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.

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.

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.

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.

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.

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.

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.

**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.

Benefits

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

Our offering

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

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

Precise consumption forecasts for favorable power supply contracts.
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.

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 MindConnect 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.

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.

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.

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

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

Virtual commissioning of automation solutions with SIMATIC S7-PLCSIM Advanced and NX Mechatronics Concept Designer (MCD).

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.

Flexible machines require power motion control systems
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.

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.

Benefits

• Consistent database
• Automated workflows
• Fewer sources of error

Our offering

TIA Portal
siemens.com/tia-portal

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.
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.

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.

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Visit our Reference Center and find out how our customers use the Siemens TIA portfolio to implement their application: siemens.com/automation/references

**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.
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

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- Digital transformation
- Use cases
- TIA added value
- TIA portfolio
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