PROFINET
Productivity advantages through fast and open Ethernet Standard
PROFINET – sustainable competitive advantages for your machines and plants

With PROFINET, Siemens uses the Ethernet standard for automation. PROFINET facilitates rapid and safe data exchange on all levels and thus supports the realization of innovative machine and plant concepts. Thanks to its flexibility and openness, PROFINET offers maximum flexibility to the user when it comes to designing the machine and plant architecture. The efficiency of PROFINET ensures the optimum utilization of available resources as well as a considerably increased plant availability. Innovative Siemens products coupled with the performance of PROFINET result in a sustainable increase in corporate productivity.

Setup for success
Globalization is opening up completely new growth opportunities for companies. Yet, this also entails new challenges: Standing up to global competition in the long run necessitates the rapid production of high quality as well as reliable maximum plant availability. Flexibility, productivity and efficiency also represent decisive success factors for your company, which can be optimized on the basis of PROFINET.

Systematic future security
With the Totally Integrated Automation Portal (TIA Portal), we offer an engineering framework which combines all engineering tools. Within the TIA Portal, PROFINET represents the communications standard of all new products such as SIMATIC S7-1500. This combination creates the basis for integrated data management and maximum consistency.

Continuous development
The world’s largest field bus organization PROFINET International (PI) promotes the technical development and international implementation of PROFINET – as well as the conversion from PROFIBUS to PROFINET. Since September 2014, PROFINET has become a national standard in China.

Your advantages at a glance

<table>
<thead>
<tr>
<th>Flexibility</th>
<th>Efficiency</th>
<th>Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tailored plant concepts</td>
<td>Optimum utilization of resources</td>
<td>Increased productivity</td>
</tr>
<tr>
<td>Industrial Wireless LAN</td>
<td>One cable for everything</td>
<td>Speed</td>
</tr>
<tr>
<td>Safety</td>
<td>Device/network diagnostics</td>
<td>High precision</td>
</tr>
<tr>
<td>Flexible topologies</td>
<td>Energy efficiency</td>
<td>Large quantity structures</td>
</tr>
<tr>
<td>Open standard</td>
<td>Easy wiring</td>
<td>High transmission rate</td>
</tr>
<tr>
<td>Web tools</td>
<td>Fast device replacement</td>
<td>Redundancy</td>
</tr>
<tr>
<td>Expandability</td>
<td>Ruggedness / stability</td>
<td>Fast start-up</td>
</tr>
</tbody>
</table>

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Maximum flexibility for the realization of your ideas

Against the background of ever shorter innovation and product lifecycles throughout all sectors, rapid response times and optimized processes represent the basic prerequisite for permanent competitiveness. Thanks to maximum flexibility in terms of plant structures and production processes, PROFINET facilitates the realization of innovative machine and plant concepts. For example, mobile devices can also be integrated in difficult-to-access locations.

Increased flexibility with PROFINET

**Industrial Wireless LAN (IWLAN)**
IWLAN ensures reduced maintenance costs, increased reliability as well as a high-performance communication. Only PROFINET allows the combination of safety and IWLAN.

**Safety**
Safety-related communication via PROFIsafe ensures the reliable protection of persons, environment and plants. No special network components are required as standard switches and gateways can be used without restrictions.

**Expandability**
PROFINET supports the expansion of network infrastructures as required – also during ongoing operation.

**Open standard**
The openness of PROFINET creates the basis for a uniform automation network for machines and plants to which both automation as well as conventional Ethernet devices can be connected.

**Web tools**
PROFINET is 100 percent Ethernet and supports TCP/IP. Amongst others, this facilitates the utilization of web technologies such as access to the field devices’ integrated web server.

**Flexible topologies**
In addition to line structures, PROFINET also supports star, tree and ring structures. This results in a high degree of flexibility. The PROFINET network can be installed without any special expert know-how and complies with all relevant requirements in industrial environments.

With Industrial Wireless LAN, the SIMATIC Mobile Panel provides the plant operator with greater mobility. He can work from wherever his presence is required – without compromising on safety.

PROFINET supports various network structures and thus facilitates a high degree of flexibility in terms of machine and plant planning – also in combination with profiles such as PROFIsafe.

- **Flexibility**
- **Tailored plant concepts**
- **Industrial Wireless LAN**
- **Safety**
- **Flexible topologies**
- **Open standard**
- **Web tools**
- **Expandability**

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Increased efficiency for increased profitability

With continuously increasing prices of raw materials and strict environmental regulations, companies are looking to employ their resources worldwide more economically and efficiently – particularly in the field of production.

The key to solving this problem is PROFINET: Easy engineering for accelerated commissioning coupled with reliable devices for increased plant availability. Moreover, comprehensive diagnostics and maintenance concepts ensure minimized plant downtimes and maintenance costs.

**Increased efficiency with PROFINET**

**One cable for everything**

PROFINET offers many functions in a single cable: Machine and standard IT data are merging. This results in consistency and saves costs thanks to reduced wiring and training expenditures.

**Device and network diagnostics**

Extensive diagnostics data can be read from the devices to locate faults quickly. HTML standard websites serve the maintenance of PROFINET devices – on site and remote.

**Increased energy efficiency**

PROFInergy disconnects individual loads or complete production units during break periods – in a coordinated and centrally controlled manner.

**Easy wiring**

Fault-free assembly of industrial-standard networks in minimum time and without expert know-how: PROFINET makes this possible with the FastConnect cabling system.

**Fast device replacement**

When a PROFINET device is replaced, the I/O controller detects the new device and automatically assigns a name to it.

**High ruggedness**

The use of switches also in field devices ensures that interferences in one part of the network do not influence the entire plant network. For particularly EMC-critical areas, PROFINET allows for the use of optical fiber cables.

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High performance for increased productivity

Performance and precision are the decisive factors for market success. Therefore, accurate motion control, dynamic drives, high-speed controllers and deterministic device synchronization represent key factors for superior production plants.

The performance of PROFINET offers sufficient reserves for current and future requirements and thus facilitates continuously increased productivity.

Increased performance with PROFINET

**Speed**
Fast motion control applications necessitate high-speed data exchange. The short PROFINET cycle times increase the productivity of machines and plants.

**Precision**
Communication via PROFINET is deterministic. A jitter of < 1 μs results in a highly precise clock rate and thus ensures high product quality.

**Redundancy**
Increased plant availability can be ensured through redundant installation. This can both be realized by means of external switches as well as directly via the integrated PROFINET interfaces.

**High data rate**
PROFINET offers a considerably higher data rate than conventional field buses. Even the transfer of large data volumes is smoothly supported without any effect on I/O data transfer.

**Large quantity structures**
With PROFINET, up to 256 devices can be managed by one SIMATIC controller. The number of stations per network is factually unlimited.

**Fast start-up**
In modular plants, I/O controllers have to rapidly detect new machines or plant parts. Using the fast start-up function, PROFINET devices can be identified as fast as < 500 ms and connected with the I/O controller.

PROFINET offers excellent performance. Already today, all your applications can be realized with PROFINET. With cycle times of up to 31.25 μs, the PROFINET standard offers sufficient reserves also for future requirements.

SINAMICS drive technology and PROFINET ensure sufficient speed in your machine as well as maximum precision for motion control applications.

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Can I further use existing PROFIBUS know-how?
PROFIBUS will continue to play a major role also in the future. This is why the easy and smooth integration of PROFIBUS was already taken into account in the development of PROFINET: The engineering of PROFINET very closely resembles that of PROFIBUS. For example, a SIMATIC ET 200SP station can be converted to PROFINET through simple replacement of an interface module: Simply change the configuration and reload it – done.

Do I have to convert plants completely or is gradual conversion also a possibility?
Existing plant parts can be easily connected to PROFINET: Via the IE/PB Link PN IO or also wireless in combination with SCALANCE W. This way, field devices on PROFIBUS can be effortlessly integrated in new PROFINET plants – for individual and gradual conversion.

Is the transition complicated?
The basic technologies are familiar: Easy integration of distributed I/O analogous to PROFIBUS DP, address assignment and naming analogous to a PC. This makes conversion easy and enables you to promptly benefit from PROFINET. Utilization of the VD technology also allows for the further use of existing PROFIBUS lines.

Try it out and configure a known, frequently used PROFIBUS application with PROFINET. Ease of handling and perfect results will convince you.

Is the transition worthwhile for me?
Thanks to the many advantages regarding the implementation of automation tasks, conversion to PROFINET is in any case worthwhile: Flexible topologies, one cable for all applications, wireless with safety and a considerably increased system performance through scalable mechanisms speak for themselves.

When is the right time for me?
With 7.6 million nodes, PROFINET is the leading Ethernet standard for automation, on which more than 14,000 of our customers already rely today. Ever more devices feature a PROFINET connection – for almost all application areas and sectors. You can thus use every function for the realization of automation solutions with increased flexibility, efficiency and performance.

What about support?
Siemens supports your conversion process with comprehensive services – from training courses to direct consulting on site down to your networks’ approval.

PROFIBUS or PROFINET?
PROFIBUS has been established as the leading field bus for machines and plants for many years. Based on serial bus technology, it revolutionized the automation world in the 80’s and for the first time created the basis for distributed concepts. In the 90’s, Ethernet spread throughout IT and industry applications. Today, both systems have become indispensable in the field of production. PROFINET combines the advantages of both standards: The industrial experience of PROFIBUS and the openness and flexible options of Ethernet.

Good reasons for conversion

PROFINET allows for considerable performance gains. The advantages of the leading field bus PROFIBUS, combined with the manifold options of Ethernet, represent the basis of PROFINET. Highlights such as safety via wireless are supported just as smoothly as highly dynamic isochronous motion control applications.
**PROFINET profiles**

PROFINET profiles specify additional manufacturer-independent characteristics and behaviors for devices and systems in the field of automation technology, e.g. energy management, functional safety and controlled drive technology. They thus serve as a device- and manufacturer-neutral software interface for the user program. Device-specific details as well as all details of communication are hidden. This ensures that the software engineering of equipment used in the machine or plant remains absolutely independent.

### PROFIdrive: Rapid and easy implementation of drive concepts

PROFIdrive defines the device behavior and access procedures to internal device data for electric drives on PROFINET – from simple frequency converters to high-performance servo controllers. The drive interfaces are kept as simple as possible and free of technological functions.

**Your advantages**
- Uniform application interface for motion control and drive-based safety
- Replaceability of devices
- Diagnostics via bus

**Reduce your engineering and commissioning time – with PROFIdrive!**

### PROFIsafe: Safety-related communication – open, integrated and proven

PROFIsafe facilitates the realization of safe plants and machines on the basis of PROFINET via a communication line (wired or wireless) – without a second separate bus system. Moreover, the transmitted telegrams are permanently monitored.

**Your advantages**
- Reusability of safety concepts
- Established standard of safety technology
- Minimized wiring
- Fail-safe wireless communication via IWLAN

**Benefit from the easy and reliable implementation of safety applications!**

### PROFIenergy: Communication with energy saving potentials

PROFIenergy supports the easy automatic disconnection and connection of technologically correlated plant parts. Coordination is realized centrally via a higher-level control. The result: Considerably reduced energy costs.

**Your advantages**
- Controlled energy consumption
- Coordinated disconnection and connection of complete plant parts
- Elimination of the need for permanently wired external systems

**Reduce your energy costs with PROFIenergy!**

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**PROFINET for machine builders**

Future security and investment protection as well as high availability are of paramount priority for mechanical engineering. Against this background, PROFINET offers the optimum solution thanks to its flexibility, efficiency and performance. The Industrial Ethernet standard offers clear added value throughout a machine’s entire lifecycle.

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**Concept and engineering**

PROFINET creates the prerequisites for efficient engineering and thus supports the implementation of a modular system concept. The resulting advantages are particularly outstanding for mechanical engineering: Customized machines can be realized faster and with significantly reduced expenditures – from small mounting units to complex production machines. Furthermore, they can be expanded or retrofitted more easily and adjusted to new tasks more flexibly.

- **Safety** – Highly efficient compliance with increasing requirements placed upon functional machine or plant safety with PROFIsafe and already integrated safety functions in the devices; simultaneous transfer of safety, I/O and standard communication via the same network (wired or wireless)
- **Open standard** – Integrated communication of products by various manufacturers based on a harmonized standard (IEC 61158/61784)
- **Expandability** – Expansion or modification of stations in PROFINET networks through option handling, also within the station itself, without impact on the network performance (cycle time)
- **One cable for everything** – Transfer of all relevant data via a single network

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**Your advantages of PROFINET for machine builders at a glance:**

<table>
<thead>
<tr>
<th>Concept and engineering</th>
<th>Commissioning</th>
<th>Operation and maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety</td>
<td></td>
<td>Safety</td>
</tr>
<tr>
<td>Open standard</td>
<td></td>
<td>Performance</td>
</tr>
<tr>
<td>Expandability</td>
<td></td>
<td>Expandability</td>
</tr>
<tr>
<td>One cable for everything</td>
<td></td>
<td>Fast device replacement</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Device/network diagnostics</td>
</tr>
</tbody>
</table>
Commissioning

When it comes to commissioning, the advantages offered by networking all devices via PROFINET become obvious. For example, diagnostics messages are not only available on the machine, but can also be transferred to superior stations.

The interoperability of various devices and systems operated with PROFINET facilitates uniform access during commissioning.

PROFINET is particularly suitable for series machine manufacturing as it allows for a considerably easier and more cost-efficient reproduction of machines. This ultimately results in time savings thanks to accelerated commissioning on site. Not least, also the independent commissioning of individual machine parts is supported – even when the overall system is not yet available.

- **Device/network diagnostics** – Partial commissioning by means of inspection and advance testing of all configurable parts after wiring; polling of diagnostics data (wired or wireless) via web server integrated in components
- **Open standard** – Ethernet standard (TCP/IP, IEEE 802.3) as basis for the application of wireless technologies (e.g. WLAN according to IEEE 802.11 and mobile radio)
- **One cable for everything** – Simplification of partial commissioning and integration in the overall system through use of a universal communication medium

Operation and maintenance

In productive operation, particularly a machine’s performance is of the essence. Besides minimum downtimes and high production quality, also maximum product throughput and precision are called for. Machines based on PROFINET can be easily integrated in existing infrastructures and flexibly modified in the long run (investment protection).

- **Device/network diagnostics** – Monitoring via integrated diagnostics (e.g. web server) and application monitoring via integrated system diagnostics (e.g. TIA Portal); diagnostics of machines also across long distances via remote access
- **Performance** – Maximum accuracy in the system through reduced clock rates – PROFINET with IRT (isochronous real time) as ideal basis for rapid and precise communication for motion control applications
- **Fast and easy device replacement** without programming unit; automatic transfer of parameters to the new device
- **Safety** – PROFINET with PROFIsafe meets the continuously increasing requirements in terms of functional machine safety with maximum efficiency
- **Expandability** – PROFINET offers sufficient reserves for expanding existing plants with minimum expenditures

overview of typical applications

- Bottling plants
- Milling, turning
- Baking machines
- Wafer sawing machines for the solar industry
- Magazine inserters, printing machines
- Weaving machines
- Furniture construction
PROFINET in plant engineering

From planning of the plant concept to realization of the plant down to its integrated operation: Each phase of plant engineering depends on a sustainable overall concept which ensures the efficient networking of all technical components. PROFINET fully meets these requirements – and thus contributes to particularly high performance and speed in production applications.

Overview of typical applications

- Car body manufacturing
- Paint shops
- Wind power plants
- Newspaper printing lines
- Glass production
- Solar panel production
- Rolling plants

Concept and engineering

PROFINET reduces the complexity in plant engineering and facilitates central engineering for the entire process. This results in enormously accelerated integration. Moreover, maximum flexibility ensures the overall plant’s easy assembly and conversion: Depending on the process step, components can be added, replaced or complete plant assemblies can be multiplied. Also the reuse of individual plant parts is supported. All this decisively contributes to increased efficiency in terms of conceptual design and engineering.

- **Open standard** – Smooth communication between products by various manufacturers through PROFINET standard (IEC 61158/61784); clear definition and conclusive roles, e.g. with fast start-up, PROFIenergy (energy efficiency), parameterization and diagnostics
- **Expandability** – Effortless integration of additional network components; also older plant parts based on PROFIBUS can be integrated
- **Version management** – Expansion of stations in PROFINET networks; expansions or modifications within the stations with option handling without impact on the network performance
- **Flexible topologies** – Transfer of PROFINET in various topologies; in addition to line, star and tree structures, also redundant rings as well as wireless technology are supported; connections made of copper, glass optical fiber or plastic optical fiber; Industrial Wireless LAN for wireless connection

Your advantages of PROFINET for plant engineering at a glance:

<table>
<thead>
<tr>
<th>Concept and engineering</th>
<th>Commissioning</th>
<th>Operation and maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open standard</td>
<td>One cable for everything</td>
<td>Open standard</td>
</tr>
<tr>
<td>Expandability</td>
<td>Easy wiring</td>
<td>Ruggedness / stability</td>
</tr>
<tr>
<td>Version management</td>
<td></td>
<td>High data rate</td>
</tr>
<tr>
<td>Flexible topologies</td>
<td></td>
<td>Safety</td>
</tr>
</tbody>
</table>

Device/network diagnostics
An important challenge for plant commissioning lies in keeping with tight time frames from project start to realization. PROFINET supports considerable time savings, for example thanks to independent testing, commissioning and validation of individual plant parts. Such partial commissioning can be temporally implemented depending on the degree of realization. PROFINET thus offers the benefits of rapid and flexible commissioning coupled with reduced costs.

- **One cable for everything** – One network for the transfer and transport of all required data such as diagnostics, safety, I/O, energy efficiency or TCP/IP data

- **Easy wiring** – Easy and rapid assembly of copper and optical fiber cables on site thanks to color coding of lines and plugs; reduced overall costs throughout the system’s entire service life thanks to reliable shield contacting, strain relief and sound EMC shielding for copper cables

- **Device/network diagnostics** – Direct access to diagnostics information via standard web browsers and the web servers integrated in the products without special engineering; testing of all configurable parts after wiring with the help of PRONETA with I/O check (individual parts can also be tested in advance)

Maximum efficiency and productivity necessitate reliable plant operation. With PROFINET, this reliability is enormously increased and the overall plant’s monitoring is supported by means of integrated system diagnostics. The used production parameters ensure data security and integrated safety for persons and machines. PROFINET also contributes to increased energy efficiency: With the standardized PROFIenergy profile, loads can be disconnected during break periods and switched back on as required.

- **Ruggedness / stability** – Unproblematic application of PROFINET also in EMC-critical areas

- **High data rate** – Investment protection through integration of PROFINET devices in networks with higher transfer rates

- **Energy efficiency** – PROFIenergy facilitates the disconnection of PROFINET devices during break periods – as well as the detection of measured values and status information for energy and load management

- **Open standard** – Access to machines and plants based on Ethernet standard (IEEE 802.3) via secure VPN connection, e.g. for remote maintenance purposes; protection of the automation cell and all devices without separate protective function against unauthorized access (espionage, manipulation, etc.) by means of security modules

- **Safety** – Reliable protection of persons, machine and environment with Safety Integrated, the intelligent answer to continuously increasing functional safety requirements – integrated in engineering, communication and devices; safety also via wireless technology

- **Device/network diagnostics** – Monitoring of the complete network as well as integrated system diagnostics; safe remote plant maintenance via remote access

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PROFINET in process automation

The establishment of a uniform communication structure throughout the plant is becoming increasingly important in the process industry. PROFINET, the leading Industrial Ethernet standard in automation, now supports safe and fast data exchange on all levels – thus ensuring increased flexibility, efficiency and performance.

Efficient engineering is the most decisive factor for plant manufacturers. However, this represents a challenge in expansive, complex plants often seen in the process industry: System architectures have to be as flexible as possible and also have to support joint usability to allow for the realization of both central and distributed solutions. At the same time, not only commissioning is to be implemented as rapidly and smoothly as possible in order to increase the plant’s profitability. Also plant modifications and adjustments have to be possible at any time. Our answer: PROFINET for the process industry.

- **Flexible topologies** – Complete spectrum of supported architectures such as line, star, ring or mixed architectures for the plant’s individual adjustability; thanks to the use of VD technology, also existing lines such as PROFIBUS can be further used and even larger distances can be bridged!
- **One cable for everything** – Transfer of all required data via a single network: diagnostics, safety, I/O, energy efficiency and TCP/IP data
- **Safety** – Functional safety thanks to Safety Integrated, integrated in engineering, communication and devices; communication is realized via PROFIsafe
- **Open standard** – Integrated communication of products by various manufacturers based on a harmonized standard (IEC 61158/61784)
- **Expandability** – Option handling for expansion of stations in PROFINET networks as well as within the stations themselves, without impact on the network performance
PROFINET facilitates integrated communication from the management to the field level. The Ethernet standard allows for the rapid localization of faulty or incorrectly configured devices and the fast rectification of such faults. Furthermore, also the independent commissioning of individual plant parts is supported – even when the overall system is not yet available.

Discover the numerous advantages offered by networking all devices via PROFINET within the scope of commissioning:

- **Device/network diagnostics** – Rapid access to diagnostics messages and available web servers of the devices
- **Open standard** – Ethernet standard (TCP/IP, IEEE 802.3) as basis for the application of wireless technologies (e.g. WLAN according to IEEE 802.11 and mobile communication)
- **One cable for everything** – Simplification of partial commissioning through PROFINET as universal communication medium and effortless connection with the overall system

During ongoing operation, the avoidance of downtimes is the paramount objective. After all, plant standstills entail enormous costs. Such downtimes can be avoided by means of proactive and predictive maintenance as supported by device and network diagnostics via PROFINET. High clock rates coupled with constant quality result in increased production capacity and intelligent safety concepts for the protection of persons, environment and plant are implemented in parallel and in a non-reactive manner on a cable or via IWLAN.

- **Device/network diagnostics** – Monitoring of the entire plant through integrated diagnostics, also from remote locations via remote access (UMTS)
- **Open standard** – Ethernet standard (TCP/IP, IEEE 802.3), on which also wireless technologies are based (WLAN according to IEEE 802.11)
- **Safety** – Unrestricted application of standard gateways and switches as well as support of fail-safe communication without special network components

Your advantages of PROFINET for process automation at a glance:

<table>
<thead>
<tr>
<th>Concept and engineering</th>
<th>Commissioning</th>
<th>Operation and maintenance</th>
</tr>
</thead>
<tbody>
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<td>Flexible topologies</td>
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<td></td>
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</tbody>
</table>

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**Vertical transparency**
Totally Integrated Automation (TIA) relies on international, manufacturer-independent standards which are inter-compatible. This ensures maximum integration in terms of communication, irrespective of the topology – whether wired, wireless or remote. At the same time, the consistent application of these standards creates the prerequisites for maximum flexibility regarding the planning and realization of tailored network infrastructures – with minimum expenditures.

**TIA Portal**
With the Totally Integrated Automation Portal (TIA Portal), Siemens offers an engineering framework which facilitates the implementation of automation solutions in all sectors. From planning, commissioning, operation and maintenance down to upgrading of existing automation systems, the TIA Portal ensures reduced engineering time, costs and expenditures.

**One cable for everything**
PROFINET offers many functions in a single cable: Machine and standard IT data are merging. This results in consistency and saves costs thanks to reduced wiring and training expenditures.
• **Diagnostics**

PROFINET supports particularly high-performance machine and plant diagnostics. Siemens offers support tools matched to each project phase of mechanical and plant engineering (TIA Portal, PRONETA, SINEMA Server, BusAnalyser).

• **Products and services**

Within the scope of TIA, a comprehensive portfolio of PROFINET-capable products is available. Of course, all components are designed for application in harsh industrial environments with a clear differentiation from the characteristics of standard communication technologies. Specific products are offered for special requirements – for example including all relevant safety features, redundancy mechanisms or required security features.

In addition to this comprehensive product portfolio, Siemens offers additional services pertaining to PROFINET such as validation and risk analyses.
Everything about PROFINET

› Diagnostics with PROFINET – TIA Portal, PRONETA, BusAnalyser, SINEMA Server
› The world speaks PROFINET – questions and answers
› PROFINET in application – current reference videos
› Your advantages – presented in a 3D plant animation

Find out more:
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