SIEMENS
Ingenuity for life

Where digitalization becomes reality

Totally Integrated Automation in the Digital Enterprise

siemens.com/tia

Enjoy the benefits of the digital transformation

Totally Integrated Automation in the digital enterprise

Digitalization is changing our world – and the production methods used by today's manufacturing companies to ensure their long-term competitiveness. Customer requests are becoming increasingly individualized. In order to respond appropriately, plant operators need to reduce time to market and become more efficient and flexible, while at the same time maintaining or even improving their products' quality. Simply optimizing automation is no longer enough: Consistent, end-to-end digitalization offers real potential throughout the entire value chain.

Totally Integrated Automation (TIA) already provides everything necessary to turn the benefits of digitalization into genuine added value. With an integrated portfolio of hardware and software components, the TIA automation concept enables efficient engineering and transparent operations. As an integral part of the Digital Enterprise Suite, TIA makes digitalization tangible and enables its step-by-step implementation. With our scenarios, you see how quickly and reliably you can implement digitalization in the TIA environment.

Manufacturing companies are facing tremendous challenges

Reducing time to market

Manufacturers today have to launch their products more and more quickly, despite the products' growing complexity. In the past, the larger competitor eliminated the smaller one, but today it's the fast competitors that leave the slow ones behind.

Enhancing flexibility

Consumers want individualized products, but at the prices they would pay for mass-produced goods. That's only possible if production is more flexible than ever before.

Increasing quality

To increase quality and win over consumers, companies need to install closed-loop quality processes, and products must be traceable.

Increasing efficiency

Today it isn't just the product that needs to be sustainable and environmentally friendly – energy efficiency in production has also become an increasingly important competitive advantage.

Developing new business models

Collecting and analyzing machine data enables new, data-based business models to be developed. This lets machine builders sell their customers machine hours instead of machines, and to offer innovative services like predictive maintenance and condition monitoring. Manufacturers benefit from growing flexibility, greater plant availability, and increased productivity.

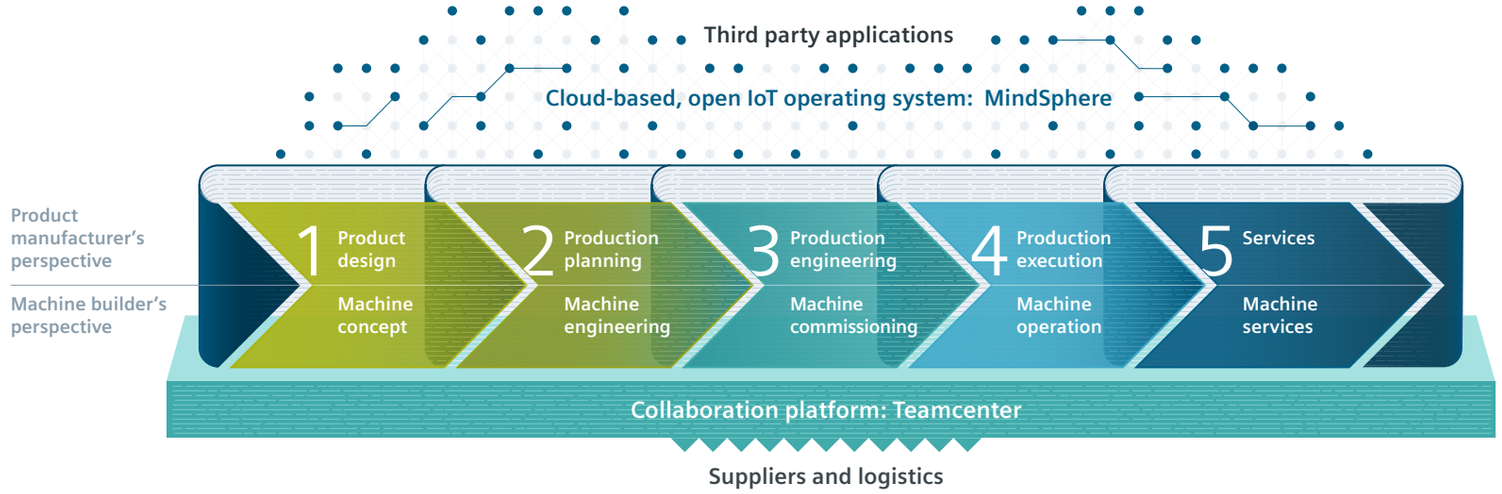
Increasing security

Another basic requirement is protection from cyber attacks. Digitalization makes production plants more vulnerable and thus requires appropriate security measures.

Digital twins across the entire value chain

A holistic approach

Remaining competitive now requires more than just optimizing individual steps in the value chain. What is needed is a comprehensive approach that takes into account the specific requirements of product manufacturers and machine builders. We support manufacturers from product design, production planning, and engineering to the production itself and services. Machine builders benefit from our portfolio beginning with the creation of the machine design to engineering, commissioning, and operation all the way to our machine service offerings.



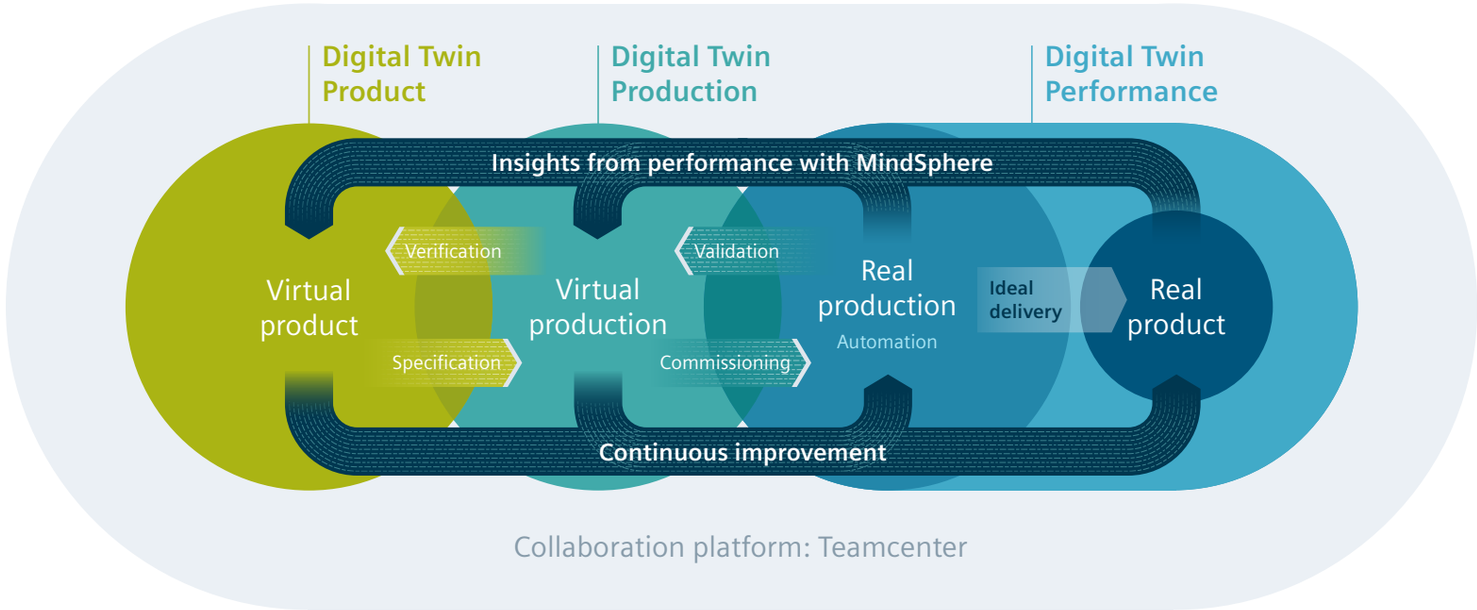
The digital twin in automation

Siemens has developed the ideal portfolio to meet all these needs: The Digital Enterprise Suite links consistently and digitally all phases and process steps all the way to the suppliers. Three interconnected digital twins are created across the entire value chain of the product and production lifecycle: the digital twin of the product, the digital twin of production, and the digital twin of performance.

The digital twin of performance involves the automation portfolio. With its end-to-end integrated hardware and software portfolio, Totally Integrated Automation lays the foundation of automation for the digital enterprise.

Production data is generated in the course of plant operation: for example, from drives, controllers, and SCADA systems. This data is fed back continuously into the virtual world of product and production development in order to get transparency, optimize the performance and increase quality in the real world of production and product through simulations and tests, and to acquire new knowledge. Teamcenter guarantees the planning of more efficient and flexible production processes using a common collaboration platform as an enterprise-wide data backbone.

Companies can implement digitalization at any point in their value chain and extend it gradually based on their current needs – even in the presence of existing system solutions.



Learn more about
Digital Enterprise Suite
siemens.com/des

How can you create machine versions faster?

With the automated execution of engineering tasks.

Reducing redundant engineering tasks

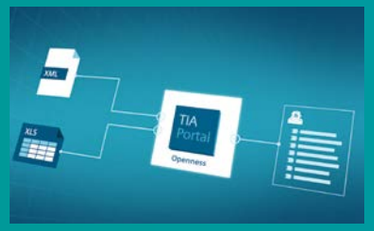
Efficient engineering is a result of shared data storage, comprehensive libraries, and intelligent editors. Thanks to the reusable program modules in the TIA Portal, you can reduce engineering effort by an average of 10 percent. Engineering tasks can also be automated with the support of the portal. External program generators can be connected to the portal via the open TIA Portal Openness interface.

In addition, the SIMATIC Visualization Architect can generate the HMI visualization automatically based on the control program.

Standards and versions of program modules ...

... can be managed using libraries and ...

... integrated into existing development processes ...



... via the open TIA Portal Openness interface.

Using a separate user interface, the engineering process is automated and ...

... the HMI visualization is automatically generated using the SIMATIC Visualization Architect.

Benefits

- **Redundant processes are eliminated as of the second machine**
- **Program quality is increased by preventing errors**
- **Efficiency is increased during maintenance and adjustments**

Our offering

TIA Portal
siemens.com/tia-portal

SIMATIC Visualization Architect
siemens.com/sivarc

TIA Portal Openness
siemens.com/tia-portal

How can you keep your automation data consistent and up to date?

With PLM integration of automation engineering.

Centrally managing large amounts of data

Teamcenter and PLM integration of automation engineering enable the central management of mechanical construction data, electrical plans, and automation data. You have the option to be automatically notified when project data changes.

Adjustments to automation projects are stored directly in Teamcenter. Consistent data retention makes it easy to reuse engineering across different machine versions.

The central management of mechanical construction data, ...

... electrical plans, and now automation data provides you with an overview of your projects.

Automatic notifications inform you when project data changes.

Adjustments to the automation project are stored right in Teamcenter.

Engineering is easy to reuse – thanks to consistent data retention ...

... across different machine versions.

Benefits

- **No time-consuming search processes**
- **Errors avoided thanks to consistent engineering data**
- **Service support thanks to up-to-date data always being available throughout the machine park**

Our offering

TIA Portal

siemens.com/tia-portal

Teamcenter

siemens.com/teamcenter

How can you always have the right engineering version at hand?

With efficient, cloud-based engineering.

Always have the right engineering version available

In order to use the correct engineering version for on-site maintenance, machine builders simply need to start the TIA Portal Cloud Connector and connect to the company network. After selecting the required version with installed license keys and activating the Cloud Connector, they can then connect to the local machine network and repair the fault in the relevant automation environment.

It's that simple: To perform maintenance, start the TIA Portal Cloud Connector ...

... and connect to the company network.

Select the correct engineering version, including a license key ...

... and activate the Cloud Connector.

Connect to the local machine network ...

... and repair the fault in the appropriate automation environment.

Benefits

- **Cross-network software access**
- **Central software management**

Our offering

TIA Portal Cloud Connector

siemens.com/tia-portal-cloud-connector

How can you use virtualization to rule out errors at an early stage?

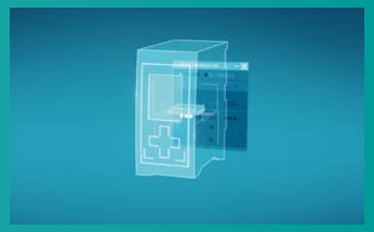
With virtual commissioning.

More time in the office, fewer on-site errors

For machine builders and operators, commissioning is a crucial time when everything has to work. Virtual commissioning at an early stage shortens actual on-site commissioning time, minimizes the risk of errors during a subsequent development phase, and makes it possible to start production sooner. The SIMATIC S7-PLCSIM Advanced virtual controller simulates controller functions and can control a virtual model of the machine or plant via an open interface as needed. The machine or plant is imaged using, for example, NX Mechatronics Concept Designer or TECNOMATIX Process Simulate.

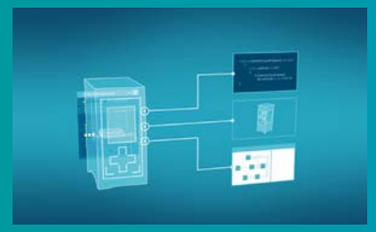
Using STEP 7 and the TIA Portal at the configuration and engineering stages ...

... and with the help of the SIMATIC S7-PLCSIM Advanced virtual controller, ...

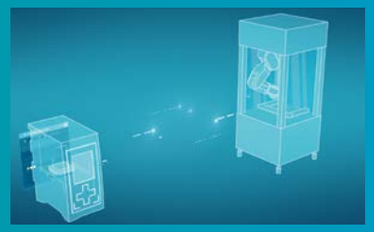


... operators can simulate and validate controller functions – without the real controller hardware.

In addition to control logic, you can also validate communication, Web servers, and fail-safe functions.



Via an open interface, you can integrate external simulations ...



... and test the controller in the context of a virtual machine, production line, or entire plant.

Benefits

- **Shorter development time thanks to parallel mechanical and automation engineering**
- **Reduced error costs thanks to early detection**
- **Easier to calculate costs for real commissioning**

Our offering

Virtual commissioning

siemens.com/virtual-commissioning

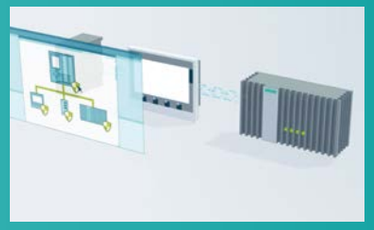
How can you protect your productivity?

With Industrial Security for plants and machines.

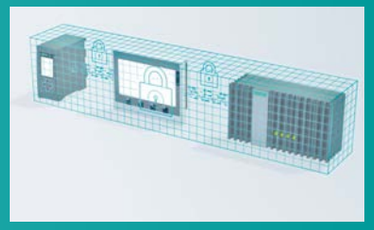
Comprehensive protection of productivity in the digital enterprise

To protect digital enterprises from cyber attacks, plant operators and machine builders need a comprehensive approach. Machine and plant security enables efficient implementation of security measures thanks to integrated security functions in the TIA Portal. Scalable and predictable security services lead to reduced costs. The security qualities of our automation components also comply with IEC 62443, the leading Industrial Security standard.

The security functions protect automation components and systems from unauthorized access, ...

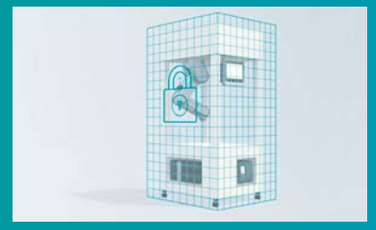


... protect the integrity of stored and transmitted data, and ...



... protect communication and authentication.

Consistent, end-to-end security engineering for automation and network components ...



... enables comprehensive protection of machines and ...

... complete protection of plants.

Benefits

- **Protection of productivity**
- **Consistent, end-to-end security engineering**
- **Comprehensive security concept**

Our offering

TIA Portal

siemens.com/tia-portal

Industrial Security

siemens.com/industrial-security

How can you monitor and analyze machines worldwide?

With data acquisition for cloud services.

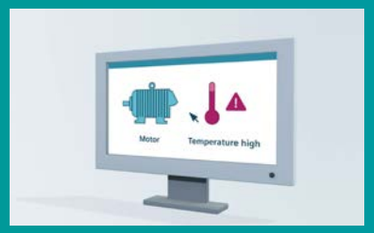
Monitoring and analyzing machines worldwide

MindSphere – the cloud-based, open IoT operating system from Siemens – allows you to monitor and analyze machines worldwide. The secure connection between machines and the cloud is easily established using MindConnect connectivity elements. Machine builders and plant operators benefit from the diagnostic and analysis options for their global distributed machines. It's also possible to use the resulting data to develop new business models with sustainable competitive advantages.

Monitor and analyze machines using MindSphere – the open, cloud-based IoT operating system.

You can easily and securely connect machines to the cloud using the integrated MindConnect function modules, like SIMATIC IOT2040 and MindConnect IOT2040/Nano.

Machine builders and plant operators will benefit from a resulting optimal plant availability.



The machine manufacturer is immediately notified of any deviations from standard values via MindSphere ...

... and can offer the operator both services and original spare parts.

It's even possible to compare machines worldwide.

Benefits

- **Secure data exchange with MindSphere**
- **Transparency across all machines worldwide**
- **Creation of new business models**

Our offering

MindSphere

siemens.com/mindsphere

IOT2000

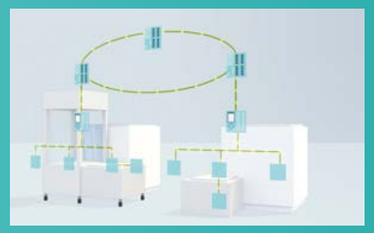
siemens.com/iot2000

How can you access production data at all company levels?

Through industrial communication.

End-to-end communication networks

It isn't just the individual machines that generate data – it's also generated by entire production lines. End-to-end industrial communication networks not only allow machines to share this data with each another; they also enable its use by enterprise IT systems or via the cloud. Data analyses then provide valuable insights into how your production lines are performing.



In modern manufacturing facilities, individual machine components communicate with one another – and so do entire production lines.

In addition to reliable machine-to-machine communication, TIA and OPC UA also ensure ...

... a secured connection to the enterprise IT system and the cloud.

The network is engineered in the TIA Portal.

This means that you're fully networked and can use your data efficiently – any time and across locations.

Consistent, end-to-end digitalization is a function of individualized concepts and services for industrial communication networks.

Benefits

- **Reliable communication**
- **Maximum transparency**
- **Uniform configuration**

Our offering

Industrial networks

siemens.com/industrial-networks

How can you systematically reduce your energy consumption?

With integrated energy management.

Making energy flows and energy consumption transparent

Collecting and visualizing energy data is essential for increasing energy efficiency. This applies not only to electricity but to all other forms of energy relevant to production, including heat and compressed air. With the help of the SIMATIC Energy Suite, this data is gathered and processed directly in the controller. SIMATIC WinCC can store and visualize the energy data for the purpose of evaluation. The SIMATIC Energy Suite is a consistent, end-to-end system with transparency from the infeed to energy distribution to the consumer.

Collect and visualize production-related energy data ...

... right on the machine with SIMATIC Energy Suite.

Compare and analyze entire production lines in SCADA using WinCC Professional.

Establish a company-wide basis for management decisions based on all collected data with SIMATIC Energy Manager.

Identify major energy consumers and derive energy-efficiency measures.

Precise consumption forecasts for favorable power supply contracts.

Benefits

- **In-depth energy analysis**
- **Calculable energy consumption**
- **Optimized production costs**

Our offering

SIMATIC Energy Suite
siemens.com/simatic-energy-suite

SIMATIC WinCC
siemens.com/wincc-tia-portal

SIMATIC Energy Manager PRO
siemens.com/simatic-energy-manager-pro

How do you maintain full transparency all along your value chain?

With RFID-enabled supply-chain management.

Making simple objects smart

Full process transparency is a fundamental component of the digital factory – which in turn requires that different objects can communicate with one another.

Radio frequency identification (RFID) solutions allow you to transform any objects into smart assets. Simple objects like containers and workpieces independently share information on their condition, location, and recording time with other automation components and IIoT systems along the entire value chain – worldwide, reliably, flexibly and in real time.

With RFID readers and transponders, parts and containers communicate with one another as well as with other automation components and plants.

This means that you can clearly identify and track products and containers along the entire value chain.

For example, plant communication and control occur on the controller via PROFINET. Production and quality data is written directly on the transponder ...

... and optionally transmitted to IIoT systems like MindSphere via OPC UA.

You're always informed about the utilization, condition, location, and recording time of all parts and containers ...

... and can share this information with all members of the value chain – and, if necessary, with destinations outside the company.

Benefits

- **Full process transparency**
- **Efficient production**
- **Development of new business models**

Our offering

Industrial identification

siemens.com/ident

RFID systems

siemens.com/rfid

How can you align maintenance activities with actual needs?

By analyzing drive data.

Basing maintenance activities on actual needs

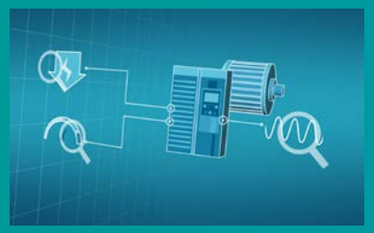
You can monitor all drive components using the Analyze MyDrives MindApp. The operational data is analyzed via the connection provided by Mind-Connect to MindSphere – the cloud-based, open IoT operating system.

This newly obtained transparency allows you to recognize trends and derive recommendations for actions, receive active notifications of critical machine states, and therefore initiate maintenance only when it's actually needed.

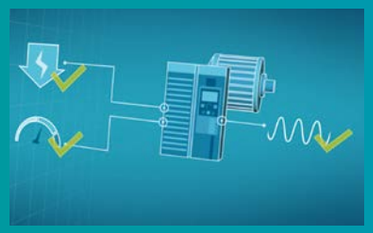
The Analyze MyDrives MindApp enables monitoring of all drive components ...

... that are connected to MindSphere via MindConnect.

Analyzing operational data prevents unnecessary maintenance.



You'll benefit from maximum transparency thanks to the collection and evaluation of a variety of parameters.



As a result, you'll recognize trends and can derive recommendations for actions.

Active notifications inform you of critical machine states and of maintenance that's actually needed.

Benefits

- **Predictive maintenance**
- **Fewer service intervals**
- **Optimized resource utilization**

Our offering

SINAMICS converters

siemens.com/sinamics

TIA Portal SINAMICS Startdrive

siemens.com/startdrive

How to optimally combine individual machines into a synchronous line?

With standardized data interfaces and status models.

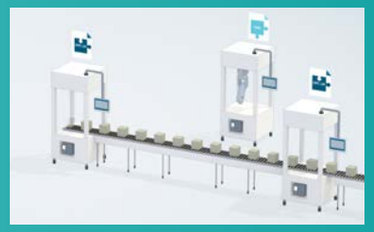
Line integration the fast and safe way

Integrating machines into a line becomes significantly easier with standardized data interfaces and status models.

Thanks to these well-established industry standards you are implementing upon a validated foundation that helps you reduce failures and to increase openness of your automation solution. OPC UA Companion Specifications make it easier than ever before to use standardized data interfaces.

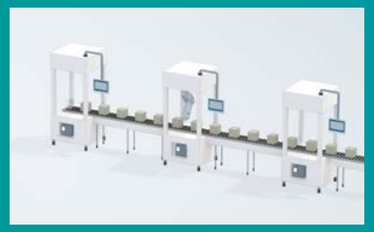
When the behavior of the machines is synchronized as well, synchronization of machines in a line becomes even easier. Implementing a standardized behavior, e. g. OMAC state model, all machines can be controlled centrally from a line control unit.

Different data interfaces make the data exchange difficult.



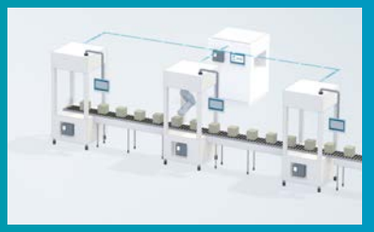
Standardized data interfaces are the solution.

Using the OPC UA Modeling Editor to link the standardized data interface with the controller data to a standardized interface.



Standardized state models enable synchronous machine behavior during operation ...

... and control by a single line controller.



For easy machine control and reduced communication load.

Benefits

- **Line integration in record time**
- **Reduced risk thanks to validated standards**
- **Open and flexible thanks to standardization**

Our offering

SIMATIC OPC UA S7-1500

siemens.com/opc-ua-cpu1500

Siemens OPC UA Modeling Editor (SiOME)

siemens.com/opc-ua-modelling-editor

How do you integrate different kinematics in your plant?

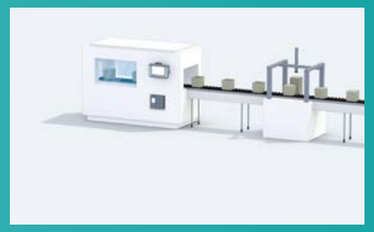
With integrated engineering of kinematics.

Flexible machines require power motion control systems

An increasing automation degree and merging of kinematics and automation technologies increasingly change machine building.

Kinematics are often used for transportation processes of products within machines, while using different engineering tools and operation philosophies. Siemens offers a unified and consistent engineering and operation concept for these applications in the familiar SIMATIC environment, with requiring specific kinematics know-how.

Easy configuration and programming of different kinematics with five to six axles thanks to program integration in the TIA Portal.



SIMATIC T-CPU: Use one controller for all automation tasks.

System integration of kinematics with up to four axles with technology objects.

Uniform HMI face plates for different kinematics.

Intuitive operation and programming of trajectories with SIMATIC HMI.

Validation of motion programs with SIMATIC S7-PLCSIM Advanced and NX Mechatronics Concept Designer (MCD).

Benefits

- **Easy integration without any expert know-how**
- **Validation of engineering**
- **Uniform operating philosophy for all kinematics**

Our offering

Robot integration in the TIA Portal
siemens.com/tia-portal-robotics

SIMATIC S7-1500 T-CPU
siemens.com/simatic-technology

Virtual commissioning of automation solutions
siemens.com/virtual-commissioning

What's the perfect training method for operators of new machines?

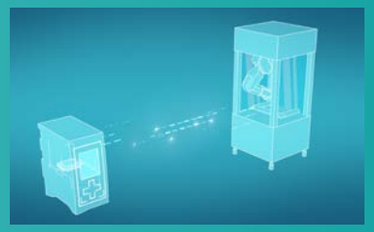
With virtual training.

Training of machine and plant operators before the new machine exists

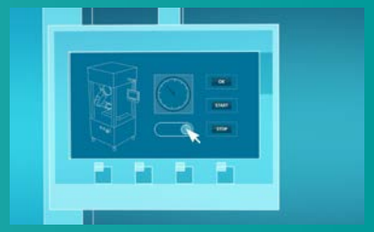
Virtual training enables you to train your customers under the most realistic conditions, before the real plant even exists. This makes it possible to create trainings for new plants and new operators with maximum realism and highest efficiency.

Different technical approaches, from training with a real operating device or training with a simulated device, enable to cover different training scenarios and requirements in order to qualify employees quickly. It's also possible to validate usability of operating devices during the engineering phase and to reduce costs for trainings with virtual training.

As early as the engineering phase, routine tasks and error scenarios ...



... can be trained at the virtual machine ...



... with simulated operating devices ...

... or with virtual machines and real operating devices.

Operating experiences can flow into development of an operating concepts early ...

... and lead to shorter training times at new machines and plants, thus reduce costs from operating errors.

Benefits

- **Improve operating concepts**
- **Reduce training periods**
- **Reduce costs from operating errors**

Our offering

SIMATIC S7-PLCSIM Advanced
siemens.com/tia-portal-plcsim-advanced

Technomatix NX MCD
siemens.com/plm/nx-mcd

TIA Portal
siemens.com/tia-portal

How to exchange planning data digitally and platform independent?

With Automation Planning.

Seamless transfer of planning and engineering data

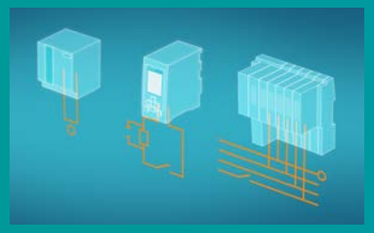
Configuration of automation hardware in the TIA Selection Tool enables time and cost savings thanks to error-free configuration of the entire automation portfolio.

Transfer of automation configuration for engineering in the TIA Portal or for electrical planning in ECAD systems via automation markup language (AML) files leads to increased quality and avoiding redundant planning steps and errors. Full flexibility is enabled thanks to the standard AML interface.

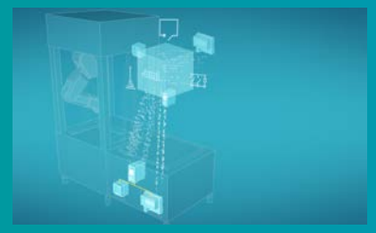
Transferring plant planning data between hardware planning, electrical planning and hardware engineering.

Configuration of hardware with the free TIA Selection Tool.

Saving individual configurations as AutomationML file.



Continuing electrical planning without redundant multiple inputs.



Direct import of data for engineering in the TIA Portal.

Consistent automation workflows and uniform data exchange.

Benefits

- **High data quality through consistency**
- **Faster planning**
- **One exchange format for higher flexibility**

Our offering

TIA Portal

siemens.com/tia-portal

TIA Selection Tool

siemens.com/tst

How can mechanics, electrics and automation be processed in a structured and parallel manner?

With Collaborative Automation Design

Optimization of the development process

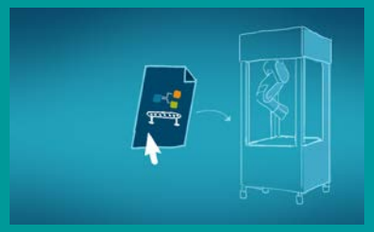
Shorter innovation cycles have a considerable impact on engineering and require an optimization of the development process of machines and plants. The Automation Designer links the available data from the mechanical design and planning process with the electrical and automation design. A common database ensures data consistency between all disciplines and enables concurrent engineering with a central application.

In addition, the required electrical schematics and associated automation programs can be generated according to predefined rules and templates instead of being programmed manually. This increases the efficiency of the engineering, improves the quality of the automation solution and reduces the risk of errors.

All disciplines of machine and plant planning.

Parallel working based on Teamcenter.

Connecting mechanics, electrics, and automation.



Mechatronical templates allow reuse.

Visualization and simulation of machines.

Cross-discipline engineering with Automation Designer.

Benefits

- **Consistent database**
- **Automated workflows**
- **Fewer sources of error**

Our offering

TIA Portal

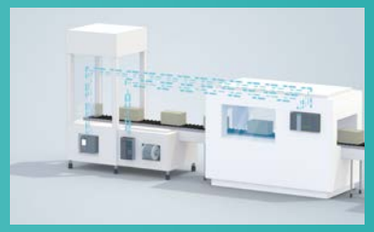
siemens.com/tia-portal

How to process data from your machines in a future-proof manner?

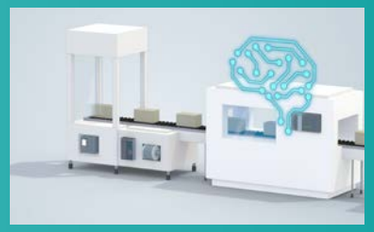
With local processing and implementing benefits of the cloud.

Expanding automation with new functions

Industrial Edge is the next generation of digital automation. With Industrial Edge you can use the intelligence and scalability of the cloud directly in your production – easy, powerful, and without your data leaving the shop floor. Industrial Edge combines local and powerful data processing directly in the automation environment with the benefits of the cloud: app-based data analytic, data processing and Infrastructure-as-a-Service concepts with central update functionality.



Extract and process data from automation components in real-time ...



... and expanding automation with new functionalities like Artificial Intelligence.

Thanks to central connection of all Edge devices to the Edge Management ...

... Edge devices can be diagnosed globally.

Central distribution of new functions based on apps with just a mouse click.

Siemens Industrial Edge takes your productivity to the maximum.

Benefits

- **The link between automation and the cloud**
- **Central administration and security**
- **Continuous updates and innovations**

Our offering

Siemens Industrial Edge

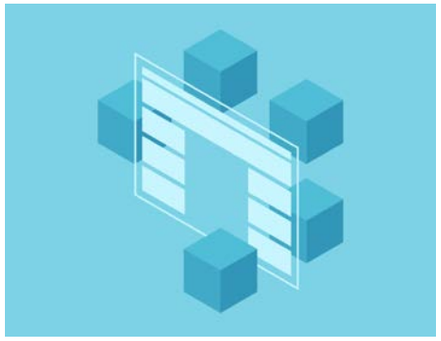
siemens.com/industrial-edge

MindSphere

siemens.com/mindsphere

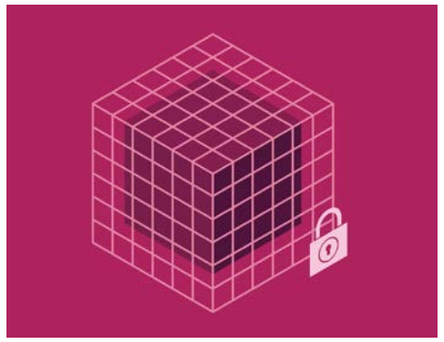
TIA creates added value in all automation tasks

Totally Integrated Automation – industrial automation from Siemens – stands for the efficient interoperability of all automation components. The open system architecture covers the entire production process and is based on the consistent presence of shared characteristics: consistent data retention, global standards, and uniform hardware and software interfaces. These shared characteristics minimize engineering effort, resulting in lower costs, reduced time to market, and greater flexibility.

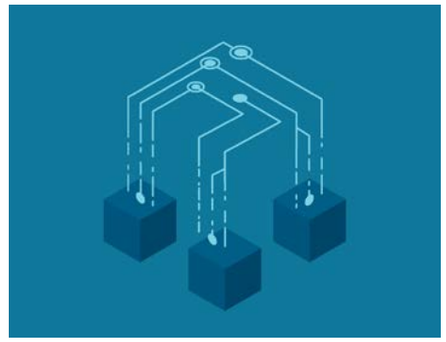


Integrated Engineering
TIA enables holistic engineering all the way from mechanical construction to electrical configuration and to automation. This reduces costs, effort and expenditure of time.

Industrial Communication
Transparency across all levels is important. That's why TIA relies on consistency with powerful communication networks for horizontal and vertical communication up to the cloud. Without language barriers, thanks to standards that are international and independent from vendor and platform.



Industrial Security
At the same time TIA strictly uses integrated security and defense measures to ensure that despite increasing networking and open standards machines and plants are as secure as possible – to protect productivity.



Data Intelligence
TIA provides the platform to collect data along the entire value chain, to transform data into information and hence to create knowledge.

Digital Industry Services
Digital Industry Services are an essential part when it comes to a customer specific and individual implementation of the Digital Enterprise. With our holistic approach starting with consulting and implementation to data analysis you will not only unlock hidden potential but reduce downtimes or cut energy consumption.

Visit our Reference Center and find out how our customers use the Siemens TIA portfolio to implement their application:

siemens.com/automation/references

Product portfolio factory automation

Cloud

Applications

MindSphere

Management

Manufacturing Execution System

Operations

SCADA System

Network Management

Totally Integrated Automation Portal

Energy Management

Industrial Edge

Control

Controller

Human Machine Interfaces

Industrial PCs

Industrial Communication

Motion Control

CNC

Field

Power Supply and Distribution

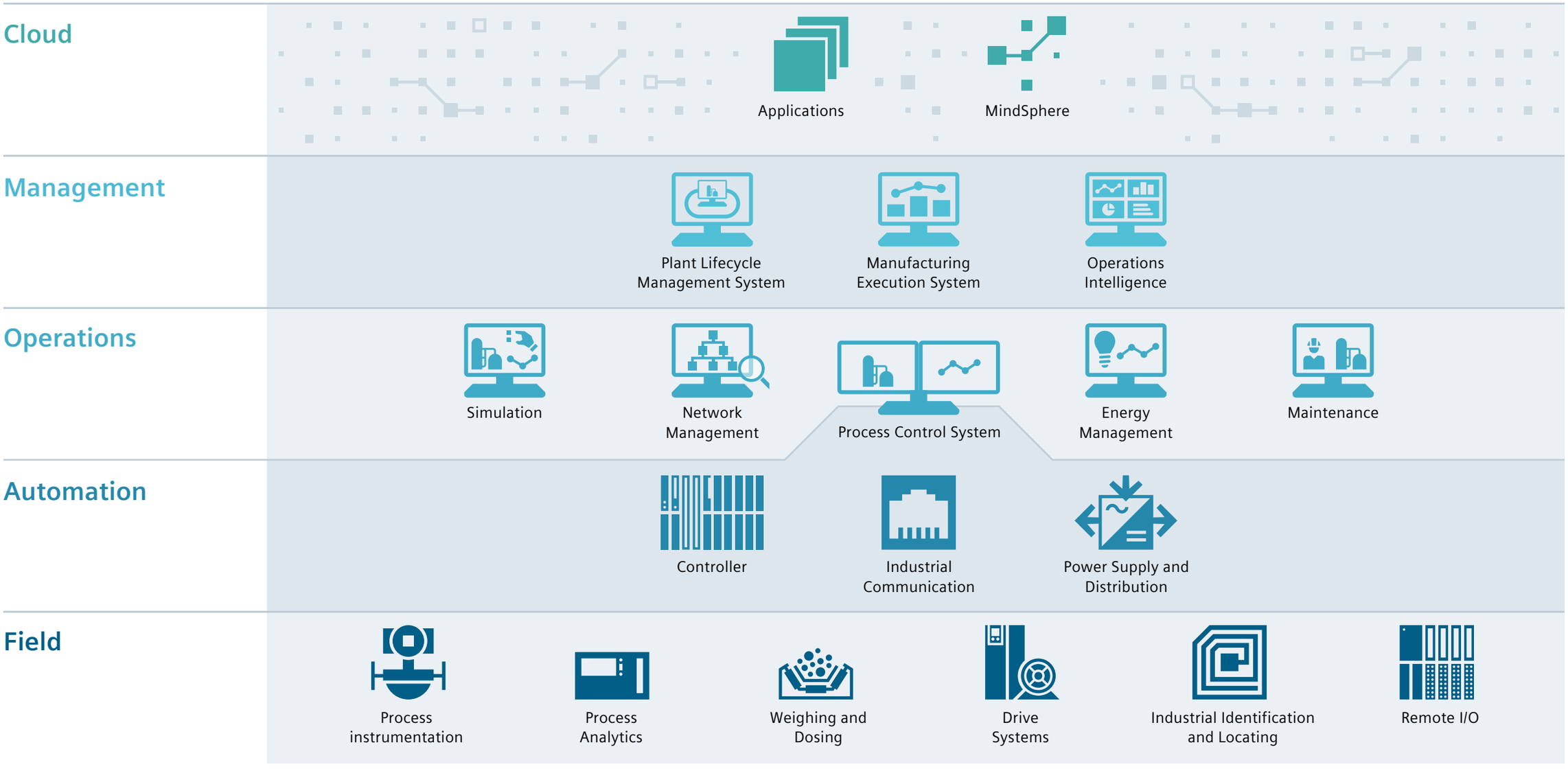
Industrial Identification and Locating

Distributed I/O

Drive Systems

Industrial Controls

Product portfolio process automation



Our digitalization solutions are already being used successfully in many industries.

"We can now automatically generate more than 90 percent of the automation code – and can fully concentrate on the specific customer requirements defined for each application."

Armin Egli, Software Developer
at Bühler AG

"To configure communication connections with the click of a mouse and be able to rely on their functioning – that simplifies engineering tremendously."

Ulf Könekamp, Engineering Manager,
Dieffenbacher GmbH Maschinen- und Anlagenbau

"The digital twin allows the early detection of errors, which significantly shortens commissioning time."

Dr. Hagen Gehringer,
Managing Director of Bausch + Ströbel Maschinenfabrik Ilshofen GmbH+Co. KG

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Digital Factory
P.O. Box 48 48
90026 Nuremberg, Germany

For more information, please contact
our Customer Support Center.
Tel.: +49 180 524 70 00
Fax: +49 180 524 24 71
(Charges depending on provider)

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