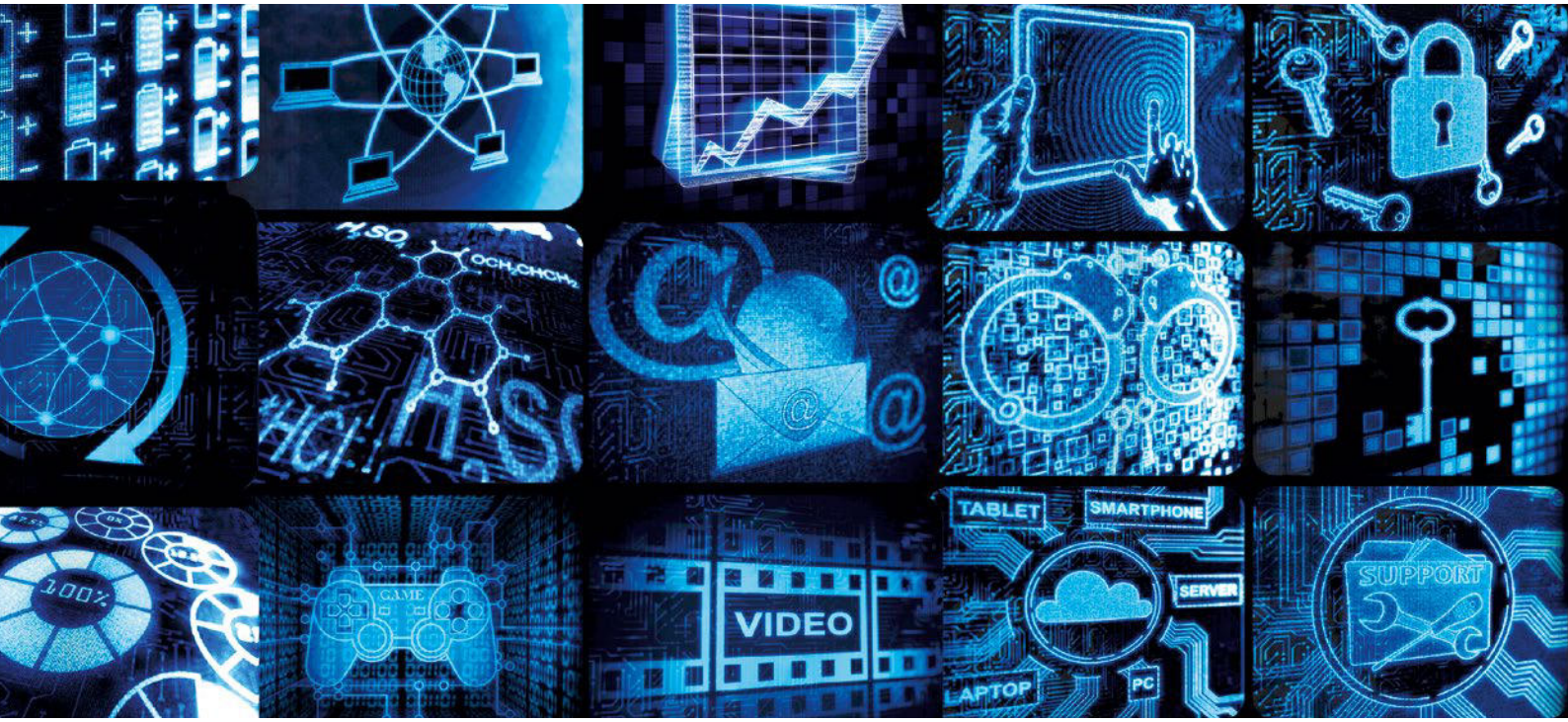
Industrie 4.0 in practice – solutions for industrial applications



German mechanical engineering companies are turning the vision of Industrie 4.0 into reality – with innovative ideas and technologies that help Germany to position itself as a lead supplier and a lead market of Industrie 4.0 in global competition.

With this brochure we want to use examples from VDMA member companies to show specific solutions for the industrial practice. The following topics are in focus:

Production processes

By using Industrie 4.0 technologies, companies can rise to the global challenges of increasing customer requirements and volatile market developments. When products and processes are interconnected, and data is available in real time and is transparent, the foundation for decentralised production control is laid. This allows greater flexibility in production and thus increases competitiveness.

Source: iStock Photo / alengo

Automation and condition monitoring

Through the interconnection of intelligent measurement technologies in production, data becomes available which together with automation solutions can be used for self-optimisation, self-configuration and self-diagnostics. In this way, the state of machines can be continuously captured and monitored from anywhere in the world. Thus, the conditions for predictive maintenance and services are created.

Industrie 4.0 is not a parallel world, but rather a step forward on our path into the future.

Planning

The increasing flexibility of production creates challenges for capacity planning, especially staff planning. New solutions and instruments are required – for example, stronger employee participation.

IT security

That everything is interconnected is both a blessing and a curse. To make use of the benefits for production, security aspects must be considered with the planning and operation of production facilities. Especially relevant is the security of data in a company and in our dealings with it.

Source: ARBURG

ARBURG: Individualised serial products – with Industrie 4.0

ARBURG unites two worlds: injection moulding and additive manufacturing. Incorporating Industrie 4.0 and host computer technology, the innovative machine manufacturing company has developed a fully networked process chain for the production of individualised, fully traceable rocker-type light switches.

Using the example of a rocker-type light switch, ARBURG demonstrates the path from large-volume products to individualised plastic parts. The technology and expertise in the field of additive manufacturing, injection moulding and process integration via a host computer system are provided by ARBURG. The cooperation partners in this project are Gira (product and mould construction), Trumpf (lettering applied by laser), Fuchs Engineering (quality checks) and FPT Robotik (automation).

Interaction: injection moulding combined with additive manufacturing

The process chain begins at the product design stage on a CAD workstation with a freeformer that produces prototypes in an additive manufacturing process. The order is entered in the system and the light switch rockers are produced on an ALLROUNDER injection moulding machine. The automated production cell incorporates a laser lettering process with a data matrix (DM) code and a quality control step. The freeformer turns the injection moulded part into a unique item by applying an individual identifier during an additive process in the next step. Finally, the finished product is packaged in a robotic cell and printed with a QR code.

The individual code enables the process and quality parameters of each moulded part to be retrieved online – in accordance with the individual part traceability required by Industrie 4.0. The ARBURG host computer system (ALS) is of central importance, recording all the parameters and transmitting them to a web server.

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Asseco Solutions: The factory of the future gains momentum

Enterprise Resource Planning (ERP) software enables companies to make optimum use of their resources and to initiate and perform processes in a controlled way. "ERP II" is the name for the second generation of ERP systems that are internet-based and not limited exclusively to internal processes. With "APplus", Asseco Solutions AG offers an ERP II solution for SMEs.

Source: GBneuhaus / N+P Informationssysteme

In cooperation with its long-time partner N+P Informationssysteme (N+P), Asseco Solutions supports SME customers in the implementation of ERP II solutions. One of these companies is Thuringia-based GBneuhaus, which, among other things, finishes torches for vehicle lights with special coatings. These special coatings are produced using a multi-level surface finish. The Manufacturing Execution System (MES) implemented by GBneuhaus has optimised this process.

Monitoring and optimisation

At the start of a processing process, the relevant parts are held in a marked container and checked into the manufacturing system. The information managed using Asseco's APplus solution such as work sequence and default values are combined here to form work steps.

Once all resources have been checked, the process starts: The container moves on automated roller conveyers with switches, robots and buffers to immersion baths, heat treatment furnaces and measuring stations. At each station, the container is identified. The process is checked and the required process parameters such as temperature, program or duration are transferred to the system. If deviations occur during the quality check, the parts will be directly ejected from the process.

All information is gathered in APplus MES. Not only does it serve for material flow control but also for the creation of certificates and optimisations. As a result, GBneuhaus could reduce the error rate and work being completed twice and grow at an above-average rate.

asseco SOLUTIONS

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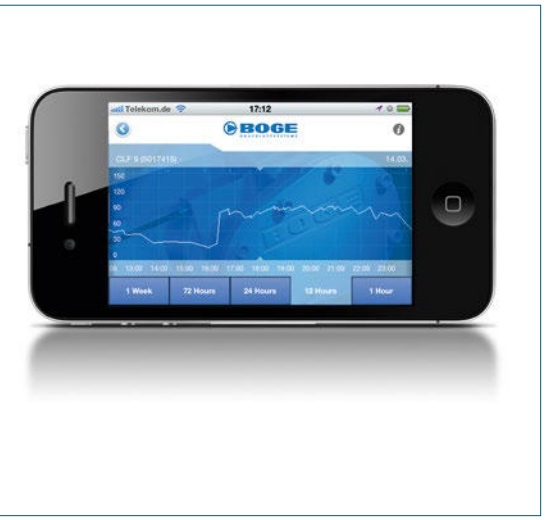

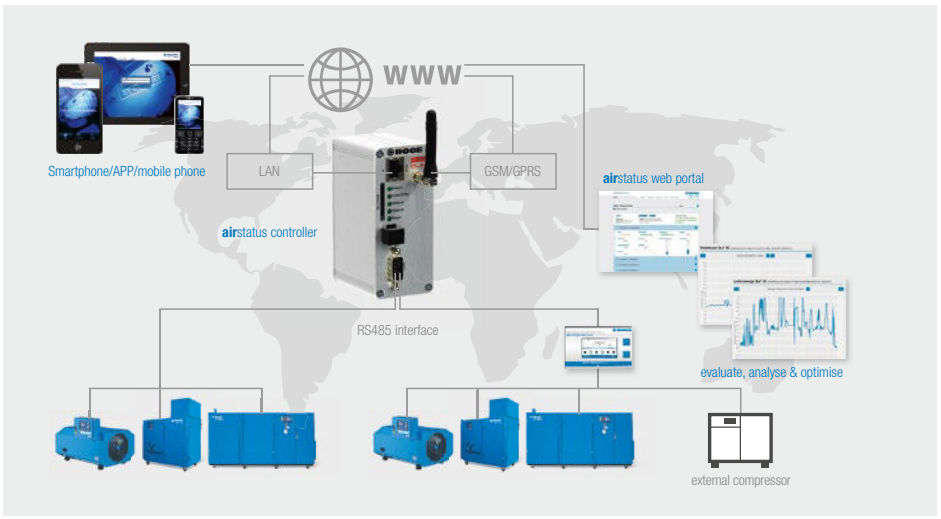

Source: BOGE Kompressoren

BOGE KOMPRESSOREN: Compressed air technology of the future

The BOGE airstatus is based on pioneering technology that redefines the communications between man and machine. This remote diagnostics tool is a new solution which increases safety and transparency in compressed air production and all associated components. This tool maintains the high-level performance and efficiency of a compressed air station and is ideally suited for monitoring and managing complex systems and plants.

With airstatus, users have the status of up to 32 components firmly under control – from anywhere in the world. Process data such as status, maintenance messages, temperatures and pressures is directly transmitted and displayed, making airstatus a powerful remote diagnostics tool. Users can identify, analyse and react immediately to fault messages on their own computer or smartphone, considerably reducing the time needed to rectify faults. Or they can use the BOGE airstatus for condition monitoring in order to manage proactive measures and to plan and coordinate maintenance work. All of this can be easily managed using the BOGE airstatus app, which works with all mobile iOS and Android devices.

Easy installation, lasting safety

A ModbusScan to detect each of the compressors and components makes it easy to commission the BOGE airstatus monitoring facility. The system data communication is processed in real time via GSM/GPRS or a LAN connection. Users can view data in the BOGE airstatus web portal or in the BOGE airstatus app. Alarm management by e-mail or SMS – if defined limits are exceeded or undercut – provides an additional safety feature.

BOGE DRUCKLUFTSYSTEME

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Bosch Rexroth: Industrie 4.0 assembly line in use

A new assembly line for producing electro-hydraulic valves for tractors semi-automatically allows the Bosch Rexroth plant in Homburg to produce individualised products flexibly and efficiently. With the practical application of Industrie 4.0 concepts in-house, Bosch Rexroth gains experience for their further development.

Source: Bosch Rexroth

The production of six different basic valve types with more than 200 variants shows how the rapid connection of humans, machines and products works. The line, tool holder and operator communicate on their own by means of RFID and Bluetooth technology. The intelligent tool holders, which are equipped with RFID tags, each detect the desired product variant and receive information about the production steps. Each station reads these RFID tags and displays the relevant information on a screen for the respective employee. This reduces the processing time while simultaneously optimising resource efficiency.

Software detects weak points

Different employees can also manufacture different products up to batch size 1 and always achieve consistent quality. The production information system “Active Cockpit” developed by Rexroth identifies potential weak points: It continuously collects, filters, and displays the production data and provides employees and decision-makers in production with all relevant data to quickly initiate any necessary solutions. This reduces downtimes and increases productivity. Each employee carries a Bluetooth tag with his user profile, so that settings such as lighting, font size or language can be adjusted on the monitor at each assembly station. The information depth on a screen automatically adjusts itself to the qualification of the respective user.

Rexroth
Bosch Group
The Drive & Control Company

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CIIT: Solutions for the factory of the future

Source: CIIT

In the science-to-business centre CENTRUM INDUSTRIAL IT (CIIT), partners cooperatively work on solutions for the factory of the future. The integrated SmartFactoryOWL assembly system of the Fraunhofer Society and OWL University of Applied Sciences fulfils the goals of Industrie 4.0 and puts them into practice. Approaches for adaptability, usability and energy efficiency are demonstrated.

The Fraunhofer Application Centre Industrial Automation (IOSB-INA) and the Institute Industrial IT (inIT) of the OWL University of Applied Sciences jointly want to anchor Industrie 4.0 standards in assembly systems. In the future manufacturing companies can configure a needs-oriented assembly system by using just a few basic modules.

Plug-and-produce techniques facilitate custom configuration within a very short period of time. The SmartFactoryOWL offers a high degree of adaptability, compatibility and modularity, taking into account increasingly complex production procedures, shorter product life cycles and smaller lot sizes.

By using assistance systems production workers are guided intuitively through operational processes, thus allowing a trouble-free change of production staff as well as a minimisation of downtimes.

High flexibility resulting from modularity

Because of the high modularity of the single stations, the assembly system can – depending on the current order situation – be expanded or reduced individually. In the case of extension, productivity increases significantly. When the volume of incoming orders is small, the assembly system can easily be adapted again by taking out single modules. In this way energy consumption can also be optimised.

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Source: ebm-pabst

At ebm-papst, a global technology supplier for ventilation and drive engineering, the focus for Industrie 4.0 is on the digitalisation and networking of production processes and on the production of components that are ready for Industrie 4.0. When people, machines and software work efficiently and productively together, energy efficiency increases too.

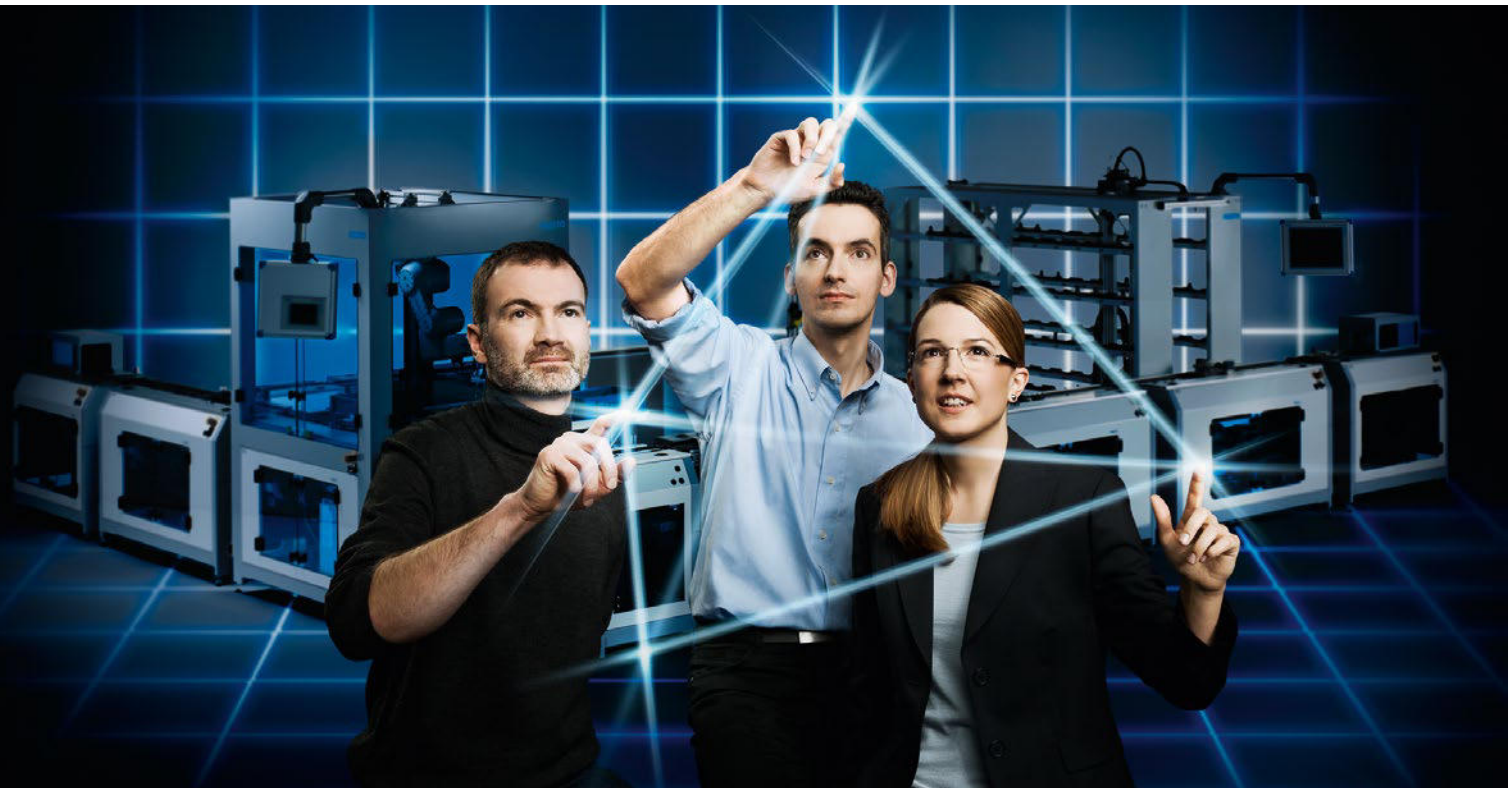
ebm-papst: Benefits of digitalised production

ebm-papst was quick to see the possibilities offered by the advance of digitalisation and in 2009 it became one of the first companies in Europe to begin using SAP ME (Manufacturing Execution). This application makes it possible to centrally manage the wide variety of data from the various production processes in a single high-level system. Since adopting the software, ebm-papst has worked closely with SAP as a member of the Customer Council to further improve the application.

Optimisation and transparency

With the digitalisation of production, processes are being optimised, controlled and designed in a more transparent fashion. This includes easily operated user interfaces, nearly paperless production, support for lean processes, following and verifying the process sequence, ensuring the use of correct and defect-free materials, traceability and recording process data.

Between the production machines and the high-level SAP ME, data are retrieved and production steps are initiated using a unique identification for the product to be produced in an independent and continuous request-response process. Production is then managed and monitored from start through execution and all the way to completion in a central system so that any errors in production can be identified and rectified immediately. All steps in production can be tracked since the data are collected and stored centrally.



Source: Festo

Festo and Siemens: The Multi-Carrier-System

Close cooperation between Festo and Siemens has resulted in a flagship product – the Multi-Carrier-System, an innovative transport system for more flexibility in production processes. The advantages range from free configuration and flexible transport through to sturdy carriers and the integration of a complex servo controller and an Industrie-4.0-compatible motion controller.

The system includes important options relevant to Industrie 4.0:

- Ultra flexible electromechanical design for economical production with batch size 1
- Decentralised sensors and intelligence in the workpiece carriers and drives
- Modular servo controllers and motion controllers
- Full simulation of future layout and installation to allow configuration and optimisation of the system
- Generation of program data from simulation
- Ready-prepared with OPC-UA interface for open integration into Industrie 4.0 host environments

FESTO

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What is behind the Multi-Carrier-System in detail?

Innovative transport system for more flexibility in production processes

- Freely configurable linear system
- Easy integration into existing intralogistics
- Supplement to classic transport solutions to provide maximum flexibility
- Product transport and positioning on carriers with aid of linear motors
- Integrated controller for transport motion and motion control functionality

Advantages: free configuration and flexible transport

- High flexibility: seamless infeed and outfeed of carriers
- Easy integration: existing transport and logistics solutions can be used
- Flexible operation: acceleration and speed can be set freely and individually, several carriers can be grouped and moved synchronously
- One controller for everything: for the Multi-Carrier-System and other machine modules
- Highly dynamic operation and high speed combined with high carrier working load

Sturdy carriers

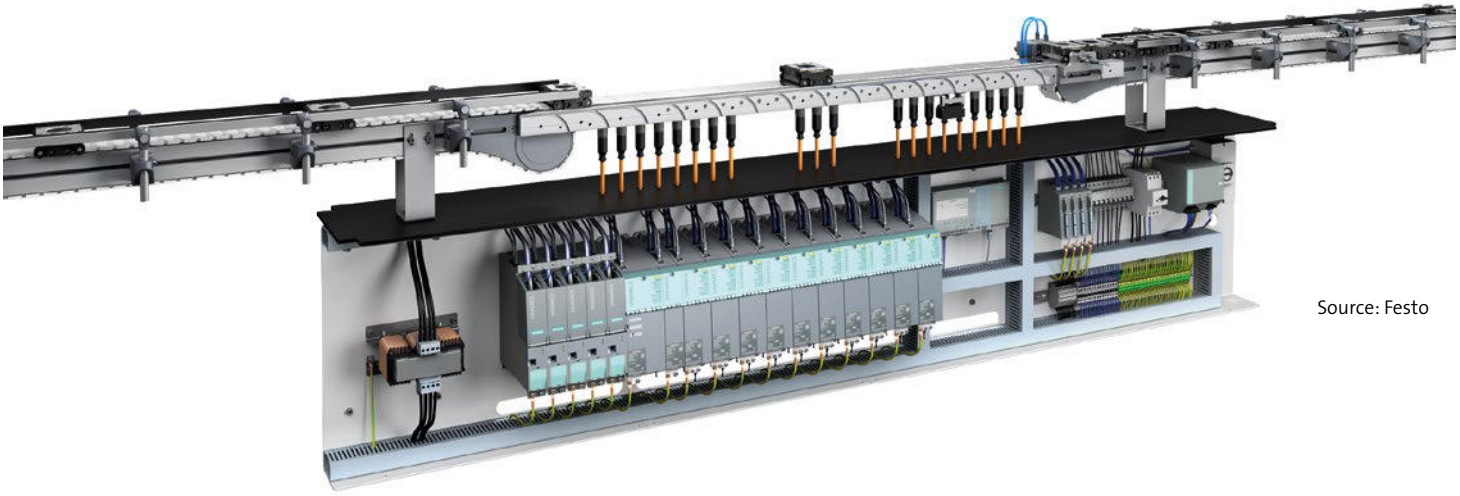
- Product is transported directly on passive carriers
- Low-vibration and jerk-free motion
- Free motion of each individual carrier in the system, including travel with constant force
- Grouping and synchronous motion of several carriers

SINAMICS drive system

- Modular drive system for machine and plant construction
- Suitable for single- and multiple-axis applications
- Enables modular and flexible machine concepts

SIMOTION motion control system

- Scalable and modular motion control system for highly dynamic applications
- Only a few mouse clicks required to create a loadable, ready-to-run project with the project generator SIMOTION easyProject
- SIMOTION SCOUT for uniform, consistent engineering across the entire system
- Application-oriented hardware platforms: PC-based or drive-based



Source: Festo

SIEMENS

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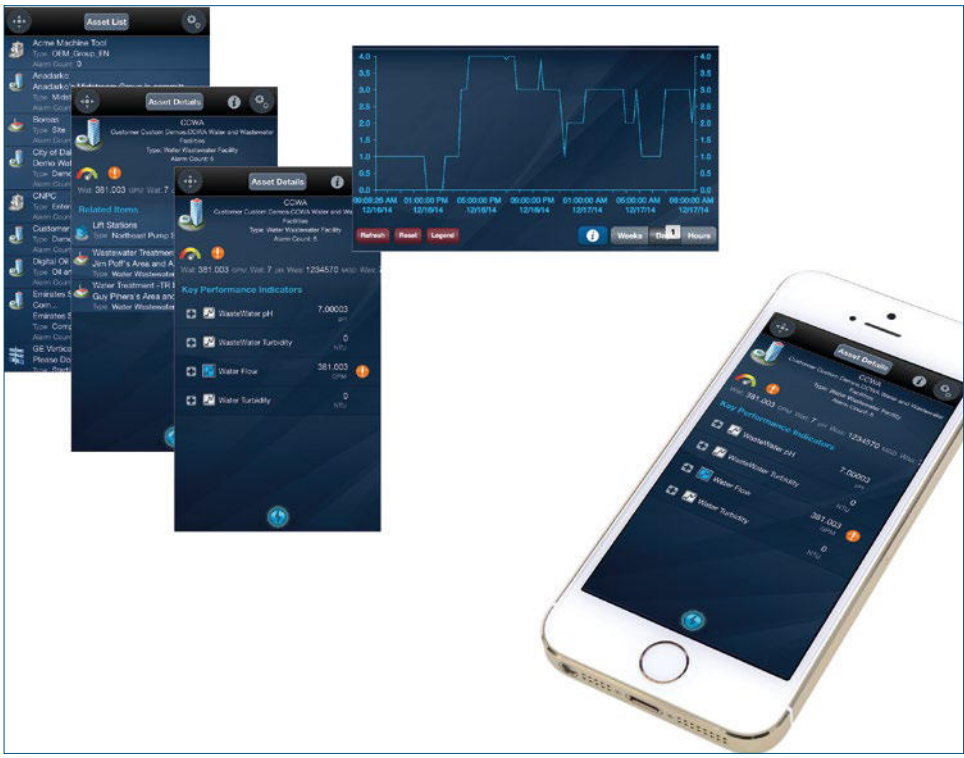
Real-time operational intelligence solutions address the key market trends mobility, security, and analytics. These intelligent solutions form an integrated and powerful combination which will fundamentally change how infrastructure and manufacturing users manage their installations. Operational intelligence will enable them to realise huge gains in productivity.



Source: GE Intelligent Platforms

GE: Real-time operational intelligence – a paradigm shift for the industry

The industrial landscape is changing. Operators today have many roles and wear multiple hats. As a result, there is a need for greater efficiency and mobility for operating and controlling assets across a plant or geographic areas. What operators need is real-time monitoring and control. New generation tablets and smartphones installed with intelligent applications bring the right knowledge to operator action.

Real-time operational intelligence represents a paradigm shift in the way infrastructure and manufacturing operations work, from the plant floor through the operational centre to executive dashboards. The efficiency of the operator or supervisor or both will increase thanks to new technologies in visualisation, mobility, analytics, and collaboration. These help to bring knowledge to action anytime, anywhere.

Intelligent alarm notification

Alarm management is one of the top challenges for industrial users. More than 75 per cent of all alarms are perceived to be noise. An ageing workforce and loss of domain expertise compound this problem. Intelligent alarm notification reduces the information overload experienced by users, thus increasing his or her productivity and efficiency through informed actions. It provides an intelligent and accurate representation of the state of operations and allows for informed actions to be taken at the right time, rather than when it is too late.

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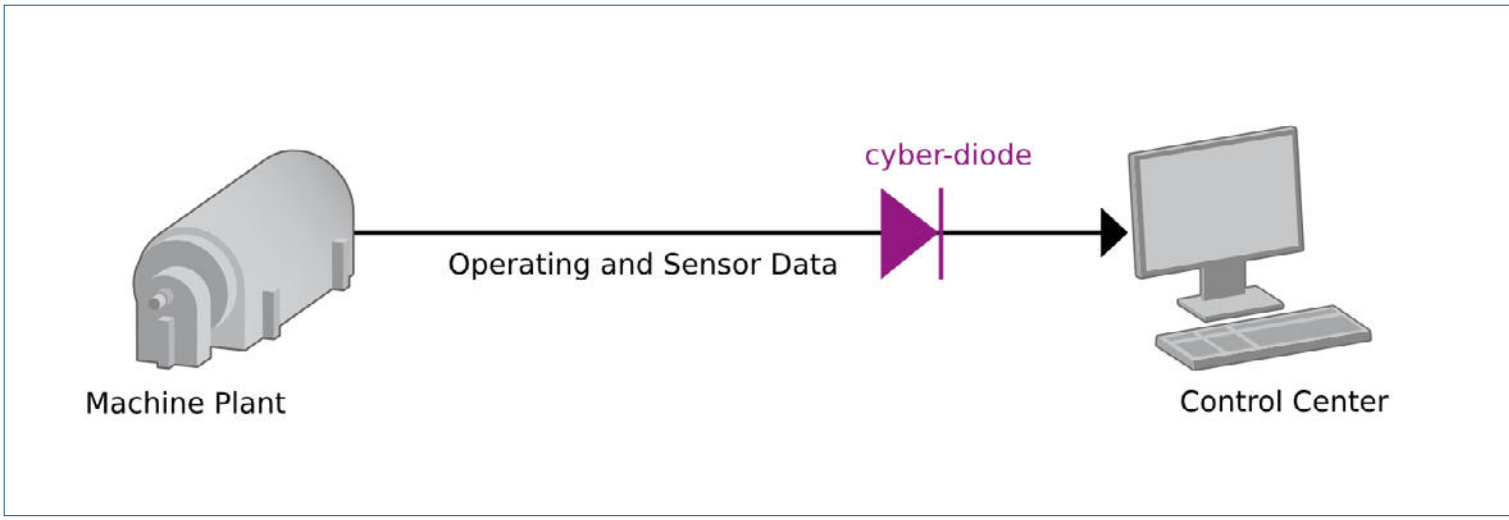

Source: genua

genua: Top quality IT security in Industrie 4.0

Machines communicate with other machines, products provide information via bar codes or RFID chips. The other systems along the production line from stores to logistics and service are networked with each other and can independently organise optimised processes: This great leap forwards for industrial production is – from an IT security point of view – a challenge.

When all components in the smart factory can communicate with each other, how is sensitive data to be protected from unauthorised access and how can control systems be protected from malicious software and manipulation? There is a particularly high need for the protection of systems which control critical infrastructure or plants such as power station turbines, chemical production facilities or industrial robots, where incorrect functioning could lead to extensive damage or loss of life.

Only one-way data transfer allowed

The risks of networking highly critical control systems can be minimised through the use of the "cyber-diode" from the German IT security specialist genua. This solution monitors network connections and only allows one-way data transfer – information flow in the opposite direction is completely blocked. Systems protected in this manner are free to send control information via the Internet without becoming vulnerable to attack and risk their integrity being compromised. The "cyber-diode" allows data transfer rates of up to 1 Gbit/s for TCP and UDP protocols and supports FTP file transfer and SMTP for e-mail traffic.

A key feature of the "cyber-diode" is its low complexity. The diode function is provided by a few hundred lines of program code and runs on a microkernel operating system that has been reduced to an absolute minimum. The central process is simple to analyse, the code can be examined line by line to ensure that it is error free. The "cyber-diode's" low complexity means high IT security.

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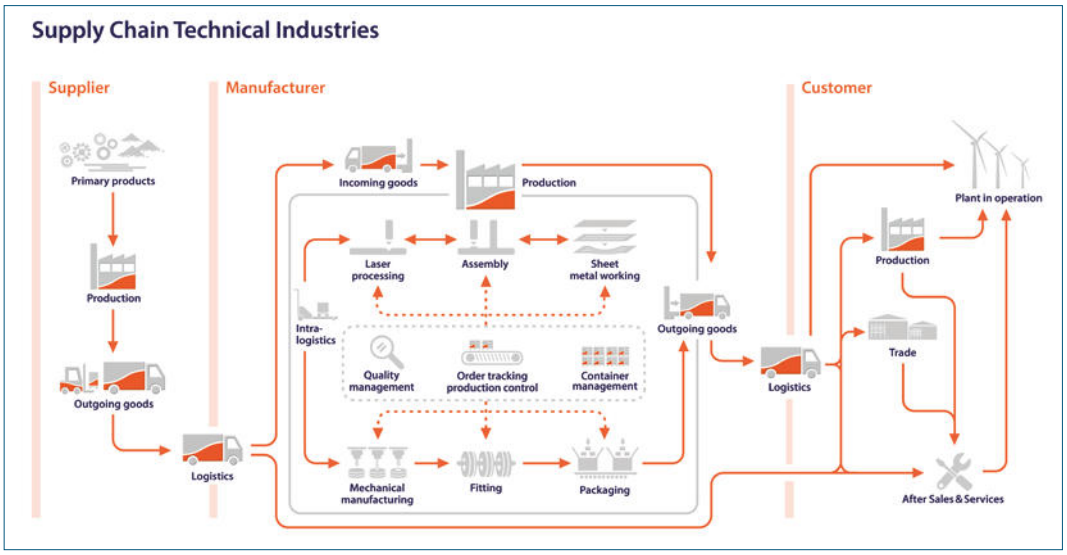

Source: GS1 Germany

GS1 Germany: Standards as the basis for Industrie 4.0

Everyone is talking about the interconnectedness of manufacturing, logistics and many other processes. Industrie 4.0, the "Internet of things" and similar terms are being used. But what does this really mean and what requirements have to be met for implementation to be possible? GS1 Germany, as a standardisation service provider in the global network "Global Standards One" comprising over 110 country organisations, focuses on how Industrie 4.0 can be implemented.

The term "Industrie 4.0" is being used everywhere. In the German government's research framework plans or in the strategic position papers of large companies and meanwhile in smaller companies, too. Yet the idea of interconnecting machines is not new. Rather, it is the integration of different solutions also beyond company borders that is increasingly being put in the spotlight. This, however, also raises new issues.

How can objects be clearly identified across company borders? How can the increasing volume of documented process events be organised? How can this information be exchanged within companies and across companies?

Defined interface formats for efficient data exchange

GS1 Germany is concerned with questions like these, which by no means entirely cover every aspect of Industrie 4.0. It develops solutions in close cooperation with more than 50,000 users.

Companies from various sectors such as the engineering, the automotive sector and defence technology already use GS1 standards to optimise their processes. It is with clear global standards that a number of relevant business objects such as products, machines or load carriers can be clearly identified in a way that is useful along the entire supply chain. Defined interface formats for storing and exchanging process events make it possible to use relevant information within companies and across companies and thus achieve integrated process optimisation.

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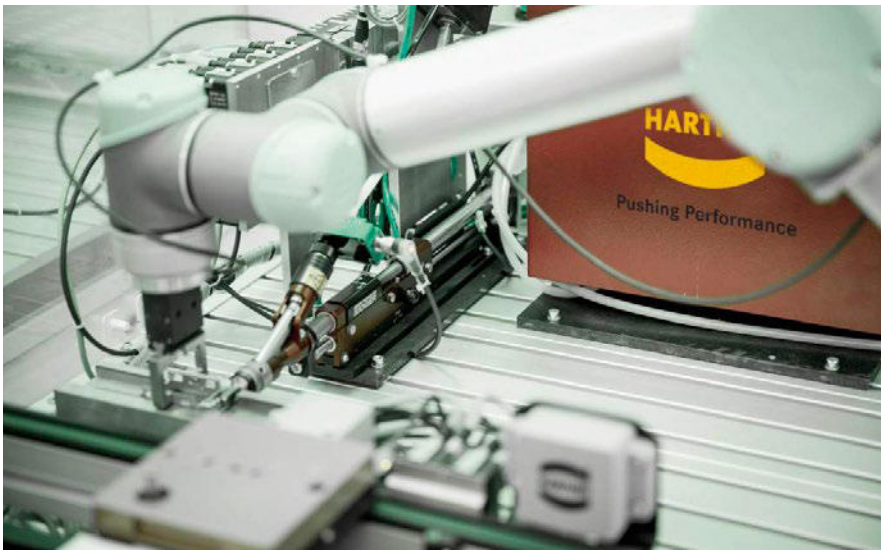

Source: Harting

The HARTING Technolgy Group has developed a production line to present solutions for the Integrated Industry.

HARTING: Solutions for the Integrated Industry

The HARTING production line, as an Integrated Industry demonstrator, presents the topic holistically and combines elements such as the flexible assembly system “FlexiMon”, a research project conducted within the framework of the “it‘s OWL” leading-edge cluster, with system integration solutions on the basis of SAP. “With this production line we have also included the aspects of the smart factory, the Internet of things and services, and the industrial Internet,” says Claus Hilger, Managing Director HARTING IT Services.

The Espelkamp family company is positioning itself as a trailblazer for technological change. “Integrated Industry will change almost all industrial companies in coming years. We offer customers tailor-made solutions and accompany them along the way,” says Dr. Volker Franke, Managing Director, HARTING Applied Technologies.

Modularisation concept implemented

Consequently, a Plug & Produce modularisation concept based on the Han-Modular standard was implemented in the demonstrator, for example. The production unit with three production cells is linked into the fabrication environment via a smart infrastructure solution.

HARTING
Pushing Performance

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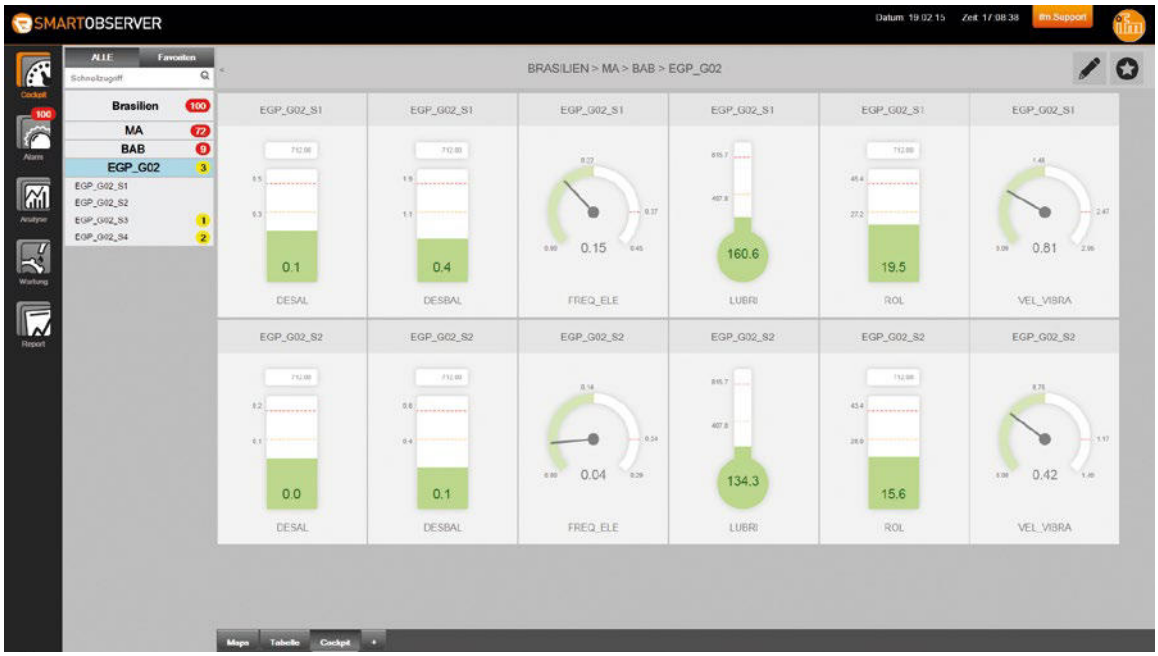

Source: ifm electronic

ifm electronic: Sensors monitor the water supply

Two software systems from the sensor manufacturer ifm electronic monitor the status of the water supply in a large Brazilian city. The process data they prepare, analyse and evaluate is directly transferred to the SAP system of the water company via a cooperative software called "LR Agent CP".

If the supply is interrupted, entire parts of the town are cut off from the water supply. Therefore, the goal was to continually monitor and visualise the status of the supply system. If limits are exceeded or not reached, an early alarm should be triggered in order to plan maintenance works and prevent downtimes. All generated data should be available to the operator's SAP system.

Fewer incidents

Smart sensors and evaluation systems (vibration sensors, evaluation units, vibration and inductive sensors) were installed on all motors and pumps and the "Smart Observer" software was installed at all points of measurement. A display at every station and in the control centre provides an overview of the relevant points of measurement. In addition to the display of defined limit values, the current status can be quickly identified by means of traffic light indicators. When the limits are exceeded, predefined alarm escalation chains are activated via mail or text messages. In addition, the values of different units can be compared over longer periods of time. The LINERECORDER agent transfers all measured values to a database and provides SAP with all data for further analysis.

Since the introduction of the system there have been considerably fewer incidents and down-times. Furthermore, maintenance works and the ordering of required spare parts via the SAP system can now be planned.

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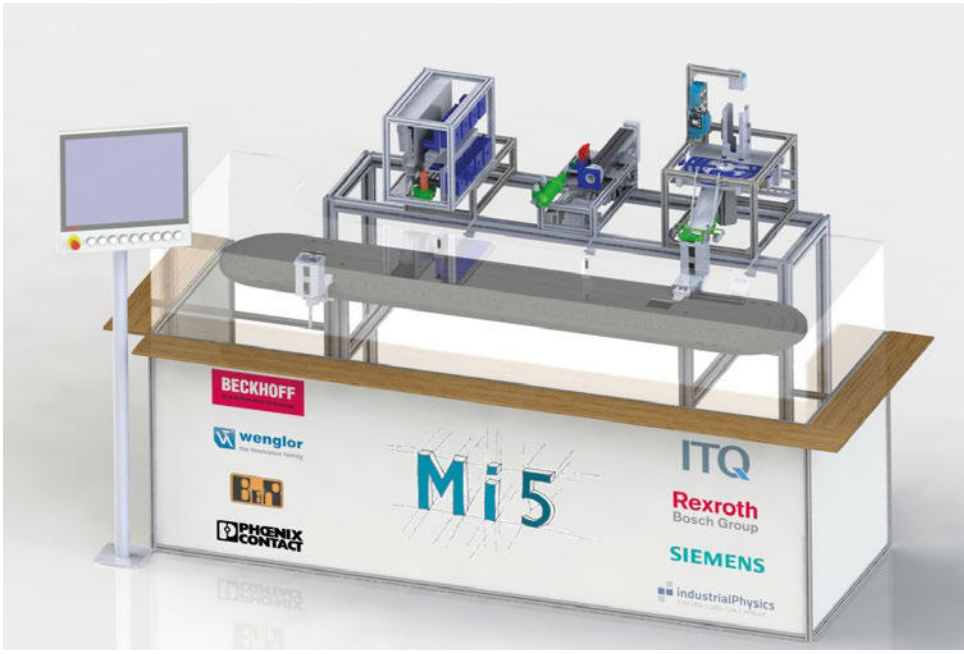
In the project "Showcase Mi5" by ITQ GmbH, a student team developed a modular and intelligent production line for cookie burgers and cocktails. The goals of the project comprise the implementation of key technologies of Industrie 4.0 in a functional demonstrator machine and the exemplary application of agile-mechatronic development methods during the entire development process.



Source: ITQ

ITQ: Student project for mechatronic engineering

The Mi5 fair demonstrator is designed to feature a modular production system that is able to manufacture any goods within a single plant. The sequential manufacturing steps are performed by exchangeable production modules, arranged around a central transport system. This setup facilitates a batch size of 1 with a similar effort of resources. In order to initiate a production job, the fair visitor is able to create an individual product via a HMI touch panel.

Autonomous modules

The central idea of a modularised production plant is realised by a scalable system architecture. A standardised, OPC UA-based software interface guarantees a decentralised production control, which requires a high level of autonomy of the production modules – therefore each one is designed as an independent cyber-physical system (CPS). This enables an automated (re-) configuration of the entire plant. Single modules can be (de-)coupled during runtime mode, which allows a continuous adaption of the production process according to continuously changing needs.

Simulation

In order to perform a concurrent, mechatronic development, a Hardware-in-the-Loop (HIL) simulation concept was devised. This supports early software development and features virtual commissioning of new production steps. Furthermore, the concept promoted interoperability checks of diverse hardware components (i.e. Beckhoff, Bosch Rexroth, B&R, Siemens, wenglor).

The student team "Showcase Mi5" is now going to be extended to several European countries and enhanced with Industrie 4.0 features such as industrial cloud integration or virtual remote maintenance via VR devices.

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Kaeser Kompressoren: Intelligent use of compressed air

Scholz, a high-tech company in the plastics industry, is currently revolutionising its compressed air supply with the "Sigma Air Manager 2" master controller from Kaeser Kompressoren – to ensure continued company success into the future – and is already enjoying significantly reduced energy costs as a result.

Source: Kaeser

Horst Scholz GmbH & Co. KG, based in Kronach, Upper Franconia, is a manufacturer of precision plastic parts. These include products used in medical technology and precision engineering parts, destined primarily for the automotive industry, medical technology industry and lifestyle products. The medical sector in particular insists on stringent requirements to ensure high product quality – and it is no different when it comes to the quality standards for the compressed air the company relies on for control and process air.

When it came to the recent modernisation of the existing compressed air station, the company's management decided to opt for a compressed air contracting arrangement to ensure that the compressed air supply will always meet the latest technical standards and be capable of taking advantage of the benefits that Industrie 4.0 has to offer. The station is equipped with new, innovative features, such as the "Sigma Air Manager 2" master controller and the innovative "Sigma Network".

Energy cost savings

This controller not only guarantees a reliable and efficient compressed air supply that is harmonised with the actual needs of the company, it also delivers significant energy cost savings. Furthermore, it enables connection of the compressed air station to the management system, which in turn makes possible energy management as per ISO 50001 and predictive maintenance. As Scholz also took advantage of available heat recovery options, in the first winter alone, the company reduced its previous oil consumption by some 50 per cent.

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Flexible, transparent and reconfigurable production layouts necessitate smart components that offer a host of functions, services and information in a networked environment while fulfilling application-specific technical requirements. At KSB, target-oriented examples that have already been implemented underscore the way in which the digital pump will be integrated in future production settings.

Source: KSB

KSB: Digital pumps – functions and services on the shop floor

In this context, central assets such as pump systems and valves must transform from hardware components to become networked providers of functions and services in the digital production environment. To better facilitate service logistics as well as streamline other activities, KSB's PumpMeter already today displays the current operating status and the status history directly at the pump or makes them available on the network. Furthermore, it accurately identifies the pump by accessing the order data saved to the device. KSB's PumpDrive adapts the mode of the pump or multiple pump system to changing operating conditions autonomously and decentrally while ensuring a resource-efficient and flexible production process. This functionality is transparent and network capable.

From data to networked information

The sensors integrated in the pump record key operating data that is then evaluated directly at the pump by PumpMeter. This information is used to automatically adapt operation to changing operating conditions and to optimise operation through PumpDrive. On-site displays or mobile terminals can be used to determine the operating point of the pump, identify optimisation potential and adapt and reconfigure operating modes. This information can also be accessed in vertical and horizontal integration setups via a large number of field buses used in conjunction with a cloud-based connection, for example. Electronic documents can also be called up directly at the pump to assist with site surveys and service work.

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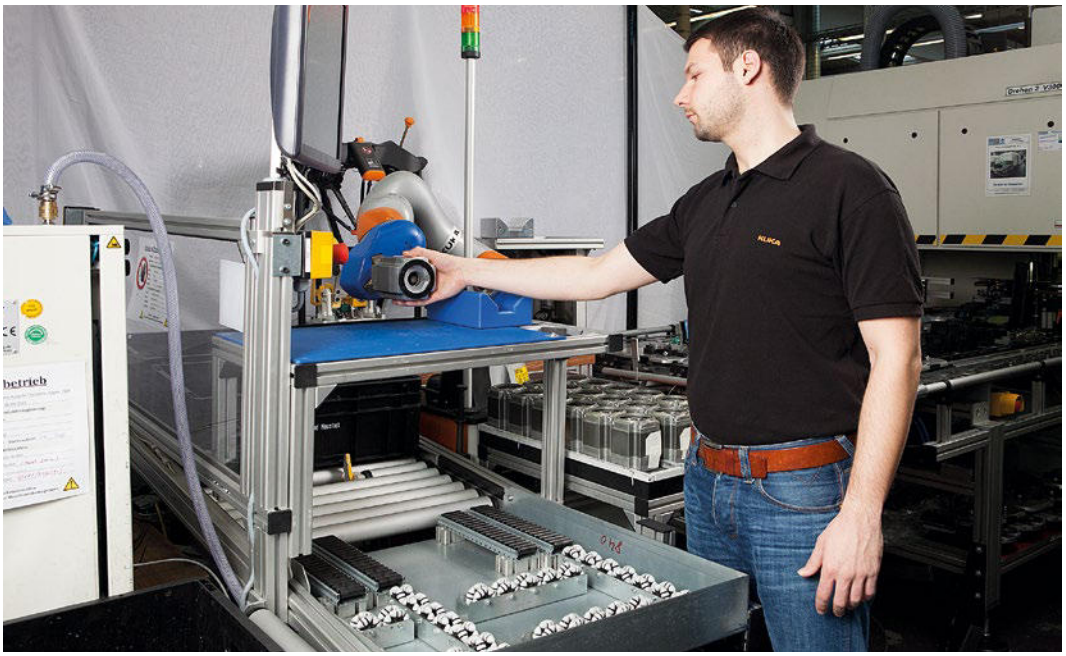


Source: KUKA

KUKA: Flexible assistant for production of the future

Using a flexible automation solution from KUKA, the Siemens lead factory for electric motors in Bad Neustadt, Germany, applies human/robot collaboration. The sensitive lightweight robot serves as a flexible multi-tasker for a production to be as adaptive as possible.

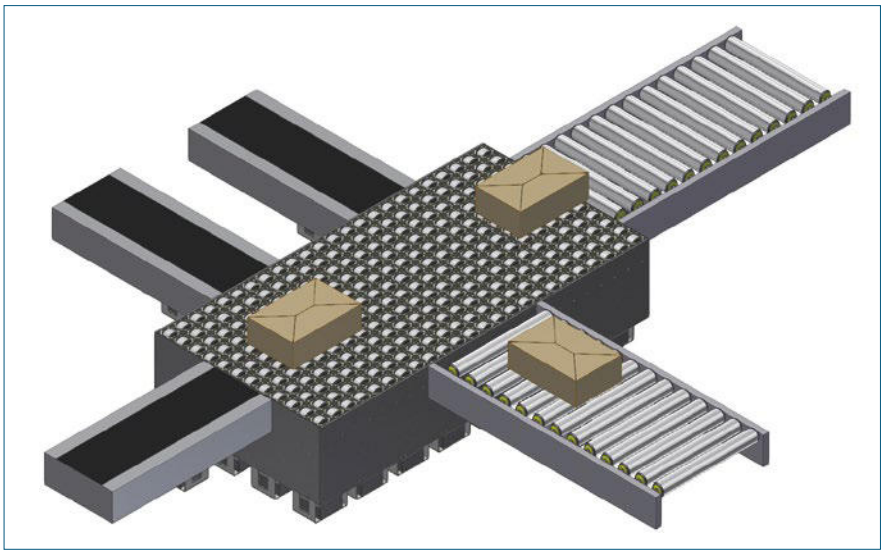
At the site in the town of Bad Neustadt an der Saale, Siemens operates a lead factory for electric motors. For its stator manufacturing operation, the company was on the lookout for a flexible solution to automate the simple activity of passing on and positioning workpieces which had previously been done by hand.

Together with the Augsburg-based company, KUKA Systems GmbH, and its Advanced Technology Solutions department, a flexible cell was developed for this application using KUKA's "LBR iiwa" lightweight robot. Its sensitive capabilities make this robot ideal for human/machine collaboration.

The robot functions as a roving multitasker (Knight) mounted on a carriage with the task of taking the part to be processed – the stator consisting of a basic body made from punched magnetic steel sheet and an aluminium bearing plate – out of a workpiece carrier and supplying it to a lathe for machining the stators.

A system organises itself

The robot is also used for the quality check. Thanks to networked technology, the precise measurement and identification of each component make it possible to calculate immediately whether a correction is required, and this can be implemented in the system. The system consequently organises itself. After that, the robot places the part in a plastic box so it can be delivered.



Source: transnorm

Lenze: Conveyor matrix for networked, cognitive production

To ensure that future production can be competitive, material flow systems will have to be adaptable and completely networked. For this purpose, the netkoPs project is developing a material flow system with a decentralised control. Based on a human being's cognitive abilities, this will enable machines, handling systems and transport systems to communicate, act intelligently and adapt to changes in the prevailing production conditions.

When the means of conveyance and production are completely networked, it is possible to transport material and information simultaneously. Using the information, a decentralised product routing system can "see" the production conditions and plan the optimal route that a product should take. A dynamic route diversion function prevents the overall production system from coming to a standstill in the event of faults occurring in individual parts of the system. Also, changes in the material flow or an extension of production are possible without needing to make elaborate changes to a central control system.

Modular and multi-dimensional drive solutions

The project's central innovation is a decision-making conveyor matrix that uses the newly acquired cognitive abilities of the decentralised control. The matrix consists of numerous small-scale conveyor modules that can interact and, independently of each other, perform the movements necessary for swivelling and conveying. This interplay enables the decision-making to be done locally, and it allows the routing to be adapted to the prevailing situation by the intralogistic functions. There are also new degrees of freedom on the conveyor matrix: In addition to infeeding, transporting and outfeeding, it is also possible to rotate, align, individualise and sequence the material being conveyed.

The basis for the flexible conveyor matrix is provided by intelligent drive solutions from Lenze, which also meet the relevant energy efficiency and power density requirements. The matrix also incorporates the company's knowledge of control modes without rotary transducers and direct drives without gearboxes, as well as its expertise in the field of servo technology.

Cloud computing promises unlimited computing power and storage capacities, cost savings, reliability, and worldwide accessibility. Solutions based on this technology are characterised by high availability, the ability to scale IT up and down as required and usage-based billing. Cloud computing security is also one of the key challenges of Industrie 4.0.

Source: M&M Software

M&M Software: Cloud platform for condition monitoring

Many machine manufacturers would like to permanently monitor the performance and condition data of their machinery throughout the world and collect this data in a central place. This would allow them to provide a higher service level to their customers and gain valuable insights for improving their products. Plant operators, however, need to feel confident that sensitive information about their production processes will not fall into the wrong hands. Only then will they allow machine manufacturers to cyclically transmit data from the production network to their "home".

The provision of a secure and high availability IT infrastructure, which comprises computer resources, software applications, IT personnel and processes ensuring reliable continuous operation, is another major issue.

Cloud solution to overcome obstacles

M&M Software's cloud-based service platform enables machine manufacturers to master this challenge. Data is collected, stored, analysed and visualised in a secure cloud application. The service platform is made up of a universal core system and individual customer portals based on it. The complete package offered to machine manufacturers includes the development of a portal solution, its integration with the machine control system, reliable operation and usage-based monthly billing. Plant operators benefit from a consistent security concept that allows them to control the type and amount of data being transmitted.

SOFTWARE BY PEOPLE WITH PASSION M&M

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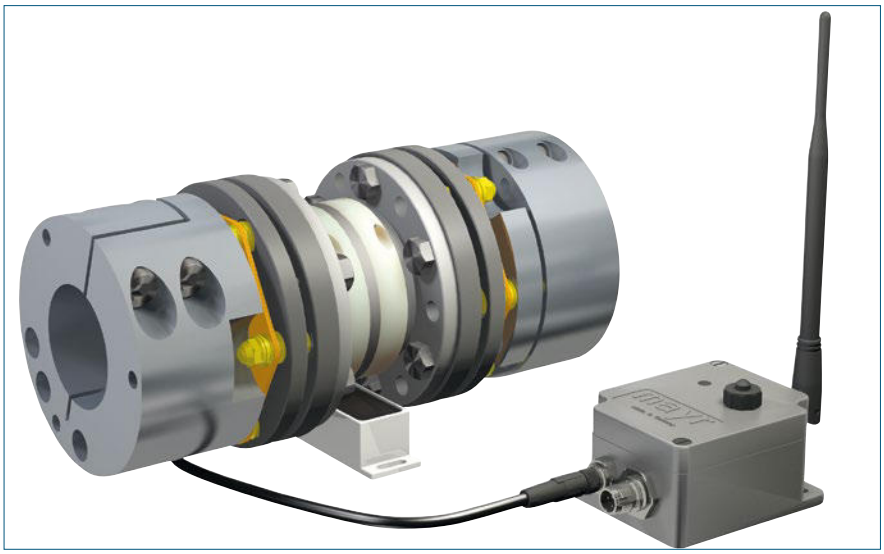


Source: Mayr Antriebstechnik

Mayr power transmission: The measuring machine element

The torque measuring shaft coupling ROBA®-DSM permits easy status monitoring of machines and systems. Machines can be optimally utilised using the data from the coupling, which is based on the backlash-free ROBA®-DS shaft coupling. The range of applications for this torque measurement coupling extends from the classic test bench to use in serial machines, right up to condition monitoring.

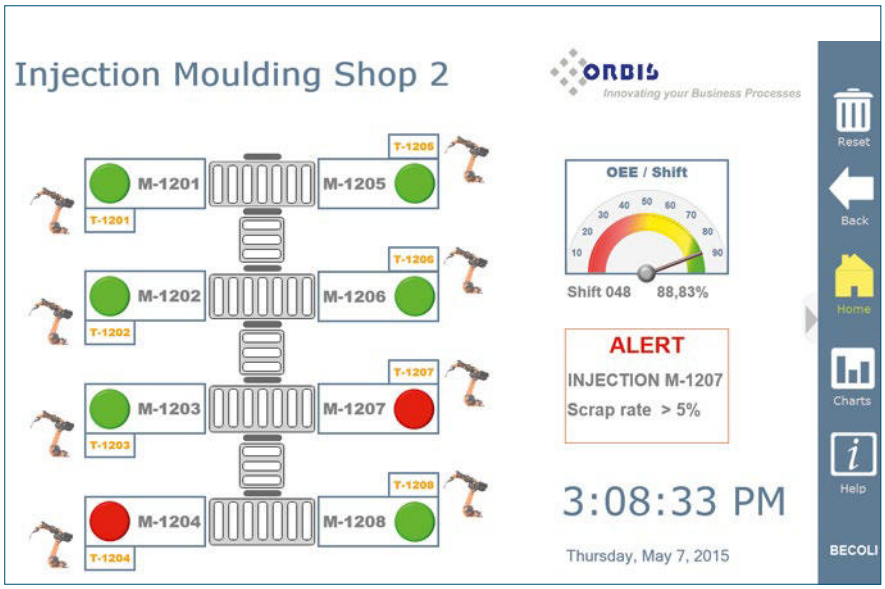
Measurements on rotating parts simultaneously require the transmission of energy to the rotor and of data from the rotating part to the receiver. The torque measurement ROBA®-DSM shaft coupling uses two completely different ways to do this. Due to the high bandwidth of up to 3.5 kHz, it is also able to reliably record fast, dynamic processes.

The digital preparation of the data directly on the rotor permits optimum reinforcement and an offset compensation even after installation.

A further advantage of this coupling is the use of a radio system in the globally available 2.4 Gigahertz ISM band, which utilises up to 80 channels. This makes it possible for several couplings to be operated within the same environment, without them influencing each other. In addition, the data transmission is encoded with an address so that only the respective receiver can accept the signal and assess it.

A fast overview of measuring data

Like industrial standard systems, the coupling supplies an output signal of +/-10 Volts for the torque right/left, which can be used as the input signal for a programmable logic controller (PLC). In addition, the system features a USB interface. Using this interface, measurement data can be monitored and recorded using a PC or laptop, without additional hardware being required. One practical application is the easy recording of data on-site for subsequent analysis and assessment.



Source: ORBIS

ORBIS: Transparent processes in production and intralogistics

For companies using SAP ERP, ORBIS offers an add-on that is completely free of interfaces and is integrated into SAP with version compatibility – the ORBIS Multi-Process Suite (ORBIS MPS). Technical data from different types of systems are seamlessly transferred on the processing level into the SAP system in real-time, and visually prepared information is forwarded directly to the machine control.

This provides a clear view of the ERP and shop floor processes and of the data flow along the entire inventory and supply chain. It also allows for an immediate realistic visualisation of the material flow in a Kanban shelf with ORBIS MPS. Depending on your requirements, all inventory movements can be mapped, from the raw materials supplier and transport, to current inventories right down to the packaging unit.

Intuitive user interfaces

You can also create a clear overview of your internal warehouse stock situation on a monitor or mobile device, for example as a table, graph or image. If necessary, additional individual process-related key figures are visualised, e. g. staff planning or statistics on accidents or absences due to illness.

Even quality-relevant characteristics, such as the weight of the finished product, can be compared and checked against the reference data in the SAP master data. Should the actual product weight differ significantly from the specified data, the dispatch department is immediately notified. In addition, the captured weight data are available for statistical evaluations.

Optimised for SAP HANA and big data

ORBIS MPS is also suitable for “big data” scenarios, as it can be operated in conjunction with the in-memory platform SAP HANA. This means that even huge amounts of data, which need to be managed for Industrie 4.0 due to the linking of systems, can be processed extremely quickly.

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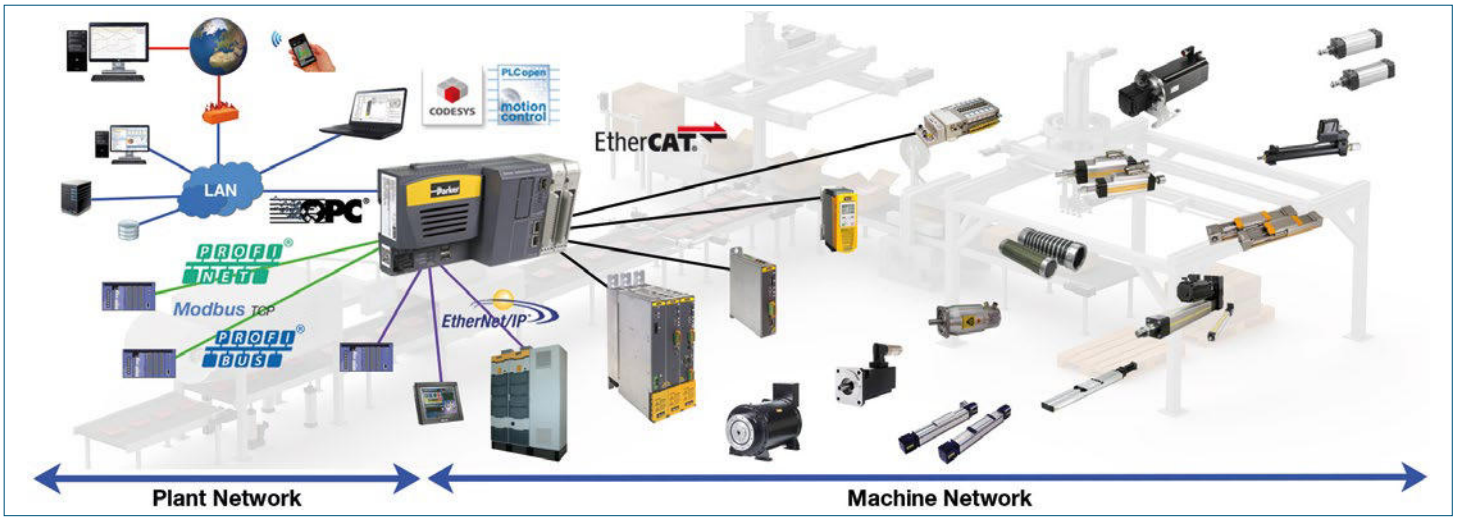

Source: Parker Hannifin

Parker: Motion control solutions for Industrie 4.0

A new automation platform is systematically designed for open Ethernet communication standards. It makes an essential contribution to the consistent data exchange required by Industrie 4.0, all the way from the factory network down to the actuator level. Crucial elements of this new platform are the PAC automation controller and the PSD servo drive series.

PAC, the new Programmable Automation Controller, is an intelligent multi-axis-motion controller designed to tackle the most complex control applications. It combines the characteristics of a PLC with real-time motion control, robotics and visualisation. The new PAC is a sophisticated solution for demanding tasks on a single control platform, eliminating interface issues between multiple components required in conventional systems. Within a machine, PAC coordinates motion of the individual servo drives, even in combination with hydraulic and pneumatic motion if required.

A machine controlled by PAC can easily be integrated into horizontal machine-to-machine communication structures via open interfaces to enable data exchange within the complete production line. PAC Controller is the central hub for machine process data which are collected from all connected field devices and made available to the factory control level via Ethernet or visualised on a smartphone or tablet computer via integrated web publishing.

Increasing demand for flexibility and the degree of automation of today's production facilities lead to an increase in servo drives. With its modular PSD series, Parker has developed a new ultra compact multi-axis servo system. Designed for use in central motion control architectures, PSD servo drives support the precise monitoring of processes and thus contribute to a flexible, fully-automated production process. Standard Ethernet-based ports allow access to the drive data in real time.

Thanks to intelligent components, existing installations can be optimised and prepared for Industrie 4.0.

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Source: Phoenix Contact

Phoenix Contact: Adaptable Industrie 4.0 demonstrator

Phoenix Contact has already developed specific approaches to implement Industrie 4.0. Among these, the Industrie 4.0 demonstrator for automated control cabinet construction enables adaptability, the manufacture of more customised products and end-to-end data integration.

The demonstrator consists of three cells. Feed-through terminal blocks are automatically snapped onto a mounting rail in the first cell. The partially automated second cell autonomously prints the labels for the terminal blocks that are attached to the blocks by hand. In the third cell, a camera inspects the label and verifies the width and completeness of the terminal strip. Product customisation results from the specific composition and labelling of the individual terminal strips.

The demonstrator is made adaptable due to its modularity and the interchangeable magazines, which hold the terminal blocks in place. While the first cell always remains the same, the other cells can be replaced, their order changed, and they can be added to as desired. Reconfiguration proceeds automatically.

Comprehensive data integration

The digital article, a combination of the AutomationML and eCl@ss standards, effects comprehensive data integration. It describes not only the individual product but also the manufacturing process. This is transferred to the demonstrator's control system, which checks whether all the cells required for manufacturing are in fact connected and if the magazines have been assembled with the necessary terminal blocks. A connection between the actual terminal strip and the digital article is established via the article's order number on an RFID chip in the terminal strip, which is read out by the cells' RFID read stations. Only then does machining commence.

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Source: Pilz

Pilz: Control concepts for the future

Modularisation and decentralisation are two of the key success factors on the road to the future of manufacturing automation. What's needed are automation systems that are able to control the intelligence distributed in the mechatronic units in a user-friendly way. Plants can then be broken down into manageable, independently functioning units.

Centrally designed programmable logic controllers (PLCs) have a major disadvantage when compared with modular systems: Changes in individual plant sections have far-reaching effects at control level, because program structures at central points of the control system need to be modified. That's why the automation of the future calls for solutions that are able to distribute control intelligence and guarantee that it will remain easy for the user to handle the necessary decentralisation and networking of multiple control systems.

Distributed intelligence – mechatronic approach

The Industrie 4.0 compatible automation system PSS 4000 from Pilz allows the mechatronic approach to be transferred to the control level. Aspects of distributed intelligence and the mechatronic approach become clear using a model of an existing application and today's available technologies. PSS 4000 enables complex, distributed plants to be broken down into manageable, independently functioning units.

Thanks to the mechatronic approach, the cost of engineering, commissioning and maintenance is significantly reduced. The degree of standardisation of plant and machine components also rises, allowing them to be adapted rapidly and flexibly to changing customer requirements.

Source: Schwering & Hasse

proALPHA Software: Quality assurance with ERP system

Schwering & Hasse Elektrodraht GmbH produces enamelled copper wire for the manufacture of electric motors and transformers. The customers, most of which come from the automotive industry, insist on the highest quality standards for wire. To ensure this quality, the company has automated the analysis of the data measured in production. This is possible thanks to the seamless integration of machine controlling and the ERP system.

It is a great challenge to ensure a consistently high quality for every centimetre of wire produced at speeds of up to 1,000 metres per minute. Employees operating the machines manually and those working in quality assurance can only check a fraction of the products. “By means of automation we ensure that the process is reliable, and the wire meets the customers’ requirements,” explains Dirk Jäger, head of IT at Schwering & Hasse and CEO at Jäger Informatik GmbH.

Optimum quality, reduced costs

The data measured at 300 production machines provide information on the wire’s quality – several thousand records per second. In order to automatically use them to monitor and increase the quality, the company has connected the machine control system to the enterprise resource planning (ERP) system by proALPHA. Information on the outside temperature, thickness of the wire and spool speed are collected and analysed for each spool. Critical performance data are transferred to the ERP system and trigger an event. The machine operators can then directly interfere with the process before the quality is affected: “We can immediately switch to a new spool. This reduces rejection rates and costs,” Jäger explains.

To exploit all potential that lies in Industrie 4.0, medium-sized companies would be required to constantly analyse their processes to create a uniform information flow between ERP and machine control, Jäger points out.

Source: DFA Demonstrationsfabrik Aachen GmbH

PROTECA: High adherence to schedules through transparent order progress

At the Reference Factory Industrie 4.0 (Demonstrationsfabrik Aachen) located on the RWTH Aachen Campus innovative approaches and solutions for Industrie 4.0 are implemented and tested in a real production environment. Among many others, the results of the BMBF-funded research project ProSense are implemented: A concept for high-resolution production control on the basis of supporting software systems and intelligent sensors.

The Production Technology network in Aachen, known as PROTECA, which is part of RWTH Aachen University's Integrative Production Technology for High-Wage Countries Cluster of Excellence, supports the technology transfer between research and industry. In the research project ProSense (FKZ 02PJ2495) a concept is developed which includes hitherto unavailable data on material flows by additional sensors and associates those with existing data to form new information. Proposals for action for the production supervisor are automatically generated in order to facilitate decisions about necessary measures on the shop floor and in IT systems. All this allows for more dependable planning and adherence to deadlines despite a turbulent manufacturing environment.

Sensors allow for more transparency

At the Reference Factory Industrie 4.0 a cyber-physical production system has been implemented: All delivery areas in front of machines were equipped with RFID sensors and all charge carriers were furnished with RFID tags which contain information about the production order. Thanks to this sensor solution, the transitional periods between working operation are exactly known and the order progress is automatically monitored. The higher transparency permits more precise planning for the production processes' throughput time. To make optimum use of the high-resolution data, the software system was combined with the ERP system via an interface as extension of hardware-based components. If problems with capacity, staff, inventory levels or urgent orders occur, users receive recommendations for actions via specially developed visualisations.

ProTECAACHEN
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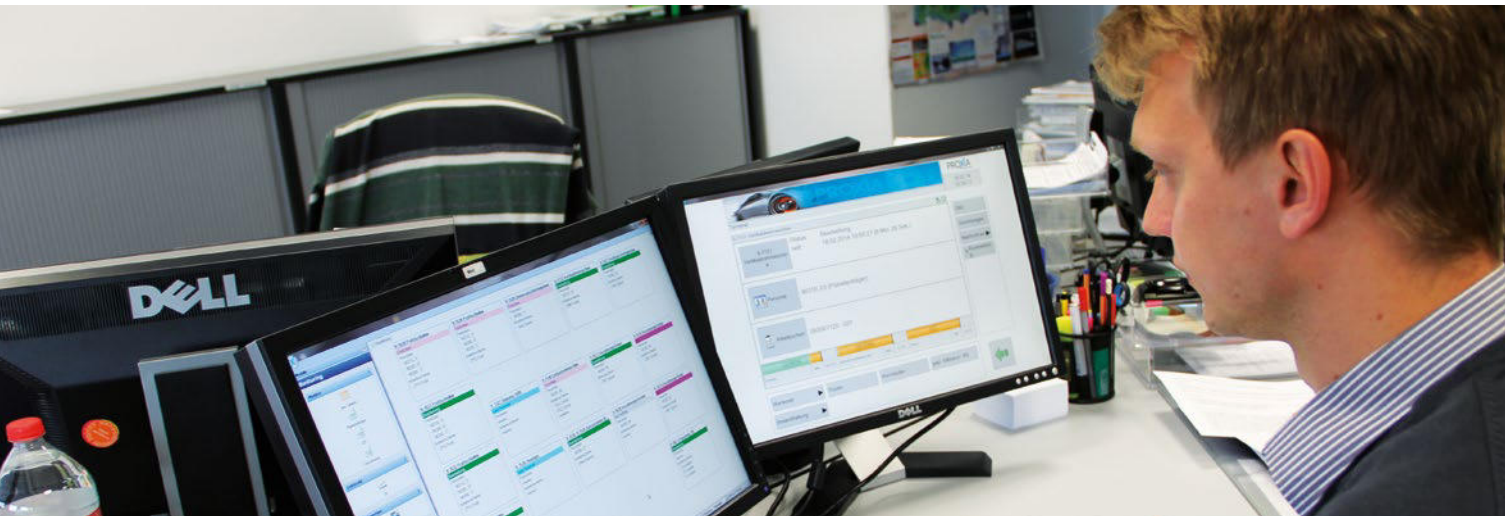

Source: PROXIA Software

PROXIA Software: MES for seamless production monitoring

The wind turbine manufacturer Eickhoff Wind Power from Klipphausen near Dresden is already geared for Industrie 4.0. Eickhoff uses a Manufacturing Execution System (MES) by PROXIA Software to monitor its production. Machine running times and operating cycles are captured in real time, capacities are planned on a cross-plant basis, and bottlenecks are detected in time.

The plant belonging to Eickhoff Wind Power GmbH, a subsidiary of the machinery factory and iron foundry Gebr. Eickhoff Maschinenfabrik und Eisengießerei GmbH of Bochum, was built in 2008. The scientific factory planning of RWTH Aachen and others were enlisted to produce a plant based on the most modern lean production philosophy and material flow optimisation.
In order to compare its performance with that of other plants in the Eickoff Group, data on the availability of the plants, their performance, and reject rate, as well as other information, is captured by the MES software by PROXIA. Because Eickhoff also uses this software in other plants, a uniform database is ensured.

On-time delivery guaranteed

Approximately 30 machines, systems, and productive workstations in the Klipphausen plant are connected to an automated data capture and production data acquisition system (MDE/BDE) and linked to each other. All the production steps can be fully traced. With the PROXIA BDE/MDE software, production planning and control have a close eye on the processing status of an order and can detect production bottlenecks and compensate for them with the help of other plants in the group as needed. This way, Eickhoff can introduce measures in time to make sure that a specific order will always be delivered at the agreed time. “On-time delivery is one of the most important benefits that we draw from the MES software,” says Uwe Steinhagen, IT Manager of the Klipphausen plant.

PROXIA The MES Company

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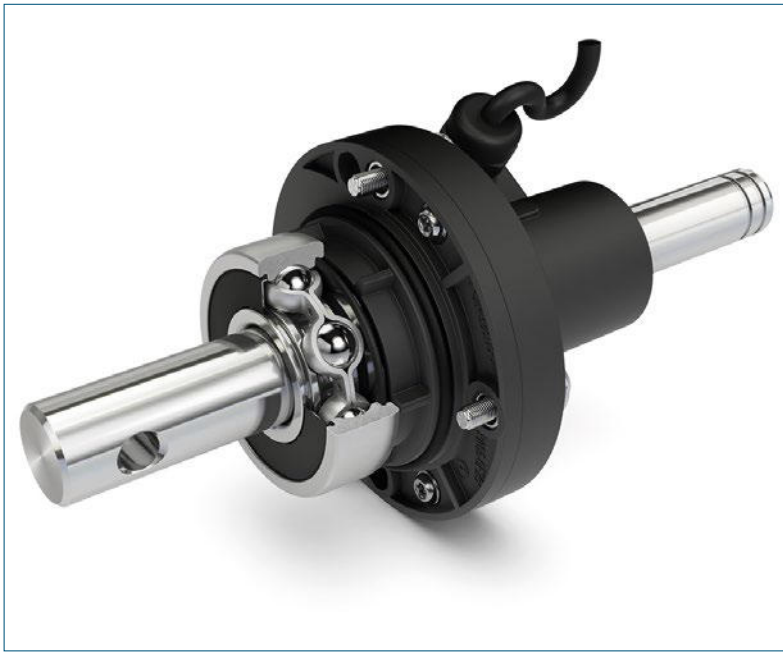
Schaeffler: Integrated torque sensor technology

Schaeffler´s new magneto-elastic torque sensor technology allows material stresses occurring in a shaft to be directly measured and converted into a torque signal. The company thus offers a mechatronic solution that allows applications and processes to be monitored and controlled with greater precision, as the torque is recorded right where it is applied. Disruptive influences in the drive train can be reduced.



Source: Schaeffler

As a supplier of bearing and subsystem solutions, Schaeffler offers torque sensor technology in ready-to-fit modules. In addition to rolling bearings, Schaeffler's application engineers are also specialists in the field of sector-specific mechatronic modules, which means they can develop optimised solutions together with the customer. In allowing machines' condition and processes to be precisely monitored by recording the torque, Schaeffler is providing an important prerequisite for interconnected and intelligent processes.

Torque sensor technology has found its first applications in agricultural engineering, which is one of the most innovative sectors on the market. Independently-driven electronically-coupled vehicles, sensor technology for measuring the quality of the ground being crossed, digital field record systems and yield charts, networking via ISOBUS, and control strategies for the targeted use of seeding machines are just some of the examples.

While digitalisation has made significant improvements to precision as far as control systems are concerned, the electrical, mechanical, and hydraulic actuators must also be able to implement this precision, which offers a great deal of potential for torque sensors.

Sensors control the amount of fertiliser

FAG torque measurement modules have been integrated in the drive hubs of the latest generation of fertiliser spreaders from agricultural machinery manufacturer RAUCH. These modules precisely measure the current fertiliser flow rate, directly adjacent to the process and with no contact. Blockages and jams in the metering slides are detected. Costly fertiliser spreading thus becomes even more precise and reliable.

SCHAEFFLER
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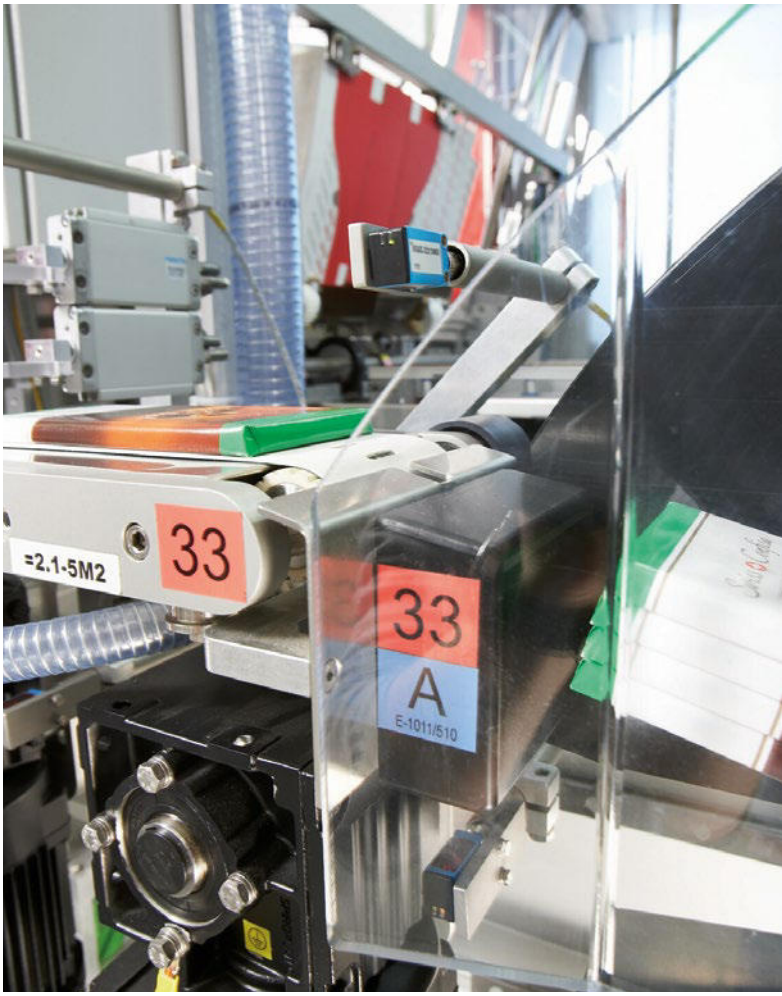
SICK: Better packaging with IO-Link

Since 1974, SOMIC Verpackungsmaschinen GmbH & Co. KG has been developing and building packaging systems, predominantly for the food industry. The SOMIC 424 W2 wrap-around packer is just one example of these systems. Equipped with intelligent sensor and control technology, including SICK IO-Link sensors, the machine provides greater operational safety, increased packaging quality, and higher output.



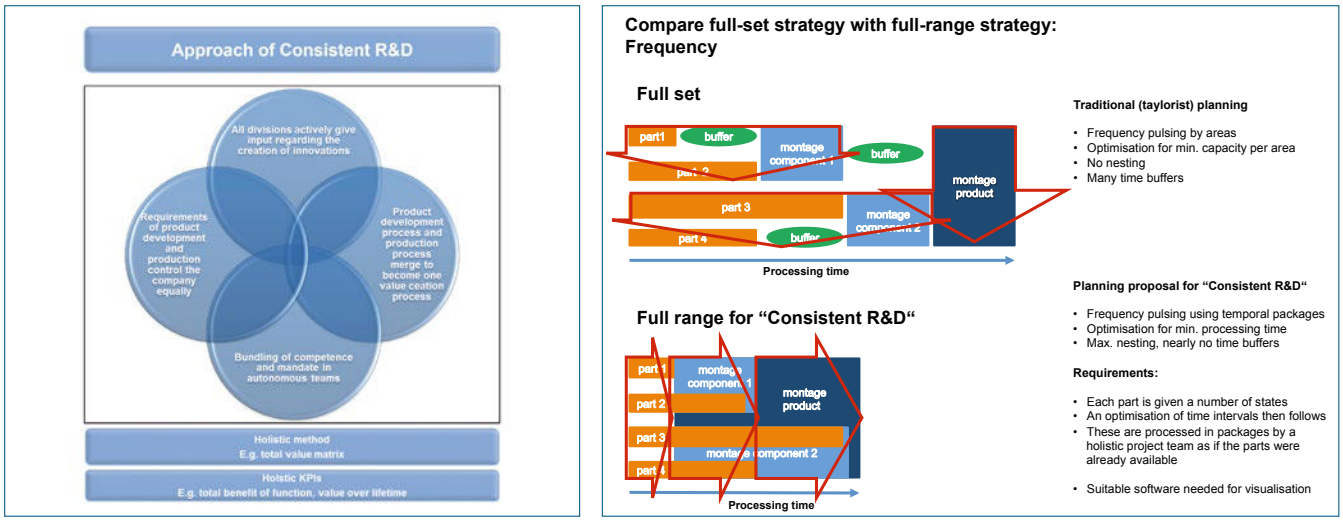
Source: SICK

SOMIC fit SICK photoelectric sensors as IO-Link sensors – for example, the WTB4-3 miniature photoelectric sensor for detecting and counting products entering machines. The sensors' miniature construction saves space, they reliably detect different forms of packaging, they have precise background suppression, and because of their special chip technology, they are the natural first choice of IO-Link.

Condition monitoring by active sensor self-monitoring

The IO-Link functionality wins SOMIC customers over thanks to the focus on rapid and safe commissioning, consistently high quality of the packaging process, improved availability of the final packaging machines, rapid return on investment, and the ability to carry out remote diagnosis.
By far the most important function of IO-Link sensors is their automatic contamination monitoring. "Using IO-Link with SICK sensors, the machine carries out its own active troubleshooting," explains Stefan Julinek, Head of Design at SOMIC.

"It warns independently if the optics become contaminated by dirt. Thanks to condition monitoring, machine operators can service their systems preemptively, for example during a planned production break. This then prevents downtimes caused by unscheduled shutdowns." SICK IO-Link sensors therefore help SOMIC final packaging machines to reach new limits when it comes to availability.



Source: Techniciency Consulting

Techniciency Consulting: "Consistent R&D"

Industrie 4.0 requires not only the change of production processes, but also the redesign of processes in the field of product development. "Consistent R&D" stands for a holistic approach because it integrates all corporate areas.

"Consistent R&D" stands for an all-round approach, consistency and consequence. The focus is on four approaches:

- **All divisions actively provide input for innovations:** They should all be involved in the innovation process. Service people understand customer needs better than people in distribution, and purchasing and procurement teams have know-how about global sourcing, suppliers and supply chains.
- **The requirements of product development and production control the company equally:** If the proportion of new products steadily increases, then this must be taken into consideration in the KPIs to control the company with respect to orders, sales and results.
- **The product development process and production process merge:** The possibilities arising from simulating processes for purchasing, manufacturing, installation and service are not used consistently today. But the trend towards the individualisation of products is intensifying. The task to deliver series-ready products immediately requires a new approach in the planning of processes and capacities and influences assembly structures. It is necessary to establish suitable methods for this. A proposal is shown in the picture above on the right-hand side.
- **Competence and mandate should be bundled in autonomous teams:** The manufacture of individualised products means greater internal complexity. Small units can handle the increasing responsibilities much better than a centrally-controlled company. Defined conditions are required for this.

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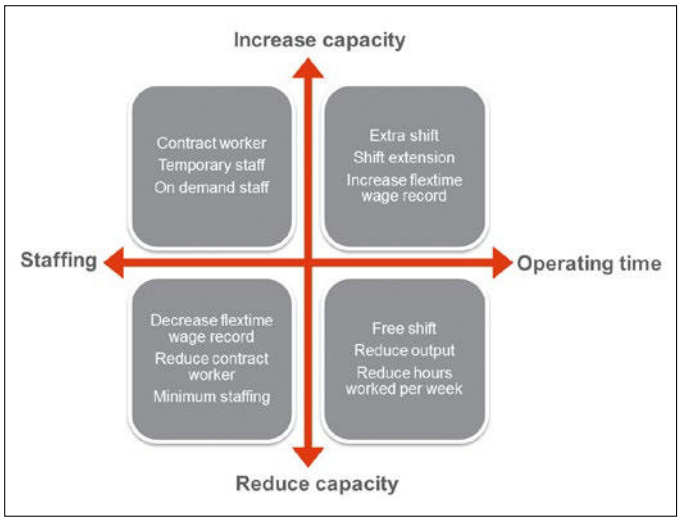

Source: Trebing + Himstedt

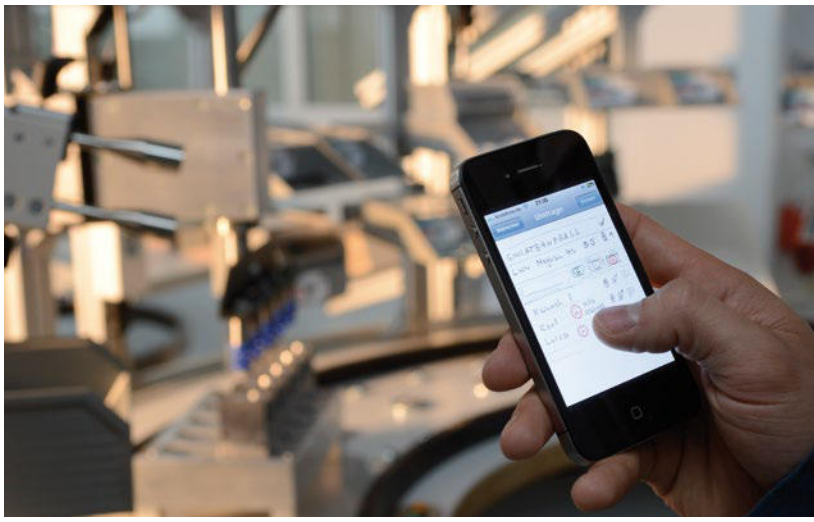

Photo: Bernd Müller, © Fraunhofer IAO

Trebing + Himstedt: Personnel resource planning by smartphone

In the Industrie 4.0 research project "KapaflexCy", the SAP MES Expert Trebing + Himstedt, is developing a networked, flexible and self-organised capacity management system. The SAP partner researches together with service and industry companies, software system and consulting firms as well as research institutions personnel resource planning in production, developed cooperatively with employees.

The project "Capacity Flexibility in Cyber-Physical-Systems" (KapaflexCy), funded by the German Federal Ministry of Education and Science, develops tools based on cyber-physical systems, implementation strategies, and conditioning methods for self-organised capacity flexibility. Similar to the "just in time" principle used in material logistics, "KapaflexCy" aims to reduce idle times and excessive stress on the "human" factor in production.

Shift schedule via shift doodle

In self-organised capacity control, employees involved in the manufacturing process plan their tasks as required and according to the skills demanded largely independently. In the research project, Trebing + Himstedt is developing an SAP-based software solution that supports scheduling, even in the case of extended and extra shifts. Shifts are no longer planned centrally, but rather on a "shift doodle". Employees coordinate with each other via smartphone app or at a kiosk terminal in the cafeteria. Only in the case of deviations or conflicts are other departments and hierarchical levels involved.

Self-organised capacity control shortens reaction times in case of fluctuating orders, avoids unproductive times, and reduces effort. Employees experience transparent personnel resource planning in which they themselves are involved, which increases their acceptance. As a result of improved work-life balance, motivation increases.

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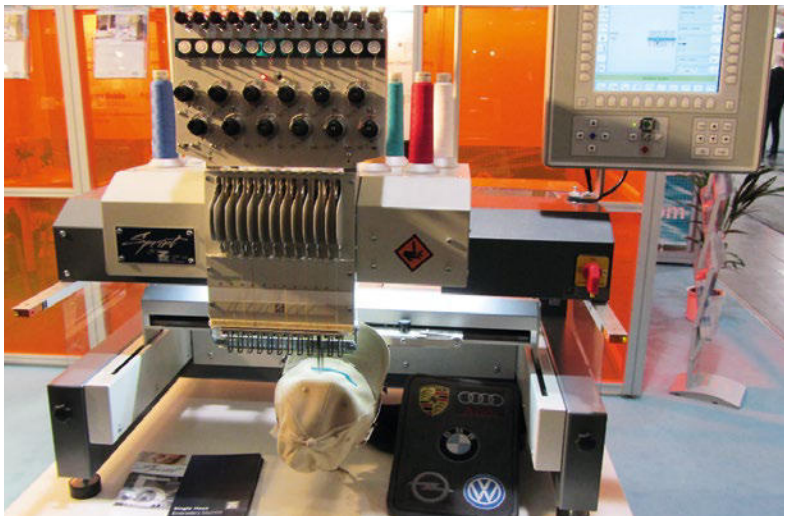

Source: Wibu-Systems

Source: @ Frank Ossenbrink

Wibu-Systems: Securing production data and know-how

A bright future for Industrie 4.0 can be envisaged only if interconnected production data and know-how are protected from piracy and tampering. Deutsche Telekom, the Fraunhofer Institute for Secure Information Technology, Hirschmann, Infineon Technologies, Trumpf and Wibu-Systems are committed to making this vision become a reality. With their demonstration "Secure Industrie 4.0 – Made in Germany" they show how it can be done.

The demonstration shows end-to-end communications, where all critical components have been developed and manufactured in Germany. Wibu-Systems is participating in the project with its CmSticks – USB dongles that provide logical access control to authorised personnel and safeguard against product piracy and tampering attacks. The units embed a security controller from Infineon as an anchor of trust. The installation demonstrates how to connect two remote production sites through a secure communication channel. The security controllers are in charge of specific security tasks: They authenticate staff, communication components and production plants, and encrypt sensitive data. In the event of a non-trusted device, this device is excluded from the network. Such protected infrastructure can be remotely maintained via two-factor authentication: CmStick and PIN or password using a tablet PC.

Toward a secure and intelligent production

Oliver Winzenried, CEO and co-founder of Wibu-Systems, explains: "Industrie 4.0 will only achieve its full potential if both data and process know-how as well as any level of communication are encrypted and kept secure from espionage and tampering. For companies to become confident in the smart production concept, security must be urgently addressed, offer reliability and cost effectiveness."

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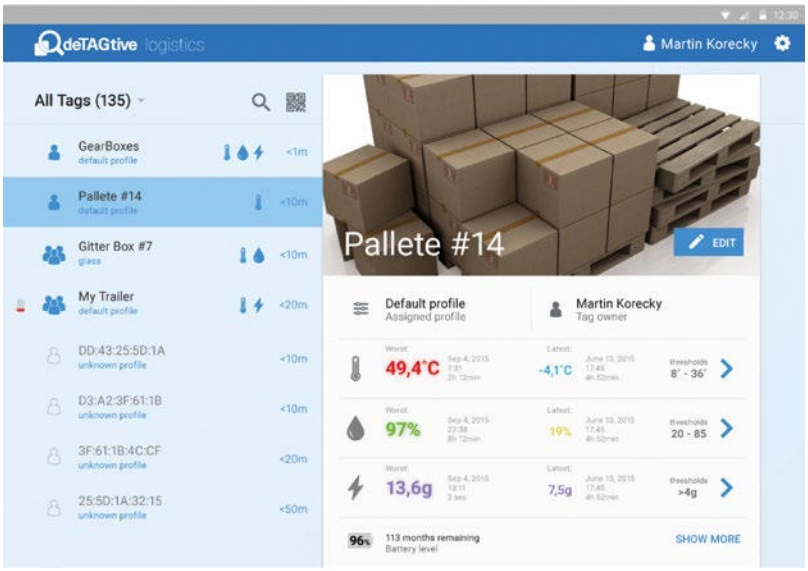
ZF: Optimising logistics with Bluetooth tags

It is possible to transmit digital information over large distances with low energy consumption using Bluetooth Low Energy (BLE). Many procedures in logistics are simplified and the efficiency of numerous processes is improved. With their small size, high data security and low cost, BLE tags are universally applicable and fulfil a wide range of requirements.



Source: ZF

Based on this BLE technology, the ZF subsidiary company, Openmatics, has developed an innovative solution for optimising logistics processes. The "ZF Logistics Tag" is equipped with a battery with a five-year service life, a three-axis accelerometer, a temperature sensor and a humidity sensor. The tag can save extensive amounts of data that can be transmitted over a range of up to thirty metres in real time to smartphones and stationary receivers.

Ambient profile of the goods is saved

Comprehensive process optimisation is possible due to the assignment of the load carrier to the "ZF Logistics Tag ID". The special sensors in the tags can produce an exact profile of the ambient conditions during the dispatch, transport and receipt of the goods to enable the status and incidents to be checked. Environmental conditions and events are saved and communicated with the objective of automatically detecting damaged goods so that, where necessary, they are automatically rejected on receipt of the goods or at other points in production. In this way, processes such as goods-inward inspection are in most cases superfluous and immediate rejection of defective goods occurs.

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