

News for the **Digital** **Enterprise**

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DIGITAL ENTERPRISE

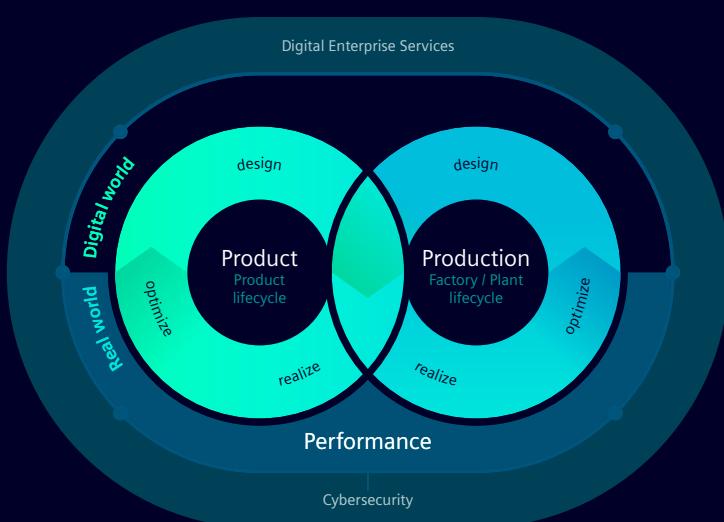
Accelerate your digital transformation to become a **Digital Enterprise** now

The industrial world is facing rapidly changing challenges. Our resources are finite and we all need to make smarter decisions to reach our sustainability goals faster. Digitalization and automation are the game changers to meet these challenges on the way to Industry 4.0. It is essential to collect, understand, and use the massive amount of data created in the Industrial Internet of Things (IIoT). The Digital Enterprise is doing exactly this by combining the real and the digital worlds. As a result, the infinite amount of data allows us to use our finite resources efficiently and with that make the industry more sustainable.

The industrial world is facing urgent challenges, including disrupted supply chains and cost pressures and demands for efficiency, faster innovation cycles, high-quality products, and greater flexibility. Above all, there's the pressing need for sustainability. As a result, complexity has never been greater in the industrial world. It's essential for companies to collect, understand, and use the infinite amount of data created in the Industrial Internet of Things (IIoT). This paves the way for them to become Digital Enterprises that can use our finite resources more efficiently and make industry more sustainable.

Dream it? Make it!

Combining technologies from the digital and the real worlds through our comprehensive digital twin approach enables the integration of the entire product and production lifecycle. Thanks to multi-level cybersecurity concepts for industry, the use of data is comprehensively protected from the shop floor to the top floor of a company. It allows you to design, simulate, test, optimize, and validate products, machines, lines, plants, and factories in the digital world and make them faster and more efficient and sustainable. The result is a continuous loop of optimization, from designing a product to realizing and optimizing it with performance data. All of this enables companies to exploit previously unrecognized potential and find solutions that seemed unimaginable not long ago. In other words: If you can dream it, you can make it. >



Siemens Industrial IoT – The convergence of IT and OT

To become a Digital Enterprise, connecting Information Technology (IT) at the office and management level with Operational Technology (OT) at the field and plant level of production is essential. This IT/OT convergence enables to collect the huge amounts of data generated in the Industrial Internet of Things (IIoT), understand correlations, and leverage potentials.

Become a Digital Enterprise faster with Siemens Xcelerator

Siemens Xcelerator is our easy, flexible, and open digital business platform that helps our customers innovate faster and ultimately become Digital Enterprises.

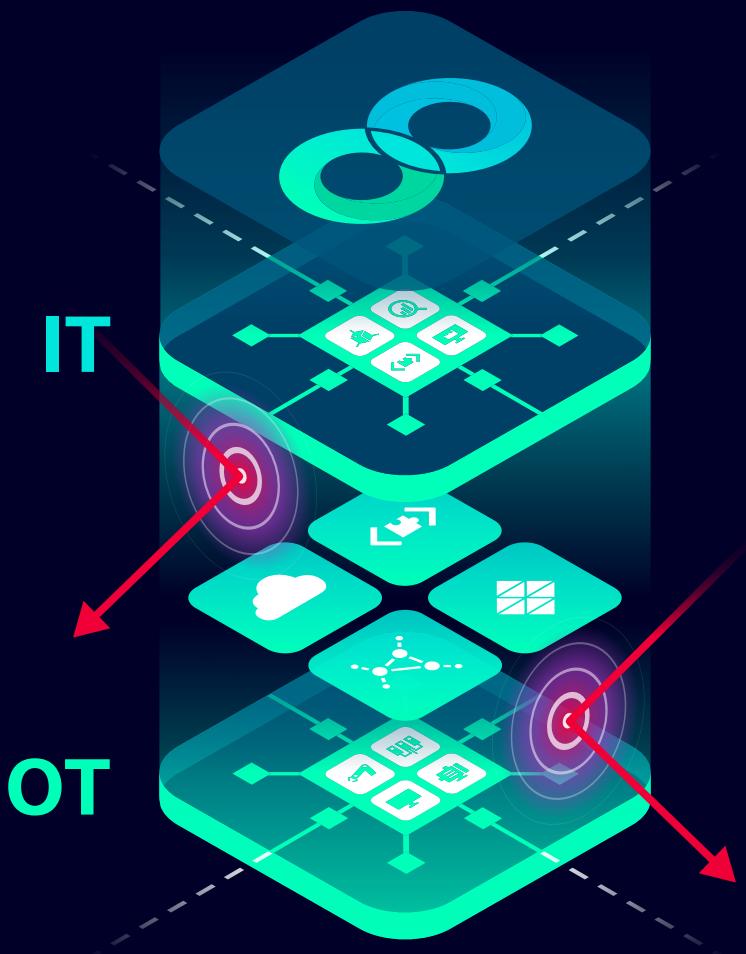
It comprises three elements:

- a curated, modular portfolio of software and IoT-enabled hardware built on standard application programming interfaces and a variety of services from Siemens and certified third parties
- a growing ecosystem of partners
- and a marketplace to explore, educate, share, and purchase alongside a community of customers, partners, and experts.

Supporting you to become a Digital Enterprise

Moreover, the service experts from Digital Enterprise Services are here to help you from the beginning to the end of their digital journey and focus on the individual needs of your Digital Enterprise. ■

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THE SMART FACTORY IN THE MACHINING INDUSTRY

The key to greater **efficiency** and **flexibility**



With today's highly optimized automation processes and physically perfected machines, how can even more productivity improvements be achieved in the machining industry? The Smart Factory approach enables industrial operations to give efficiency in their factories another powerful boost. The transition to a Smart Factory can be made in either large or small steps.

To begin with, you can make your shop floor more efficient and improve its performance without needing to invest more in the IT infrastructure. In the overall manufacturing context, Siemens offers entry solutions to leverage productivity right at the machine tool level, with no need to network your machines or take further action.

One example of an easy step toward developing a Smart Factory is feed rate control. The Optimize

MyMachining /AdaptiveControl application optimizes current cutting parameters in real time and automatically adjusts the feed rate to the ideal setting. That speeds up the process, if the machining conditions will permit it, and slows it down when geometry, material hardness, or tool condition indicate caution. Grob Systems Inc. – a developer of highly innovative production and automation systems – opted for this application to find out what savings they could achieve while leaving their process intact. Using a high-end Sinumerik CNC, the software was very quickly and easily installed on the machine. By using Optimize MyMachining /AdaptiveControl, Grob was able to reduce cycle time by around 18 percent, protect its cutting tools from breakage, and improve tool service life – all while maintaining workpiece quality.

Greater productivity with digital resource management

With a little more investment in IT infrastructure, manufacturing businesses on their journey to becoming a Smart Factory can start applying practical approaches: for example, digital resource management, which uses process data from the machine to reduce setup time, increase transparency, and improve tool and machine capacity.

W. Andreas Pfeiffer – Maschinen- und Apparatebau, an SME in the manufacturing industry faced the challenge of having to integrate different IT systems in its office and shop floor and implement deep integration at the controller level. Thanks to an integrated NX CAD/CAM-CNC chain using Sinumerik and shop floor optimization using Manage MyResources, the company benefited from a 30 percent reduction in capital costs for tools, reduced setup time at the machine, less >

time spent searching for tools, improved tool service life, and a 40 percent reduction in programming time. As a result, Pfeiffer improved its productivity by five percent.

Higher productivity and quality using edge and AI

An important success factor for a Smart Factory is the use of real-time data from the shop floor. Using Industrial Edge for Machine Tools, companies can enjoy benefits such as reduced throughput time in CNC manufacturing, systematic quality improvements, and increased efficiency. Here is a practical example from the Siemens Electric Motor Factory at Bad Neustadt: The shop floor at Bad Neustadt contains a production cell consisting of a machine tool and a robot system for loading and unloading the machine. The local team uses the edge app Protect MyMachine /Setup to identify components and place them in the machine tool in the correct position. The position of the work-piece is determined by state-of-the-art camera systems and immediately compared to reference images by the edge app. The systems learn by themselves, with assistance from AI, and provide valuable information to help improve efficiency on the shop floor. This means that clashes in the machine tool and resulting damages are prevented and automatic setup processes can be implemented. The Analyze MyWorkpiece /Monitor app is used in the Siemens Motor Factory to monitor process quality in the machine tools. This allows detection of anomalies such as inclusions in a thread that occur regularly in die-cast aluminum parts. The system automatically separates out the parts in

question, reducing costs and manual overhead for quality control. Documentation on high-quality batch production is supplied to the customer with their products.

Flexible solution from a single source

Companies enjoy many benefits from being able to develop their Smart Factory in both large or small steps. And by opting for Siemens as their partner, they get the complete solution for improving efficiency and flexibility on the shop floor from a single source. ■

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ID LINK

The “online profile” for products

The ability to access relevant information and data plays an important role throughout the entire value chain, but making data accessible at any time and from any location is often difficult in actual practice. This is where the ID Link comes in. This QR Code from Siemens is enabling its customers to completely digitalize their existing processes for product design and use.

Outdated information, incorrect information: There are several reasons why customers today are spending 80 percent of their time searching for relevant, up-to-date information on a specific product for their maintenance or service workflows. Thanks to the new, unique ID Link on the product, customers can access a product's digital nameplate. But what is behind the digital nameplate? The Industry 4.0 platform defined the specifications for the Asset Administration Shell (AAS) concept. The AAS guarantees access to all product information so that products can be organized in the digital value chain. One of the central components of the AAS is a product's digital nameplate, which can be used to access all the relevant information on a product's use and classification – comparable to a product pass or an online profile.



Simple, standardized, and time-saving

Siemens is already using this digital nameplate in the form of a standardized ID Link that corresponds to the new IEC 61406-1 international standard. The ID Link enables manufacturer-neutral interaction and ensures widespread use by customers. For example, the ID Link provides information that is always up-to-date and findable, from manuals for reducing downtime during a failure to technical data for planning. The ID Link also makes it possible to uniquely identify devices for inventory, eliminating the need for time-consuming manual entry by serial number. Even maintenance logs and warranty claims are easily organized. The QR Code can be scanned by a standard smartphone or automatically on a large scale by cameras in logistics facilities. >

A professional for processes

Many customers are already actively requesting the ID Link. For the process industries in particular, it plays an important role because it is one of three central concepts in the Digital Data Chain (DDC): automatic and unambiguous identification of physical objects (ID Link), structured documentation of product information, and product data exchange via cloud-based platforms. Customers benefit from shorter search times in maintenance and repair workflows, which results in significantly reduced costs. Various stakeholders can easily and seamlessly exchange product information within an ecosystem – across the supply chain and throughout the entire lifecycle. Last but not least,

the seamless traceability of all plant components and the manufacturer-neutral digitalization of the Asset Administration Shell are guaranteed.

A vision becomes reality

Whether in the process or discrete industries: by using the digital nameplate as part of the Asset Administration Shell, Siemens is helping its customers realize their vision of a digital twin in a consistent, end-to-end digital value chain. What is more, this combination already meets the EU's future requirements for a digital product pass (DPP), making it future-proof. ■

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- Technical data
- Certificates
- Manuals
- Mall
- and much more

INDUSTRIAL ARTIFICIAL INTELLIGENCE AND EDGE

Entering the future **with** **customized solutions**



To enable manufacturing companies to remain viable into the future, it is important that their production facilities continuously adapt to future developments. Thanks to a combination of industrial artificial intelligence (AI) and Industrial Edge, these businesses can now create a more efficient and reliable structure.

Automation engineers and plant operators have access today to numerous innovative solutions and tools they can use – even with no expertise in machine learning (ML) or familiarity with AI – to ensure system stability and security.

Executing and managing AI models

For companies that want to bring AI to the shop floor but also want to avoid high implementation costs and maintenance efforts, the AI Inference Server is the perfect solution. AI Inference Server is an edge application that standardizes AI model execution on Industrial Edge, facilitates data acquisition and orchestration of the data traffic, and is compatible with powerful AI frameworks thanks to the embedded Python interpreter.

Simultaneously executing and managing currently running AI models is costly and time-consuming. AI Model Manager, which is independent of the cloud provider, will make this task easy to perform in the future. Users just have to download the relevant AI model from the cloud, and they can then integrate AI models more quickly and easily in the shop floor.

Simplify the development and operation of ML models

Can ML models be generated and validated in a short period of time? The AI Software Development Kit (SDK) makes this possible. It contains project templates that provide notebook-based workflows for training AI models, package them, and test the packages. This allows users to generate standard packages that can be used on Industrial Edge and Simatic S7-1500 TM NPU.

Monitoring multiple production lines at the same time using AI solutions is challenging for operators. Because more and more ML models are being used for different AI applications, the work is becoming increasingly complex. And AI solutions also require extreme reliability and availability. AI Operations Services monitors ML models during operation, issues an alarm in the event of an error, and actively manages malfunctions if there is a failure. This substantially reduces the operating effort involved in working with AI solutions in manufacturing. Early problem detection and fault processing that makes an instant recommendation for corrections reduce operating costs and minimize manual effort. ■

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INDUSTRIAL GESTURE CONTROL

Touchless interaction between people and machines

Especially in production areas, system interactions are only feasible to a very limited extent. In environments with special requirements, there is usually some distance that has to be traversed to make operator entries, which takes unnecessary time. That is why touchless machine operation using gestures offers unimagined potential.



Controlling devices via voice assistance has become commonplace and is most frequently used in private homes – but it is often difficult to rely on voice commands in industrial environments. In these settings, the method of choice is a gesture-

controlled HMI that allows users to easily bridge the distance from the operator hardware to the machines. Touchless machine operation is also simpler and more hygienic.

One example of a gesture-control application is manual quality control. Operators can very easily provide feedback from their workstation using hand gestures (thumbs up, thumbs down) without having to first walk to a panel. More complex actions such as navigating between a close-up screen view and one from a distance are also possible. When operators are farther from the panel they need less information, but it needs to be enlarged.

Gesture training and detection using AI

Gesture control gives machine operators a lot of freedom because there is no defined repertoire of gestures. Each person can train their own gestures to fit the application – and the technology used to train and detect gestures is machine learning (ML). In gesture training, a machine with learning capability collects the gestures that are used to train the neural network, and the data is evaluated via the edge app. For gesture detection, a video stream records the gestures and transmits them to the HMI. ■

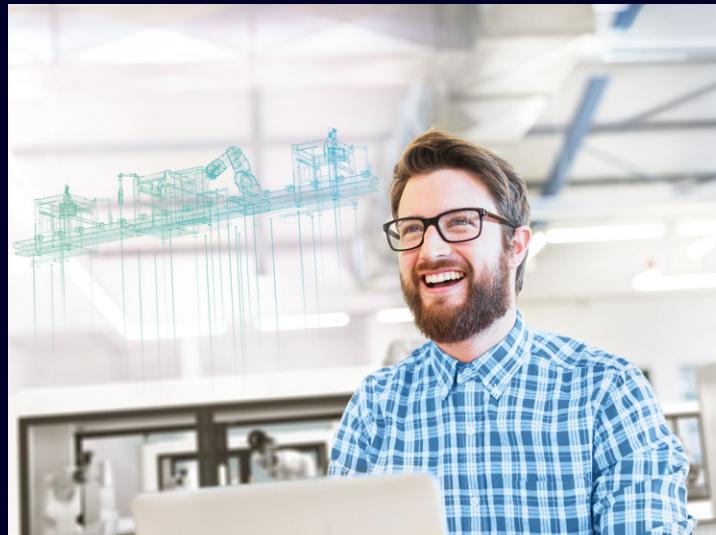
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SIMULATION FOR AUTOMATION

It's really time to **simulate**

Sustainability, customization, digitalization, changes in the labor market, and growing pressure due to global competition are all challenges confronting machine builders and manufacturing companies today and having a tremendous impact on their operations. Simulation for Automation helps them meet these challenges.

The dominant megatrend is sustainability. Today the need for sustainable and resource-saving production that minimizes the ecological footprint of goods and services is universally acknowledged. That is why industrial enterprises have to optimize their resource consumption. On the other hand, consumers increasingly expect that a product or service will be specifically tailored to their needs and requirements – and this boosts the importance of customization in production. Manufacturing companies have to produce a large number of products on short notice and in small quantities without sacrificing quality. Given these circumstances, companies can remain competitive only if they reduce their costs for the design, construction, and testing of production plants. One of the keys to more efficient production is digitalization: However, many companies are initially skeptical when facing the major challenges of implementing technologies such as edge computing, artificial intelligence, and simulation, especially when their existing solution often appears to fulfill its purpose. All of these requirements are compounded by changes in the labor market. Fewer and fewer skilled workers are available who can handle today's increasingly complex systems and technologies – and who also expect a high degree of flexibility from their employers. At the same time, global competition is becoming fiercer and faster, which in turn increases the pressure to adapt and use new technologies.

**Simulation across the entire value chain**

Along with efficient engineering, standardization, and many other factors, Simulation for Automation helps meet these challenges. In order to test and optimize their machines, production cells, and production lines in virtual environments and fully exploit all the resulting benefits, users can take advantage of simulation in conjunction with the digital twin – not just in the engineering and implementation phases but also across the entire value chain. Simulation offers them new opportunities for acquiring detailed insights into workflows as well as knowledge about the behavior of their processes down to multiphysical variables such as pressure, temperature, and flow.

Implementing of virtual sensors

Using a virtual sensor or executable digital twin makes it easy to measure physical variables without expensive real sensors to optimize control strategies before production – and even to measure the “unmeasurable.” With the help of Simcenter Amesim, users first create a multiphysical model of the process – for example, pressure or temperature – in the virtual environment and then validate whether the digital twin represents >



reality. If necessary, virtual optimizations can be performed. Users then transfer the simulation model to the LiveTwin app that is running on an Industrial Edge device connected directly to the machine. LiveTwin ensures that the virtual model runs parallel to actual operation and supplies the necessary automation values. Along with a virtual controller such as Simatic S7-PLCSIM Advanced, the virtual sensor serves to optimize the automation program. At the real machine, the Industrial Edge device is connected to the real controller and the virtual sensor supplies the relevant calculated values during ongoing operation. Thanks to the comparison of reality with the virtual model, users require fewer costly real sensors and also obtain higher-quality products.

Simulating behavior of switching devices

Virtual sensors are just one option for using the simulation portfolio: Other simulation tools enable many different types of simulation. For example, Sirius Sim can be used to simulate the behavior of low-voltage switching devices. With the new interface to the Simit simulation platform, it is now also possible to use 3RW55 soft starters and 3SK2 safety relays in complete automation projects. In addition to the behavior of the switching devices, all interactions with other components in the plant can be consistently simulated using the digital twin. ■

› siemens.com/simulation

IT/OT INTEGRATION

The foundation for the **digital transformation**

The connection between a company's IT and OT networks is the basic requirement for advancing digitalization. End-to-end solutions from IT (information technology) to OT (operational technology) are driving digitalization forward and enabling customers to achieve market maturity more quickly with the help of new technologies that increase productivity and sustainability.

When manufacturing companies talk about the future, they often envision autonomous production units or even fully autonomous factories with self-organizing systems and collaborative robots. But these concepts remain mere visions if the companies cannot ensure data transparency from the shop floor to the IT level. Without data, every orchestration system, from a traditional MES or ERP to advanced AI, is "blind and deaf" – meaning nonfunctional. Basically, there is no data-based decision-making without data. This applies to all systems that support human decision-making with data.

A prerequisite for a successful data exchange is the convergence of IT and OT. IT systems comprise servers, storage, networks, and other devices for executing applications and processing data, and they are the basis for data-centered computing and ERP and PLM systems. OT systems include machines, electromechanical devices, and other industrial equipment as well as automation and control systems for monitoring events, processes, and devices in companies and industrial workflows. Until now, very little meaningful data could be gathered because these two environments largely operated separately. In addition, employees with different capabilities were required. Today, IT and



OT are drawing closer together. Advanced data analysis tools and machine learning applications on the OT level, big data analyses in the cloud on the IT level, and the vertical and horizontal networking of production elements allow the digital information environment to see, understand, and influence the physical operational environment. When implemented correctly, IT/OT convergence can combine business processes, knowledge, and inspections in a single uniform environment.

Think holistically, start small

Do I need to reduce operational implementation costs? Increase production performance? Improve regulatory compliance? The importance of an IT/OT integration project for companies depends on the anticipated added value. When implementing proven IT/OT solutions, it is helpful to approach the customer's challenges from different perspectives and to start small and intelligently, without losing sight of the big picture. Sometimes the right choice is a slightly more costly standardized solution that will allow users to run additional applications on the same platform in the future. However, there is more than one way to implement >

an IT/OT integration solution. Genuine added value comes from an end-to-end solution based on three steps: That is the only way to make full use of the data and exploit the entire potential of the IT/OT integration project.

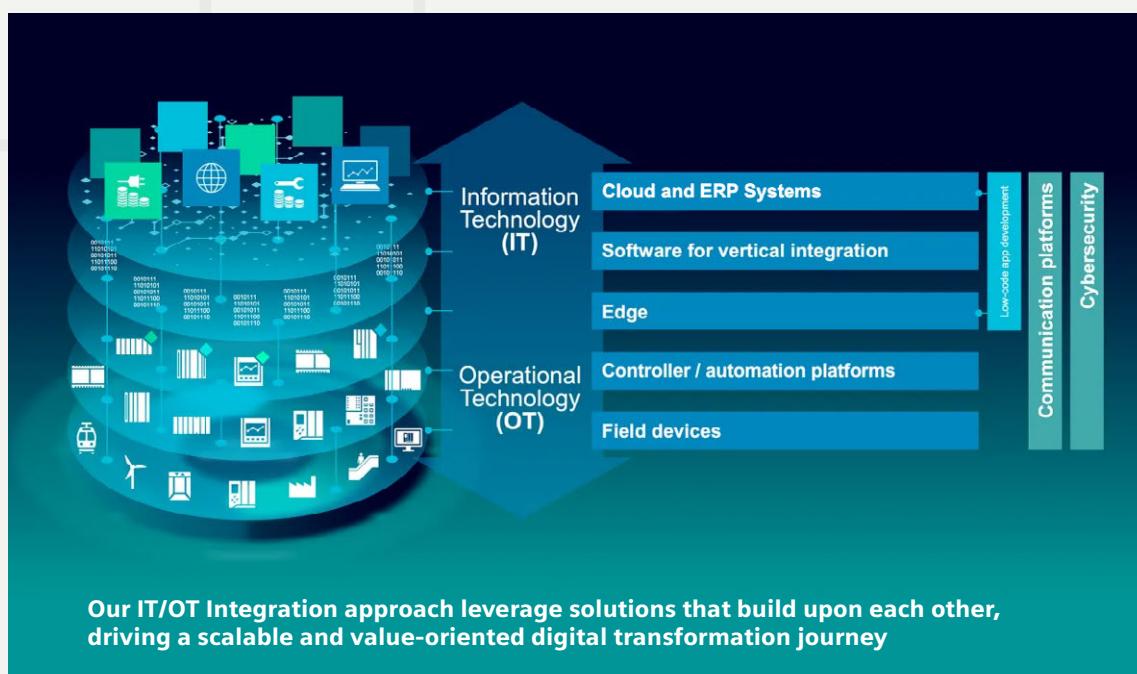
In the first step, connectivity and security solutions are developed that provide access to all the sensors, automation systems, machines, and processes necessary for acquiring and supplying the relevant measurements and data. In the second step, solutions are generated for harmonizing, supplying, and contextualizing the data from plants and automation systems. A number of systems can be used for the IT/OT infrastructure depending on the installed base and customer requirements, including traditional SCADA systems such as WinCC Unified and edge computing platforms such as Industrial Edge. The third step provides solutions for evaluating and improving processes and workflows in

the cloud or on-site, such as analysis apps and software (MindSphere, Mendix, Opcenter, Teamcenter) or ERP systems such as SAP.

IT/OT integration in practice

One example of an application for integrating OT and IT is traceability, which makes critical parts of the user's value and supply chains transparent by creating a sort of digital life story of their products. Certifications and verifications are important when specific products or their status need to be documented: for example, to comply with rules and regulations. Traceability enables companies to trace data and acquire insights into a product's health status and information on its use. These are just some of the ways that traceability improves efficiency and boosts sustainability potential. ■

› siemens.com/integration-it-ot



EDGE COMPUTING

Fully exploiting the potential of data with the IIoT

In all companies, huge amounts of data lie dormant and unused. At the same time, machine and process data provides tremendously valuable insights – if it is used. Edge computing makes it possible to collect, consolidate, and process production data – locally, decentrally, and in real time.

Edge computing with Industrial Edge starts with optimally collecting, structuring, harmonizing, and potentially storing locally a wide variety of data from production machines, IT systems, and other sources. The data is then evaluated: for example, to optimize the production process or maintenance

window or to make the entire production process transparent. The Italian-Dutch chewing-gum and confectionery manufacturer Perfetti Van Melle introduced an Industrial Edge solution for identifying and correcting the causes of existing productivity losses. Thanks to vertical integration from the shop floor to the ERP system, precise details on the machine status can be displayed at any time, and energy consumption data and the maintenance status can be recorded. This is how the company boosted its productivity and quality and reduced plant downtime.

Industrial Edge can be used to create transparency, and it can also implement advanced systems for AI-supported self-optimization. For example, ➤

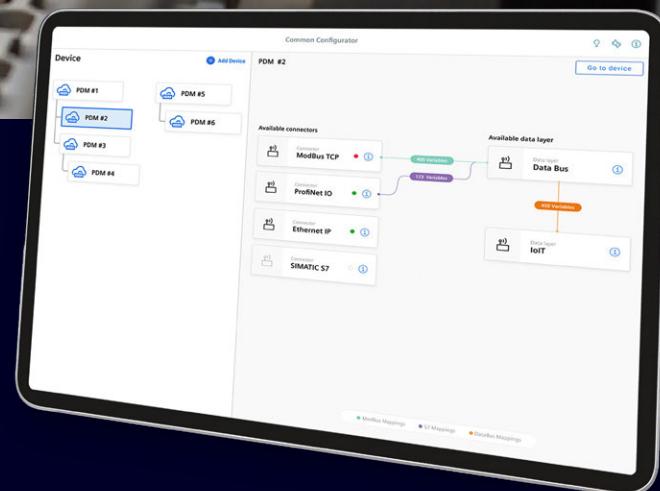




Hansa Klimasysteme GmbH uses the LiveTwin edge app for smart climate control. LiveTwin allows users to integrate simulation models in automation via edge devices which allows the company to perform predictive control. In the third step, Industrial Edge can be used to thoroughly analyze the data and link it to higher-level systems such as SAP and cloud systems. This helps companies achieve a better integration of their IT and OT networks to increase efficiency across the entire value chain.

Store for software and services

In the Industrial Edge Marketplace, users can find a rich selection of ready-to-use apps, including edge apps for processing, visualizing, and analyzing data as well as connectivity for applications such as condition monitoring and predictive maintenance. Using the central Edge Management System, IT administrators can make such apps available to production systems and can also deploy applications that they have developed themselves.



Data management for the future

With the Industrial Information Hub (IIH), Siemens is creating a data management platform for agile and autonomous production plants. Utilizing semantic data models, production data from the entire company can be collected, thereby paving the way for digitalization. Thanks to this one-stop solution for data management, users can employ the IIH to lay the foundation for the adaptability and expansion of their digital factory. ■

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EFFICIENT ENGINEERING

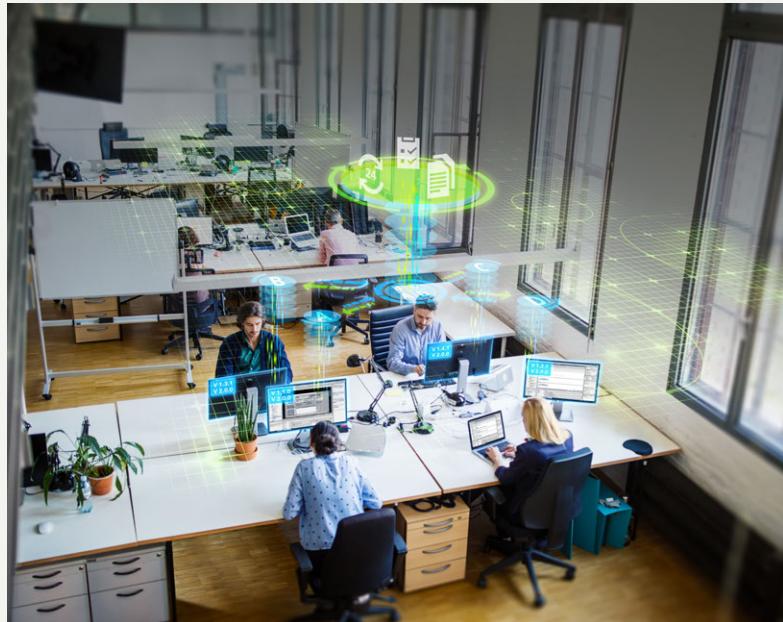
Optimally equipped for the transformation

Machine builders today are facing greater challenges than ever before. To survive fierce global competition, they need to forge new paths in manufacturing – and increasing engineering efficiency plays an important role. Efficient engineering is based on TIA Portal.

The challenges confronting machine builders today are shaped by three megatrends: Rapid changes in customer demands and in trends are making global markets more and more volatile and dynamic. The result is a demand for a shorter time to market and extreme flexibility in production – including increased customization down to batch size 1. The industrial transformation is also being driven by new technologies in the digitalization environment such as the Industrial Internet of Things (IIoT) and autonomous factories. Another factor is the transformation of the labor market. Many machine builders are already experiencing difficulties finding workers skilled in automation, and today's university graduates are more likely to specialize in IT than in electrical engineering. The result is high investments in education and training and a long familiarization period. Given these challenges, how can companies survive in the global market? Efficient engineering performed by highly qualified engineering teams has considerable potential.

Efficient engineering in automation

When it comes to engineering in machine building, the amount of time spent on repetitive, manual, routine tasks and on coordinating the processes of different disciplines is often underestimated. This is time that engineers could otherwise spend on their own creative and innovative work. Add to



this the fact that unforeseeable faults during commissioning frequently delay the market launch of a machine or plant and can also result in a significant increase in project costs.

Automating routine tasks and using reusable machine modules and components free up valuable resources for employees, save a tremendous amount of time, and reduce the risk of error. Another important approach for boosting efficiency is to parallelize work processes in engineering. When all departments and engineers can access a shared database and use standardized exchange formats to simplify the coordination of their work, this significantly minimizes development processes. What is required is a cross-discipline collaboration platform and the standardization of processes and data in reusable libraries. These libraries of tested, standardized, and reusable software modules improve software quality and simplify the design process for modular, flexible >

machines. New features can easily be added as modules without interfering with other features. A library of standardized components also helps engineering teams automate tasks and processes. It lets them generate hardware configurations as automatically as program modules and HMI interfaces.

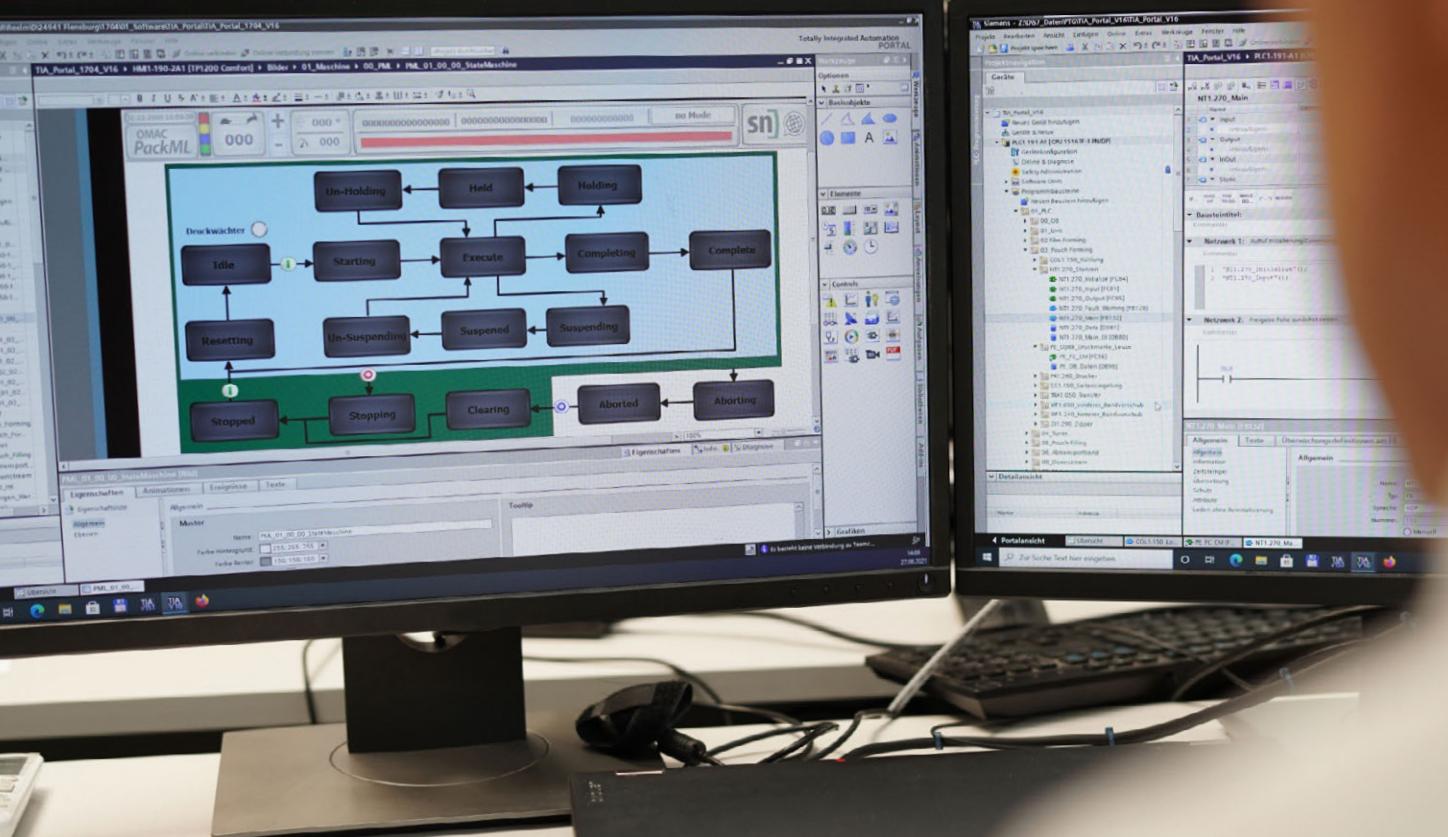
TIA Portal as a comprehensive framework

TIA Portal assists users in managing the challenges involved in efficient engineering. This uniform, open, and comprehensive framework for industrial automation provides all the essential elements and tools for digital engineering and covers the entire machine lifecycle, from planning and engineering to simulation and maintenance during ongoing operation. During the design phase, for example, TIA Portal enables faster parallel work by making mechanical and electrical data available to all employees on the engineering team using specific exchange formats. It also creates stan-

dardized, reusable components or modules in libraries with versioning to be used in programming and visualization. Workflows for generating complete applications can be automated to a large extent, all the way to simulation and parallel commissioning.

In addition to the basic features, TIA Portal also offers numerous options that allow users to expand and supplement the framework according to their individual needs. The most recent addition to the framework, Simatic AX, enables users to integrate modern programming methods into automation. It also lets the new generation of university graduates generate libraries using the high-level languages they are familiar with from their studies and make these libraries available for use by automation engineers in TIA Portal. ■

siemens.com/tia-portal



DIGITAL TRANSFORMATION OF OPERATION AND MONITORING

From visualization to **vertical integration**



The digital transformation of the machinery and plant construction industry calls for a high level of standardization, efficient engineering, transparent machine and production data, and easy IT/OT integration. The Simatic WinCC Unified visualization system was designed specifically for these demands.

Industrial applications are becoming increasingly multifaceted, which requires the use of flexible hardware and software systems for all kinds of platforms and areas of application. The Simatic WinCC Unified system was developed for all industrial applications and enables users to efficiently create their own visualization standards.

Consistency between different platforms and a high level of user-friendliness make work easier for developers and operators in equal measure. Something that was developed for a WinCC Unified station can be utilized on any other WinCC Unified device, regardless of screen dimensions. This helps create future-proof applications for panel to PC-based solutions that are scalable and open for expansion. The zooming and decluttering functions now allow operating concepts to be developed that can either reveal or hide additional detailed information, depending on the zoom factor.

Many industries – the packaging and automobile industries, for example – require not only a graphic HMI display but also physical controls that provide access to important functions. It is for this specific purpose that Simatic HMI Unified Comfort Panels PRO provides sturdy, standardized hardware with comprehensive protection to the IP65 level. Flexible assembly options enable machine-level installation using a pedestal or support arm, and a wide range of controls can be flexibly modified to suit individual operating requirements with minimal wiring effort: using card readers, for example, to provide convenient registration via user cards based on the RFID standard.

The right information for everyone – anywhere, any time

Depending on the task, users need to be able to access machine and system data from anywhere and at any time. It is hugely important in this →

regard to ensure very secure web access in addition to high flexibility in issuing access authorizations. Flexible remote access via any HTML5-based browser is included as standard with all Simatic HMI Unified Comfort Panels and WinCC Unified PC systems. Another function is the ability to link images and alarm information between different WinCC Unified devices. This Collaboration option allows, for example, displaying alerts from remote machines or lines locally, so users can respond to events more quickly.

Easy and flexible IT/OT integration

To ensure future-proof visualization, it is crucial to have reliable data sharing across standard inter-

faces between the shop floor and the IT landscape. With version V18, WinCC Unified now offers powerful and flexible web-based access to data and alerts from PC stations thanks to GraphQL. Required data can be easily and securely exchanged across networks using IT applications, with no need for domain-specific expertise. The process can use programming languages that are in common use in IT, including Python, Jupyter, and Node-RED. The result is extremely high-performance communication, because data from several sources can be accessed with a single query in real time. ■

› siemens.com/wincc-unified-system

SIMATIC WINCC UNIFIED V18

Visualizing **the future**



The latest web and edge technologies combined with open interfaces: Simatic WinCC Unified allows mechanical engineers and plant manufacturers to meet the challenges of digitalization with ease. With the Simatic HMI Unified Comfort Panels and the PC-bases Simatic systems, users are already benefitting from the high performance offered

- **Integration of various applications and platforms** such as IP65, Hygienic Design
- **Standardization of user interface** using faceplates
- **Remote access at the panel and PC** via HTML5-based web clients
- **IT/OT integration via the standard interface GraphQL**
- **Reduced carbon footprint** thanks to Energy Suite

by the visualization system. The new devices in protection classes IP65 and IP69/shatterprotection class IK10 expand the range of applications to include a protected, cabinet-free automation solution and meet special hygiene requirements. ■

› siemens.com/wincc-unified-system

TRUSTED TRACEABILITY

Ensure traceability and transparency

The unavailability of data is a challenge, especially when value chains are long and complex. At the same time, the demand for transparency raises due to stricter regulations, and the wish for quick and precise reactions to problems. Trusted Traceability fills this gap.

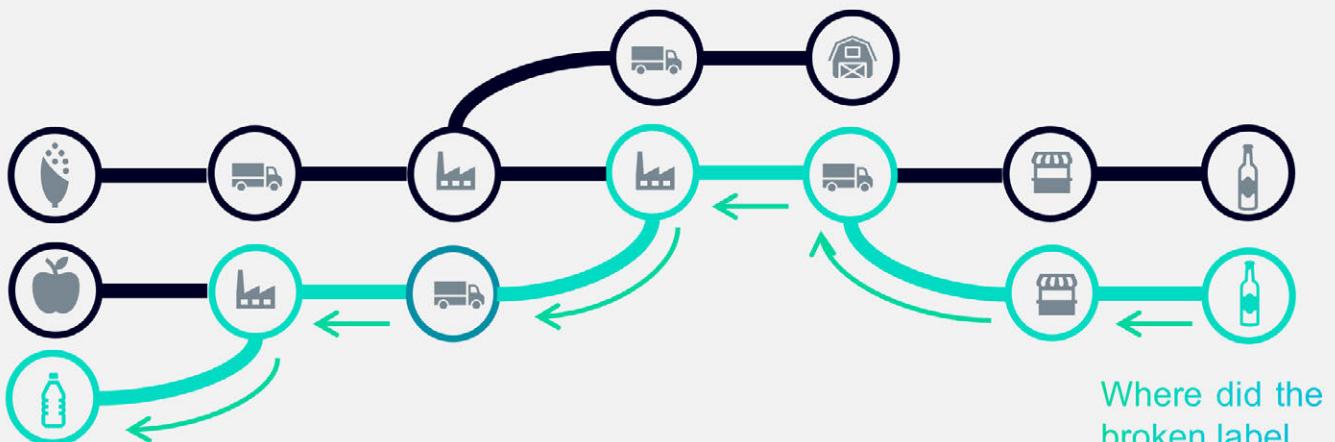
Bacteria on lettuce, glass shards in baby food, the risk of fire in a car's wiring harness – in cases like these, companies need to respond quickly and efficiently to avoid high costs and damage to their reputation, as well as to guarantee the safety of customers and consumers. Which batches are affected? What was the cause? With Trusted Traceability, companies can quickly, easily, and reliably obtain evidence of a product's origin

and other relevant information from the value-added process. This allows them to verify and prove compliance with rules and regulations as well as to react efficiently in the case of recalls or quality problems.

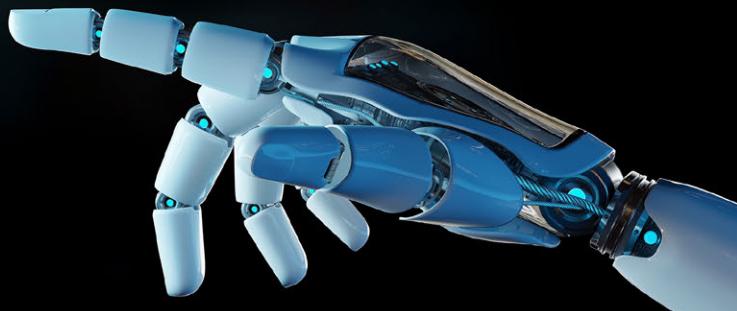
Transparency thanks to a detailed product genealogy

Trusted Traceability combines all relevant data – of a product, its components, the production and the suppliers and partners – in a genealogy along the value chain. The resulting transparency makes it possible to quickly obtain product-related information across complex value and supply chains and whenever needed. ■

› siemens.com/trusted-traceability-contact



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AI-DRIVEN PIECE-PICKING ROBOTS

Unleash operational efficiency in warehouses

The worldwide need for flexibility in industrial automation is increasing and especially served by one technology – robotics. However, their potential is still limited, because a "cognitive flexibility" is missing that allows reasoning and adapting adaptively to dynamically changing situations in 3D space at run-time. But exactly here is the uncovered automation demand that is unmet worldwide – especially in warehouse operations. Scalable automation remains unsolved.

Today's warehouse operations for production and fulfillment are still highly manual. The reason is an extraordinary demand for flexibility to manipulate a high variance of objects with various shapes, sizes, and types of packaging. In addition, many items of the same type can also deform, and smaller items are commonly stored in structured or unstructured heaps in bins. This results in an exceptional level of complexity that automation must master in a reliable and efficient manner. E-commerce is heating up the complexity in warehouse operations. According to the market research institute Interact Analysis, that will lead to a demand for over 5 million full-time equiva-

lents (FETs) for manual labor – working like machines – to cover picking and packing operations tasks in 2027. Interact Analysis also states that over 90 percent of all piece-picking tasks in warehouses are still performed manually. The Technical University of Munich, Chair of Materials Handling, Material Flow, Logistics (TUM fml) found that 30-55 percent of overall warehouse costs are related to this. A global increase in labor shortages and costs while consumer demands are rising and competition is intensifying, results in a mission-critical dilemma.

Even if today there are advanced robots that become mobile or are equipped with sensing such as 3D camera to grasp pre-trained objects from bulks, they will fail with simple but more generic sensomotoric tasks like grasping arbitrary objects which are unknown at run-time – for us as humans an everyday task.

The combination of artificial intelligence (AI) or more precisely machine learning (ML) with advanced sensor and gripper technologies and standard robot arms is currently introducing a fundamental paradigm shift in automation to system suppliers. Three major challenges need to be addressed to enable this new generation of autonomous robot systems economically and >

at scale: lack of industrial-grade cognitive flexibility, lack of standardization, lack of experts. Siemens offers a unique answer to enable solution provider to create autonomous and economical piece-picking robots at scale.

Simple and fast transition to reliable AI-driven piece-picking robots

Simatic Robot Pick AI, the first perception-based machine learning run-time capability for robots, is enabling robot systems to grasp any items in warehouse bin picking tasks from structured or unstructured heaps, delivered in the easiest-to-use and easiest-to-integrate manner for automation experts – with out-of-the box performance that will no longer require any training by the user. In less than 20 minutes from robotic systems with static pick points to AI-driven piece-picking robots: It has never been so easy. For uniform robot programming and operation, users can combine the ML application with the Simatic Robot Library and Simatic Robot Integrator in TIA Portal. Perfectly integrated in Totally Integrated Automation (TIA) and deployed on e.g., S7-1500 TM MFP (Multifunctional Platform) with backplane communication to S7-1500 PLCs.

Use of creative potential for business success

AI-driven piece-picking robots provide the demanded flexibility to manipulate a high variance of objects with various shapes, sizes, and types of packaging in dynamically changing situations at run-time. This will reduce the labor-shortage impact, free



the limited manual labor force from monotonous piece-picking tasks, and enable them to use their creative potential in higher-value tasks for business success. At the same time, it will unleash operational efficiency in warehouses. Right now, the first generations of autonomous robots worldwide are finding their way out of research proof-of-concepts and showing an immense potential by automating the unknown. ■

- › siemens.com/intralogistics
- › siemens.com/robot-integrator

INTRALOGISTICS

Future-proof solutions for a rapidly growing market

Strong growth in e-commerce is one factor underlying a number of new challenges facing the intralogistics sector: Growing inventory turnover rates with ever-shorter storage periods, small order quantities with fast delivery times, increasing return rates, and increased delivery quantities on short notice all require flexible, scalable intralogistics processes with maximum reliability and availability.

Machine manufacturers and end customers can access the advantages of digitalization with the consistent end-to-end portfolio from Siemens for all key warehouse technologies. Equipping autonomous guided vehicles, conveyors, and automated storage systems with seamlessly integrated automation and drive systems is just one part of what Siemens offers. It also includes developing new solutions for the challenges of today and tomorrow by means of targeted use of the digital twin and the combination of industry expertise, automation products, PLM software, and cloud-based IoT operating systems from Siemens.

Material transport systems – safe, reliable, and efficient

Materials handling equipment needs to do one thing extremely well: It needs to function smoothly and reliably. So much the better if it can achieve that with minimal power consumption and completely automatically, because then it increases throughput and reduces operating costs while improving the environmental balance.

Thanks to its seamlessly integrated automation and drive technology, in addition to integrated functional safety concepts, the Digital Enterprise portfolio lets users implement highly efficient automated storage systems, such as stacker cranes. These offer significant potentials for saving both time and costs, and contribute toward improved energy efficiency. Robust, decentralized drive systems are the key to implementation. Compact industrial servo motors with high power density enable a lean, high-capacity system design that is viable for the future. The energy requirement of automated storage systems is also reduced thanks to IE3 and IE4 motors and high-efficiency geared motors, multi-axis drives with a common DC link, energy storage options, and energy-optimized movements. Speed-governed drives with software ➤

controls for preventing vibration-induced delays optimize throughput with high dynamics and positional accuracy.

Users also benefit from Siemens intralogistics technology in another way. Scalable shuttle systems can be implemented without problems thanks to the automation portfolio for highly dynamic shuttle lifts and the compact and sturdy equipment for state-of-the-art shuttle vehicles.

Aisle management with integrated automation and safety systems, in addition to real-time and fail-safe communication using WLAN, ensures safe status at all times and reliably fixes system outages. Self-organizing logistics systems and freely navigating autonomous guided vehicles (AGV), based on the Simove automation solution, add more dynamics to any logistics center. ■

› siemens.com/intralogistics

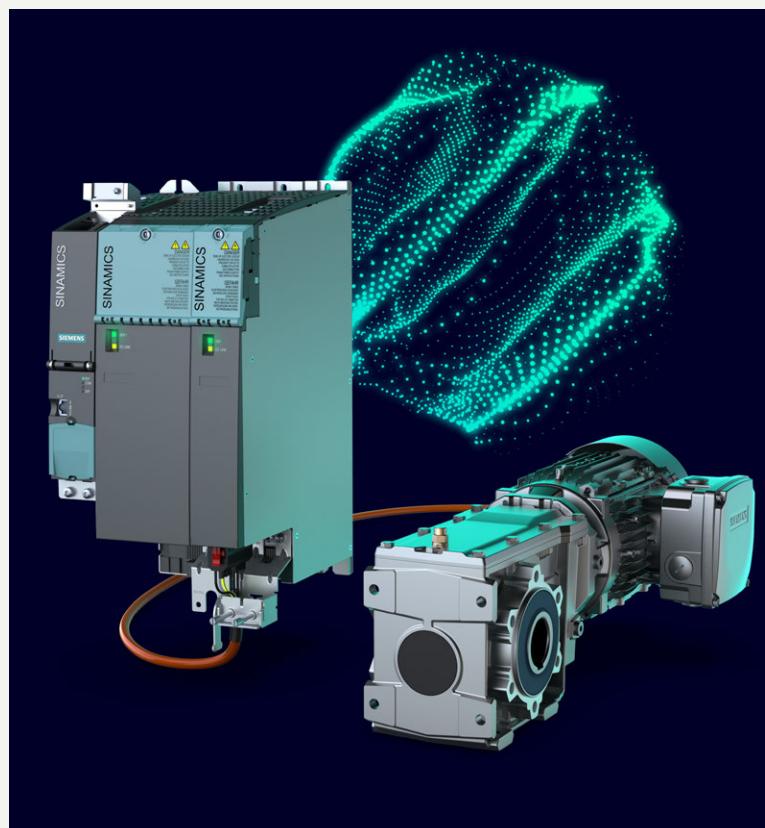
CONVERTER WORLD MOTOR

Efficient, converter-optimized, **usable** worldwide

The new Converter World Motor was developed for all industries with a focus on dynamic materials handling/transport applications in the automotive sector and sectors such as intralogistics and machine manufacturing. This geared motor is optimized for most global networks, and the various certificates are already included. Converter operation also enables the motor to provide maximum power. ■

› siemens.com/simogear

- **Broad power range** from 0.37 to 55 kW in the IE3 efficiency class
- **Easy to commission** thanks to complete integration into TIA Portal, TIA Selection Tool, and Drive Technology Configurator
- **Suitable for every application** in combination with the Simogear portfolio
- **Plug-and-play solution** thanks to Drive-Clips encoder or Motorcode



DYNAMIC PRODUCTION PROCESS MANAGEMENT

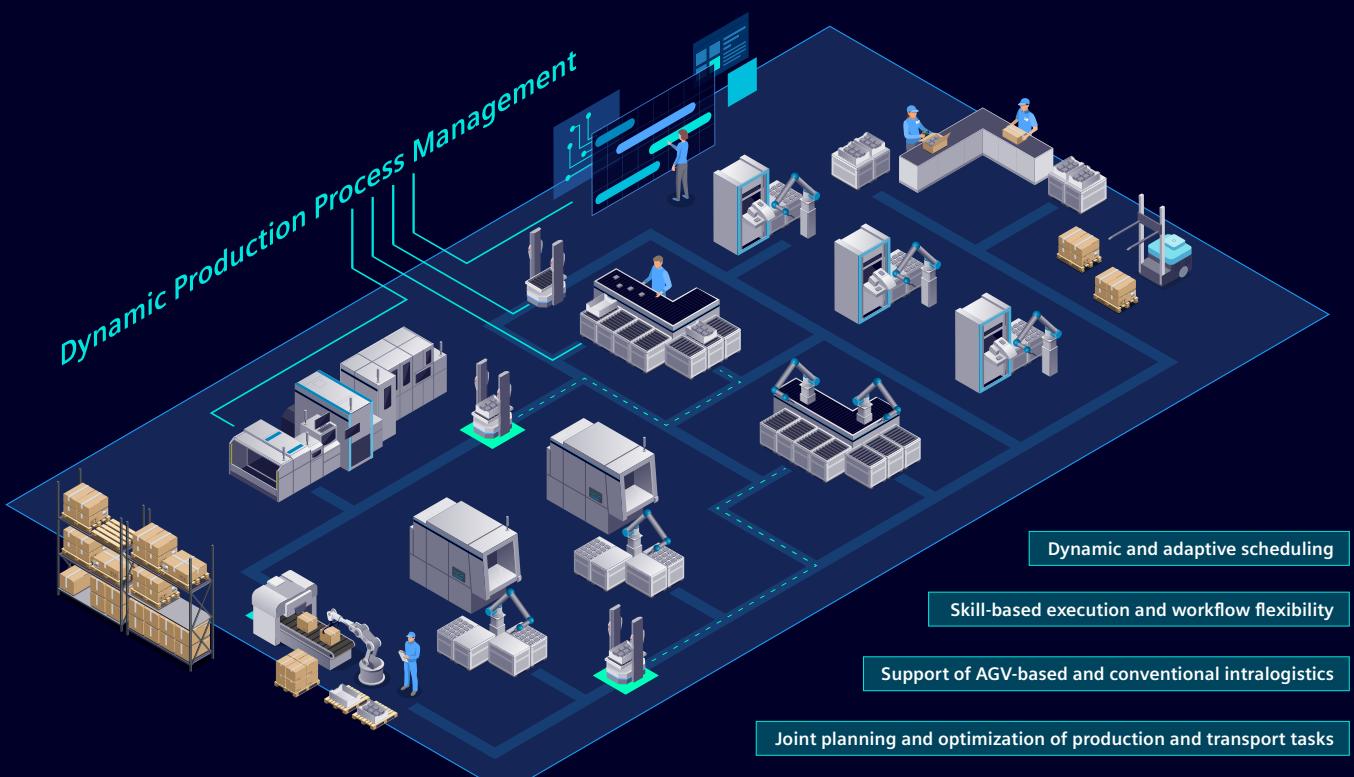
Higher productivity with a flexible production control system

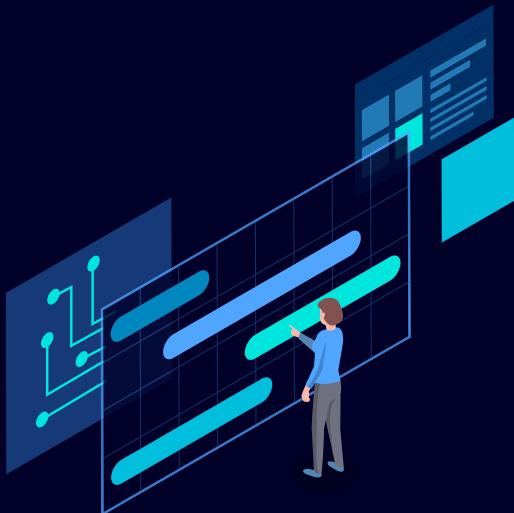
The necessity for increased flexibility in production and handling of high-variant product families is a strong trend in many industry domains, especially in Automotive and Electronics. The new Dynamic Production Process Management (DPPM) system meets these challenges.

Increased flexibility means in particular the ability to quickly react to fluctuations in the supply chain, to enable faster market launches, and to accommodate frequent product changes with little effort. However, addressing these novel requirements in a truly satisfactory way requires fundamental, disruptive changes to traditional production control

software. A promising approach to achieving this is to replace the rigid programming and the cumbersome, manual, static configuration of current manufacturing management systems with a dynamic and adaptive allocation of tasks to resources. This is the core of the new Siemens Dynamic Production Process Management (DPPM) system.

DPPM allows users to handle high product variance and new product introductions with much less engineering and configuration effort. It ensures a smooth and highly efficient production workflow by exploiting degrees of flexibility of the production process regarding operation sequence and the choice between alternative equipment. Bottlenecks caused by machine or workplace overload >





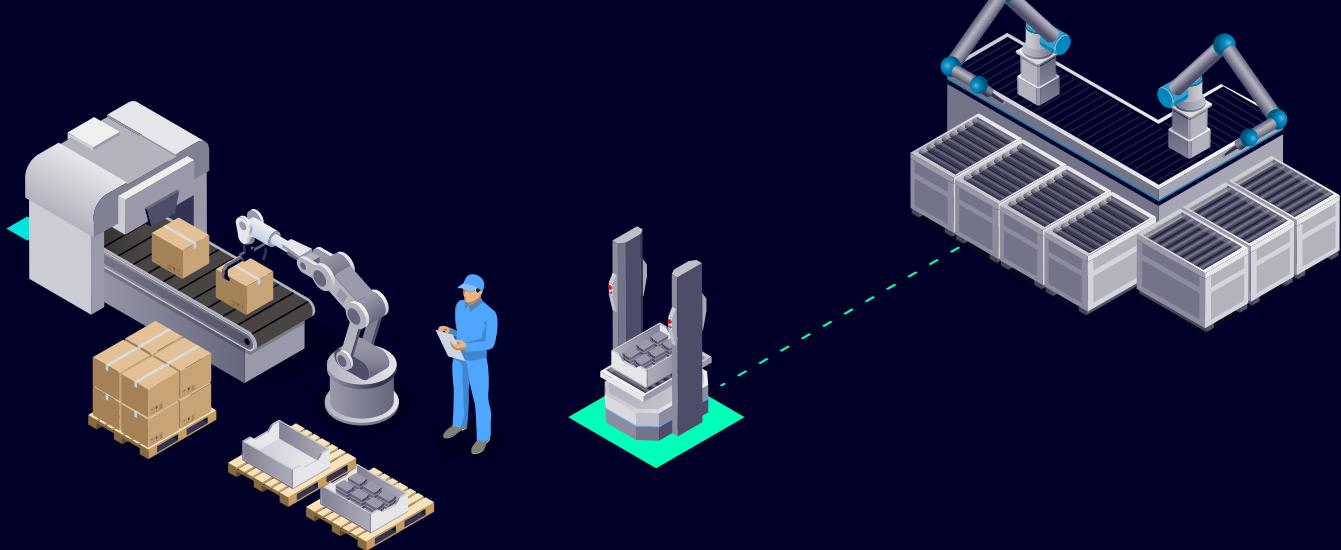
are reduced, temporary machine outages are defused by automatically rerouting products to alternative equipment, and production times are minimized. By jointly optimizing production and transports (in particular, for AGV-based transports) the overall productivity and equipment utilization can be increased. Lastly, you can schedule and execute production processes automatically without manual interference while maintaining full transparency on decisions made.

Best results thanks to optimized workflow

When carrying out joint planning of production and transport, DPPM abandons the traditional

sequential planning approach where production planning comes first and transport planning second, which turns out to perform suboptimally in many situations with high product variance and small lot size/lot size 1. Instead, powerful novel algorithms are used to exploit substantial productivity reserves, especially in connection with AGV-based material transports. For users confronted with the challenge of combining multivariant production with maximum production efficiency and optimized investment costs, DPPM is the ideal solution. ■

› siemens.com/futureofautomation



DIGITAL TWIN OPERATION SERVICES

Always make the best possible decision

Using simulation you can easily run through countless what-if scenarios in order to continuously optimize your production. This allows production parameters to be continually optimized and users to respond quickly to changing conditions.

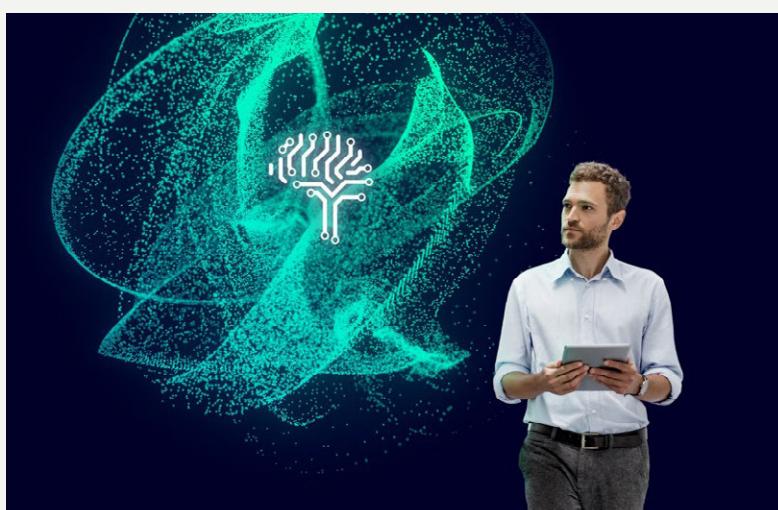
To stay competitive and flexible despite constantly changing production environments, ongoing optimization is a must. Digital Twin Operation Services allows you to raise your production to a new level. Operational data is gathered in real time via an edge device that is located in the factory. When online data from production is linked to the digital twin, users are always aware of the correct production parameters, even when conditions change on a daily basis. This helps them optimize their production forecasts and investment decisions, for example when planning production or analyzing scenarios.

With Digital Twin Operation Services, the shop floor workforce can easily manage and evaluate what-if scenarios via an app for effective production planning. The app can also be easily accessed and operated by non-simulation experts – meaning that special simulation expertise is no longer necessary.

Predictive planning in quality control

One example is the X-ray area at Siemens Electronics Works Amberg (EWA), where quality control of all the parts produced is conducted. Planning in this area is performed manually. This means, for example, that an employee decides which X-ray machine will be used next based on parameters like order intake, order priority, and maintenance windows. In this situation, it is almost impossible for a human to make the optimal choice. The solution was to create a digital twin of the X-ray department that is connected to the order management or planning system. Based on a simulation run in the app, users can easily calculate which machine is the best choice. With Digital Twin Operation Services, setup times have been reduced, throughput increased and machine utilization improved at the Electronics Works Amberg. ■

› siemens.com/dto-contact





VIRTUAL TRAINING SOLUTIONS

Innovative machine maintenance

Growing complexity in manufacturing is one of the greatest challenges for industrial enterprises. Increasingly complex production steps need to be implemented in an ever-shorter time-frame. This requires targeted employee training, especially after products or processes have been changed.

Additive manufacturing is a highly innovative and fast-growing industry worldwide. To provide customers with the service necessary for their machines, machine builders can either send technicians around the globe – or they can find new, innovative ways to deliver their expertise. DyeMansion is a leading provider of industrial postprocessing machines for the 3D printing of polymers. They've created brand-new options for service activities in the additive manufacturing industry with Virtual Training Solutions.

The virtual way to tangible results

Virtual Training Solutions helps companies optimize their training processes and production quality, improve employee qualifications, and boost moti-

vation with innovative learning methods using 3D models. Siemens and DyeMansion developed a virtual operator training course focused on maintenance tasks that make the servicing of machines as efficient as possible. Thanks to Virtual Training Solutions, DyeMansion uses the CAD data from the machines along with existing maintenance process descriptions to create what they call 3D service instructions. These instructions are programmed so that anyone can use them anytime and anywhere on desktop PCs, tablets, and other mobile devices.

Virtual Training Solutions covers varying degrees of difficulty and use-case levels, based on whether the training is intended for new employees, international service partners, or end customers who want to perform their own maintenance. All that's necessary is to specify the use case and knowledge level. End customers can then perform specific maintenance tasks on their own and reduce on-site deployments of DyeMansion service experts. ■

› siemens.com/virtual-training-solutions-demo

SITRAIN – DIGITAL INDUSTRY ACADEMY

Ready for the future of learning?

Access to the latest knowledge is becoming increasingly important. At the same time, the way we learn today isn't the same as it was in the past. Learning is more flexible, effective, and continuous – and it is best when it comes directly from the manufacturer. Sitrain offers concentrated professional knowledge and learning content for Siemens industrial products.

Face-to-face training at the training center or in a virtual classroom? With fixed dates and course times or independently? Learning in a group with a learning consultant? Or location-independent, on-demand, 24/7 digital training conducted by the learners' company? With its "Learning Journey," "Learning Membership," and "Learning Event" formats, Sitrain offers a wide range of learning opportunities, didactically effective methods, and modular options.

Different methods for maximum learning success

The "Learning Journey" format combines self-learning modules with live modules guided by learning consultants and is ideal for accommodating each individual's learning pace. "Learning Membership" provides access to the comprehensive and constantly growing collection of self-learning modules on Sitrain access, the digital learning platform that helps learners deepen their knowledge with continuous independent learning. If you would like training to be focused on acquiring and expanding practical and theoretical knowledge in a protected learning environment away from everyday work, "Learning Event" is the right choice. A learning consultant guides learners

through practical exercises and is also available for the entire duration of the theoretical units – virtually, at the training center, or on-site at the learner's company.

Relevant content and combined methods ensure efficient learning success, while flexible learning concepts promise better integration into the regular workday. In an ongoing learning process, learners are able to selectively expand their knowledge and capabilities and learn exactly what they will actually use. Sitrain offers a modern learning culture that's focused on the needs of learners and the demands of innovative companies. ■

› siemens.com/sitrain-contact



SIMATIC IPCS FOR ARTIFICIAL INTELLIGENCE

More efficient production in the digital factory

The use of artificial intelligence (AI) in the automation of machines and plants is relatively rare despite its tremendous potential. Simatic IPCs specifically designed and equipped for AI applications allow users to explore new digital dimensions.

In the plant automation environment, a multitude of data is already being collected for the purpose of controlling processes and supporting employees in production. The only way to fully exploit the potential of this data is through AI, because AI can interpret not just threshold and limit values but also external data. This makes it possible on the one hand to learn from more data and on the other hand to use the knowledge acquired to achieve specific goals and complete specific tasks. This is especially true for use cases with complex framework conditions and large volumes of data: for example, the quality control of printed circuit boards.

The right device for every requirement

For AI to learn what decisions are desirable and what are undesirable, it first has to be trained using huge amounts of data – a learning process that requires high computing power. That is where the powerful Simatic Rack PCs come in. In the next step, the acquired knowledge is applied to the specific task. Because this inference requires less computing power, a highly robust Simatic Box PC is generally used that can be installed right at the machine. For complex and demanding control,



data collection, and communication tasks, users can deploy the compact Embedded IPCs that are equipped with a number of AI accelerators and a platform specifically developed for AI-based applications.

Efficiency boost thanks to early problem detection

Artificial intelligence allows plant operators to detect anomalies in datasets, identify components based on typical patterns, and acquire the plant status based on vibration patterns, which makes it possible to efficiently perform tasks that used to be difficult. For example, maintenance jobs and issues can be predicted and corrected more quickly, resulting in fewer outages. ■

- › siemens.com/ipc
- › siemens.com/rack
- › siemens.com/box

MOTION CONTROL SYSTEM

Full Motion. Easy Control.

Custom products require machines and production lines that can be quickly and easily adjusted to different formats, sizes, product types, and production processes.

What is becoming a clear differentiator in machine building is a precise and dynamic system solution for the motion control of electrically driven machine axes that is easy to implement and always flexibly adaptable. Siemens offers users a coordinated motion control system consisting of a controller, drives, and motors – all seamlessly integrated into end-to-end engineering, with open connectivity between the OT and IT levels – that is optimally prepared to meet the challenges of digitalization.

Thanks to a system solution that includes Simatic controllers, Sinumerik CNC controllers, Sinamics frequency converters, Simotics motors, uniform engineering in TIA Portal, extensive libraries, and sample applications, users have all the tools and expertise they need to implement motion control applications of all sizes and levels of complexity. These include solutions for continuous motion in conveyor technology, positioning individual axes, moving multiple mechanically linked axes in handling systems, precisely coordinating axis movement in machining processes, and controlling highly dynamic spindles or feed and auxiliary axes when turning, milling, drilling, and sawing workpieces.

Powerful, simple, safe

The motion control system combines complete performance and future viability with high security and the simplest possible engineering. Users benefit from top performance thanks to the modular, scalable portfolio and the seamless interaction of all components in simple to complex applications. Easy engineering enables the use of integrated user-friendly features, from configuration, commissioning, diagnostics, and simulation to sample applications and application libraries. The comprehensive onboard motion control system features and a powerful ecosystem guarantee full future viability. Lastly, the motion control system excels thanks to safety integrated into all system components and automatic validation. ■

› siemens.com/motion-control



MOTION CONTROL WITH SIMATIC

More possibilities for even more efficient solutions

The market for motion control is growing – not just in absolute terms but also in its complexity. Thanks to comprehensive new features, users are now finding a custom solution for even more of their applications with Simatic Motion Control.

The current focus is on handling systems. Instead of simple pick-and-place or transport tasks, products and components now have to be gripped, rotated, and positioned. But if, for example, welding processes are followed up, motions need to be overlaid. All of these applications require powerful motion control. That is why the latest generation of the Simatic Technology Controller has been furnished with extensive system improvements, and new features have been added so that users can select the right motion control system from a flexible, scalable, and diverse portfolio. As of firmware V3.0, the Technology CPUs in the Simatic S7-1500 controller provide much more memory as well as significantly



enhanced program, communication, and motion control performance in the same design. For applications that require a motion control solution integrated in the drive solution, sophisticated applications can now be implemented with the Simatic Drive Controller that include 5D and 6D kinematics. Even machines that have distributed intelligence, a wide variety of modules, and require very little space in the control cabinet now benefit from more motion control functionality. With the CPU 1514SP T(F)-2 PN, another Technology CPU is now available for the highly flexible, modular Simatic ET 200SP I/O system in addition to the open controller. >

Simple and integrated configuration of 5D and 6D kinematics

There are now extended features for 5D and 6D kinematics that are specifically designed for the oriented handling of products or components – for example, by articulated robots and even by delta pickers and Cartesian portals with additional rotary and swivel axes. In TIA Portal V18, users can implement kinematic features with up to six

interpolating axes using selected Simatic S7-1500 Technology CPUs – with no need for additional tools in their normal engineering environment. This allows the geometry of kinematics to be very easily and intuitively parameterized using configuration masks with 3D visualizations. ■

› siemens.com/simatic-motion-control

SINAMICS S200 SERVO DRIVE SYSTEM

Servo on, move beyond

The Sinamics S200 servo drive system is a clever choice for standard applications. It contains a precise servo drive, powerful motors, and easy-to-use cables, providing high dynamic performance, flexible choices, and a compact size. Sinamics S200 servo drive system is perfectly tailored to the requirements from electronics, battery, engraving and many other applications. Together with a Simatic controller (e.g., S7-1500), users get a powerful and cost-effective motion control system with digital engineering on TIA Portal as well as the integrated web server and One Button Tuning. ■

› siemens.com/sinamics-s-news



- **Fast communication** via Profinet IRT or PTI
- **Up to 350% overload capacity**
- **Flexible solutions** thanks to different variants and the scalable system
- **Cost-effective** through brake resistor and holding brake control integrated
- **Reduced space requirement** thanks to the compact size
- **Global standards and certifications** including CE, UL, UKCA, KC, EAC and RCM

EFFICIENT SELECTION AND ENGINEERING TOOLS FOR DRIVE SYSTEMS

Simple or complex: Always the **right solution**

Is my application efficient? Does using efficient technology pay off? How do I configure my components? Siemens tools answer all of your questions about efficient product configuration, planning, and implementation. The digital control system guides users through the product selection and configuration process, all the way to the application-specific development of drive systems.

efficiency classes. It also calculates their expected energy consumption based on individual energy prices, operating times and loads, and the resulting savings in energy, energy costs, and CO₂.

The Siemens Product Configurator also makes it extremely simple to precisely configure motors, converters, systems, and other components. With the help of a new user interface with intuitive user guidance, users can select the products that are right for them and then order them directly from the Siemens online shop.

Fast and easy, thanks to planning

When planning and developing a project, what matters most is an accurately designed drive system and simple product dimensioning. The TIA Selection Tool is the right tool for determining application-specific requirements. It allows users to design and configure a complete project with just a few entries and without a manual or specialized knowledge. The configuration options can be pretested and simulated, which contributes to error-free configuration and ordering.

Do you need access to technical information anytime and anywhere? The Simotics Digital Data app makes this possible. It allows users to access technical data, spare parts, and the operating instructions for the Simotics GP/SD motor at any time. The app provides users with an important part of the digital twin of the motor, allowing them to simplify and optimize their processes. When the data matrix code on the motor is scanned, for example, the app displays its electrical and mechanical data and even service information. This facilitates commissioning and installation and optimizes service activities. >



In the first stage of planning – product selection and configuration – energy efficiency is critical. Siemens offers tools that help users quickly and easily configure their drives. The SinaSave amortization calculator identifies potentials for energy savings and the amortization period for drive products and systems based on the specific operating conditions. The tool compares your existing motors to Simotics motors in various energy



Commissioning made easy

Siemens also offers engineering tools for the final phase, commissioning. With Sinamics Startdrive in TIA Portal, Sinamics drives can be intuitively integrated in automation. The standardized user guidance for the controller, HMI, and drive technology increases the productivity of engineering and reduces the possibility of errors. The common data management of controller and converter with one tool brings consistency, and the common library concept ensures simple reusability of the converters. A wide range of diverse applications can be implemented, thanks to the extensive Sinamics drive portfolio in Startdrive, from pumps,

fans, mixers, conveyor belts, etc. to positioning axes, handling systems, stacker cranes, and packaging machines.

With Version V18, the latest update of Sinamics Startdrive, innovated Sinamics drives are finding their way into TIA Portal, including Sinamics S210 and G220. Not only do the drives themselves contain many innovations but the commissioning workflow has also been optimized, and it is now even better at guiding users through the configuration process. As a result, both beginners and experts can arrive at a finished machine faster. ■

› siemens.com/engineering-tools

MODULAR AUTOMATION AND PRODUCTION

Maximum flexibility with maximum standardization

Drastically reduced commissioning time, minimal development costs and testing efforts, and the optimal use of existing plants are the challenges facing the production of the future. One key to succeeding in the process industries is implementing modular production systems that are more flexible and efficient than ever before.

Manufacturers have to be able to react promptly to new market situations, which means that they need new and flexible production methods that allow them to rapidly change batches and scale production as quickly as possible. When a company wants to produce a new product or wants to change the batch size of an existing product, it has to be able to act quickly. There is no time to reprogram a machine from the ground up, let alone build a new machine.

Secret to success: Module Type Package

For companies in the process industries, the future of automation is in modular production using module type package (MTP) based on NAMUR recommendation NE 148 – a concept that plant operators, module builders, and system providers like Siemens are collaborating to implement. The idea behind MTP is smart, decentralized, pre-automated, and pretested process modules that are orchestrated by a distributed process control system (DCS) called the process orchestration layer (POL). The process modules – relatively small plant units such as extruders, tanks, and separation modules – can be quickly and easily integrated into a larger system. Thanks to standardized descriptions of process components, including integrated process pictures and run-time interfaces, plant operators can simply load the MTP file and integrate the module into the higher-level automation architecture via an OPC UA connection. >



Pretested, manufacturer-independent plug & produce units greatly accelerate this often time-consuming process.

Seamless interplay

The groundwork for MTP can already be laid in a module's process engineering in Comos. The data can then be transferred to TIA Portal, where the modules can then be automated using a Simatic S7-1500 controller and the Simatic WinCC Unified HMI system. The Simatic Process Function Library, which supports the MTP standard, is also involved. Function blocks and faceplates for object-based engineering reduce the time required for validation. Following programming in TIA Portal, the

MTP file is generated by Simatic MTP Creator: A single click is all it takes. The modules and backbone are orchestrated on the process orchestration layer of the process control system Simatic PCS neo. The individual modules' MTP files are imported to the POL and managed in a library as templates. From there, the library elements can be instantiated based on the physical layout of the plant. The innovative MTP solution makes it possible for users to modify their plants to meet changing market requirements quickly, easily, and with very little effort. ■

› siemens.com/modular-production

SIMATIC PCS NEO V4.0 / NEW SIMATIC S7-4100 CONTROLLER

New version of the web-based process control system

- **Suitable for process plants of all sizes,** with up to 64,000 process objects and 56 controllers
- **Support for the MTP standard** for easier integration into the process control system and manufacturer-independent description, project engineering, and automation
- **New hardware available:** Simatic S7-4100 controller and Simatic CN 4100 communication node

As the world's first and only completely web-based system, the future-ready Simatic PCS neo V4.0 process control system enables location-independent work, whether it is from a home office or using mobile devices. The new Simatic S7-4100 controller generation is 30 percent smaller, uses up to 50 percent less energy, is maintenance-free, and offers expanded communication options.



It is supplemented by the fully integrated communication gateway Simatic CN 4100, which facilitates an easy and secure exchange of process data at both the control and visualization levels simultaneously. ■

› siemens.com/pcs-neo
› siemens.com/simatic-s7-4100

SMART CONTROL PANEL DESIGN

Electrical design: The new way of dimensioning

With Control Panel Design, electrical planners benefit from simple dimensioning, a consistent workflow, digital standards expertise, and a seamlessly supported portfolio. This saves valuable time that can be used for more creative tasks.

Electrical planners are often confronted with the challenge of having to select not only suitable components for a motor starting application but also all of the parameters associated with the motor feeder. Using Control Panel Design in the TIA Selection Tool, it is possible to design and dimension the main electrical components of a machine in compliance with standards. Dimensioning the cables all the way to the motor is equally important as selecting the right switching and protection devices. Control Panel Design in the TIA Selection Tool enables planners to dimension fuseless and fused feeders up to 250 kW and 500 hp in compliance with IEC 60204-1 and UL 508A specifications easily. Main disconnect dimensioning for IEC and UL infeeds is also possible. To begin with the configuration, electrical planners just need the latest offline version of the free TIA Selection Tool and some basic information about the motor. With this foundation, the software then guides them step by step through the configuration process by means of freely selectable parameters.

Appropriate device combinations and standards-compliant documentation

The visual display in the single-line diagram makes planning the main circuit especially intuitive. Planners are also shown suitable devices and accessories for the complete motor feeder, which they can easily add to an order list in a subsequent step. Finally, planners are provided with complete PDF documentation of the technical data and calculations that they need: for example, for verifying short-circuit strength. ■

› siemens.com/cpd



SIGREEN

On the path to a climate-friendly future

Many companies are striving to reduce the carbon footprint of their products, but they often lack reliable data, because CO₂ isn't just emitted from their own production: Up to 90 percent of emissions come from the upstream supply chain. With Sigreen, companies can now optimize the carbon footprint of their products in a targeted manner.

Sigreen makes it possible to precisely quantify emissions across the entire value chain, which lays the groundwork for targeted emissions management. The carbon footprints calculated in this way are dynamic, meaning that the effects of changes cover the entire chain, shrinking or expanding the carbon footprint of the end product accordingly.

Complete security of data and results

Sigreen's solution to data security is the Trustworthy Supply Chain Exchange (TSX), an encryption technology that ensures total data sovereignty. Suppliers share only the data that is actually relevant and don't have to disclose any confidential information. Users are afforded additional security through the optional verification of CO₂ footprints by accredited certifiers, who can issue certificates to suppliers that verify that the data being provided is correct.

Sigreen is already available today as a unique, ready-to-use solution for all companies that understand that sustainability is a competitive advantage. And those who can prove that their products are more ecofriendly and are manufactured with lower carbon emissions have an edge on the market. ■

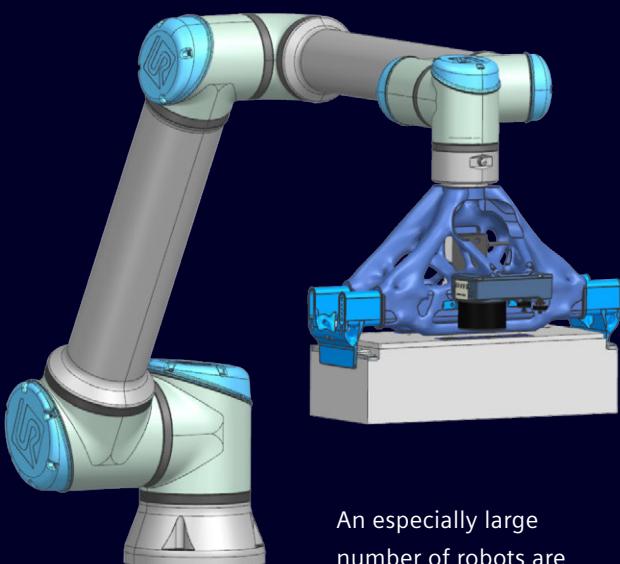
› siemens.com/sigreen



GREEN ADDITIVE MANUFACTURING

Economically and ecologically **valuable lightweights**

Optimized product design plays a key role in sustainable additive manufacturing (AM). In the case of a gripper solution for a handling robot, it was possible to significantly reduce the total mass of the gripper along with its weight, material, and costs using software from Siemens. The weight reduction also resulted in substantial energy savings and lower CO₂ emissions.



An especially large number of robots are deployed in automotive

factories. Often these gigantic robots move relatively small parts from place to place – an energy-intensive undertaking that is not exactly cost-efficient. Just the robot accessories, consisting of turned and milled parts, can weigh several kilograms. In this situation, additively manufactured lightweight constructions can offer many advantages.

A topology-optimized gripper in just a few steps

The first step is to design a topology-optimized gripper that can be 3D-printed. Based on the requirements placed on the original metal part, users deploy Siemens NX CAD software to analyze the parts necessary for functioning – like cameras, sensors, and actuators – in order to define interfaces and optimize the topology by factoring in the existing load cases. The result is a design with complex geometries that can be efficiently produced only by means of 3D printing. The concluding 3D FEM validation in Simcenter Amesim ensures that the design can also withstand high loads. Using a model, Siemens demonstrated that this can substantially reduce the part's weight: The ultralight polymer version weighs over 60 percent less than the original metal gripper. The software-supported design and subsequent additive manufacturing of the gripper not only significantly reduce the weight, they also save time. Customers no longer need to wait months to receive their robot accessories; instead, they can print them themselves in a matter of days.

Measurably lower costs and reduced CO₂ emissions

The 3D-printed part is less expensive because fewer components are needed. The extreme flexibility of AM designs also contributes to cost savings. It is easy to change the parameters of the various components in Siemens NX. The result: Users do not have to keep designing new grippers, they can simply enter the changed value and the software automatically adjusts the relevant component properties. >

In addition to cost savings, Teamcenter Product Cost Management proves that a tremendous reduction in CO₂ emissions is also possible. All the individual parts of the gripper are entered in the program, which compares various parameters like material, power consumption, alternative or conventional energy, and country of manufacture. The result is cost savings of up to 70 percent and up to 80 percent fewer CO₂ emissions for a part printed from polymer compared to the same part milled from metal.

Energy optimization through simulation

Once the lightweight robot gripper is printed, what happens when it is attached to the robot? Can it only be installed on a large robot, or can it also be used together with a small robot? With Tecnomatix Process Simulate, a model was used to determine that a much smaller robot can be deployed thanks to the weight reduction. The smaller robot has a much shorter cycle time, takes up only half as much space, and consumes only half the energy. The Tecnomatix software calculates the robot's power consumption in real time. Even more energy can be saved by taking advan-

tage of the reduced cycle time to operate the robot more slowly, while achieving the same rate of productivity. This eliminates energy peaks, which are mainly caused by fast accelerations.

Tecnomatix Plant Simulation simulates the way that robots collaborate in a factory surrounding e.g. with conveyor belts, assembly lines, and welding robots. Energy peaks can be reduced because the software automatically analyzes and optimizes various interactions between the individual stations and the overall factory.

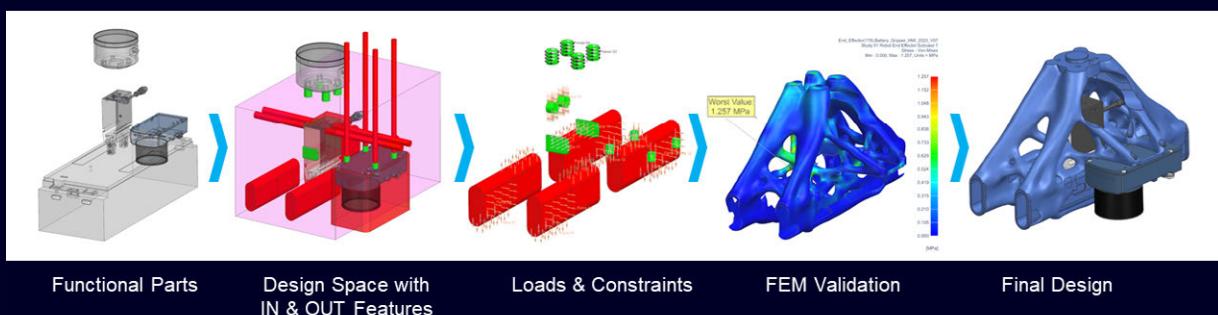
Sustainability in the automotive industry

An automotive manufacturer uses approximately 1,000 robots every day. If only 100 of these large robots with heavy grippers could be replaced with new, 3D-printed, lightweight robot grippers, there would be an annual reduction of over 125 tons of CO₂ emissions in manufacturing. In a year of operation, 742 MWh less energy would be consumed and CO₂ emissions would be reduced by 300 tons. ■

› siemens.com/additive-manufacturing

■ The way to optimized lightweight AM robot grippers

■ Process Overview – fully associative Topology Optimization with Siemens NX



DIGITAL DRIVE TRAIN

Leading the way to sustainable motion

Pumps, compressors, cranes, conveyor belts... hardly any branch of industry can survive today without electric motors. Drive trains offer huge potential for both power and carbon savings, which can be leveraged thanks to digital solutions in conjunction with the most efficient hardware components.

Companies can remain competitive or bolster their market position when motors, drives, and smart digital solutions work together. The newly established Digital Drive Train organization will enable Siemens to optimally manage the challenges faced by users and leverage the full potential offered in this area.

The key to more sustainable industrial motion lies in improving the energy efficiency of the system, which in turn is achieved by optimizing the system as a whole. Taking all individual optimization measures together, it is possible to achieve savings of up to 60 percent. Thanks to the Siemens portfolio for laying out drive trains, users can plan and simulate the performance of their industrial systems before they go into operation. This ensures that all drive components are correctly dimensioned and prevents excessive power consumption. By analyzing plant data in a completely networked system, energy efficiency can be taken to the next level and realize substantial conservation of carbon emissions and resource consumption – in addition to reducing lifecycle costs. The actual enablers of sustainable motion, however, are analytical tools and self-learning Industrial Edge and cloud applications.

**Savings in a very short time**

One example of the digitalization of factory infrastructure can be found at the Siemens Electronics Works in Erlangen. The goal was to reduce maintenance costs by minimizing manual intervention using condition-based maintenance, improving plant and system availability by identifying anomalies, and becoming carbon neutral through a combination of energy efficiency and decarbonization. An AI-based condition monitoring system for low-voltage motors was installed based on the plug-and-play Simotics Connect 400 sensor module and the Sidrive IQ Fleet analysis app. Just a few weeks after it went into operation, the app detected an anomaly, and the maintenance measures that were applied prevented a machine outage. That improved availability by five percent. It was also possible to identify the uneven capacity ➤

utilization in a redundantly structured thermal energy recovery system and take appropriate actions to increase the machine's product lifecycle by 33 percent. Optimized, condition-based maintenance cycles also reduced maintenance overhead by 15 percent. And the solution scores with a short return on investment of less than one year.

Potential in the future

In the future, the convergence of the real and the virtual drive train will be advanced using the digital IoT portfolio. What does that mean in concrete terms? Using trace data from the field device, the actual performance of the drive train and the load in question – for example, the load of a driven machine – are recorded and then the real values are compared to the simulation model.

In the next stage, the real drive train data is fed into the simulation model, which is then trained with the properties of the entire system model. The real-world data can therefore be used to modify the system model to ensure that it precisely describes the entire system. A number of scenarios can be investigated by changing various parameters. A deviation between real and simulated output highlights the change and indicates that the system's performance has changed and that maintenance is required. Applying these trained system models and digital twins to the development phase of new drive applications will result in a massive improvement in productivity and time efficiency. ■

› siemens.com/digital-drives

SIMOTICS CONNECT 400 / SIDRIVE IQ FLEET

Digitalizing low-voltage motors

Whether it is pumps, fans, or compressors: For a rapid and comprehensive overview of the operational and condition data of their low-voltage motors, users can utilize the plug-and-play Simotics Connect 400 connectivity module and the Sidrive IQ Fleet MindSphere analysis app to easily implement a low-cost, cloud-based solution for continuous condition monitoring of LV motors. ■

› siemens.com/digital-motor



- **Improved productivity** thanks to reduced downtime and fewer system malfunctions
- Optimized level of maintenance activities to ensure a **longer product service life and improved plant availability**
- **Energy savings** thanks to artificial intelligence and data analyses
- **Optimized maintenance-friendliness** thanks to remote monitoring and cloud-based fleet management

SUSTAINABLE AND ENERGY-EFFICIENT DRIVE SYSTEMS

Time to act

CO₂ emissions will become more and more expensive, which makes efficient operation much more important. Electric motors consume 70 percent of the overall energy used in industry – and that represents an enormous energy-saving potential. The latest electric motors and converters enable users to optimize their processes and access new dimensions of efficiency.

With efficiency of over 96 percent, Simotics SD IE4 motors are already very energy-efficient, and so they're optimally designed for use on the grid. Using motors in the very high efficiency classes IE4 or even IE5 enables savings of an average six percent electrical energy. Energy savings of on average 30 percent can be achieved by using perfectly matched motor and converter systems for the variable-speed operation of pumps, fans, and compressors. However, the real key to greater energy efficiency lies in the overall system. Savings of on average 60 percent can be realized in the system network through the interaction of all the individual measures: from more efficient motors with variable-speed control and digital system components and tools to the use of electrically buffered energy in the motor network.

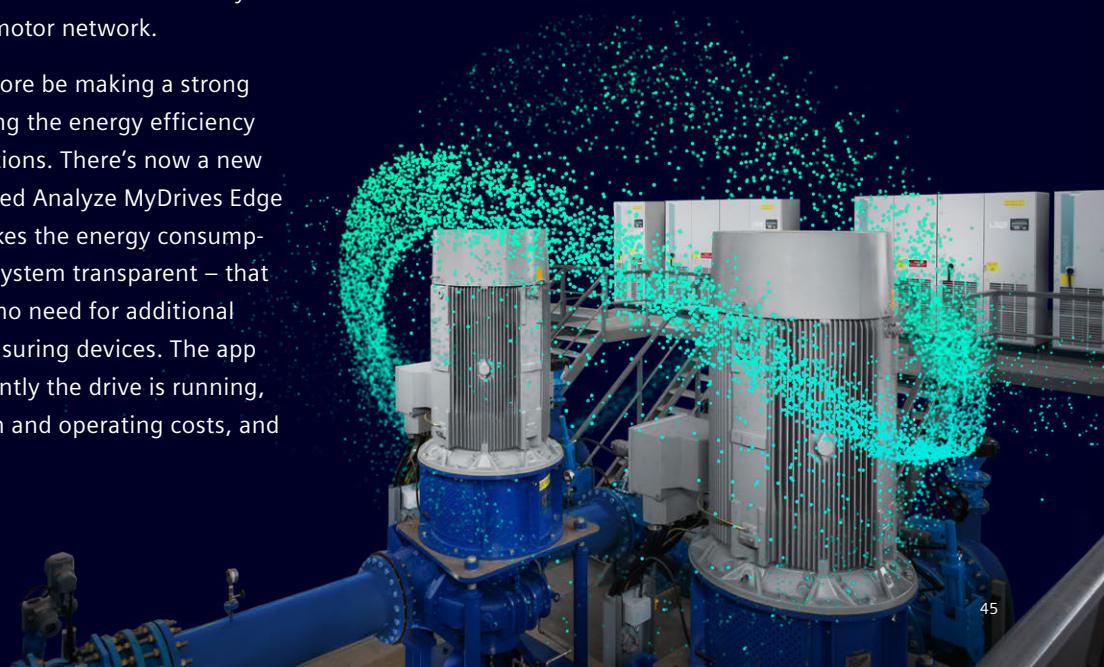
Digitalization will therefore be making a strong contribution to increasing the energy efficiency of motor-driven applications. There's now a new feature for the established Analyze MyDrives Edge application – which makes the energy consumption of the entire drive system transparent – that calculates all data with no need for additional sensors and special measuring devices. The app shows users how efficiently the drive is running, the energy consumption and operating costs, and

the carbon footprint that the drive leaves behind. Drive settings can now be optimized even more to meet customer requirements.

Efficient use of energy

In terms of hardware, Siemens has launched the Sinamics DCP 250 kW, a compact DC-DC converter that's available immediately. This means that a total of three compact DC-DC converters are available for connecting batteries or ultracapacitors to industrial drive systems. With output voltages of up to 1,200 V, Sinamics DCP 250 kW meets the high requirements in the automotive industry and is ideally suited for use in test benches for electric vehicles. DC controllers offer additional energy-efficiency advantages: In the system network, energy storage devices such as batteries can be used to smooth the load absorption from the grid. In particular, this eliminates peak loads. Braking energy can also be made available in the DC system. With an appropriate system design, DC controllers require fewer conversion steps. Another advantage is the simplified infeed from renewable energy sources such as photovoltaics. ■

› siemens.com/drives-energy-efficiency



SINAMICS DRIVESIM ADVANCED

The way to more **sustainable machine building practices**

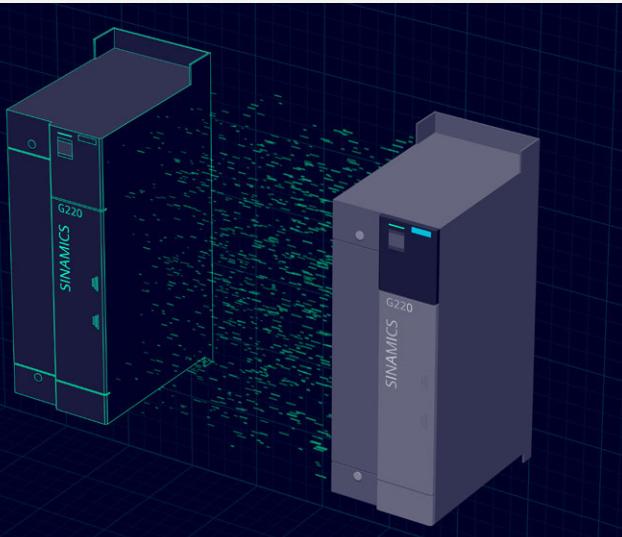
With advancements in technology, virtual commissioning, and engineering, machine builders can reduce their resource consumption and optimize the energy efficiency of their machines without compromising on productivity. This becomes obvious when using the Sinamics DriveSim family of simulation software tools for virtual commissioning and the optimization of the correct drive size and its energy consumption.

Easy and reliable simulation tool

Sinamics DriveSim Advanced provides a full-featured realistic simulation of new Sinamics converters, enabling users to create a digital twin of their drive in a virtual environment with all parameters and configurations of a real drive. This digital twin simulates the logical and functional aspects of the drive system identical to the real Sinamics drives, while the other aspects of the drive system, such as electrical, magnetic, and mechanical, are partially modeled in a simplified way.

The cutting-edge drive simulation solution offers unparalleled benefits to enhance the efficiency and productivity of optimizing drive systems and machines, mapping the real behavior of the Sinamics converter with specific modifications. Thanks to its advanced technology and user-friendly interface, users can simulate, commission, and optimize the performance of drive systems to meet the demands of their processes in a virtual environment before they are built in the real world. Because the simulation is directly integrated into TIA Portal, there is no need for other software tools.

Whether users are researchers, engineers, or technicians, Sinamics DriveSim Advanced has the tools they need to optimize their drive systems and machines efficiently and effectively. Using this virtual commissioning and engineering tool, machine builders can be confident that their simulations will accurately reflect the performance of their electric drive systems. Therefore, they can reduce resource consumption and optimize energy efficiency – for a more sustainable approach to machine building. >



In the past, machine builders had to rely on physical prototypes and testing to optimize the energy consumption and correct sizing of their machines. This process was both time-consuming and resource-intensive. However, with the advent of virtual commissioning and engineering, machine builders can now simulate and test their machines in a virtual environment, significantly reducing the need for physical prototypes and testing.

Sinamics drive for a sustainable future

The new energy-efficient variable frequency drive Sinamics G220 is a perfect example of a drive that can be at first simulated and commissioned in Sinamics DriveSim Advanced during the machine engineering process and then implemented in its optimized settings into a real machine. Sinamics G220 has one of the first digital twins

completely integrated in Startdrive (TIA Portal). This reduces integration efforts and enables users to test and optimize the behavior of the drive before having the hardware, thus contributing to a sustainable future. ■

> siemens.com/drive-virtualization

SINAMICS G220

Efficient. Secure. Future-proof.

The new Sinamics G220 is set to be the high-performance variable frequency drive for all industries, especially food and beverage, pharma, chemicals, oil and gas, and marine. With its revolutionary and integrated Clean Power technology, it is the perfect solution when it comes to reducing line harmonics and material footprint for a more sustainable industry. With Security Integrated it meets the risks of cyber-attacks and Safety Integrated functions ensure reliable operation. High-frequency data can be easily transferred from Sinamics G220 to Industrial Edge or to the cloud, increasing the availability of applications by preventing downtime. ■

> siemens.com/sinamics-g-news



- **Reduced energy consumption** with Clean Power technology in low harmonics and high-efficiency motors control
- Safety & Security Integrated for safe personnel, machines, and systems and to **protect know-how**
- **Faster time-to-market** by using the digital twin of the drive in Startdrive during design, test, and optimization phases
- Easy commissioning, diagnostics, and service, and the integration into TIA Portal for **boosting productivity**
- **Safeguarding system availability** even in harsh environments thanks to S2 redundancy, IP55, and ATEX-certified input
- **Maximized system flexibility** with a configurable drive solution via hardware and software options

DRIVE TECHNOLOGY FOR GREEN HYDROGEN

Solutions for the energy of the future

Hydrogen, and especially green hydrogen, could play a key role on the path to emissions-free, climate-neutral power generation and supply. It could be used, for example, as fuel for mobility, as a replacement for natural gas in industry, or as a storage medium for alternative energies. Siemens motor and converter system solutions cover all drive tasks throughout the entire green hydrogen value chain, from production, transportation, and storage to distribution and consumption by the end user.

Green hydrogen is generated via electrolysis, and the electricity that this requires comes from carbon-neutral, renewable energies. Reconversion is also completely carbon- and climate-neutral, yielding nothing but pure water. Sinamics rectifier and converter technology already ensures maximum efficiency in the core process, which refers to the production of hydrogen by means of electrolysis. Customized Simotics and Sinamics converter systems are also needed during this phase, for example for the compressors of the pressure adaptation unit. Various processes in the transportation, storage, and distribution of hydrogen require extremely high drive performance as well as motor-converter combinations that are individually adapted to the different tasks. The countless pumps and compressors use Simotics motors and Sinamics converters in low-, medium-, and high-



voltage versions and in the several kW to two-digit kilowatt range – the latter being suitable, for example, for extremely powerful reciprocating or turbo compressors that transport or liquefy large quantities of hydrogen.

For maximum safety and cost-efficiency

With explosion-proof Simotics motors, the customized drive solutions perfectly fulfill requirements in this sector for explosion protection, which is especially important in atmospheres containing hydrogen. The Simotics motors' high degree of efficiency – IE3 and IE4 – reduces power consumption and provides a solid foundation for cost-efficient as well as sustainable production of this valuable energy source. ■

› siemens.com/simotics-xp

SIMOTICS PM SYNCHRONOUS MOTORS

Sustainable compressed air thanks to **innovative drive technology**

"More compressed air using less energy" has always been a theme at KAESER KOMPRESSOREN. The company consistently implements this philosophy, especially in its latest generation of rotary screw compressors. The innovative drive system – with an IE5 permanent magnet synchronous motor from Siemens – represents a further milestone in cost-efficiency, flexibility, and sustainability.

A partner-like collaboration between KAESER KOMPRESSOREN SE and Siemens was the foundation for this compressor innovation. The companies' shared goal was to develop a highly efficient and compact drive unit that would supply production and work processes with compressed air and would be especially sustainable due to its exceptionally low energy requirements.

To achieve this ambitious goal, the CSDX 200 SFC rotary screw compressor uses a drive solution based on Simotics permanent magnet synchronous motors in energy efficiency class IE5, the highest class according to IEC/TS 60034-30-2. The motor excels on two levels: Synchronous technology eliminates almost all rotor losses, and the permanent excitation of the rotor allows for a compact design with optimal system characteristics. The result is both maximum energy efficiency and high power density in the entire drive.



Perfect alignment, thanks to a systems approach

Collaboration during the development process enables the drive to be tailored to the interfaces in the compressor, making it possible for the compact drive to be flexibly integrated in the compressor unit. The custom alignment of the motor/converter system – consisting of Simotics IE5 motors and Sinamics converters – also ensures an optimal drive performance in variable-speed operation that's backed by comprehensive system tests.

Integration in the Siemens digitalization portfolio and consistent implementation of the systems approach result in maximum benefits for customers, including cost-effectiveness, efficiency, and sustainability at the highest level. ■

› siemens.com/drives-energy-efficiency

DATA-DRIVEN FACTORY AND SUPPLY CHAIN MANAGEMENT

Digital connectivity is the decisive factor

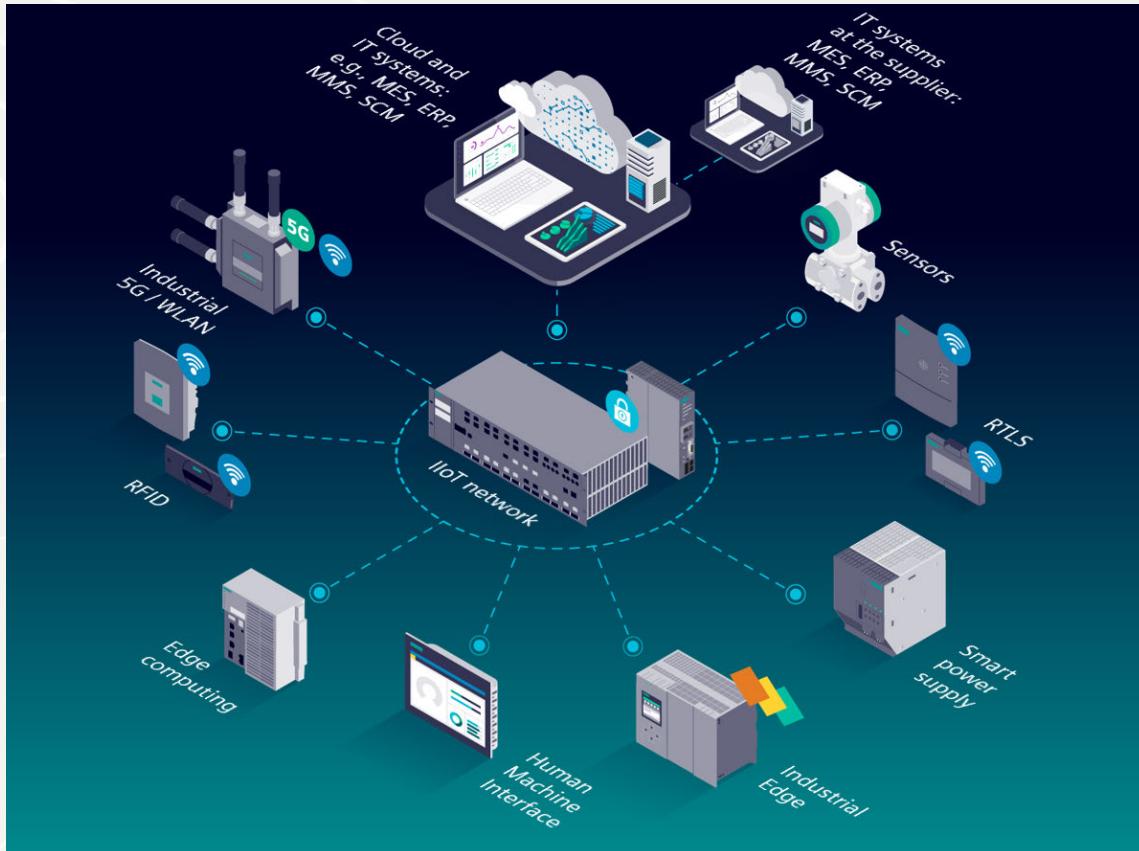
What if an entire factory could be controlled dynamically and in real time? It is easily achieved with an IIoT solution in which all the automation devices and smart objects are flexibly linked together and connected to cloud or IT systems that supplement factory management with real-time data from different sources.

Are materials unavailable, or are existing materials not being delivered to the machine on time due to broken supply chains? Flexibly responding to these challenges is no problem in a data-driven factory where – in addition to the IT systems – sensors, controllers, and mobile objects at the field level are also used as sources of information. Depending on communication performance, these sources can be connected directly via the Simatic S7

controller as an aggregation element or by technologies such as RFID or RTLS. A comprehensive communication network allows communication from any level to access any information. On the platform level, this information is made available to all relevant applications, which in turn implement the appropriate use cases on the basis of this data. This Industrial Internet of Things (IIoT) provides the basic information for the data-driven management of the processes.

What exactly does this mean for production management? In the data-driven factory, a production order, for example, is not simply put into production; it is automatically reconciled with the actual availability of the material at the assembly site. This eliminates search and wait times, which can instead be utilized productively. The IIoT architecture also provides the foundation for new factory >





layouts that consist of a loose coupling between individual machine parks instead of a fixed production chain. In this case, the control and coordination of machine utilization, mobile transport vehicles, robots, material flow, and employees are crucial.

The core of this architecture is a high-performance and flexible network infrastructure supplemented by a management platform for operation, diagnostics, and optimization. The data captured, which is processed by edge devices close to the process, can be used in different architectures and applications. A cloud-based solution with a data lake enables comprehensive evaluation and provides the basis for factory management. In addition, the data can be distributed across multiple locations and even across company boundaries, allowing suppliers and customers to feed the demand or delivery information into the data-driven factory in real time.

Innovative technologies and concepts

Industrial Wireless LAN (IWLAN) and Industrial 5G are used for communicating between mobile machines and robots. 5G in particular provides an infrastructure that also meets real-time requirements and has a significantly greater bandwidth for implementing even complex use cases (for example, the use of autonomous transport vehicles on a large scale). Radio frequency identification (RFID) and real-time locating systems (RTLS) connect movable assets that possess no communication capability, including material boxes, intermediate products, tools, and much more. RFID enables direct identification at the machines or transfer points and can also serve as permanent identification when smart labels are used. RTLS offer identification and locating in real time, and when display transponders are used, they can also enable new types of human-machine communication. ■

› siemens.com/digital-connectivity

INDUSTRIAL 5G

Reliable connectivity in flexible factory concepts

Today's companies have to respond more and more quickly to changing market conditions. In the factory of tomorrow, flexibility and thus the use of wireless communication will therefore become increasingly important. This is the only way to ensure the safe and reliable use of AGVs in intralogistics or mobile robots in production. 5G is opening up important prospects for developing new, flexible factory concepts in different industries.

5G is the first mobile communication standard to be developed with industrial requirements in mind, and it formalizes these requirements in the standard. In addition to connectivity via existing mobile wireless networks, 5G also allows the implementation of private 5G networks, also known as campus networks. Private 5G networks are exclusive mobile wireless networks for a defined local area like a company's premises. The company itself operates a 5G network locally using a private 5G frequency and its own 5G infrastructure. This has many advantages. For example, the scheduling of service intervals can be based on production utilization and, in the event of an error, network experts are available right on-site. Data security can also be guaranteed. In a self-managed 5G network, the data remains on-site and the company itself decides what data will be forwarded e.g., to the cloud. However, it is especially important for companies to be able to customize their 5G network to their precise requirements. A 5G network can support either the highest data rates, maximum reliability with the lowest latency,

or the connection of a large number of devices, but not all of these features at once. That is why it is important that the network be adapted to the company's own applications – and, for example, that safety-related applications like AGVs be integrated in a network that has the lowest latencies.

A solution for industrial use

To make these benefits available to industry, Siemens is developing a private Industrial 5G infrastructure solution that will be launched on the market in 2023. This compact, robust, and easy-to-use 5G solution runs on Siemens industrial PCs and is precisely tailored to the requirements of industrial use cases. It consists of a 5G core and a radio access network (RAN). The 5G core manages the entire 5G network, including the RAN. >



The RAN comprises three different elements: the central unit (CU), the distributed unit (DU), and the radio units (RUs). The CU connects the 5G core to the DUs and coordinates the 5G radio network. The DU converts the data packages into a digital radio signal. The RUs serve as the network's radios. They are installed in the production halls and convert digital radio signals that are sent and received to an analog radio signal for the end devices. Siemens has been testing a prototype of this 5G solution in industrial use for many years at its own Automotive Showroom and Test Center. The first live installation is now being deployed in the Siemens factory in Karlsruhe, Germany, which received the Factory of the Year award in 2021 for its innovative solutions, including matrix

production in flow and putting people at the center. In an area of 37,000 m², about 1,000 employees manufacture 24,000 different products, from automation and process control systems, Industrial Ethernet switches, and Industrial Wireless LAN Access Points to industrial PCs and Industrial 5G routers. Intralogistics is an important element in this highly varied production, and some of its tasks are performed by autonomous mobile robots (AMRs). To function reliably, AMRs need reliable wireless connectivity. In addition to Industrial WLAN, a private 5G network to which an AMR application is connected is also being used in the production area. ■

› siemens.com/industrial-5g

SCALANCE MUM856-1 AND MUM853-1

Industrial 5G routers for Industry 4.0

Scalance MUM856-1 and MUM853-1 5G routers enable the connection of machines, control elements, and other devices to private 5G campus networks and public 5G mobile wireless networks and provide the highest data rates, maximum reliability, and lowest latencies. They create new

possibilities for applications in industry: for example, autonomous logistics systems, mobile robots, and remote firmware updates. ■

› siemens.com/industrial-5g-router



- 5G communication in **public and private networks**
- **Fallback to lower mobile wireless standards** (3G, 4G)
- **Simple VPN remote access** via public 5G networks with the Cinema Remote Connect management platform
- **Profinet communication** via 5G
- Robust industrial design with **IP65 and IP30** degrees of protection

INDUSTRIAL ETHERNET SWITCHES

The basis for future-proof OT networks

The growing networking of machines, controls, and IT systems in plants is resulting in increasingly complex networks at the production level. Digitalization also requires that more and more members be connected to the network, often leading to large network structures in industry. To operate these OT networks, efficient Ethernet switches with high bandwidths are needed to reliably transmit data, voice, video, and Profinet.

The use of cameras, along with large software updates in production and the growing use of virtualization solutions, is a powerful driver of higher data rates in industrial communication. IP cameras are being used more and more in production to monitor and optimize processes or ensure quality. This also includes extremely data-intensive applications that use cameras to measure production elements in 3D. In industry-related applications, high-resolution cameras are used to precisely control cranes and for live monitoring in tunnel applications. In addition, a growing number of devices that supply data are being used at many points in production. This increases data rates as well as requirements for ever-higher gigabit bandwidths in the production network. As communication partners, IP cameras generate much higher volumes of data compared to pure automation and control data. That's why these cameras require a powerful and flexible network infrastructure where the switches have gigabit ports or even 10-gigabit ports to guarantee that data is forwarded quickly and efficiently.

Cloud and edge applications in the network

Today the boundaries between software and hardware in industrial plants are becoming blurred. As a result, more and more software applications for functions like anomaly detection, remote access, and even data analysis for preventive maintenance need to be integrated in the network. This creates new challenges in terms of finding the best way to make this data available to the applications.

The function extender interface provides connectivity that can be quickly implemented thanks to its simple installation with no assembly or wiring effort required. The Scalance LPE (local processing engine) platform can also be easily connected to the compact Scalance XCM-300 Ethernet switch in >



order to protect the power supply. But it's even more important to safeguard the network connection by means of internal high-performance Ethernet interfaces. These interfaces can make telegram information, mirrored traffic, and even access to members in the network available. This allows operators to implement applications for

cloud or edge computing, predictive maintenance, or anomaly detection. With its powerful, integrated CPU, Scalance LPE gathers, preprocesses, and forwards the data. ■

› siemens.com/x-300

› siemens.com/lpe

SCALANCE XC-/XR-300

Extreme flexibility and high performance in industry

The new Scalance XC-/XR-300 series extends the managed Layer 2 switches in the Scalance X Industrial Ethernet Switch product family – both as compact models and as 19-inch versions for control cabinets. OT networks are simply connected to IT, which enables more flexible production. ■

› siemens.com/x-300

› <https://youtu.be/R7UPvaQp-7c>

- **High port density** for connecting many devices in large network infrastructures
- **High-bandwidth ports (up to 10 Gbit/s)** for implementing a variety of OT network applications (for data, voice, video, Profinet)
- Future-proof networking of industrial plants in the future using Scalance XCM-/XRM-300 thanks to features like **time-sensitive networking (TSN)**, **edge functionalities**, and **seamless redundancy**



SENSOR TECHNOLOGY AND ANALYTICS

Sustainable solutions for the process industry

Increasing carbon emissions have become a topic of growing concern that must be confronted by economies and industry around the world. The pressure is on the energy-intensive process industry in particular: It is one of the main sources of global emissions of greenhouse gases, accounting for 20 percent of carbon emissions worldwide, and is currently responsible for one-third of the world's energy consumption. Manufacturers in the process industry are therefore under increasing pressure to make their production processes climate-friendly.

The first step toward improved sustainability is smart equipment. High energy consumption in plants can often be traced to mechanical components like pumps, motors, and fans. These assets are critical factors in keeping your systems operational – but often an on-site inspection is needed to determine whether they are operating in their ideal condition. Now, however, it is possible to retrofit a smart function without great expense: Smart sensors give artificial intelligence access to areas in a plant where digitalization has previously had little or almost no presence. Sitrans multisensors use vibration detection to continuously monitor the condition of critical assets. Condition data is transmitted securely to the cloud via a gateway where the timing of potential outages is calculated. Via the SCM IQ app, operators receive information about the condition of all monitored components at all times. As a result, plant maintenance can be scheduled with a lot more foresight, energy



consumption is reduced, and the overall efficiency of the plant is boosted. With this smart solution, unexpected downtimes are a thing of the past.

In a similar way, the Sitrans IQ portfolio makes use of the data available from the installed base of field devices and analyzers to enable condition monitoring, remote measurement, and inventory management – on-premises or in the cloud.

Reliable emissions management

Predictive maintenance also helps prevent undesired plant outages in process analytics. To monitor exhaust emissions from combustion processes or gases in accordance with regulations, Siemens offers process gas analyzers that not only help observe the required limit values, but also keep values below those limits. Thanks to the expansion of networking between IT and OT, devices that were not previously networked can now be accessed and incorporated into monitoring systems. The >

Analyzer System Manager (ASM) and Sitrans AID IQ software systems use smart data analyses to reliably assess the quality of running processes and predict the maintenance requirements of the installed analyzers. With ASM, it is possible to monitor, test, and manage all analyzers in the plant. The relevant information is collected using various communication protocols and saved in a central database.

A user-friendly interface lets operators access trends in measured values, device condition, and statistical evaluations from their PC, or initiate testing routines to validate measurement results. Sitrans AID IQ records internal diagnostics data from the devices, identifies potential problems or deviations that might develop in the future, and makes the details of these identified problems and the proposed solutions available to allow maintenance activities to be planned in advance. As a result, plant efficiency is increased and costs are reduced.

Smart technology that quickly pays for itself

The Sipart PS2 electropneumatic positioner, which has proven itself in many valve control applications thanks to its diagnostic capability and smart functions, also makes a contribution to use resources more efficiently. Unlike traditional positioners, whose valve control functions consume a lot of compressed air, Sipart PS2 consumes 95 percent less air and saves significant amounts of power in the process. A well-made investment for sustainability that amortizes quickly. Siemens focuses on sustainability when it manufactures these positioners, and discloses the energy balance from production and operation to recycling. Customers hence benefit from having a sturdy, long-lasting device, and can rely on quantifiable product-related data that can be put to use in emissions management. ■

› siemens.com/pi/digitalization

› siemens.com/sipartps2



Less compressed air consumption

SIPART positioners lead to savings in energy consumption of up to 80% compared to conventional positioners.

Sustainability certified



Sustainability aspects of SIPART PS2 & PS100 positioners



Pneumatic leakage monitoring

Smart chamber pressure control ensures faster valve adjustment. Integral pressure sensors monitor the compressed gas supply and valve chamber pressure.

Save costs and CO₂

Save CO₂ emissions in your processes and thus ensure future-oriented operation in your plant without compromising on reliability and performance.

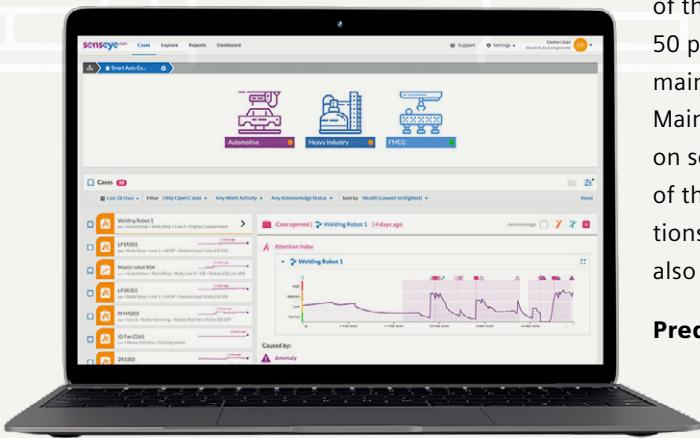


Low environmental footprint

Life cycle assessment (LCA) according to ISO 14040/44 available

SENSEYE PREDICTIVE MAINTENANCE

Prevent plant downtime



Imagine that in an automotive manufacturer's globally distributed factories, about 5 million cars will be built every year, and therefore costly shutdowns of machines and lines must be prevented. One possible solution is to evaluate the data generated on the shop floor. A globally active automobile manufacturer sought expert support from Senseye Predictive Maintenance for asset intelligence and machine learning.

Although this manufacturer has production sites in 20 countries and regions around the world and an abundance of sensor data, there were not enough qualified resources available for manual analysis. That is why they wanted to expand their use of data and machine learning, including for maintenance purposes. To reduce production shutdowns

of thousands of different machines by up to 50 percent, the company started a predictive maintenance program using Senseye Predictive Maintenance – in part because this software draws on solid experience in this area and also because of the option to scale the solution across all locations. The use of innovative AI technology was also extremely attractive.

Predictive maintenance with tangible benefits

During the more than five years that the automotive company was supported by industry experts from Senseye Predictive Maintenance, it also extended its predictive maintenance to its global production sites. Over time, the company became autonomous. The engineers can now incorporate new machines and integrate them using other in-house software independent of Senseye Predictive Maintenance.

Over 500 users are currently utilizing Senseye Predictive Maintenance to optimize maintenance activities. Thanks to AI-supported data analysis, employees now know when a machine will fail up to six months in advance and can service it in a timely manner. Reactive and preventive maintenance become predictive maintenance, with tangible results such as a reduction in maintenance expenditures, reduced downtime in the double-digit million range, and a fast return on investment in less than three months. ■

**> [siemens.com/
senseye-predictive-maintenance](https://siemens.com/senseye-predictive-maintenance)**

PREDICTIVE SERVICES FOR PRESSES

Identify press malfunctions early on

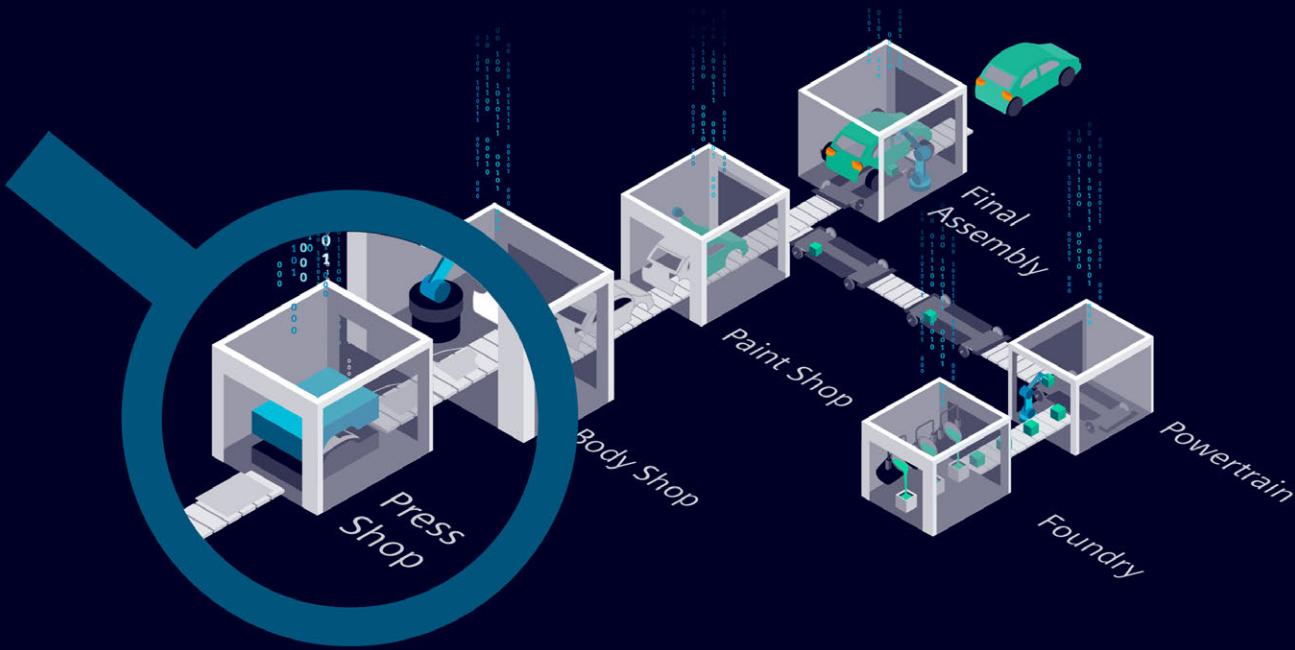
Presses are sensitive components in the automobile industry – if they fail, they can bring entire production lines to a standstill. Predictive Services for Presses let you look into the future of your presses and detect imminent faults early on. This allows maintenance work to be coordinated based on the actual condition of your production plant, instead of having to rely on set maintenance intervals.

Unscheduled downtime is especially costly in the automobile industry. A German manufacturer was experiencing regular outages in a press line for drivetrains. The employees could not meaningfully interpret the available data from the CMS (condition monitoring system) – for example, the frequency spectrum – and so were unable to identify the cause of the problems.

Sound data analysis and processing by service experts

Experienced service experts are essential for meaningfully utilizing the massive volume of generated line data. Predictive Services for Presses enable presses to connect to edge and cloud solutions. Professional analyses of drive trains displayed on the dashboard help identify the causes of wear and tear. Because every press is structured differently, our experts design customized plans and data analysis models that significantly improve transparency throughout the entire lifecycle. That makes it easier for users to plan maintenance work and improve the plant's availability and productivity on a long-term basis. ■

› siemens.com/predictive-services-contact



DRY-RUNNING PROTECTION

Reliably protect pumps in Ex-atmospheres

If flammable materials are transported in hazardous areas, the centrifugal pumps used need to be protected against dry running. Simocode provides an innovative monitoring technology.



Centrifugal pumps are monitored conventionally with level sensors that are susceptible to faults and require intensive maintenance. Whereas conventional dry-running detection is performed by the dry-running sensor via the process control to the pump, Simocode pro monitors the status of the pump

via the active electrical power consumption of the pump motor. This eliminates the need to install additional monitoring devices or sensors to detect dry running of the pump. Users benefit from reliable explosion protection per ATEX and IECEx criteria and save money and time on commissioning and maintenance.

How does active power-based dry-running protection work?

The active power is detected by special current/voltage measuring modules that are certified for use as ignition-source monitoring devices corresponding to a type b1 ignition protection system certified by ATEX and IECEx. If the flow rate decreases, the active power consumption of the pump motor also decreases. If the active power – and therefore the flow rate – falls below a minimum value, the pump is switched off promptly and automatically to prevent impending dry running. A menu-guided teach-in procedure in the engineering software helps users set the limit values. ■

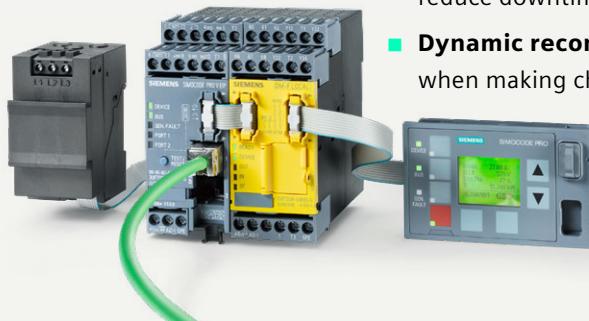
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SIMOCODE PRO

Safe, transparent, and efficient

The Ethernet-based devices of the Simocode pro motor management and control unit provide comprehensive protective, monitoring, and control functions. With the new version, users benefit from features such as Profinet S2 system redundancy that enable the uninterrupted operation of Simocode in system-redundant plants to reduce production outages. ■

> siemens.com/simocode



- **Maximum safety** thanks to ATEX certification
- **Simocode ES V18 based on TIA Portal** for consistent, efficient, and intuitive automation
- **Uninterrupted operation with redundant controllers** to boost plant availability and reduce downtime
- **Dynamic reconfiguration** for maximum flexibility when making changes in ongoing operation

SMART POWER DISTRIBUTION

Data is the new gold

A smart electrical infrastructure is the backbone of smooth operations and improved productivity – in all businesses, in all increasingly networked environments, in every sector, and for every application. The Indian company SRF Ltd., operating worldwide, has already had good experience in this regard.

More and more industrial businesses are introducing digital technologies to make their processes safer and more efficient and flexible. Power distribution and digitalization – which have become inseparably associated – play an important role here.

The intelligence of a smart power distribution is in the measuring- and communication-capable devices that are installed. They supply numerous data and thereby pave the way to greater productivity and safety. The only way to create smart power distribution is through the comprehensive use of this data – for example, data on energy condition, power quality, and the state of health of the plant components. The connectivity of this data makes it possible both to identify potential energy savings and to prevent system outages and downtimes. This saves time and money.

Future-proof with air circuit breakers

The management of SRF Ltd. needed to modernize its plants. SRF is focusing on future-proof technologies that are in line with its vision of connected, safe, and smart systems. Siemens is the right partner. SRF is already using smart products from



Siemens in its plants today. The chemical company was, however, looking not just for a product that was smart but also one that was advanced and viable into the future. In other words, a technology that would enable it to achieve its vision of safe, smart, and networked power distribution.

The Sentron 3WA air circuit breaker is therefore the cornerstone of the low-voltage power distribution system at SRF. Air circuit breakers are protection devices that are installed in the incoming feeders of the low-voltage power distribution system. In the event of an error, they can also supply higher currents, maintain them over a ➤

longer period of time, and safely disconnect them again. That is why SRF had clear requirements when it came to the circuit breaker: reliable operation, easy maintenance and diagnostics, and advanced connectivity. All of these features make the Sentron 3WA air circuit breaker the ideal partner for the company on its path to digitalization. Rajesh Tripathi, Senior Vice President Project and Engineering at SRF Ltd., confirms this:

"After deploying the new Sentron 3WA air circuit

breakers in our new factory in Bharuch for several months, we were impressed by the simple operation, availability of data, and cybersecurity features. The detailed diagnostic data and preventive maintenance notifications helped us to schedule our maintenance and minimize unscheduled down-times. We recommend this product for smart and safe power distribution." ■

› siemens.com/3wa

SENTRON 3WA AIR CIRCUIT BREAKERS

Made for makers. Simply reliable.

- **Flexible addition of features** via software improves protection of investments
- **New protection technologies** prevent failures in a distributed power supply
- **Seamless integration** in digital environments

The new Sentron 3WA air circuit breakers are more than a protection device. They are also measuring devices that can collect, measure, and transmit data. The Sentron 3WA air circuit breakers support software-based planning and configuration, digital testing and monitoring, and seamless integration in automation and IoT systems. And upgrades can now be performed on a fully digital basis for the first time. ■

› siemens.com/3wa



CO-CREATION VPW ENERGY

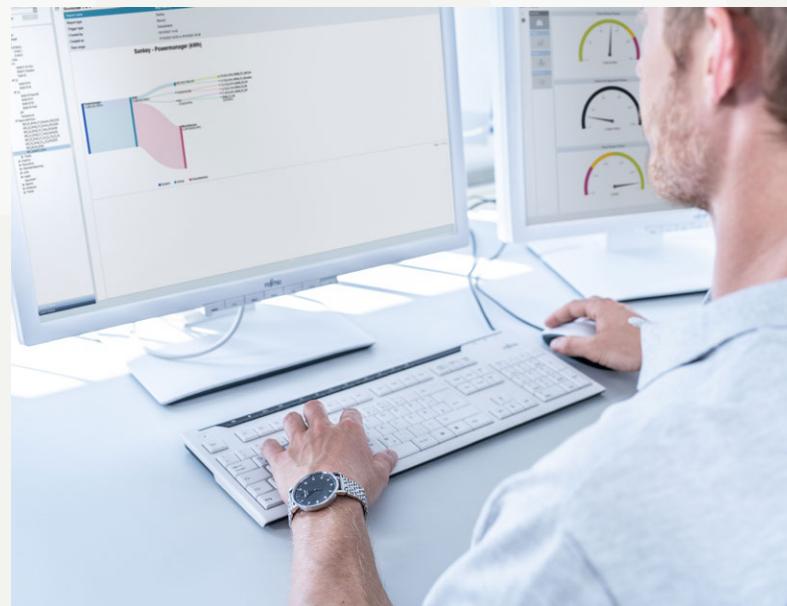
Integrated energy consulting

VPW energy and Siemens are working together as co-creation partners to develop a new function for self-learning data analysis and interpretation for the Sentron powermanager power monitoring software. In the future, this will allow users to directly derive energy-saving optimization measures and recommendations for action more quickly and precisely via software.

How can you bring decades of energy consulting experience and expertise into the future? That is the question that VPW energy asked itself. The energy consulting company – which has roughly 30 years of energy consulting experience – has long been successfully using Sentron powermanager. But the experts at VPW were still relying on their own analysis tools to analyze and interpret the measured values and derive optimization measures. To bring a majority of their comprehensive expertise into the future so they can continue to access it, VPW energy and Siemens initiated a co-creation project for digitalizing human data analytics for Sentron powermanager.

Advancing power monitoring with co-creation

Co-creation makes it possible to identify challenges, find innovative solutions, and develop new business models early on. In this co-creation project, experts from VPW energy are contributing their application expertise and field experience as energy consultants, while Siemens is offering its knowledge of the Sentron platform and its software development expertise. The key questions



behind their collaboration: How can the analysis of energy data be more fully automated and digitalized for faster results? And how can this analysis be designed more intelligently and enhanced with recommendations for action?

The analysis and evaluation process – which is based on VPW energy's vast application experience – is first being digitalized as part of the co-creation project. The goal is an intelligent add-on function for Sentron powermanager that will not only enable the software to gather and display the measured data but will also allow it to intelligently analyze and interpret the data, identify required actions, and suggest measures. All this will be achieved in a short period of time, highly precisely, and – thanks to AI – using extremely large amounts of data. To develop the intelligent data analytics function for Sentron powermanager, self-learning algorithms are being fed and trained with key >

performance indicators. Siemens experts identify these algorithms using empirical values from VPW energy, with the large pool of energy data from an injection molding company in the automotive supply industry as the source. The faster energy data can be captured and the more relevant it is, the faster savings potential can be achieved. That is where the benefits of the new Sentron powermanager add-on module come into play, because it processes large amounts of data extremely rapidly, enables impressively precise data analyses, and delivers reliable results very quickly. The AI-based module will also allow users to depend less on human empirical values in the future.

Win-win-win situation

Co-creation for power monitoring with Sentron powermanager ultimately benefits all companies

from industry to infrastructure that want or need to reduce their energy consumption – including VPW energy and Siemens. End customers benefit because their understanding of their plant will continue to improve thanks to self-learning data analytics. As a result, they are able to identify energy waste and savings potential faster. Thanks to optimized data and intelligent evaluations, VPW energy will be able to provide energy consulting services even more efficiently and selectively. Siemens also benefits, because the smart indication of required actions and recommendations for energy optimization will make the Sentron powermanager power monitoring software solution even more attractive to more customers and users in the future. ■

› siemens.com/vpw-energy

SENTRON POWERMANAGER

Power monitoring software for **smart infrastructure**

- **Improved usability and numerous innovations** in the latest version
- **High energy transparency** thanks to comprehensive reporting
- Higher plant availability thanks to **reliable condition monitoring**
- **Flexible commissioning** thanks to a customizable user interface and comprehensive graphics library for creating the dashboard
- **Secure access and operation** thanks to a clear separation of user roles



Transparency for lower energy costs and higher plant availability: The Sentron powermanager software lets energy managers, energy consultants, and facility managers monitor energy consumption in buildings and plants, identify peak loads, keep an eye on the condition of their low-voltage power distribution, and generate reports for operational power management according to ISO 50001. ■

› siemens.com/sentron-powermanager

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