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Digital Enterprise – on the way to Industrie 4.0

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The art of invention

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Digitalization in machine building

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(c) Michael Hitoshi

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Dr. Kurt Wolff GmbH & Co. KG

Digitalization in Machine Building

Plant Data Services

Totally Integrated Automation

Integrated Drive Systems

Totally Integrated Power

Industrial Identification

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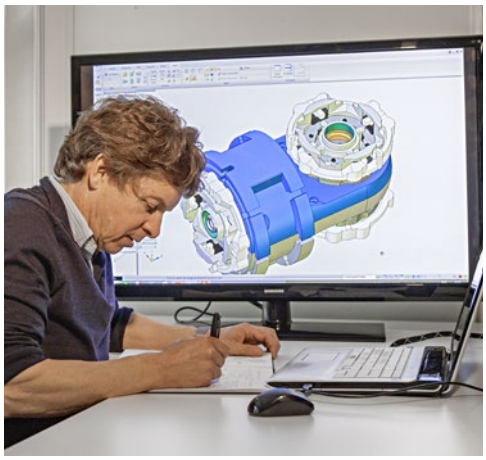


Siemens AG / Andrea Artz

Editorial

Dear readers,

Siemens AG / E. Malter

The Internet as a global platform for real-time communication acts as an enormous accelerator of business processes around the world. Customized single-unit production and just-in-time delivery to the customer are becoming critical competitive factors for an increasing number of companies. This development affects not only the consumer goods industry but also machine building and OEMs.

We are convinced that every company needs to find its own way into the digital future. However, we want to support our customers in this and are working on providing a corresponding comprehensive portfolio of products, systems, and solutions. Ultimately, every enterprise will need to create a digital twin of its entire industrial value-added process in order to respond flexibly to customer behavior and market changes.

Our Digital Enterprise Software Suite with Teamcenter software as the data backbone is an important step toward a digital future and enables effective, sustainable solutions for all industrial enterprises that wish to embrace and shape the transition toward digitalization and Industrie 4.0.

This issue illustrates how we support machine builders in particular on their way to digitalization, and demonstrates the advantages users have already gained from it. Digitalization helps companies make their processes leaner, faster, and more flexible – and thus enables them to be more successful in the market in the long run.

Enjoy the read!

Anton S. Huber
Chief Executive Officer der Siemens AG
Digital Factory Division

(c) Michael Hitoshi

Digitalization helps improve quality and efficiency in machine building

The digital twin

Soon it will accompany every machine from initial idea to modernization. With a digital twin, machine manufacturers are able to use the power of digitalization to achieve improved efficiency and quality. This approach helps ensure optimized machine design, straightforward commissioning, short changeover times, and smooth operation.

Digitalization and Industrie 4.0 are major trends not only in Germany but also globally. New products need to reach the market in ever-faster cycles, and in many cases these products are completely individualized items that customers configure online and that are then produced on demand. The classic static production line in manufacturing is being complemented by modular designs.

Digital Enterprise comprises four core elements

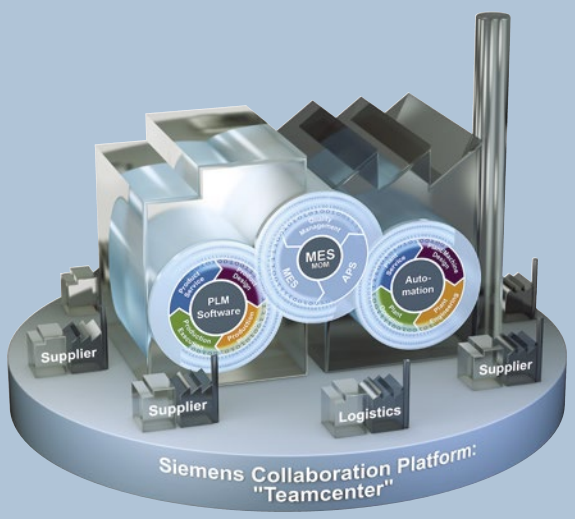
Reduce time to market
Shorter innovation cycles
More sophisticated products

Increase flexibility
Individualized large-scale production
Volatile markets

Increase efficiency
Energy and resource efficiency
as key competitive factors

Digital Enterprise Software Suite

The comprehensive portfolio of software-based systems for discrete industry, developed over a time of more than fifteen years, uses Teamcenter as collaboration platform (data backbone) and interlinks PLM (Product Lifecycle Management), MES/MOM (Manufacturing Execution System/Manufacturing Operations Management) and TIA (Totally Integrated Automation).



PLM
Teamcenter / NX

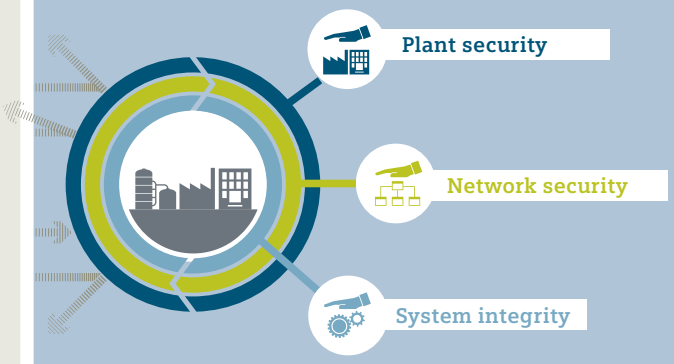
MES / MOM
Simatic IT

Totally Integrated Automation
Simatic / Sinumerik

Industrial Communication

With Industrial Communication, Siemens has a comprehensive set of communication network offerings matched to one another from Industrial Ethernet with the associated Scalance family of network components to open and future-proof Profinet.

Industrial Security



With Industrial Security, Siemens offers the industry a wide range of products and services to implement the "Defense in Depth" concept to protect industrial plants from cyber attacks. This portfolio includes plant and network security as well as system integrity products.

Industry Services

With Industry Services, Siemens offers the traditional services as well as data-based services such as Plant Data Services, Plant Security Services and Plant Cloud Services.

Higher flexibility is also required for another reason: despite the increasing variety of products and processes, production must not consume more time, energy, and resources than previously. Consequently, innovations related to digitalization are also always being examined for their potential contribution to higher efficiency, from product design and engineering to production design, commissioning, operation, and modernization of machines and plants.

Green light for digital machine building

This is precisely where the concept of the digital twin comes in. This term is used to describe a digital copy that is created and developed simultaneously with the real machine – ideally from the first study on. Siemens provides its customers with high-performance software systems for the development of these digital twins. For example an innovative transport system from the German machine manufacturer Optima was digitally mapped (more on page 10). The company produces packaging and special machines for many industries and placed great emphasis on the machine's design as a mechatronic system that can be tested, developed, and validated digitally.

This allowed ideas to be tested and further developed before the actual manufacture began. The data of the real machine were loaded into the model already during the design phase. This resulted in a digital twin that enables simulation of changeover operations and product flow across the entire lifecycle of the machine. Using a cloud connection, it is possible to evaluate KPI data such as produced items, downtime analyses, failure rates, and energy data. To protect sensitive production data, comprehensive industrial security systems are also critical. By using state-of-the-art software tools for the digitalization of the machine lifecycle, the user gains considerable flexibility in the design and operation of the machine – a milestone for machine manufacturing.

Integrated foundation for digitalization

With the right tools, digitalization boosts efficiency in all phases of the machine lifecycle. It is possible to validate designs earlier and test the configuration of the machine control system earlier. Routines and checks take place earlier in the engineering process, which reduces the risk of failures and errors in critical phases of the lifecycle, such as during commissioning, which previously could only be eliminated with great effort and under time pressure. If the machine information is available on an integrated data platform, later modifications can be tested and verified in exactly the same way, thus accelerating the introduction of a new product. In addition, with the help of models, the operating data of the machine can also be used to optimize characteristic parameters for production – from energy consumption to error rates and cleaning cycles.

Siemens is already supplying essential components for the complete digitalization of the value chain and the digital enterprise in its portfolio for the digital enterprise. These aligned solutions address four areas: software to create a central data platform for digitally supporting the entire value chain for discrete manufacturing; intelligent networks for industrial communication as a basis for simple data exchange within the different production modules and for collecting operational data; and, due to the growing number of networked systems, effective solutions to protect digital factories against security threats. One security solution is the so-called defense-in-depth concept that Siemens has been systematically implementing for several years. This concept is based on the new IEC 62443 standard. Structured security mechanisms, ranging from using passwords to continuous security monitoring, allow for reliable and customized adaptation to the current security requirements of the digital factory.

At the same time, Siemens is driving the expansion of industrial services. For example, the open Siemens Cloud for Industry platform serves as the foundation for new digital business models for industrial enterprises. With this platform, machine

Foto + Studio HESSE

Dr. Bernhard Quendt,
CTO Siemens Digital Factory Division
Siemens AG

Partner for a sustainable transition to Industrie 4.0

Mr. Quendt, what is Siemens' view on Industrie 4.0 as part of the Internet of Things?
Industrie 4.0 has two meanings for us: First, we are currently working on the digital transformation of our own factories, for instance, in our Simatic production facility in Amberg. Second, we are supporting our customers in the manufacturing and process industries and machine building with tools and systems for the optimization of industrial value creation. We are continuously improving solutions that integrate our tools and systems into a consistent digital tool chain, the Digital Enterprise Software Suite. This suite is the answer of Siemens to the challenges of Industrie 4.0.

How far along is the machine-building sector in the digitalization of its value chain?
Fortunately, the debates surrounding the topic of digitalization have created a great awareness. Many small and medium-sized enterprises – and this includes a large part of the German machine-building sector – are currently working on appropriate strategies. However, there is still a lot left to be done. It is important that we accompany our customers in their digitalization strategies by demonstrating with concrete examples, how the digital image of real machines – the so-called digital twin – and the associated simulation capabilities can make the business processes of our customers more flexible and efficient. Many capabilities are already available today and it pays for our customers to start now instead of waiting until there is a comprehensive specification of Industrie 4.0.

What is the role of data for the machine building of the future?
Data are an important factor already today, and we will expand this through services for intelligent data analysis and evaluation, for example. These services allow companies to support industrial decision-making processes and make a significant contribution to productivity increases. We help our customers to expediently collate and analyze the rapidly growing volume of data that is generated worldwide as a result of digitalization and to develop completely new business models.

Do such data-based applications in industry have special requirements?
The digitalization of industry and the integration of the virtual and the real worlds need not only "big data" but also "smart data," that is, the intelligent utilization of data in the context of automation and process know-how. The security context is also vital: with our tools and our consulting expertise, we can support our customers in protecting their data and increase the willingness to use data-based applications.

And how can Siemens offer companies support specifically as they move toward Industrie 4.0?
We are the only provider of a comprehensive portfolio that comprises the following core elements: a Digital Enterprise Software Suite, industrial communication networks, secure automation, and business-specific industrial services. Additionally, we are available as an experienced partner for a sustainable transition to Industrie 4.0, allowing our customers to invest in future-proof solutions already today.

Mr. Quendt, thank you for speaking with us.

and plant data can be securely transferred to the cloud and evaluated using special tools – for instance, in order to assess and optimize the condition of machines and plants. In this way, Siemens supplements its offering of data-based digital services for the industrial environment.

New plant designs, new business models

An example from the machine tool industry shows how far digitalization has already come and how machine manufacturers are benefiting. The development of a new milling machine with a standardized CAM platform based on Teamcenter significantly shortens the time from virtual product to real production facility. As a data backbone, Teamcenter integrates all modules and guarantees access to information for later retrofits or for maintenance and servicing. The virtual machine tool enables a realistic simulation of the real Sinumerik control on the real workpiece. The results of this project were impressive: the deviation of the real machine from its digital twin was less than 1%, the running-in period of the machine was reduced by more than 70%, and productivity during operation was increased by more than 10%.

The next steps

Today, customers can already invest in future-proof solutions for a step-by-step transition to Industrie 4.0 using the Siemens portfolio for the digital enterprise. The solutions for digitalizing the processes upstream and downstream of machines and making them more flexible are already very tangible, especially for parts and materials handling. Robots will carry out increasingly complex and advanced processing steps both precisely and efficiently. The networking of machines with each other and with higher-level systems is also making great progress. For instance, resources and production data can be managed centrally.

A great benefit here is the consistency of the Siemens portfolio, as Product Lifecycle Management and Manufacturing Execution Systems can also be connected for even greater productivity. This ensures cost benefits in procurement and operation. Order data are thus available throughout the entire company, and it is possible to identify optimum production strategies for allocating orders to the various production sites in the organization. Moreover, material stocks, logistics processes, and tool availability can be seen at a glance and efficiently coordinated.

While the simple "plug-and-produce" addition of machines to a line, analogous to the USB connection of external devices to a computer, is still a long way off in the manufacturing environment, it is one important goal for development in the areas of automation and industrial communication. Machines should then be able to identify themselves and connect to the network, making the required modification of lines faster and more efficient. According to automation experts, the digital twin's potential to increase quality and efficiency due to the improved documentation of processes and machines is much more exciting. In the future, every manufacturer will know exactly which component has been installed with which characteristics in which of its products and will thus be able to respond to problems in a targeted manner and to optimize processes.

In its Simatic production facility in Amberg, Germany, Siemens is already using a comprehensive documentation and evaluation system and has achieved an extremely low level of errors in production. And the digital twin is ensuring greater efficiency and productivity in other sectors as well: with the step from integrated engineering to integrated operation, Siemens enables the process industry to build a continuous data model from plant engineering to operation. Here, too, digitalization ensures a shorter time to market, greater flexibility, and increased efficiency. This gives companies the opportunity to respond effectively to the volatility and diversity of global markets and to increase productivity as well as energy and resource efficiency.

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Dr. Kurt Wolff GmbH & Co. KG

The Multi-Carrier-System was used for the first time in an Optima bottling plant from the Moduline range of machines at Dr. Kurt Wolff GmbH & Co.KG.

Flexible and cost-efficient product packaging with the innovative, modular Multi-Carrier-System

Individuals in the swarm

How can frequently changing (and in extreme cases single) products in a line be filled, sealed, labeled, and packaged in a flexible and cost-effective manner? With their new Multi-Carrier-System, Siemens and Festo offer an innovative response to current and future trends in the packaging industry and beyond.

Individualized products – for example, products that are "personalized" via online configurators – and thus packaging in very small quantities, in batch sizes as small as one, will be the rule rather than the exception in more and more sectors in the future. Producers of cosmetics and pharmaceutical products are traditionally among the trendsetters in the packaging industry. But in other areas as well, product and/or packaging variations changing seasonally or for special campaigns, and ever-shorter product lifecycles in general, are placing increasingly higher demands on the flexibility of production systems.

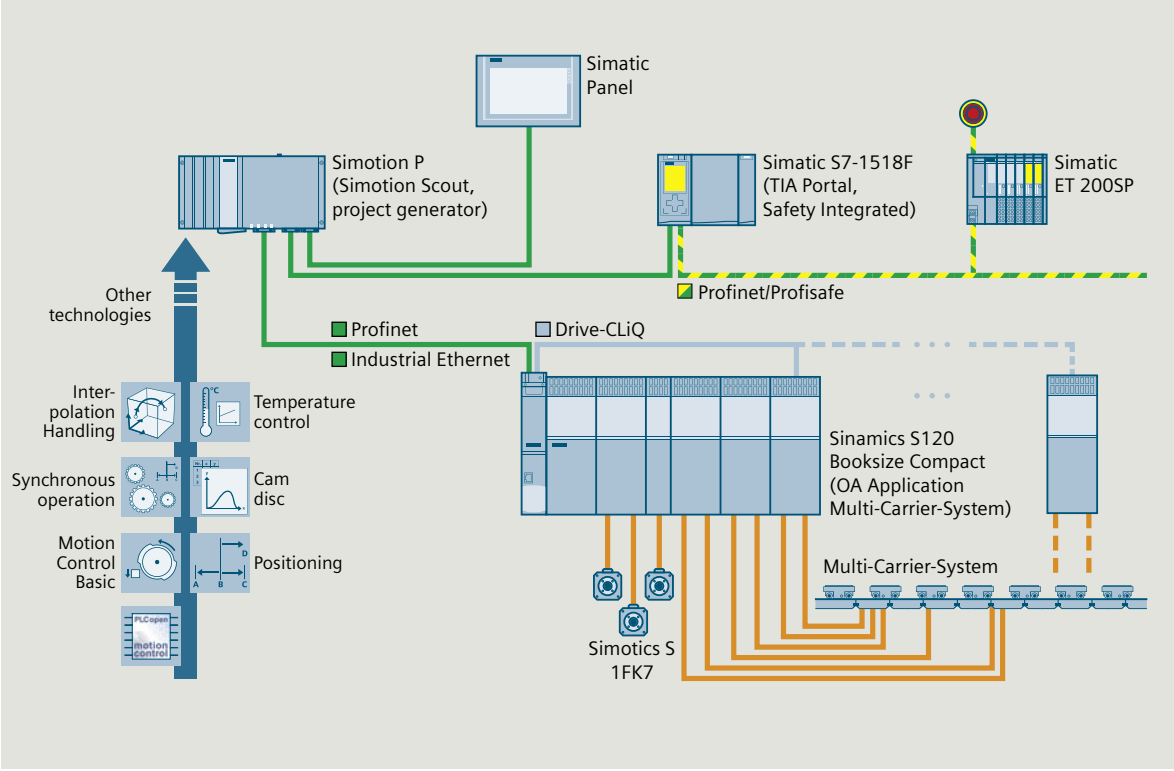
Of paramount importance in this process is a production and material flow in the plants that can support the increasing number of variations, although the focus is not so much on very high throughput rates but rather on high flexibility and dynamism between the stations as well as on process safety. Many operators would like a continuous material flow with optimized (i.e., small, or preferably no) buffers in between in order to be able to design future generations of machines that are even more compact. In the face of increasing numbers of different product formats, minimized set-up times are also a stated aim.

Modules for an optimized material flow

With their joint development of what they call the Multi-Carrier-System (MCS), Siemens and Festo have created an innovative solution for the changing transport tasks within plants. The solution is a new and modular linear drive system that allows for more flexible and dynamic transport of multi-format-capable goods or workpiece carriers. At the

Within the machine, the individually controllable carriers move synchronously with the process, either singly or in groups

Marion Stephan Photographie



Topology of a Multi-Carrier-System

core are primary components available in varying lengths, with which transport distances of any length can theoretically be set up. The associated secondary components are integrated into the carriers.

To avoid bottlenecks, the carriers run synchronously with the process – optionally singly or in groups – within the machine according to the rules of swarm behavior, exactly as required by flexible processes. Individual carriers can be easily moved into and out of the plant. In addition, the entire MCS is easy to integrate into existing transport routes, so that the machine can be quickly changed to accommodate different formats, other product types, or seasonal requirements.

The primary and secondary components of the linear motors by Festo are completely sealed and have a high degree of protection, safeguarding them from contamination by leaking product and making them easy to clean. This is critical in the cosmetics and pharmaceutical industries, but also in the food and beverage industry. The carriers are placed on the secondary elements and can be designed individually, enabling, for example, easy adaptation to various guide systems or particular properties for special hygiene requirements.

The MCS development was substantially driven by Optima Consumer GmbH. The packaging-machine specialist is now successfully using the system for the first time in a packaging line of the Moduline machine series at Dr. Kurt Wolff GmbH & Co. KG in Bielefeld, Germany. The Bielefeld-based company fills, seals, labels, and boxes just under 20 bottle formats of its shampoo series Plantur 21, Plantur 39, and Alpecin in constant alternation and in various groupings.

The key to achieving the required output of at least 120 bottles per minute was a detailed material flow analysis; simulation in the Mechatronics Concept Designer based on that analysis; and perfect teamwork between Optima, Siemens, Festo, and Dr. Wolff, the partners involved in the project. The MCS implemented in the packaging line of the Moduline machine series includes more than 100 MCS linear motors in the drive-based motion control system and more than 60 additional, synchronized (servo) axes at a total of nine stations.

Proven drive performance

Siemens implemented the high-performance drive and control system for the MCS within just a few months. The existing standards played a decisive role in this. They include the Simotion motion con-

trol system, proven in many industrial applications, as well as the matching modular Sinamics S120 drive system and a software solution previously patented for high-end applications for precise control across motor segments (closed-loop operation with transmitter) or automatic control (open-loop operation without transmitter) of the carriers. This allows for speeds of up to 4 m/s and accelerations of up to 50 m/s^2. The levels actually achieved depend on the type and volume of the given product. The motion control can be optimized using standard Sinamics and Simotion tools. The combination with special drive functions such as VIBX (for vibration extinction) is also possible. This allows sophisticated control algorithms to actively counteract even the spilling-over of liquid media during fast acceleration and braking.

The MCS is format-compatible with established workpiece carrier systems, meaning it can be combined with them as needed; subsequently expanding existing systems is also easy. For instance, carriers can also be (re-)equipped outside the line and easily moved in and out as required, significantly speeding up production changes.

The carriers are equipped with noncontact readable and writable RFID (radio-frequency identification) transponders for an optimized production flow and seamless traceability. It is also possible to record and analyze the individual performance data of each carrier. Using a condition monitoring system, imminent problems of individual carriers or of a transport route can be identified and eliminated quickly and the plant availability maintained at the highest level.

Because the MCS builds on the standards mentioned above, it can be electronically linked with the (Sinamics) drive axes of the core processes and of the auxiliary units, with all the options offered by Simotion. As each carrier technically corresponds to a virtual axis in the drive system, perfectly matched interpolated processes – for instance, also synchronized via disk cams – can be realized. And, ideally, this can be done without an additional controller, although in principle it is also possible to distribute the tasks onto several "shoulders." In any case, the fast communication via Profinet with IRT (isochronous real time), also across controllers, means shorter cycle times and thus maximum (drive) performance.

Virtual validation – "automated" programming

Mechatronics Concept Designer

The Mechatronics Concept Designer, a simulation tool from the Siemens software suite integrated into the NX CAD tool, facilitates and accelerates the implementation of new, typically increasingly complex machine designs. With it, static designs can be "brought to life" with little effort already in an early phase of the development cycle, and different mechatronic concepts and/or production and material flow scenarios can be created, compared, and tested in a virtual environment. This early testing helps users detect and correct errors while the costs to do so are still very low. The results can be used directly by different disciplines for further development.
For instance, exporting the simulation results to the Simotion easyProject project generator enables an executable machine program to be generated automatically (and thus free from transmission errors) and uploaded directly into the motion control system.

Advantages at a glance:

- Shorter time to market due to the reduction of the machine development period by up to 30%
- Quick creation and validation of the mechatronic concept on-screen
- Optimal collaboration along the entire engineering chain and among the different subspecialties, such as mechanics, electrical systems, and automation
- Virtual commissioning of the machine instead of expensive prototypes

Highest flexibility for diverse applications

With the MCS, Siemens and Festo not only anticipated current trends in the packaging industry; other applications with frequent product changes, particularly in assembly automation, also benefit from the high flexibility and dynamism. ■

INFO AND CONTACT

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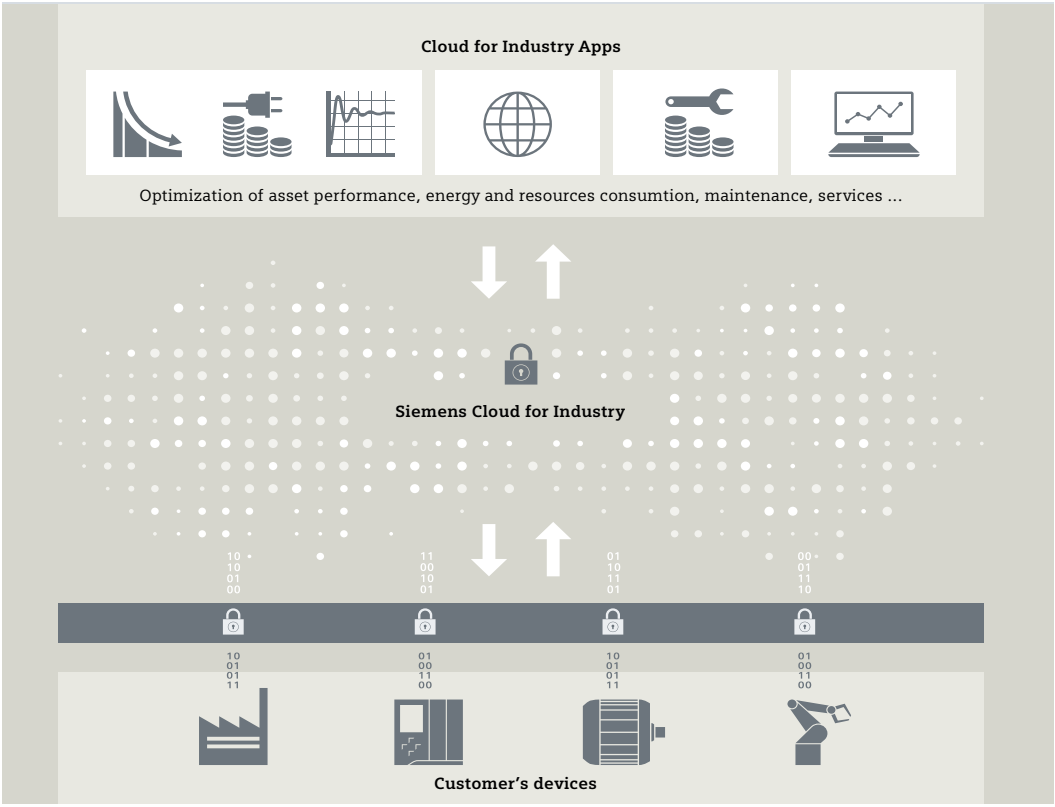

Siemens AG

Securely collect, save, and analyze large data volumes in Siemens Cloud for Industry

Data management with added value

Siemens Cloud for Industry

As in many other industrial sectors, digitalization – the integration of real processes in digital models – is playing an increasingly important role in the manufacturing industry. This process generates enormous volumes of data that need to be recorded and analyzed. With Cloud for Industry, Siemens offers a cloud platform that provides added value for the customer through its openness and versatility.

A plant that is able to maximize cost advantages by adjusting its production output to current resource prices without human intervention is just one of the advantages offered by digitalization in production, also called Industrie 4.0. To enable this development, the large volumes of data generated during the production process must be collected, saved, and analyzed in real time and turned into information – so that big data becomes smart data. This in turn allows for a whole new dimension of services that contribute to improved asset management and energy efficiency through data analysis and simulation.

"Three dimensions of openness"

Siemens AG

**Dr. Florian Beil,
Head of Technical Sales,
Customer Services,
Siemens AG**

"Our cloud platform is characterized by three dimensions of openness. This is, first, the OPC-based open interface. All Siemens products, such as controls, converters, HMI systems, and SCADA systems, can be integrated on this basis. However, non-Siemens products can also be connected using this technology, as they are standardized and disclosed via OPC. This means that other partners and even competitors can link up with the Siemens cloud platform. Second, the customer is free to choose where to store the data, whether in a public or a private cloud, or an on-site cloud solution for those customers who prefer to maintain their own cloud infrastructure. And third, we offer an open application framework. Currently, Siemens and SAP applications can be created with it. In the future, the platform will be opened up completely so that customers can also create their own individual applications."

Open IT ecosystem

The foundation for these services is a reliable cloud infrastructure, such as the one Siemens has developed with its Cloud for Industry. This open IT ecosystem is based on the SAP HANA cloud platform, an open platform that customers and developers can use to develop, extend, and operate applications in the cloud. OEMs and application developers can access the platform via open interfaces and use it for their own services and analyses – for instance, for the online monitoring of globally distributed machine tools, industrial robots, or industrial equipment such as compressors and pumps. Using Cloud for Industry, customers are also able to create digital models of their plants with real data from the production process. This allows them to synchronize the model and the plant, enabling them to carry out simulations and optimize business processes. In the future, users will also be able to develop their own web services with Cloud for Industry, which can also serve as a basis for digital services such as predictive maintenance, energy data management, or resource optimization, for example.

High connectivity and security

The new Connector Box, a Simatic IPC–based cloud gateway, makes it possible to easily and securely collect machine and plant data – such as data from PLCs or drive systems from Siemens and other manufacturers – and transmit them to the cloud. The cloud platform can be used by all customers, and even devices by third-party manufacturers can be integrated into the system. In the future, these functions will also be integrated into the communication-capable products of the Siemens industrial portfolio.

Naturally, data security plays an important role in all online transmissions. Encrypted communication as well as the use of certified data centers for processing and storing the data ensure high security. Siemens uses the latest cybersecurity technologies.

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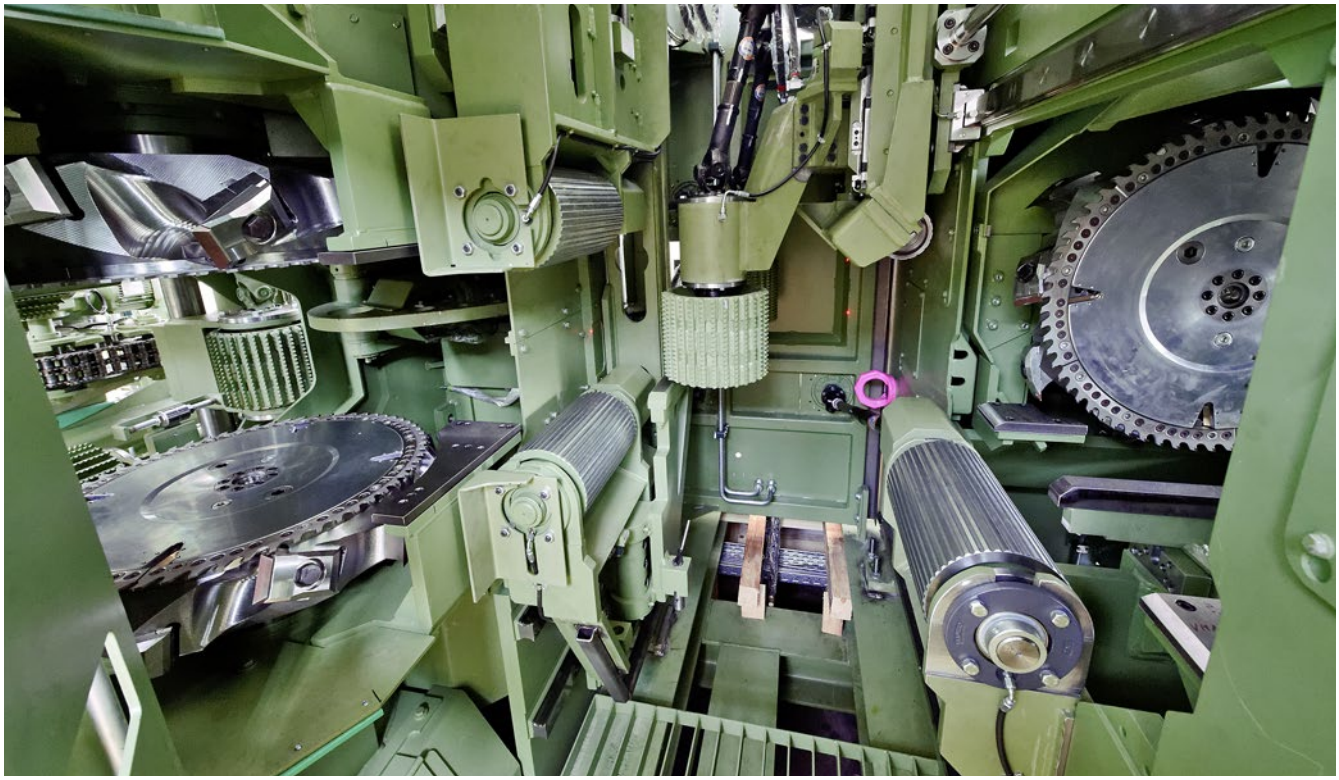
Consistent automation for compact four-edge chipping machine

Perfect log by log

Linck's latest development is a compact four-edge chipping machine for processing small-diameter timber, which can be retrofitted even in existing plants with little space. Equipped with modern control technology from Siemens, the machine ensures continuous log guidance for maximum yield and high scantling quality.



Siemens AG / W. Marschner

Four-edge chipping machine with continuous log alignment

Linck Holzverarbeitungstechnik, based in Oberkirch, Germany, has been an established partner of large sawmills for decades. To survive in the face of intense competition, everyone wants to cut the maximum amount of lumber from every log. Precise alignment and centralized feeding into the first processing unit are crucial for the yield rate to be achieved. The shape of the raw material, such as out-of-roundness and/or bending, must be taken into account in this process.

Linck has developed a solution for processing small-diameter timber, which also fits in plants with little space due to its compact design. The central element is a four-edge chipping machine that works the log from all sides in one pass. An alignment station guiding the log through the chipping machine is part of the set-up. Unlike in conventional saw line feeding, in which the log is first worked horizontally and then vertically by two similar machine groups, the new solution by Linck reduces the overall length by a rotating unit and an alignment unit. This makes the plant a good log length shorter than conventional solutions.

Continuous log alignment – high scantling quality

A master computer calculates the highest scantling yield for each log using laser scans. Depending on the position of the calculated scantling, the log is rotated while being drawn in and aligned exactly to the tools of the chipping machine unit. The

calculated squared beam must stay precisely aligned on the four-edge chipping machine throughout the entire machining pass so that an accurately straight and torsion-free scantling results. During the feeding, the rollers and hook chains must follow the shape of the trunk. Servo-hydraulic drives continuously perform the horizontal and vertical adjustments required for this; the master computer supplies the necessary specifications to the PLC based on the 3D model of the log. "The continuous trunk guidance is what makes this machine so special," explains Andreas Martin, head of the electrical department at Linck in Oberkirch. "This way, we achieve canting-free scantlings in rectangular shape even in a plant as compact as this one."

Efficient engineering framework

The automation of the new four-edge chipping machine and the corresponding alignment station served as a pilot project for the developers to explore the possibilities of engineering with TIA Portal. TIA Portal integrates controllers, converters, motors, distributed I/O systems, and safety functions in one engineering environment and allows users to perform all automation tasks efficiently, thanks to the common data storage and libraryconcept. "You work with a fully integrated tool landscape suited for teamwork and at the same time have access to a complete portfolio of the required control and drive components," says Martin. "This offers us new options to more efficiently and more powerfully design the control and operation of our more complex machines in particular. Plus, we can execute new developments, fulfill customer wishes, and perform commissioning quicker and more reliably with it."

Higher feed rate due to increased computing power

Especially in the new compact machine center, many components must interact perfectly. Linck uses the current most powerful controller of the Simatic family – the Simatic CPU 1518F – for the fast alignment of the log through the continuous adjustment of the horizontal and vertical positions of the feed rollers and the guide rollers parallel to the feeding of the log. "This allows us to achieve good feed rates and to control the entire plant with only one PLC – including all safety functions," Martin explains. The high computing power of the PLC enables up to 150 motor and servo-hydraulic drives to be activated in each basic cycle of the CPU. The power of the chipping machines, driven by four 160-kW asynchronous motors linked to Sinamics S120 converters, additionally ensures the maximum feed rate. Equipping the plant with only one PLC creates a leaner system structure but also requires a powerful distributed I/O system. Linck is using the new Simatic ET 200SP distributed I/O system here for the first time.

Siemens AG / W. Marschner

Linck uses the current most powerful Simatic PLC S7-1500 for controlling the entire plant as well as for all safety functions

Siemens AG / W. Marschner

The new Simatic ET 200SP distributed I/O system – Profinet-capable, compact, and with high connection density – is being used for the first time at Linck in the new four-edge chipping machine

The use of integrated technology is one of Linck's strategies to enable more efficient engineering and to make the machines more powerful and maintenance easier. This is why the company continues to keep a close eye on the further development of the automation systems. "We expect engineering with TIA Portal to be standard at Linck in one to two years," Martin concludes. ■

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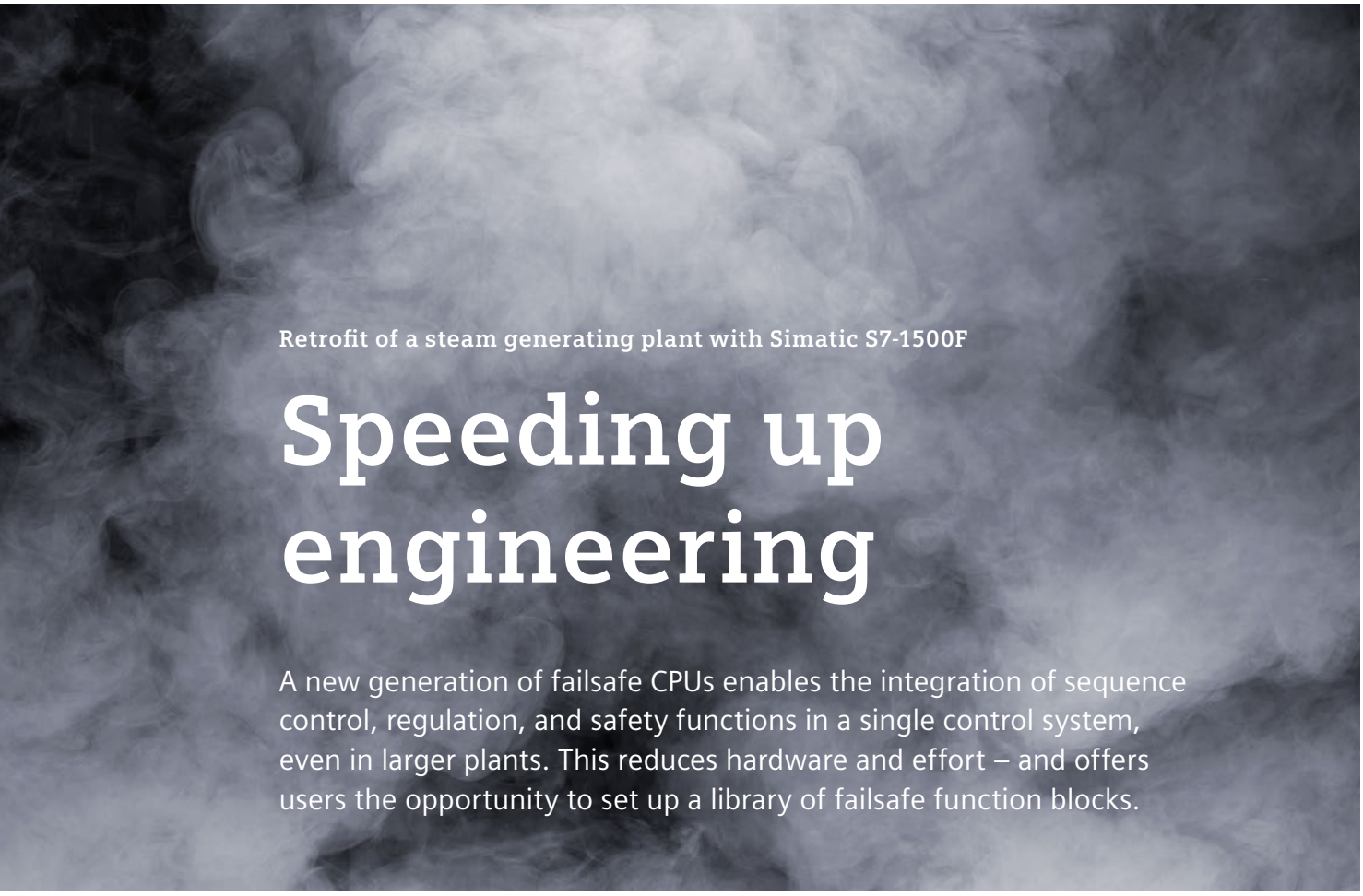


Retrofit of a steam generating plant with Simatic S7-1500F

Speeding up engineering

A new generation of failsafe CPUs enables the integration of sequence control, regulation, and safety functions in a single control system, even in larger plants. This reduces hardware and effort – and offers users the opportunity to set up a library of failsafe function blocks.

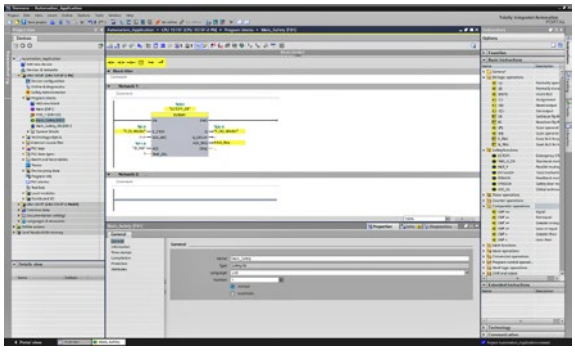
Fotolia / Przemyslaw Koch

The availability of spare parts for the failsafe Simatic control of a steam generating plant commissioned in 1984 was no longer guaranteed, and the plant owners needed to update the automation. Suatec GmbH, the certified Siemens Solution Partner commissioned to modernize the control system, used the new Simatic S7-1500F control system for a future-proof retrofit. "The project gave us the opportunity to transfer our know-how regarding the Simatic S7-300F to the newest control system generation," explains managing director Heiko Scholz.

Integrated sequence control, regulation, and safety functions

The steam generating plant with a redundant design consists of two boilers with identical design and a thermal output of 10 MW each. Each boiler is fueled with an oil/gas burner and controlled separately. In the event of a longer failure, the redundant steam generator is automatically activated from standby operation. The programmers at Suatec had already implemented non-failsafe control tasks and HMIs using the TIA Portal engineering framework. Now, sequence control, regulation, and safety functions could be implemented in an integrated way for the first time in the powerful new Simatic CPU of the S7-1500F series. This reduced the hardware and wiring requirements and standardized the engineering.

Safety engineering as efficient and easy as the engineering of standard tasks: safety-relevant elements are highlighted in yellow in all program segments and editors



Siemens AG

Using the internal Profibus interface of the CPU 1516F and IM153-2 interface modules, both standard and failsafe I/O modules of the Simatic ET 200SP and ET 200MP series were able to be connected. Safety-oriented sensors and actuators are now connected with the control system via Profibus and the Profisafe protocol on two channels. The control system interrupts the start-up in the event of a safety-relevant failure and safely shuts down the plant. The control tasks for steam generation can run in the "not safe" part of the F-CPU. Interaction with the higher-level control system takes place via an integrated Profinet / Industrial Ethernet interface of the F-CPU.

Safety engineering as easy as engineering for standard functions

The engineering framework is expanded by the Simatic Step 7 Safety Advanced V13 option package for the configuration and programming of F-CPUs. This allows failsafe controllers to be managed in the same engineering environment as standard CPUs – with convenient mechanisms such as drag and drop and context-sensitively optimized options. The structure of the safety program and the F-addresses are automatically created and managed in the background when an F-CPU is incorporated. The safety-relevant elements are highlighted in yellow in all program segments and editors.

"We selected the required safety function blocks from our own collection and transferred them to the new engineering system," explains project manager Dirk Tenzer. "In this process, we also used the certified safety elements of Step 7 Safety Advanced V13 and the new functions of the system. Our collection will now grow with each application and accelerate projects." Thanks to the openness of the system, elements can be quickly adapted to individual requirements.

The library concept in TIA Portal allows function blocks or even entire modules to be saved and reused. Program segments declared as function types automatically receive a version number that is automatically increased with each change: Comparing the version is especially helpful during commissioning in online operation, as changes to the offline project can be visualized at any time.

Safely into an innovative future

The advantages of integrated engineering have convinced Scholz: "Switching from PLC to HMI programming under Simatic WinCC V13 and then creating an operator interface for a Simatic TP1500 Comfort Panel with a uniform look and feel lets you reach your goals quicker." In addition, the automatic tracking of variable changes results in project-wide data consistency. This also enabled Suatec to create a detailed diagnostic system for the plant beyond the standardized system diagnostics for S7-1500F CPUs in just a short period of time.

Suatec plans to gradually transfer its library of safety-relevant elements to the new engineering platform and is already considering certification, as this can make the entire process even simpler and faster. ■

suatec.com

Suatec GmbH offers customized control and automation solutions from planning to service. The company, which has 60 employees, specializes in applications in combustion and safety technologies as well as the automation and visualization of plants in municipal and industrial environments.

Solution Partner

Automation Drives

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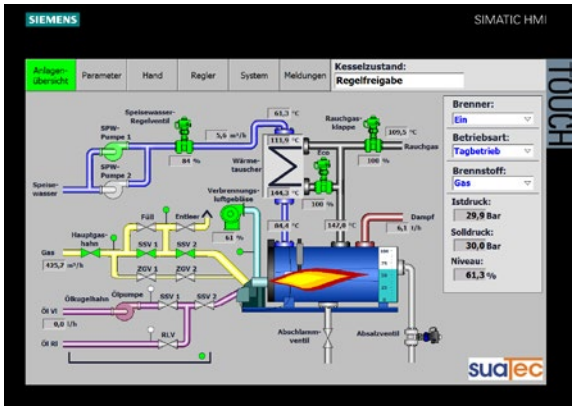

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Plant overview, on a Simatic Comfort Panel, of the failsafe burner/boiler control in a visualization created with WinCC V13 in TIA Portal

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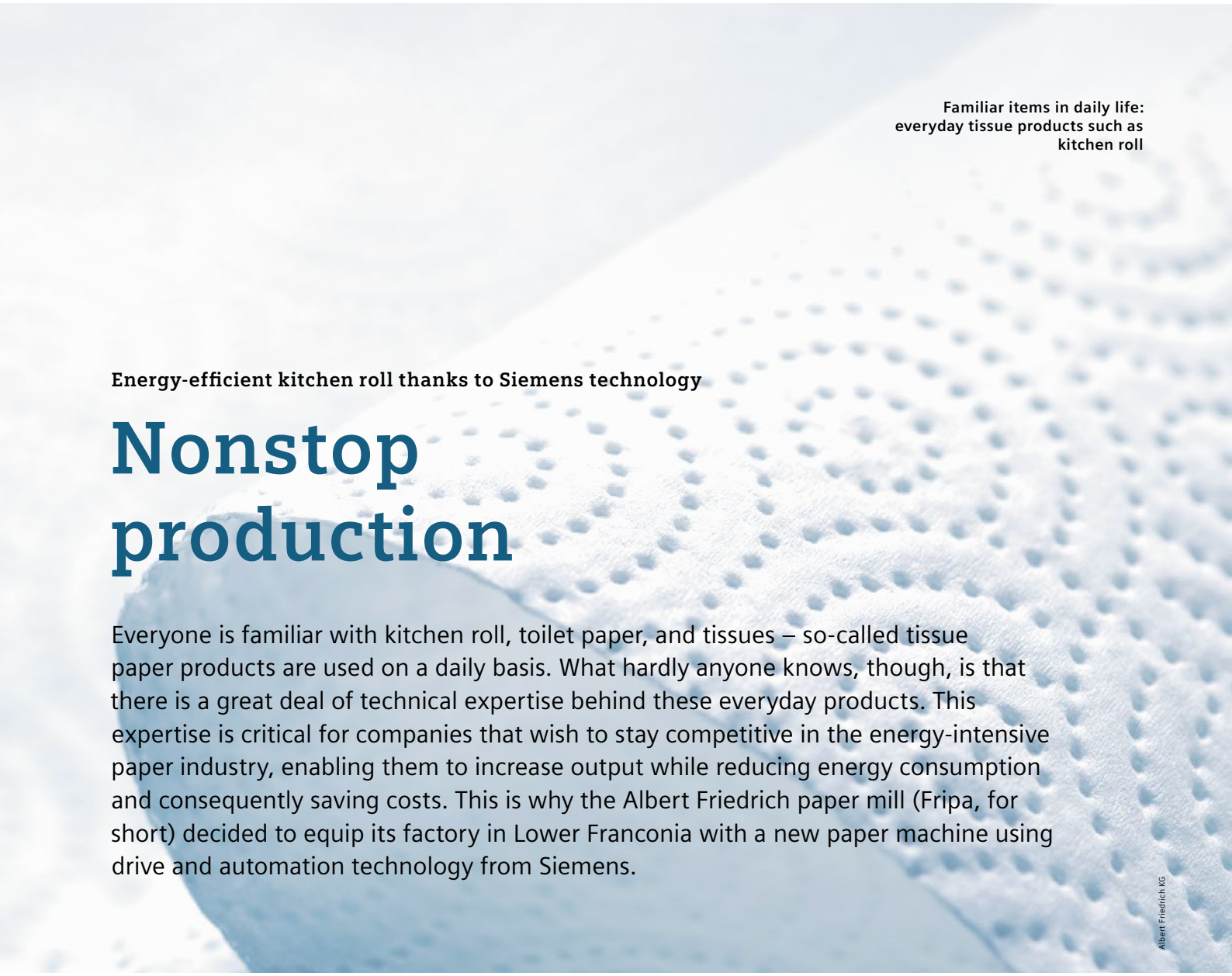

Familiar items in daily life: everyday tissue products such as kitchen roll

Albert Friedrich KG

Energy-efficient kitchen roll thanks to Siemens technology

Nonstop production

Everyone is familiar with kitchen roll, toilet paper, and tissues – so-called tissue paper products are used on a daily basis. What hardly anyone knows, though, is that there is a great deal of technical expertise behind these everyday products. This expertise is critical for companies that wish to stay competitive in the energy-intensive paper industry, enabling them to increase output while reducing energy consumption and consequently saving costs. This is why the Albert Friedrich paper mill (Fripa, for short) decided to equip its factory in Lower Franconia with a new paper machine using drive and automation technology from Siemens.

The paper sector is one of the industries with the highest energy consumption worldwide. Long machine running times and time-intensive drying processes require considerable amounts of power and heat. With constantly rising energy prices, this quickly results in significant costs. In Miltenberg in Lower Franconia, Germany, the Albert Friedrich KG paper mill (Fripa, for short) produces tissue paper products for the German market. Practical items for everyday use are created there, from toilet paper to paper towels and tissues.

To produce these tissue paper products, a pulp bale is first dissolved, and the resulting paper suspension is then spread onto webs. At this stage, the solids content is below one percent. By draining, pressing, and drying the pulp, this proportion is increased to 95 percent – in less than one second. Energy consumption in production plays a crucial role in enabling manufacturers to remain competitive despite rising cost pressures. This is why Fripa relies on energy-efficient technology from Siemens for its new PM7 tissue paper line.

Technology for the paper industry

The new PM7 line in Miltenberg uses the Sipaper line of drive and automation technology products. “Our Sipaper portfolio is a sector-specific solution for the paper industry. This has the added value that the products and services are exactly tailored to the needs of this sector, and we are thus able to optimally support our customers in all matters,” explains Jan Bass, the Fripa contact in end customer sales at Siemens.

From power distribution to drive and automation technology, Siemens sup-

plies the right components – matched to the needs of the paper industry. "With Sipaper, we receive drive components that are already preconfigured for the paper industry. We also have the advantage of only having to contact one company to meet all our requirements for automation technology," says Jochen Giegerich, head of purchasing for technology at Fripa. What he means is that Siemens is the company Fripa turns to when it needs electrical equipment, power distribution and supply solutions with Totally Integrated Power, Integrated Drive Systems (IDS) for machine drives, and process control, including engineering, training, and service.

Sinamics converters, Simotics motors, and Flender gears and couplings are among the Siemens products that have been installed in Miltenberg. The perfect coordination between all the components results in an IDS that allows for high availability with minimized energy consumption. The Simatic PCS 7 process control system simplifies the operation of the entire plant and ensures safe production, thanks to industry-specific automation and control functions. Thanks to the high-quality control, risks such as web tearing or even loss of production are significantly reduced.

Siemens AG / C. Nielinger

The new PM7 line from Fripa in Miltenberg with drive and automation technology from the Sipaper range

Greater productivity – lower costs

With the new line in Miltenberg, Fripa is able to significantly increase its output: more than one million kilometers of tissue are being produced in the new plant per year. That is enough to wind around the earth's equator 27 times. At the same time, Fripa benefits from an increased throughput speed, excellent plant availability, and the certainty of having invested in future-proof technology. All three papermaking machines in Miltenberg are already running with Siemens technology; reliability and a close partnership are highly valued there. "I am especially pleased that everyone at Fripa, Siemens, and Voith who was involved in the project was very committed. We had direct communication channels, we were able to start building the machines within a very short time, and we were able to commission them within the agreed time. Especially when it comes to the collaboration with Siemens, we greatly appreciate receiving everything from one source: from the medium-voltage system to the control system and the drives to the visualization technology," summarizes Giegerich. "As everyone knows, after seven comes eight. We can very well picture ourselves working with Siemens again to implement another tissue machine."

Siemens at SPS IPC Drives 2015

You can experience first-hand the energy-efficient kitchen roll and see how it is produced at this year's SPS IPC Drives. At the Siemens booth in Hall 11 (Frankenhalle) you will find a model that is based on the PM7 used at Fripa. ■

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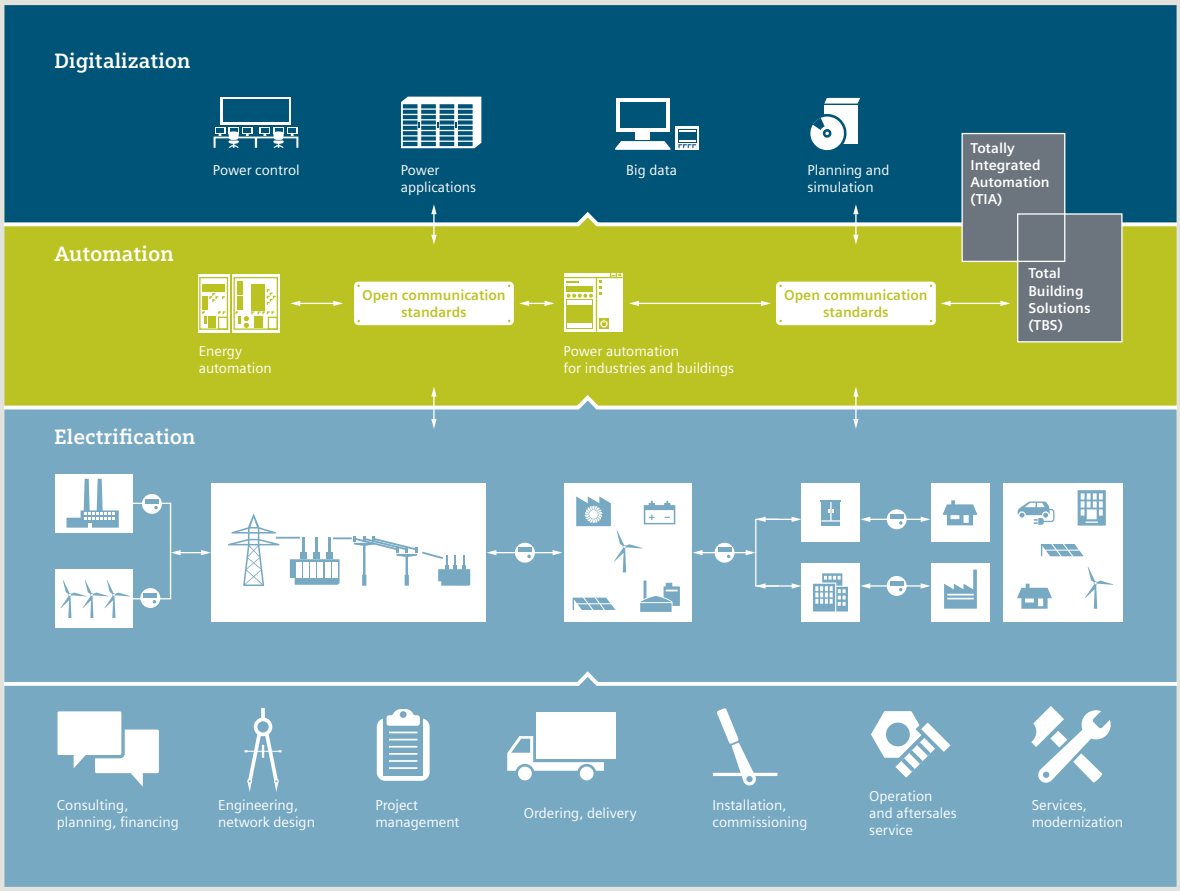
Intelligent power supply for Industrie 4.0

Totally Integrated Power in production



Totally Integrated Power perfectly supports the production process by integrating electrification, automation, and digitalization for efficient, safe, and reliable power supply

Digitalization also introduces intelligence into the electrification of industrial plants. Totally Integrated Power (TIP) for power distribution, combined with industrial automation, shows its full capabilities here and contributes significantly to higher productivity, safety, and efficiency in production.

Producing power centrally and merely distributing it in one direction is a thing of the past. Feeding in renewable energies is making power systems ever more complex, which can affect even the manufacturing industry, for example, due to voltage fluctuations. The mixture of power consumers and power suppliers calls for automation and causes data volumes to rise, while companies, not least for cost reasons, increasingly focus on the efficiency of power supply and consumption. At the same time, the digital networking of machines, products, and information flows is fundamentally changing industrial manufacturing processes, based on a reliable, safe, and efficient

power supply. To tap the full potential of industrial electrical systems in the move toward Industrie 4.0, the systems themselves must become even more digital, flexible, and intelligent.

Threefold integration in digital environments

With Totally Integrated Power (TIP), Siemens has for many years been offering an integrated and comprehensive range of solutions for power distribution in industry and infrastructure. TIP stands for an integrated portfolio of products and applications for high, medium, and low voltage (hardware and software), supplemented by comprehensive services. The concept includes individual solutions for specific areas and sectors, such as the automotive and chemical industries, but also for buildings and data processing centers.

With increasing digitalization and automation, TIP can play to all its strengths, as the comprehensive approach and broad solution portfolio allow for a threefold integration of electrical power distribution systems in digital environments. First, power distribution systems can be integrated into planning processes with the comprehensive spectrum of software and data. Second, TIP also includes communication-capable devices and open interfaces with which the power distribution system can be integrated into the industrial automation system itself. And lastly, the power distribution system can also be included into comprehensive concepts for increased energy efficiency through systems, components, and software for energy data recording.

Concepts for greater transparency and energy efficiency

Energy monitoring systems and measuring devices can interact and communicate via an industrial communications network, which enables condition monitoring and data collection. With communication-capable components from the Sentron portfolio, plant data can be recorded precisely, reproducibly, and reliably. The evaluation of the data in a control room is used for the assessment of plant condition and network quality, but it also enables optimization of power consumption and capacity utilization and the efficient interaction of all components. In this way, digitalization contributes to both increased output and cost savings.

Support throughout the entire value chain

Ultimately, TIP supports solutions for a sustainable increase in efficiency and productivity throughout the entire value chain of electrical power distribution – from planning to operation to future expansion and modernization. One of Siemens' highlight exhibits at SPS IPC Drives in Nuremberg, a Sivacon control cabinet for a production machine connected to its "digital twin," shows how TIP works and how the distribution of electrical power can be integrated into digital industrial processes. Here, virtual control cabinet engineering meets real production automation. With the digital copy of the cabinet that was created during the electrotechnical planning stage, the interaction of electrification and automation components can be simulated and tested in advance. This enables engineers to avoid errors in the real world and allows optimization of the cabinet layout. The real control cabinet shows how the components of the low-voltage power distribution system – for instance, the 3VA molded-case circuit breakers – and the components of the machine control and automation system ensure smooth production processes. ■

TIP in the automotive industry

Current projects in the automotive industry show the advantages of TIP:

- Under the terms of a leasing contract, Siemens installed a complete energy monitoring system in a factory belonging to Gestamp, a supplier of automobile components based in Madrid, Spain. This system collects the energy data of all equipment on-site. The data are sent to a Siemens control center in Seville and analyzed there. Via web interface, Gestamp receives the detailed analysis of all consumption data in real time together with specific optimization suggestions.
- For a new Kia Motors factory in Mexico, Siemens delivered and installed medium- and low-voltage power distribution boards, transformers, and protection and measuring devices, thus achieving the required maximum reliability of the power supply.

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Closer link between production and logistics

Competitive advantage through smart identification

The digitalization of the industrial sector promises process optimizations in production and logistics. Ultimately, this development changes the relationships between companies, as suppliers turn into partners in integrated value creation. Identification technology plays an essential role in implementation of this transformation.

Siemens AG / M. Weinländer

Automatic identification via optical codes or radio is a key technology for managing logistics and production already today

Modern communication devices have intensified global competition. The Internet and e-mail have made markets more transparent than ever before. Information about products and services is easily available, but an alternative provider is also just one click away. Nevertheless, this higher degree of transparency can also be an advantage for suppliers. Just like the customers, the suppliers now have much more information. Companies not only know the technical specifications of competing products but also competitors' prices and terms of delivery. Therefore, the systems generally require meaningful sensor technology to capture changes in the real world in real-time, to digitize the changes, and to make that information available to systems. In the area of the Internet of Things (IoT), this role is often assigned to radio frequency identification (RFID) or optical codes (1D/2D codes).

Implementation in C-Parts Logistics

At Würth Industrie Service GmbH & Co. KG, a supplier of small parts (called C-parts), innovative RFID kanban systems supplement the previous solutions for supplying customers. The company's CPS® RFID system enables the radio-controlled, automatic transmission of article and container data from the customer's production location to Würth's central warehouse in Bad Mergentheim, Germany.

The need for goods is signaled by placing an empty parts container in the RFID pallet box (iBOX®). An RFID reader installed in the box reads the container's transponder data. This enables the clear allocation of customer, container size, filling quantity, and storage location as well as

tracking & tracing of the batch.The data are regularly transmitted to Würth's logistics center, thus ensuring that the orders are processed without delay. "The RFID-supported C-parts management offers the customer a well-organized storage with optimal space utilization, as well as the opportunity to track and analyze all container movements and therefore parts consumption," explains Heiko Ehrmann, who is responsible for software and development at Würth Industrie Service. This solution creates transparency and offers maximum reliability in the kanban process.

RFID reader: integrated antenna with variable polarization

Some technical challenges remain, however. RFID in the UHF range (865 MHz) is suitable as a universal technology for identification tasks in production and logistics. This enables long reading ranges, and the transponders in the form of smart labels are affordable. To simplify the application of RFID UHF technology, Siemens is investing heavily in the diagnostic and commissioning potential of its devices. Ideally, the systems should adapt automatically to changing boundary conditions. To achieve this, the engineers have equipped the Simatic RF685R RFID reader, for example, with an integrated antenna with variable polarization. The reader automatically determines the optimal setting and changes it if radio conditions change. A built-in web server supports commissioning, and diagnostic tools enable the fast detection of deviations.

Additionally, manufacturers of identification equipment are increasingly focusing not only on the devices but also on the system as a whole. Because every manufacturer has thus far implemented its own interfaces, switching to alternative RFID devices is expensive. On the initiative of Harting and Siemens, the identification industry is therefore working on an integration standard for auto-identification systems based on OPC Unified Architecture (OPC UA). The joint working group of the industrial association AIM and the OPC Foundation plans to present the specification at Hannover Messe 2016.

Further development of identification systems

These activities result in an increasingly close linkage between production and logistics – for instance, when just-in-time and just-in-sequence logistics are controlled by production specifications. If a supplier already controls production via RFID labels, it makes sense for cost reasons alone to use the same transponder in temporary storage, loading, transport, goods receipt at the secondary producer, and in the material flow and production control systems.

If, for instance, the transport containers or the actual goods are already equipped with transponders, the locating in a particular space would be a significant additional benefit. This way, search processes would no longer be necessary, and warehouse management would become easier. Equipping the containers or goods with sensor technology is also important in order to monitor transport conditions. And it is only with the option of processing independent rules and making decisions that transponders become truly "smart." This turns a workpiece into a component that can make decisions on its own and thus control itself within certain limits. ■

Siemens AG / W. Geyer

Würth Industrie Services offers an RFID-based kanban system for small parts

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Siemens AG / M. Weinländer

Even manual processes can be optimized with identification – for example, the monitor-guided final assembly of the RFID readers in the Siemens factory in Karlsruhe

"RFID is a lever for Industrie 4.0 – beyond production"

Interview with Herbert Wegmann, General Manager Industrial Communication and Identification at Siemens, about the role of RFID technology.

Mr. Wegmann, RFID is part of the "digitalization of industry." What strategic approach is Siemens pursuing in order to drive this initiative forward?

Traditionally, the focus has been on discrete manufacturing, but today we aim to introduce RFID into other industries and processes as well. It is clear that digitalising processes and information is of interest to more than a single industry. The trend toward Industrie 4.0 is also being discussed in the process industries. This is why we continue to drive digitalization beyond discrete manufacturing.

What importance does RFID have in the context of Industrie 4.0?

RFID is an enabler of Industrie 4.0: the concept of the "digital factory" affects a product from creation to simulation to its physical realization. Industrie 4.0 requires technologies for identifying semi-finished workpieces, toolings, containers, and machinery as well as communication technologies for the digital transmission of data between machines or factories.

What markets does Siemens address, and how great is German companies' interest in RFID solutions?

We increasingly address applications that are not exclusively characterized by PLC control technology. In the automotive industry, for instance, RFID – especially UHF technology – is transitioning into the supplier industry. Today there is increasing interest in other industries too in intelligently optimising entire processes. In breweries, for example, secondary functions such as cleaning and repairing the barrels are managed and controlled by RFID. And it makes sense to include all partners along the value chain in the inventory monitoring. New business processes are emerging as a response to ever closer process integration, and these are much more effectively managed with RFID.

What synergies result for companies that rely on code-reading systems and RFID as part of their automation strategy?

The pharmaceutical industry shows how synergies from code-reading systems and RFID technologies are effective across the entire value chain. A technological switch or transition in the chain even makes sense in order to implement a complete track & trace. This starts with the optical identification of imprinted capsules, continues with the external packaging, and extends all the way to tracking with RFID. It does not matter which components are used for the connection to the MES or ERP system.

How do you manage to serve a wide range of industries, and to what extent can processes and RFID systems be transferred?

Companies that are familiar with RFID know very well how to design their processes. For less experienced RFID users we offer advice in identifying any weak spots and help in designing their processes. Many of the processes

Siemens AG

Herbert Wegmann

in discrete manufacturing can be transferred to other industries or applications. For example, in trade logistics, RFID processes are now being rolled out to other locations, often using blueprints. The new generation of RFID readers using UHF technology now incorporates the intelligence required for highly variable and flexible configuration of functionalities to meet process requirements.

The initial RFID hype was followed by five weak years. Where is the technology today?

We have seen very satisfactory growth rates. Therefore, we are also investing strongly in research and development. UHF technology in particular has developed significantly. Today, UHF data storage units with capacities of 4 KB enable the storage of much larger data volumes and allow faster data access. And the third generation of UHF readers also has much more intelligence integrated.

From Solid Edge to cutting edge: Ross Robotics CEO Philip Norman on the future of robotics

The art of invention

Ross Robotics CEO Philip Norman honed his draftsman techniques with pen and paper. The former artist is now using Solid Edge from Siemens PLM Software and has been awarded multiple patents for his designs.

Siemens AG / Andreas Artz

When Antoni Gaudí was designing the Church of Colònia Güell in 1898, he created an inverted model made of string, weighed down with birdshot, to visualise its majestic catenary arches. It is one of the earliest known and most striking examples of parametric design.

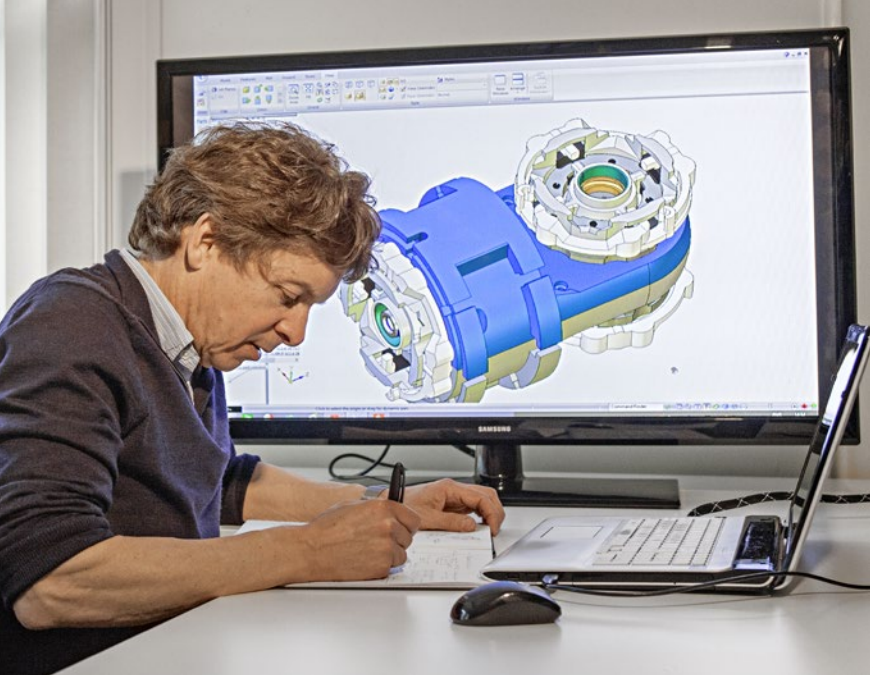
Artist and inventor Philip Norman, the founder of Ross Robotics, is not designing a cathedral upside down, nor is he using string. He is equally versed in parametric design however and like Gaudí, he is planning to stand something on its head: in his case, the world of robotics.

Although he uses computer-aided design (CAD) software – in his case, Solid Edge from Siemens PLM Software – for a long time he did indeed use, if not string, then a pencil and paper and even on one occasion wood and a chisel; as an artist, these things come naturally.

Philip Norman has worked as a builder, caricaturist, ceramicist, children's book illustrator and now Director of Research and Development at Ross Robotics rolled into one. His restless creativity and constant desire to perfect his designs have cost him a comfortable life in the south of France as he pursues his vision – and it has not always been an easy journey.

A large family of patents, a robot he created that is operating in the largest particle physics laboratory in the world at CERN and an elegant simplicity to his design that belies years of trial and error are testament to his efforts however; and as remote sensor and battery technology develop, his modular, reconfigurable, plug-and-play robot platforms look increasingly prescient.

During a visit at his offices just west of London, he highlighted the importance of his background in



Siemens AG / Andrea Artz

Restless Creativity – Ross Robotics' Philip Norman at his computer

art in his engineering design: "Artists spend a lot of their time in a state of misery trying to work out things, and they put up with a lot of failure. In most other walks of life, that's not permitted. If you're in business, in banking, in engineering, you can't have all that failure. Artists will scrap 98 % of their work but be very happy when that 2 % really works."

So how and when did CAD become part of this process? Mr Norman laughs: "I had been hand-drawing some designs and showed them to an engineer friend at a party; he thought I should learn Solid Edge. I was enjoying the evening and largely forgot about it, but he was the kind of person whose idea of fun was taking his multivitamins, so at about 12:30 in the morning and still very sober, he opened his laptop and insisted he walk me through the program!"

He adds: "What has kept me a captive customer of Solid Edge and what keeps coming back for more, is that you can design the thing in 3D, analyse it, test it, put it together and keep modifying it in real time; learning as you go. Basically it becomes an extension of your brain. You can export files then have them manufactured immediately from your laptop; do analytics on a particular part. It's a very dynamic, very sophisticated program and I probably don't use a fraction of all of its capabilities."

Making Modular Machines

So what, exactly, has Mr Norman created? His scalable robotics platform is based around a clever 3D modularity, a coaxial physical/power/data connector – just plug and twist to connect power and data streams - and a number of clever biomimetic traction devices that allow Ross Robotics' robots to scramble through dense brambles, up and down stairs and even swim. He sees potential for their application in relief work, in the oil and gas industry or in security, among just a few sectors.

With the rise in availability and fall in costs of remote sensing devices that can monitor anything from air to soil to water quality, high resolution cameras or any other form of application, the platform is fundamentally adaptable to whatever a customer would want from it and designed to be both operable by untrained specialists and – again taking lessons from nature – engineered to ensure "graceful degradation" or the ability to maintain functionality even when a part been destroyed.

One, heavily modified – as the robots are designed to be – is operating at the largest particle physics laboratory in the world for the European Organization for Nuclear Research, known as CERN. Mr Norman explains: "The Large Hadron Collider totals about 50 km of tunnel built in the sedimentary rock floor of the valley just outside Geneva and there is a very large amount of sophisticated equipment down there that needs to be monitored and maintained by robots rather than people."

"Some parts of the Collider, especially when it is operating, are no-go zones for living creatures, either because of the background nuclear radiation or because of the magnetic fields which are, as far as I am aware, the strongest on the planet. Our robot system is largely non-metallic and non-magnetic as it is built using a hybrid plastic / non-magnetic metallisation process and can operate in extremely harsh conditions such as those found in the Collider."

He adds: "CERN have performed some specialised engineering work on our system to further harden it for their environment (certain components and types of circuitry do not tolerate their environment and CERN has a very good understanding of what is required). One of our robots has performed remote monitoring in the CMS experiment – this is the experiment that captured the Higgs Boson – equipped with cameras, LiDAR scanners and a number of other specialised sensors. The robot is now autonomous and can therefore operate without requiring a human controller."

The Building Blocks

This journey all started with his frustration at the limited nature of his children's construction toys.

Mr Norman, who was raised in Zambia, was living in a barn he had converted into a family home near Toulouse at the time and a passion for tinkering and building meant games soon lost their charms.

Taking one of the deceptively simple basic building blocks in his hand, Mr Norman does his best to explain its complexity: "I wanted to design a single, three dimensional part that could physically connect with and lock to others on the X, Y and Z planes without any impasses in assembly."

He continues: "What was really difficult to crack was the exact geometries and the math in it. After a lot of trial and error and frustration, I started realizing there was a kind of underlying logic to my design geometrically. Later, we discovered there was actually, it's kind of fractal, with two graduations that work – one of them being the golden mean of 61.8 % and the other being 100 %."

The language granting Mr Norman his first of many patents gives a flavour of the design – and the complexity: "[The connector member] constitutes a basic member of the construction set capable of being used, as a result of simple assembly, to create complex volume shapes ...

"The assembly created between the shaft of the adapter member and the axial hollow cylindrical zones made in the bases of the connector member constitutes a connection of the sliding pivot type allowing a reversible assembly. The axial connection between two connector members or between one connector member and an adapter member thus permits the pivoting, thus providing possibilities of kinematic rotation for the assemblies created using these two members."

The Rise of the Robots

The journey has not always been smooth, as Mr Norman is the first to admit, but although it is early days for his company, the potential is huge, as the need is also great: "If we think about what's going on technologically, we're right at the cusp of a time when a lot of contributing technologies – from micro-processing to new energy storage technologies have grown up dramatically in the last decade.

"So, a lot of what we're using is actually very mature; but what seems to have been missed is something that brings this together in a compelling format. It wasn't considered sexy in the robotics world to make platforms. It was much sexier to write AI or make very clever sensors... I started out from modularity, then I had to make a connector that didn't exist, because there was nothing on the market that did what was needed.

"Repositionable connectors that you can snap data and power cables onto even while wearing think gloves for example have huge potential in the field; for bomb disposal, search and rescue or on oil rigs. Say you're a fire man and you need to snap an air sensor or a camera onto a robot fast; with our products you can just plug and play. It's basically kids play, but it's also very sophisticated. So, we're trying to bring these two elements together. It's kindergarten meets cutting edge technology." ■

Philip Norman with his iBoid surveillance robot

Siemens AG / Andrea Artz

Author: Ed Targett

Ed Targett is a freelance journalist based in England. His news reports have beed published and broadcast in a number of media outlets, including the BBC, the Daily Mail, South Korea's Yonhap News Agency, Yahoo! Asia, and others.

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Robot programming time drops by up to 50 to 70 percent

Less time to the field

Deere & Company / Publicis Pixelpark

John Deere is a leader in the market for round balers

Thanks to the implementation of an easy-to-learn and use robot installation, lead times were reduced and minor changes no longer required so much time at a John Deere plant in France. The factory is now even more productive and the plant manager is planning the next steps for the robotic processes.

John Deere Usine de Arc-les-Gray, a subsidiary of Deere & Company, is a factory in a region of France with deep farming roots. The factory, which is spread over approximately 14 hectares (35 acres) and has 440 employees, manufactures round balers, square balers, mower-conditioners and front-end loaders for tractors. The plant exports its products to more than 70 countries, primarily in Europe but also to the United States, New Zealand, Australia and Japan. "Our factory has a very wide international footprint, but it is based on a strong local foundation," says Sylvain Munier, the factory's manufacturing engineering manager, explaining that the factory's origin dates back to 1848 and the Thiébaud family's harvesting equipment business.

John Deere is a leader in the market for round balers, as well as a major player in the other areas such as mower-conditioners and front-end loaders. "The spirit of innovation is very present at our site," Munier explains. "During the last ten years, more than 245 patents have been filed to protect our products and our technology. A new, unique type of round baler, which offers a very real increase in productivity, is protected by more than 30 patents."

Very short timeframe demands offline programming

The operations performed in this factory are primarily sheet metal laser cutting and bending, as well as manual and robotic metal inert gas (MIG) welding of chassis parts, drawbars, rotors and other components, and painting and assembly. Currently the factory operates 25 industrial robots, but this number grows annually as the product line expands. "At the end of 2013, we introduced a new round, fixed-chamber baler in the 400 series that needed to be ready for delivery at the beginning of 2014," says Munier. "This project involved the installation of three new robotic units."

The tight deadline for the new baler left an extremely short timeframe between the delivery of the new robots and the beginning of production. Waiting for the arrival of the robots to begin programming would have been impossible since the welding programs were relatively complex, with cycle times of 45 minutes to an hour. "The window was much too short. We only had three months to begin production," recalls Munier. "To speed up the process, we planned on offline programming the robots, before even installing them," Munier adds. But at the time, the factory had no offline programming software. They did have an extensive digital factory environment consisting of computer-aided

design (CAD), computer-aided manufacturing (CAM), and plant design and manufacturing simulation software. “At John Deere, all software is managed on a worldwide basis. It conforms to the John Deere standard,” Munier explains. “The company has been using product lifecycle management (PLM) products from Siemens PLM Software for a long time.” These include FactoryCAD software and FactoryFLOW software, both in the Tecnomatix portfolio.

Choosing a programming solution

An ad-hoc task force was formed that included the factory’s own specialists as well as representatives from other John Deere plants. Munier particularly wanted input from the welding and sheet metal competency center at John Deere’s headquarters in Moline, Illinois. Other members of the task force included representatives from John Deere factories in Moline and Horicon, Wisconsin that were already doing offline programming of robots, and the John Deere design department in India. The task force looked at all the potential suppliers within a week. Three were selected for comparison testing that included use on an actual robot installation. Siemens PLM Software’s RobotExpert in the Tecnomatix portfolio best met the selection criteria, and John Deere signed a contract for the worldwide use of RobotExpert with floating licenses.

RobotExpert proved easy-to-learn and use. A new hire, just out of welding school, succeeded in modeling a robot installation and creating a part program simply by using the online tutorials and the demo version of the software. Today, two robot programmers create their programs using the software rather than by guiding the robot’s arms physically step-by-step.

Benefits of deploying RobotExpert in the virtual factory

Lead times at the factory have been notably reduced now that it is possible to prepare the programming without waiting for the robots to be installed. In the past, a week was needed for manual robot programming, with point-by-point learning using the robot’ teach pendant. Using RobotExpert, that time has been reduced to two or three days, which includes a day at the most for physical tests and final touch-ups.

In the design of new products, the use of RobotExpert enables John Deere to practice concurrent engineering. Manufacturing processes can be simulated as soon as the 3D design models are ready. It is now possible to discover manufacturing problems, and to choose welding robots, their capacities and the number of work- stations, very early in the development cycle. In addition, RobotExpert allows for preliminary studies aimed at defining best production processes, estimating the exact level of investment needed, obtaining good estimates of costs and validating the factory’s production capability.

“With existing robot installations, a minor change to a part no longer requires a long break in production to reprogram the robot,” notes Munier. “All that is needed is to prepare the program virtually, and then to stop production briefly to load and validate the program.”

The factory is controlling more of its existing robots with RobotExpert, starting with the most-used. Munier is now planning the next step, which is the dynamic simulation of robotic processes to analyze and optimize the flow of parts into the shop. He explains, “After that, we want to simulate an entire and more complex robotic production process, combining several collaborating robots: welding robots, bending robots and handling robots. The ultimate objective is to use robots programmed to produce a completely finished part, ready to be used.” ■

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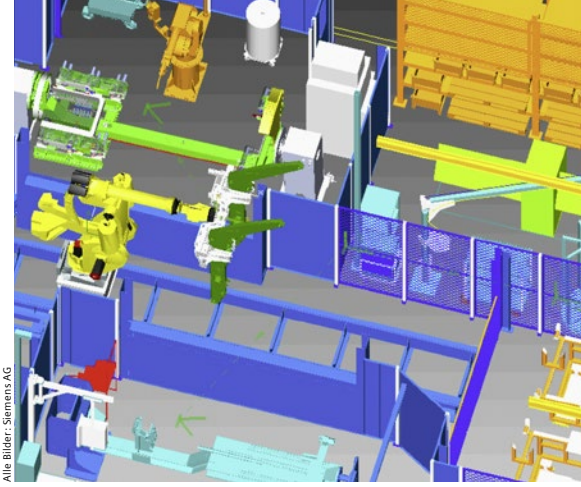

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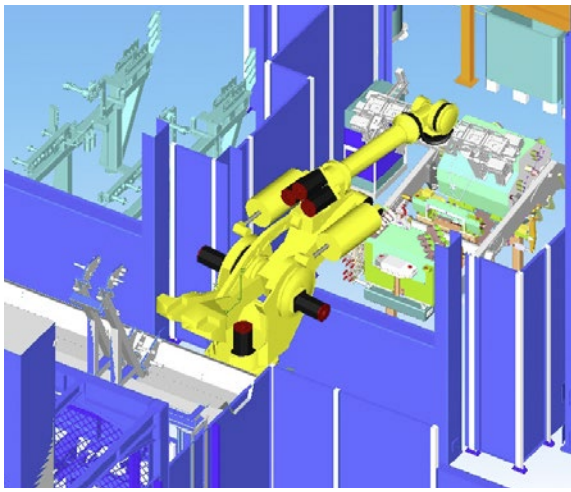
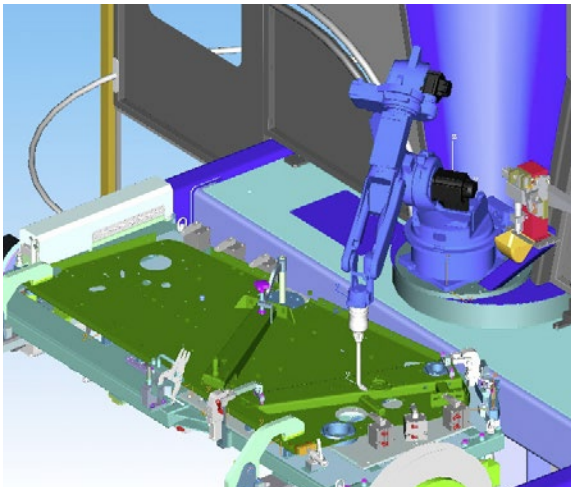
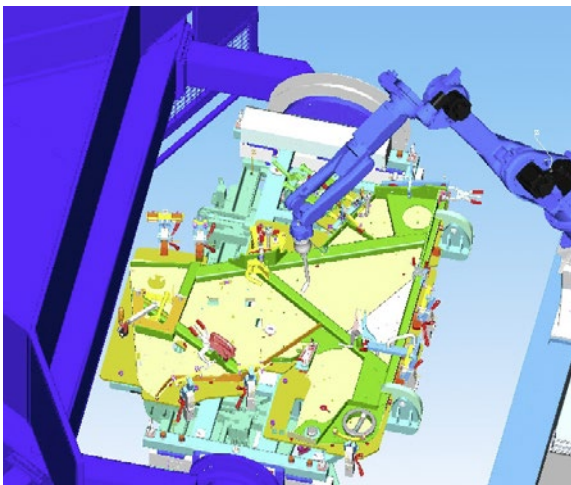
Offline robot programming using RobotExpert

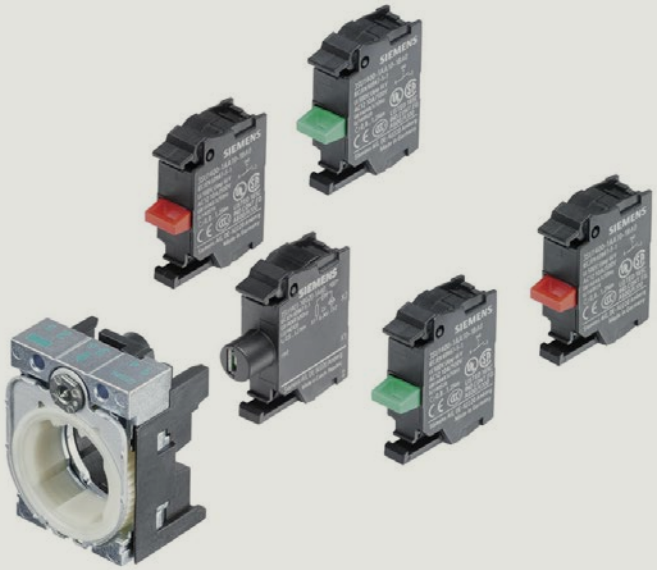


Handling robot: gripper design validation



Validation and programming of welding process





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New command and signaling devices in precision machine tools

Quick installation of attractive switches

The new Sirius ACT command and signaling devices offer a number of advantages, as one of the first users confirms: the company uses innovative push buttons, switches, and potentiometers in precision turning machines.

In addition to simple operation and a high degree of precision, Weiler Werkzeugmaschinen GmbH, based in Emskirchen, Germany, places a great deal of importance on equipment and design for the Praktikant VCplus and Condor VCplus precision turning machines. Since the summer of 2015, the machines have used command and signaling devices from the Sirius ACT portfolio. “The series convinced us as a technically, visually, and economically interesting alternative to the previous solutions,” explains Armin Daum, head of electrical engineering at Weiler.

Rugged components in a well-thought-out design

High-quality plastics together with a solid stainless steel front ring result in high media stability. Due to the rugged design in protection type IP69K, the components offer increased protection even during high-pressure steam cleaning, as well as protection from dust, oils, lyes, and other extreme environmental influences. The comprehensive portfolio also impressed Daum: “Now we can choose from four design lines and have the guarantee that the products will be available for years.” Especially in series machines, a standardized look and familiar operation are important selling points. One thing that enthuses the head of electrical engineering is the lighted selector switches, which allow the switching state to be seen much more easily and from a much greater distance, thanks to the integrated LED.

Modular design plus simplified assembly

A special assembly system allows the modular design of push buttons and switches, making all the components much easier to install. For example, the push buttons can be inserted into holes without grooves in such a way that they no longer fall out during one-handed assembly. The counter piece is pushed on from behind and connected with a simple positioning screw using a screwdriver. This also results in 100% anti-twist

»The new command and signaling device series is a success in terms of both construction and aesthetics.«

Armin Daum, Head of Electrical Construction, Weiler Werkzeugmaschinen GmbH

Siemens AG

protection. Sheet metal thicknesses of 1–6 mm provide for a wide application range of the new series. The devices are optionally also available with ATEX certification for use in potentially explosive areas.

Flexibility with individual combination options

The experts at Weiler see another advantage in the fact that the contacts can be flexibly combined. For example, it is possible to plug three modules next to each other onto the counter piece and two behind each other. This way, NO contacts and NC contacts can be freely configured, making it easy to multiply contacts. One good example of the design improvements is the potentiometers on the turning machines for spindle and feed. Previously, they required labor-intensive soldering; today, with Sirius ACT, they can be easily connected via a screw connection.

Sirius ACT: Advantages at a glance

- Choice of four modern design lines: black plastic, plastic with matte stainless-steel front, high-gloss metal, matte and flat stainless-steel front
- Safe and easy handling: one-handed assembly with a simple round hole without a groove, audible locking in place of the components, and durable anti-twist protection
- Extremely rugged construction for high availability: almost the entire portfolio in protection type IP69K, and exceptionally high material durability
- Minimized wiring requirements for the devices' communication links via AS-Interface, IO-Link, or Profinet
- Simplified engineering thanks to the online configurator that provides descriptions with precise order numbers for complete control panels

In Daum's view, the key-operated switches are also very rugged and "solid," as he calls them. On the two precision turning machines, about a dozen push buttons, switches, and potentiometers are neatly arranged on an aluminum board that Weiler obtains completely ready-made from Siemens and that is connected in one simple step to the machines' electrical system via a central plug. "This solution is very convenient and at the same time economical for us," Daum says.

Online configurator makes selection easier

Those who prefer to assemble their own control panels receive support. An online configurator makes it easier to select and order the panels. Users have a choice not only between plastic and metal versions but also in terms of the type of signal transmission to the machine control system: in addition to the standard wiring option, the command and signaling devices can also be connected with minimized wiring requirements via AS-Interface, IO-Link, and Profinet. "The components are well thought out with regard to both quality and construction, are priced attractively, noticeably significantly simplify installation, and look good," Daum summarizes. With the consistent look, the modular design, the various configuration options, and the online configurator, the new series offers a number of advantages compared to the previously used products, convincing Weiler to switch. ■

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Intelligent financing models for Industrie 4.0

Flexible financing of digitalization

Digitalized processes and procedures combined with energy-efficient machines and plants enable companies to increase productivity and efficiency, which in turn leads to higher cost savings and a more competitive position. Siemens Financial Services helps companies invest in modern and efficient technologies with customized financing solutions.

As the "fourth industrial revolution" brings about the transition to the digitalized factory, many industrial enterprises today must purchase new machines and plants or upgrade existing ones. However, funds for new investments are often tight, and traditional bank loans are not always flexible enough. Flexible financing models, such as those offered by Siemens Financial Services (SFS), are an alternative. These include solutions based on the total cost of ownership or on performance, special financing models for energy-efficient technology such as energy performance contracting, and continuous financing solutions with predefined options for subsequent investments that may become necessary due to technical progress. These flexible models allow for predictable payments over the contract period and permit the term, frequency, and amount of payments to be adjusted according to the individual needs of the company.

Successfully tried and tested

A number of companies in the manufacturing and mechanical engineering industries are already benefiting from this flexibility – for example, OHL Gutermuth, a manufacturer of industrial fittings based in Altenstadt near Frankfurt. This midsize company was able to install a Siemens-controlled UniSpeed 6T universal machining center for large parts, from the Swabian machine builder SHW Werkzeugmaschinen (SHW WM) based in Aalen, without a long lead time because SFS quickly provided long-term financing via hire purchase. SHW WM was so impressed by the straightforward financing model that the company now increasingly works with SFS as a partner for sales financing.

The EMAG Group based in Salach, near Göppingen, wanted a long credit period for the purchase of technology for its machines and manufacturing systems. As with many companies, liquidity was an issue because goods and components from suppliers must be paid for immediately, while sales of the finished products show up on the books only months later. SFS acts as an intermediate, called a finetrader, that first buys the required technology and then sells it on to EMAG with a term of payment of several months. This way, EMAG has been able to significantly reduce the capital tied up in its current assets. ■

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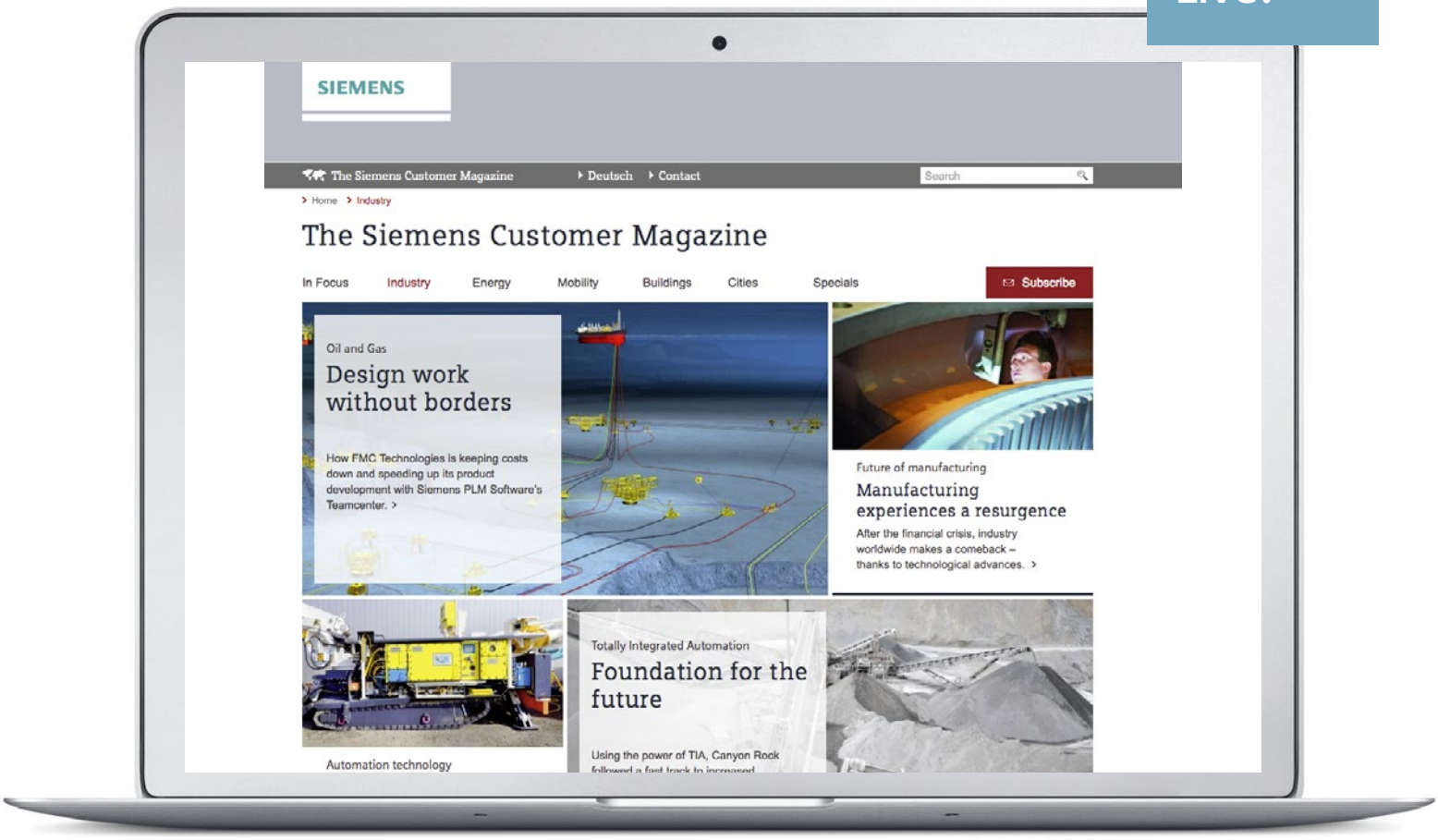

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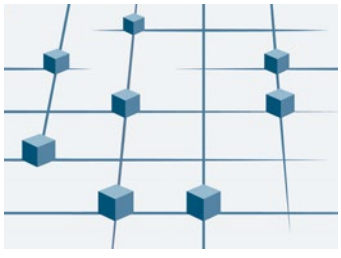
Efficient automation starts with efficient engineering

Totally Integrated Automation: Efficiency driving productivity.



Totally Integrated Automation
Efficient interoperability of all automation components

Efficient engineering is the first step for making things right: faster, more flexible, and more intelligent. Totally Integrated Automation saves time in engineering as a result of the efficient interoperability of all components. The result: lower costs, faster time-to-market and greater flexibility.

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