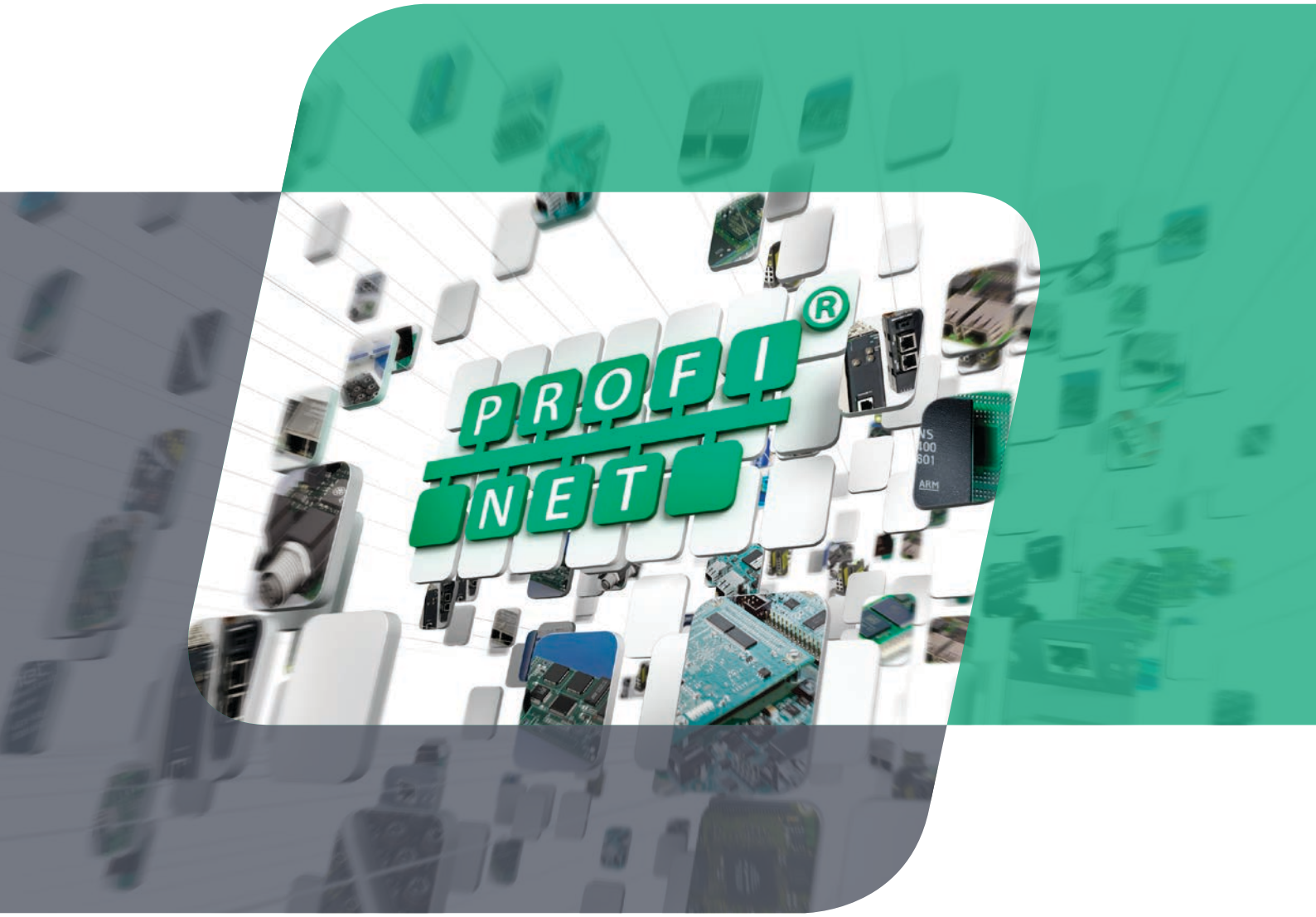
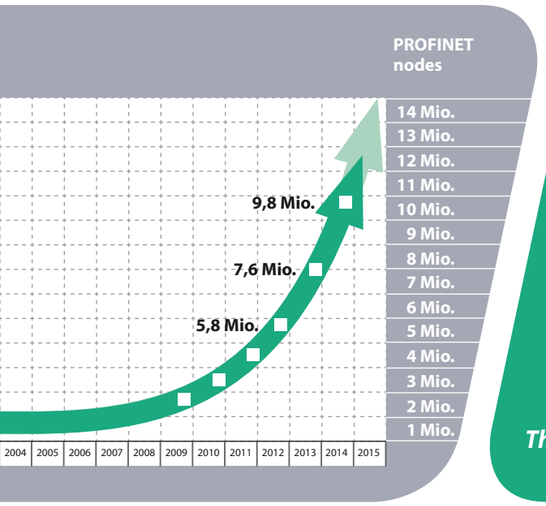
PROFIBUS • PROFINET



PROFINET Technology – the easy way to PROFINET

PROFINET

PROFINET features



PROFINET is the open, cross-vendor Industrial Ethernet standard for production and process automation.

Would you like to…

- *Share in the success of PROFINET?*
- *Equip your automation devices with PROFINET interfaces?*
- *Find out how easy it is to integrate PROFINET into your products?*

The information you are looking for is in this brochure.

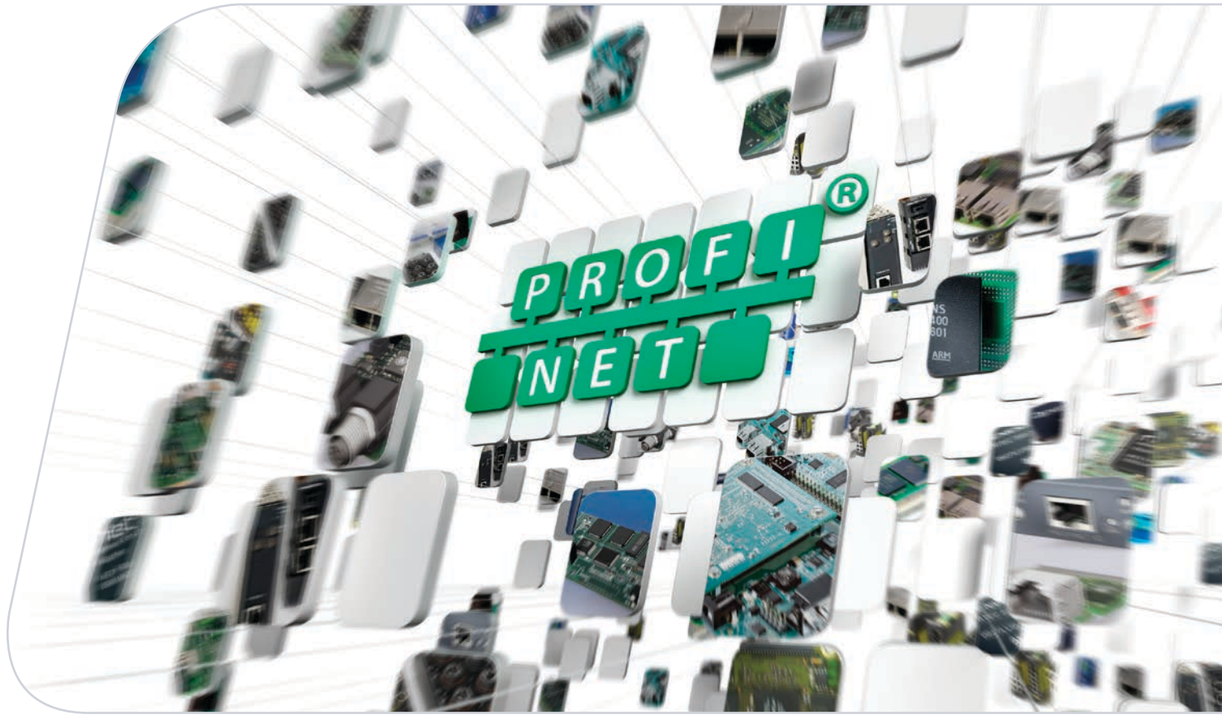
PROFINET …

- Uses TCP/IP and IT standards
- Enables consistent communication from the corporate management level to the field level
- Offers scalable real-time communication up to and including isochronous motion control
- Integrates safety technology for protecting humans, equipment, and the environment (safety)
- Protects equipment from unauthorized access (security)
- Allows seamless integration of all fieldbuses
- Provides detailed and meaningful diagnostics
- Enables flexible topologies like star and line structures when using automation devices with an integrated multi-port switch
- Supports a variety of transmission media, e.g., copper, fiber optics, wireless, etc.

With these features, PROFINET fulfills all the requirements for the use of Ethernet in industrial automation.

PROFIBUS & PROFINET International (PI) is backed by more than 1400 member companies worldwide. With around 10 million devices installed by the end of 2014, PROFINET has established itself as the leading Industrial Ethernet standard on the market. Due to trends such as Industry 4.0 and the Industrial Internet of Things, PROFINET will continue to gain in importance. It is essential for device manufacturers to deal with the technology. Through our technology providers and competence centers, we offer comprehensive support ranging from consulting services and hardware and firmware integration to certification. A wide range of available options for ready-to-use PROFINET basic technology makes it very easy for all companies to implement PROFINET quickly and cost-effectively.

Karsten Schneider | Chairman PROFIBUS & PROFINET International (PI)



Our community

The industry organization PROFIBUS & PROFINET International (PI) promotes the widespread use and further development of PROFIBUS and PROFINET and provides worldwide support.
With 27 regional PI representatives in every international market, 1,400 member companies, and around 2,500 different products, PI is the largest community of interest for industrial communications. It covers every key market of industrial automation, ranging from production automation and process automation to motion control and safety applications.
We support you during the actual product development with specifications and technical support. You are up to date on the technology and have shorter development cycles and time to market. As a member you can have your innovations certified to international standards free of charge.

Contents

This brochure focuses on the development and integration of PROFINET products.

In the rest of the brochure, you will find more information on the following topics:

TABLE OF CONTENTS

Product development cycle

Consulting | Implementation

Every device development project undergoes a product development cycle. An example of this process for PROFINET is presented here. This advice is followed by identification of implementation options, an explanation of certification activities, and a service & support offer.

Consulting

Integration of an industrial communication interface into an automation device begins with information gathering to determine the functionality of your industrial networks along with familiarization about the task at hand. PI itself as well as a number of its member companies can provide you with comprehensive information here. Advice is available from various PI Competence Center (PICC), manufacturers, books, brochures, seminars, and workshops for getting to know PROFINET.

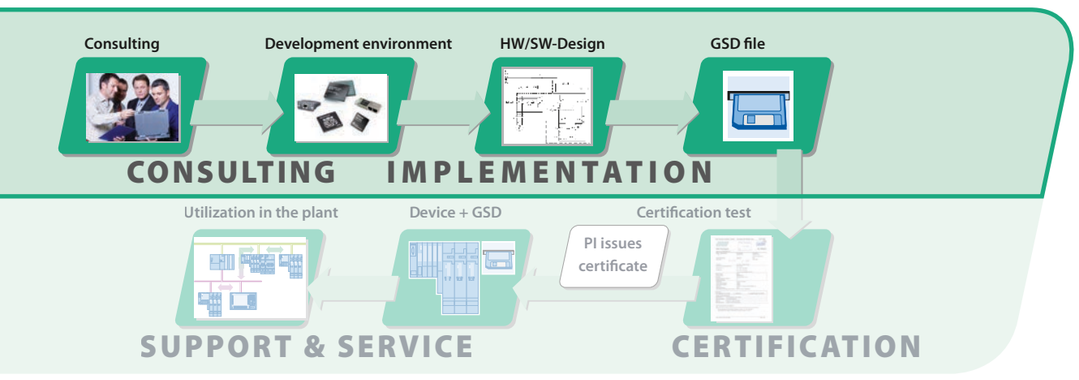
Individual consulting services support you, as a manufacturer, in every phase of implementation. Here are some typical questions: What benefits does PROFINET offer for my products? Which features (conformance classes) must be implemented for the specific automation device? What technologies and support are available for implementing PROFINET?

Specialized training is available for developers and product managers of device manufacturers, who are looking for a quick, yet solid, introduction to PROFINET technology.

Among other things, this training covers the following:

- Basics of data transmission with Industrial Ethernet
- PROFINET basics
- PROFINET field device and PROFINET communication models
- Development packages for development of PROFINET field devices
- Engineering
- Device description file (GSD file)
- Explanations of the conformance classes
- Security measures
- Profiles

Some training courses award participants a certificate.



Implementation

Every development leads us faster to the goal "if we don't have to reinvent the wheel". In order to bring PROFINET into automation devices quickly and efficiently, the expertise of PI members on the following topics is available:

- Implementation methods
- Hardware/software design
- Development environment
- Device description file (GSD file)

Implementation options

Depending on the functionality required (conformance class), it is essential to select the suitable type of implementation for each individual case. The available development capacity, company expertise, expected costs to produce the interface, and the time to market also play a large role. Whether a pure PROFINET interface is to be implemented or a universal interface that is also suitable for communication via PROFIBUS should also be considered. The companies listed in this brochure have many years of experience in the design of communication interfaces and will support you in finding the optimum solution (see expertise matrix on page 13, as well as pages 14-43).

Development environment

A variety of starter kits and evaluation boards are available for almost every implementation method. These complete sets enable a quick introduction to development activities and often contain a complete development environment, as well. Included sample programs, block diagrams, and sample circuits can be especially helpful. The development packages also include the certifiable PROFINET stack of the corresponding provider and detailed documentation.

Hardware/software design

The plan of action and expenditure required for hardware and software design depend heavily on the selected implementation methods. Here, you can carry out the development work fully and independently or work collaboratively with a development or technology partner. Independent development requires well-grounded PROFINET expertise and your own hardware and software development resources. To unburden your development resources, PI member companies can provide complete development packages, ready-to-install PROFINET communication modules, and a host of development services that give you, the device manufacturer, the support you need from the design phase to hardware and software development to certification.

Product development cycle

Implementation | Certification | Support & Service

Implementation

Device description file (GSD file)

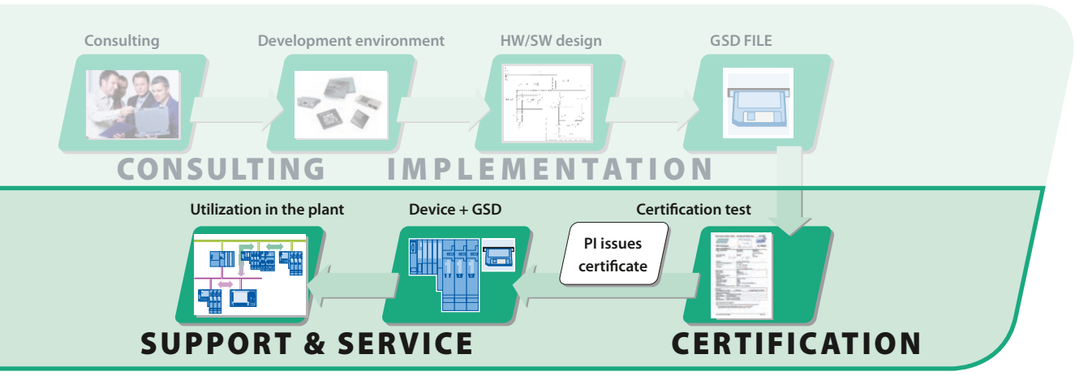
To enable fast and easy configuration of an automation system, manufacturers of field devices must provide a PROFINET device description file.

This so-called "General Station Description File" (GSD file) contains all information needed to configure a device. The GSD files for PROFINET are XML-based and enable multiple product variants and different languages to be captured in one file. The development partners also provide support for the creation of the GSD.

Certification

PROFINET communication in industrial plants is based on IEC 61158 and IEC 61784. In addition, IEC 62061/ ISO 13849-1 apply to safety modules and devices. To ensure interoperability and conformity of automation devices of different manufacturers, device certification by an accredited test laboratory is mandatory for PROFINET. As a result, end customers are guaranteed a high level of plant availability, and the risk of cost-intensive service calls is significantly reduced for you, the device manufacturer. As part of the certification process, a check is made to determine whether automation devices comply with standards, thus ensuring their problem-free interaction within an automation system.

Even though every PROFINET device must be certified, the effort required for successful certification varies depending on the technology used. When pre-certified technologies are used, you do not have to be familiar with all details of the PROFINET standard. This significantly reduces the risk that problems will be found during the certification examinations. Therefore, it is useful to consider certification aspects in advance when choosing a technology.



Certification process

For you, the manufacturer, certification is as easy as can be: The fully developed PROFINET device is tested by an accredited test laboratory. After successful testing you, the manufacturer, can apply for a certificate from the PI, using the test report as a basis.

Tests required as part of PROFINET certification include, but are not limited to:

- Hardware tests
- State machine tests
- Behavior on the network
- Testing of the GSD file
- Load tests
- Fault responses
- Alarm tests
- Security Level 1 Test

PI CERTIFIED
PROFIBUS • PROFINET

Certification is especially easy when precertified technologies are used. In this case, the technology supplier guarantees compliance with the PROFINET standard, which enables a significant reduction in the effort required for the certification test.

Experienced contact persons are available to provide you with support during the entire certification process. They can offer suggestions in advance and answer any questions.
There are currently eight test laboratories around the world:

For more information, go to:
www.profinet.com/testlabs

Support & Service

Across the globe, there are currently more than 50 accredited PICCs available to answer your technical questions. This includes a comprehensive range of services for device manufacturers and users throughout every life cycle phase.
The quality of the PICC services is guaranteed by a "quality of service" agreement. Regular meetings also ensure a uniformly high level of employee qualifications and knowledge, transfer of expertise and, naturally, the exchanging of experience as well.

A list of all the accredited PICCs can be found at:

- **www.profinet.com/picc**

The PI organization supports the marketing of devices through

- Entry in the product catalog
- Presentation at joint trade fair booths
- Publications in the PI Newsletter or series of advertisements

The offices of the PI organization are happy to advise you on this.

Implementation options

Real-time requirement | Conformance classes

Device manufacturers wanting to equip an automation device with a PROFINET interface have different options for implementing interfaces. Before deciding on a specific implementation method, it's important to first determine which functions are to be supported by the PROFINET automation device:

- *In-house development or partnership based on the criteria of expertise, time to market, etc.*
- *Real-time requirement*
- *Implementation options*
- *Device classification*
- *Development method*

The technical and commercial decision-making criteria are explored in more detail in the following.

Real-time requirement

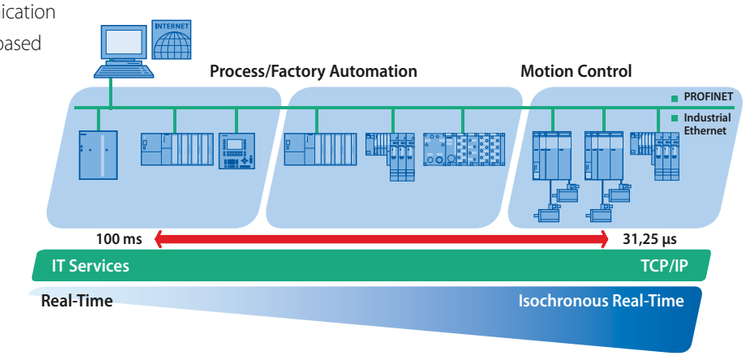
IEEE 802.3 ensures problem-free communication between PROFINET automation devices and among PROFINET automation devices and other standard Ethernet devices. For applications with very stringent real-time requirements, PROFINET offers mechanisms that enable both standard and real-time communication to take place in parallel. Communication with PROFINET can therefore be scaled using three different performance levels, which build on each other:

- The transmission of engineering data and **non-time-critical data** occurs over TCP/IP. This so-called standard communication is possible between all automation devices.
- The real-time (RT) channel is available for the transmission of **process data**.
- For **isochronous applications** like motion control, isochronous real-time communication (IRT) is used. This enables a clock rate of < 1 ms and a jitter precision of < 1 µs.

IRT capability is based on hardware support in the device. Special ASICs, microcontrollers, and FPGAs are available for this purpose. Commercial switch ASICs without IRT hardware support are suitable for implementing an automation device with RT capability only.

Devices with RT communication can be easily developed based on standard Ethernet components.

PROFINET is designed for all branches of industrial automation engineering:



Conformance classes

To meet the different requirements of automation systems, three conformance classes that build upon one another are defined for PROFINET. Each class has a functional scope determined for the typical area of application. The device manufacturer must consider the required conformance class before selecting an implementation option for the PROFINET device interface, as the type of interface implementation affects the conformance class that can be achieved.

In the following, only the key functions of the three conformance classes and their specific advantages are described:

CC-A: Use of the infrastructure of an existing Ethernet network, including integration of basic PROFINET functions. All IT services can be used without restriction. Examples of typical applications are found in building automation and process automation.

CC-B: The functional scope of CC-B comprises the functions of CC-A, plus it supports easy user-friendly device replacement without the need for an engineering tool. Furthermore, Simple Network Management Protocol (SNMP) supports extended device diagnostics of network functions, such as port status messages. To increase data reliability, a performance-adapted media redundancy protocol is available as an option. All IT services can be used without restriction. Typical applications can be found in automation systems with higher-level machine control with a deterministic, but not isochronous, data cycle.

CC-C: The functional scope of CC-C comprises all the functions of CC-B, plus it supports high-precision and deterministic data transmission, including for isochronous applications. The integrated optional media redundancy enables smooth switchover of the I/O data traffic if a fault occurs. All IT services can be used without restriction. Typical applications are in the field of motion control.

In addition, optional services such as Fast Start UP are possible.

For a detailed description, go to:

- **www.profinet.com/PROFINETcc**

Implementation options

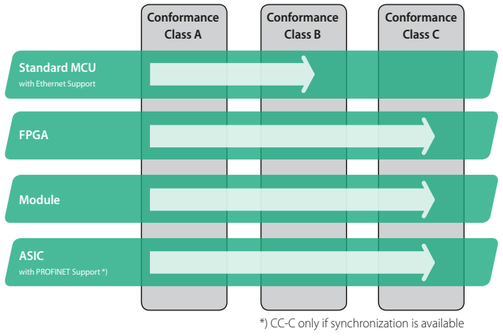
PROFINET device interface | Development method

Implementation options for the PROFINET device interface

You can choose from different options in order to implement the solution that best suits the details of the automation device:
Design | Degree of protection | Connection method | Application
Integrated multi-port switch | Real-time properties

In principle, the following options are also available:
1: Standard microcontroller unit (MCU) with integrated or external standard Ethernet controller or FPGA
2: FPGA with internal or external standard or IRT-capable switch
3: Module with standard microcontroller or with microcontroller with IRT hardware support
4: Microcontroller with IRT hardware support and IRT-capable switch

The graphic below shows these implementation options in relation to the conformance classes:



*) CC-C only if synchronization is available

The following table shows the PROFINET functions that can be achieved with the implementation methods described above.

	Single Port	Multi Port
Conformance Class A	✓	✓
Conformance Class B	✓	✓
Conformance Class C		✓

The table shows the minimum options.
For example, variants 2 and 3 also provide the option of implementing a single-port interface, but special attention should be paid to the economic viability of the solution for the particular case in question.
Various basic technology components (hardware/software) are available for each of the implementation methods shown in the table. Components offered by PI member companies for this purpose are described in ample detail starting on page 14 of this brochure. For conformance classes A and B, standard Ethernet components can generally be used. In combination with a suitable PROFINET stack, it is possible to implement a high-performance PROFINET interface for applications in this range without special PROFINET ASICs.
However, for automation devices in Conformance Class C with IRT functions, special PROFINET ASICs or FPGAs are essential.

Development paths

Each of the implementation methods described above can be realized in a different way. When selecting the most suitable method for the particular case in question, the expected production costs, the development time, and the resulting time to market must be taken into account. Consideration must also be given to PROFIsafe. Three different methods are described in the following:

Customer-specific/individual design:
In this method, the implemented PROFINET interface is embedded in a hardware and software design that has been optimized with regard to development expenditure and time to market using commercially available software solutions and standardized discrete or FPGA-based hardware design schemes.

Embedded module design:
Here, the implemented PROFINET interface is embedded in a design that has been optimized for flexibility and time to market based on preassembled commercially available communication modules.

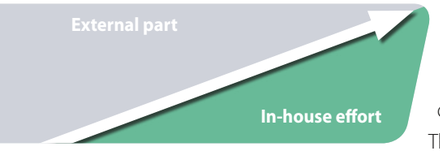
External couplers:
With this solution, the PROFINET interface is implemented without accessing the device electronics based on external couplers and using an adapter connected in series.

	Development costs	Production costs (per unit)	Time to market	PROFIsafe
Individual design	+	+++	+	+++
Communication module	++	++	++	++
External couplers	+++	+	+++	+

+++ High-benefit | ++ Medium-benefit | + Low-benefit

Implementation options

In-house development or development partnership



In-house development or development partnership

Implementation is possible by the device manufacturer itself or together with an external technology or development partner. The basic technology of the device or system plays no role when making this fundamental choice.

The advantage of collaborating with an external technology or development partner when developing a PROFINET interface is that the device manufacturer can concentrate on its core areas of expertise. This reduces development risks and time to market. The experience of the external specialists helps to ensure that the design of the automation device is competitive and technically feasible with respect to its communication technology. In many cases, project-specific training courses and/or workshops are offered so that the device manufacturer can build up PROFINET expertise quickly and efficiently and use its own resources in a targeted way for development, support, and product management.

The PI member companies offer a wide range of services during the development phase.
For details, see page 13 and pages 14-43.

	Internally required PROFINET expertise	Time to market	Requirement for internal capacity/resources
In-house development	Thorough expertise must exist internally	Long	High
Cooperation with a technology or development partner	Partner helps to bridge expertise gaps	Medium	Medium
Complete assignment of development to a development service provider	Only limited internal expertise required	Short	Low

Expertise matrix

Range of services of member companies

Phases	AIT	Deutschmann	Hilscher	HMS	Innovasic	KUNBUS	MESCO	Molex	Phoenix Contact	Port	Renesas	Siemens	Softing	TMG TE	Texas Instruments
1 Consulting															
Implementation consulting	D	D	C/D	D	D	C/D	C/D	C/D	C/D	D	C/D	C/D	C/D	C/D	–
Technology training	D	–	–	D	–	–	C/D	C/D	C/D	–	C/D	C/D	C/D	C/D	–
2 Supported development method															
Individual design															
Stack development and integration	–	–	C/D	–	–	–	C/D	C/D	C/D	D	C/D	C/D	C/D	C/D	–
Development services	D	D	C/D	D	D	C/D	C/D	C/D	C/D	D	C/D	C/D	C/D	C/D	–
Modular design															
Embedded modules	–	D	C/D	D	D	C/D	D	–	–	D	C/D	C	C/D	C/D	–
External coupling															
Protocol implementation	D	D	C/D	D	D	C/D	C/D	–	–	D	C/D	–	C/D	C/D	–
Safety															
PROFIsafe	D	–	D	D	–	(C/D)	C/D	(C/D)	C/D	–	C/D	D	D	C/D	–
PROFIdrive	–	–	C/D	D	–	–	C/D	D	C/D	–	D	D	C/D	D	–
3 Supplier for															
Embedded modules	–	D	C/D	D	D	C/D	–	–	–	D	–	C	C/D	–	–
PC cards	–	–	C/D	D	–	(C/D)	–	C/D	–	–	–	C	–	C/D	–
External couplers	–	D	C/D	D	D	–	–	C/D	–	–	–	–	C/D	–	–
Chips/ASICs/FPGA/Microcontrollers	–	D	C/D	D	D	–	–	D	D	D	C/D	C/D	C/D	–	(C)/D
Starter and evaluation kits	–	D	C/D	D	D	D	D	C/D	D	D	C/D	C/D	C/D	D	(C)/D
4 Certification & Support															
Accredited competence center	D	–	C/D	D	–	–	C/D	C/D	C/D	–	C/D	C/D	C/D	C/D	–
Accredited test laboratory	D	–	–	–	–	–	–	–	D	–	–	C/D	–	–	–
Certification support	D	D	C/D	D	D	D	C/D	C/D	C/D	D	C/D	C/D	C/D	C/D	–

C = Controller D = Device ( ) = in preparation

AIT PROFINET Competence Center & Test Lab

PROFINET – Thoroughly tested

The AIT is a PI-accredited PROFINET Competence Center and Certification Test Lab. Among the services it offers are training courses and workshops, integration tests and certification tests of PROFINET devices for manufacturers, planning support for machine and plant builders, and commissioning and acceptance testing support for plant owners.

As an international service provider, AIT specializes in performing tests for individual devices as well as complete systems. It provides numerous services for manufacturers and users of PROFINET technology in this regard.

Specifically, AIT's areas of expertise and range of services include:

Training courses and workshops
Conducts customer-specific PROFINET workshops
(Languages: German, English, Spanish).

Development support
GSDML, engineering, configuration, implementation.

Test lab/certification testing
Performs integration and conformity tests for manufacturers of PROFINET devices.
In addition to test environments used for certification, AIT has multiple test systems with up to 60 PROFINET nodes, which are employed in particular for integration and interoperability tests.

Industrial Security
Performs network load tests and vulnerability analyses for examining the robustness of devices for use in industrial networks.

Planning support
Supports PROFINET users in the specification of factory automation machines and manufacturing plants.

Commissioning and technical acceptance testing
Supports PROFINET users in the commissioning and technical testing of factory automation machines and plants.

Software tools for engineering, network analysis, and diagnostics
Develops and implements analysis and engineering tools for PROFINET.

AIT has incorporated its experience gained from performing troubleshooting and technical acceptance tests both in Germany and abroad in the development of its PROFINET diagnostic tools, such as the PROFINETanalyzer. This tool enables users to quickly determine the configuration of PROFINET nodes based on a network analysis and to identify the „health status" of a plant. This enables errors in communication and the plant configuration to be quickly eliminated.

PROFINETanalyzer –
the tried-and-tested diagnostics tool

- **Broad range of applications**
  Diagnosis and automated technical acceptance testing of PROFINET systems.
- **Configuration analysis**
  Acquisition and checking of device names, IP configuration and firmware versions of PROFINET devices.
- **Topology display**
  Graphical topology view with display of the configuration details, port connections and network monitoring functions.
- **Alarm analysis**
  Clear alarm analysis and specification of possible causes.
- **Protocol and communication analysis**
  Fast evaluation of the „health status" of a plant (Communication quality, communication anomalies).
- **Reporting function**
  Automated generation of reports and export function for measured values and results.

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www.ait-solutions.de

Industrial Communication from Deutschmann

– the ultimate Flexibility

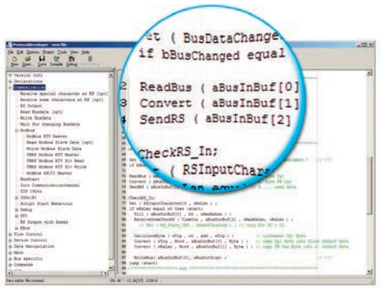
Deutschmann Automation has been working in automation technology since 1976 and started developing industrial communication products in 1989. With the UNIGATE series from Deutschmann, automation specialists save considerable time and effort on development and the adaption of device firmware to PROFINET.

PROFINET solutions from Deutschmann:

Protocol converter: For all devices with a serial interface

Embedded Solutions: Ready-to-install Bus nodes

Gateways: Making incompatible networks compatible



What sets us apart:

Protocol Developer
The UNIGATE series can easily be customized to your product using the Deutschmann Script Language and the Protocol Developer tool. This unique feature makes it possible to adapt to almost any situation, providing the ultimate flexibility in connecting your device to any network.

WINGATE
The configuration tool WINGATE with an easy-to-use interface ensures a comfortable configuration.

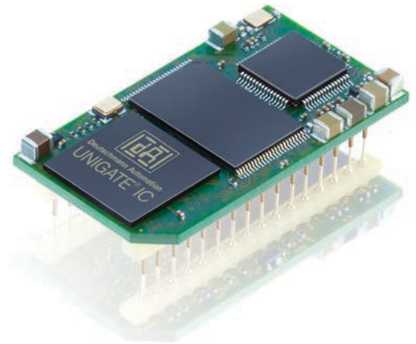
Protocol converter - UNIGATE CL PROFINET
The solution for all devices with a serial interface

UNIGATE CL PROFINET gateways are DIN rail-mounted protocol converters which connect automation components and other devices to PROFINET.
Terminal devices are connected via RS232, RS485 and RS422 interfaces. The communication between the serial side and PROFINET optionally takes places by means of standard protocols such as Modbus ASCII, Modbus RTU (Master or Slave) as well as 3964 (R), RK512, DIN measuring bus or DIN 19244.
The PROFINET models comply with the PROFINET specification. Deutschmann offer to fit UNIGATE CL converters – just like all UNIGATE products – with OEM brand labels.

Deutschmann
your ticket to all buses

Embedded Solution - UNIGATE IC PROFINET
Ready-to-install bus nodes

The UNIGATE IC PROFINET relieves automation manufacturers from having to develop interfaces and thereby help them offer products for various protocols with little one-time development effort. The all-in-one bus nodes in 32-DIL housing have been designed for embedded solutions for direct integration into terminal devices.
The modules comprise a microcontroller, flash, RAM and a bus controller. They handle the complete communication on the bus side, thus reducing the workload of the application's microprocessor. The connecting to the host processor takes place via UART interface.



CAN Gateway UNIGATE CM PROFINET
Including CAN-Master-functionality
The UNIGATE CM Gateway serves to connect CAN networks to PROFINET. The CAN- and CANopen Gateways feature CAN-Master functions. Thereby, they can be used both, to connect CAN- and CANopen networks with PROFINET and to integrate CAN devices into PROFINET environment.

Ethernet Line Gateway - UNIGATE EL PROFINET
Additional Ethernet interface on-board
EL Gateways connect PROFINET with the Ethernet world and facilitate the communication between the control / office level and the shop floor. The series is equipped with a second Ethernet interface, which allows direct access to the configuration of the connected Gateways.

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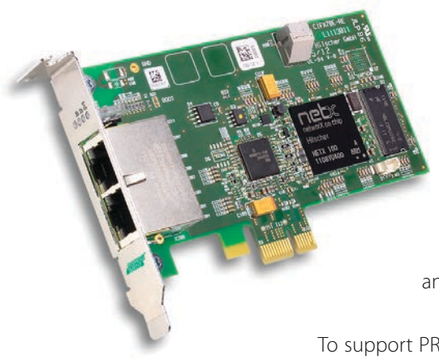
E-Mail: **info@deutschmann.de**
www.deutschmann.de

The safe path to PROFINET

In the world of automation, PROFINET is the standard that leads to the future. Signals don't always take the direct route and many a data packet must first be brought into form to be fit for fast real-time communication. A task for true experts who delve deep in the matter and find exactly the solution that leads to the goal.

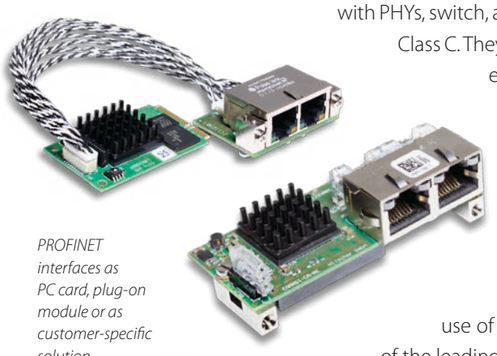
Open standards make technologies accessible and are the key to new applications. PROFINET is such a standard. As always, when striking out on new paths and striving to meet new goals, skillful leaders ensure that the process moves faster and obstacles do not become stumbling blocks.

Hilscher is a company „in the know" that is at home in the PROFINET world and finds the right solution path for every application.



One of these paths is called netX – a family of six network controllers that differ in functionality, performance, and price and are compatible with a wide array of applications in industrial communication. There are controllers with and without integrated ARM CPU in two performance classes, with dual port memory as a companion chip solution or for I/O functions, such as IO-Link and LCD controllers, AD converters, encoders. And they are suitable as PWMs for cost-critical single chip IOs and identification or motion applications.

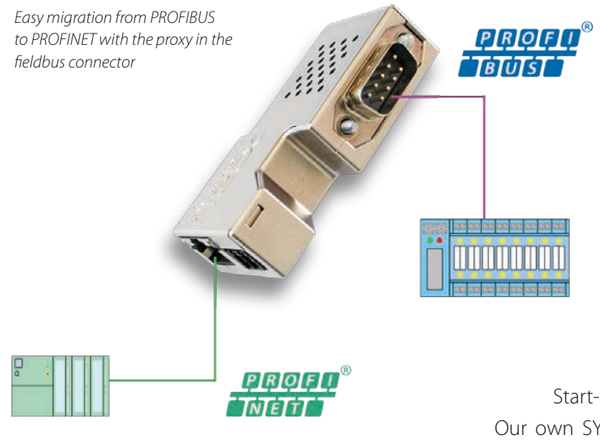
To support PROFINET the netX controllers provide integrated Ethernet channels with PHYs, switch, and IEEE 1588 and meet requirements for IRT and Conformance Class C. They are consistently based on the open PROFINET technology, are extensively documented, and have proven themselves internationally at leading PLC, sensor, and drive manufacturers.



PROFINET interfaces as PC card, plug-on module or as customer-specific solution

The technology is only one side, however. Behind it is a team of experienced specialists that know their way around down to the individual gate cell. Deep expertise that can be traced back to, among other things, the fact that we develop our ASICs ourselves. In doing so we make use of the experience of Renesas – our technology partner and one of the leading companies in the automation market. And we guarantee our ability to supply for a period of 10 years.

Easy migration from PROFIBUS to PROFINET with the proxy in the fieldbus connector



The pioneering know-how of Hilscher can also be found in our own protocol stacks. They run on controllers and devices such as our certified PC cards where they impress with features such as Fast Start-Up and IRT and others.

Our own SYCON.net tool with FDT/DTM technology is used for configuration. Its components can also be embedded and adapted in the customer's own tools.

In general, the products of Hilscher are available in a wide variety of forms – as an individual element or complete functional unit, as a development basis with source code and open interfaces or as a standardized design at agreed upon development and board costs. We even manufacture your own PROFINET interface on state-of-the-art SMD lines and guarantee uncompromising quality with AOI systems and flying probe testers.

Our fastest path to your goals is the ready-to-use PC cards in all common standards, such as PCI, PCIExpress, or miniPCIExpress. For integration in compact field devices, solutions with a serial or parallel host interface are available – as DIL-32 IC, plug-in module, or solderable chip carrier. A wide range of networks can be connected depending on the firmware.

Hilscher gateways are the proven intermediaries between the system worlds. They are user-configurable or operate according to the PROXY standard. A direct path is the PROFIBUS connector with integrated PROXY. It is simply plugged onto the PROFIBUS slave and it paves the way to PROFINET. The PROFIBUS device description is automatically converted from the GSD format to the PROFINET FSDML format.

On the path to PROFINET there are many alternatives and only those at home in the network landscape know exactly which alternative will lead safely to the goal.

For more information, visit **www.hilscher.com**, pricing information and bookings can be obtained under Phone: +49 6190 9907 790

From zero to PROFINET in 14 days

PROFINET connectivity without tedious development work

For PROFINET device interface implementation, HMS provides a wide range of certified enabling technology and services to accompany development.
What all the solutions have in common is that the device manufacturer does not need to concern himself with the details of the PROFINET protocol, yet can implement its communication interface based on proven-and-tested Anybus technology. Thanks to the modular design, a universal solution is achieved that allows connectivity to many industrial networks to be created in a single development step.

Anybus X-gateway
in PROFINET IRT/PROFINET IRT combination

The product family of the Anybus X-gateways includes over 200 different gateways that cover practically every conceivable network combination.

Anybus Communicator for PROFINET IRT

PROFINET protocol converters integrate field devices in PROFINET via their serial interface or CAN interface without hardware or software changes.

IXXAT INpact
für PROFINET

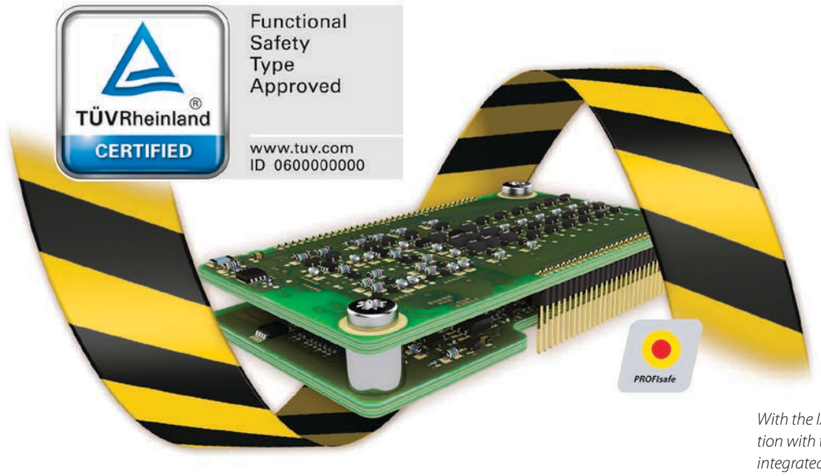
Anybus CompactCom 40-series
Embedded Anybus communication solutions are certified for PROFINET 2.31 and simplify implementation of a PROFINET device interface. Their use saves device manufacturers up to 70% of development costs and reduces the time to market.

External couplers
The use of an the Anybus communicator is advisable when the field device has a serial interface or CAN interface and the PROFINET connection cannot be integrated. Here, neither the hardware nor software of the field device needs to be changed.

PC card for PROFINET
With the IXXAT INpact you can easily connect your PC to a PROFINET network. Available in PCIe and PCIe Mini versions, the card is suitable for industrial PCs as well as for mobile handheld applications. Slave applications for process data visualization, configuration, and analysis can be easily and quickly implemented on the basis of Windows and Linux drivers.

Embedded communication solutions for PROFINET 2.31
The Anybus CompactCom 40 series is a family of communication interfaces in various designs that manufacturers can use to implement a multi-network interface in their devices. The PROFINET version is certified for PROFINET Version 2.31 and meets the requirements of the highest conformance class (Conformance Class C) and the highest network load class (Netload Class III).

Anybus CompactCom also enables PROFIsafe communication according to the black channel principle. In combination with the IXXAT Safe T100 safety module, HMS offers manufacturers a complete safety solution.



With the IXXAT Safe T100 safety module in combination with the Anybus CompactCom for PROFINET, an integrated PROFIsafe solution can be realized.

Ready for Industry 4.0 and the Industrial Internet of Things
Besides the expanded PROFINET functionality, the Anybus CompactCom 40 series enables simultaneous processing of demanding IT functions and PROFINET real-time functions. The IT functionality includes, for example, a socket interface over which a complete Ethernet frame with up to 1500 bytes can be sent. Integrated web pages, a file system, and firmware upgrades via FPT, etc., are also supported.

The 40 series includes security mechanisms. For example, software signatures are mandatory to prevent the import of unreleased software. Unauthorized copying is prevented by encryption mechanisms.

Besides the Anybus CompactCom PROFINET module for copper cable, a version for fiber-optic cable is also available.

The modular solution is characterized by low development costs and short development times. The advantage is that you not only get a functionally-compatible communication solution for PROFINET but also for many other industrial networks. Communication solutions from the Anybus CompactCom family have a standardized network-independent hardware and software interface so that the device software is largely independent of the bus system used in each case.

Customer-specific solutions
As a supplement to standard solutions, HMS offers customer-specific solutions based on the Anybus core technology. By using proven-and-tested technology, customers profit from a short development time, low development risk, and fixed development costs, which also include continual software updates by HMS.

HMS provides IIoT ready Industrial Internet of Things solutions

The PROFINET solutions from HMS set device manufacturers on the right course for the Industrial Internet of Things.

Consulting and support
HMS is an accredited Profinet Competence Center and supports device manufacturers as a partner in all phases of development. The service offer includes developer training, consulting services, development support, and preparatory tests for certification.

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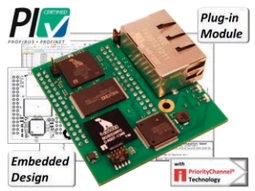
76131 Karlsruhe | Germany
Phone: +49 721 989 777 000
E-Mail: **info@hms-networks.de**
www.hms-networks.de

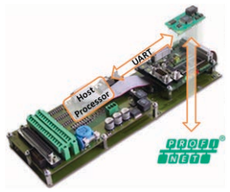
Robust and reliable PROFINET network interface

Innovasic is a global electronics supplier for companies with long product life-cycles including industrial, transportation, instrumentation, and medical applications. For nearly 25 years, Innovasic has been supplying critical communications and processor chips to the world's leading Industrial OEMs. Our breadth of experience and commitment to the Industrial market has resulted in the RapID™ Platform Network Interface – a complete, easy-to-integrate, low cost PROFINET connectivity solution.



The RapID Platform Network Interface manages the PROFINET industrial protocol and network traffic for a host processor

The Network Interface can be embedded as a module or as an embedded design for customized form factors. It contains everything needed to participate in star, line, or tree network topologies including the communications controller, protocol stacks, Flash, RAM, Ethernet switch and PHYs. The two Ethernet ports connect to any PROFINET network and a UART or 16-bit Parallel Interface connects to a host processor. At the software layer the host processor connects to a "Unified Interface" so other protocols can be used without changing the host processor software. The Network Interface has passed PROFINET v2.3 certification for Class B and Class C devices and has received Net Load Class III accreditation, thanks to Innovasic's PriorityChannel® Technology. Both advanced and legacy start-up are supported so your field device will operate problem-free in any PROFINET network.



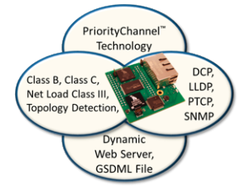
Easy Hardware and Software Integration

As a module, the Network Interface plugs into a board using standard 2.54 mm pitch through-hole pins. Simply connect Power/Ground/Reset and interface the host processor to the UART or 16-bit Parallel interface. The UART interface is suitable for Field I/O applications and the 16-bit Parallel interface is suitable for high speed motion control applications.

For custom form factors, the Network Interface hardware design can be integrated using the schematics provided. Also provided are the Bill of Materials and example layouts to minimize the hardware design effort. Software for the customized embedded design is provided as firmware that is downloaded to the on-board flash. Whether using the module or an embedded design, no Network Interface software development is required and there are no license fees or royalties.

Innovasic®

Software integration with a host processor is also simplified. Messages passed between the host processor and Network Interface follow a "Unified Interface" definition. An Innovasic supplied PC-based tool configures the Network Interface to customize the parameters required for your field device application. The tool also makes it easy to customize the example GSDML file provided by Innovasic for your field device application. The combination of the configured Network Interface and GSDML file ensures your field device can talk with any PROFINET controller. Another feature of the Unified Interface is to keep host processor software from changing if PROFINET network parameters change or if another Industrial Ethernet protocol is used. As part of the Unified Interface there is a "sockets" interface that supports direct Ethernet communication during the "RT phase" of PROFINET communication. Example C-code is provided to get your host processor communicating quickly with the configured Network Interface.



Reliable, Flexible Network Integration

The Network Interface provides reliable PROFINET Class B and Class C communication with PriorityChannel® – a technology unique to Innovasic that eliminates the effects of network traffic and ensures reliable, real-time network performance to Net Load Class III. It gives your device a significant competitive advantage, extremely low jitter, and a reliable connection that will not disconnect even with >95% network loading.

PROFINET support includes the Precision Time Control Protocol (PTCP) for synchronization, the Discovery and Configuration Protocol (DCP) for field device network configuration, and the Link Layer Discovery Protocol (LLDP) for topology management. Also included is the Simple Network Management Protocol (SNMP) along with the required Management Information Bases (MIBs) to support network configuration and diagnostics. To assist with commissioning, the Network Interface contains a dynamic webserver so web pages for your field device can be created and displayed on a standard web-browser. Your field device's network information and real-time parameters can be dynamically updated on the web page at any time.

Fast Evaluation and Development

The RapID Platform Network Interface Evaluation Kit provides a quick assessment for interfacing a host processor to the Network Interface module. An application example is provided in order to demonstrate end-to-end, host processor-to-Network Interface-to-Controller communication. Your host processor development board connects to the Network Interface evaluation board via the UART or 16-bit Parallel interface. Once the host processor-side communication is established, PROFINET communication can be evaluated using a PLC or Controller simulator. This communication can be completely verified before integrating the Network Interface into your field device design.

Innovasic Inc.
Please visit us at: **www.innovasic.com**
Download the RapID Platform at:
www.innovasic.com/developer-portal-login

KUNBUS – Your experts for PROFINET interface solutions

KUNBUS is at home in the field of industrial communication.
We focus on customer-specific solutions and standardized field buses and Industrial Ethernet modules for all commonly used industrial networks. Whether sensors or actuators, we ensure that your products can be integrated problem-free in an industrial network. With our modern development and manufacturing facility in Stuttgart, Germany, we ensure engineering that is close to development and reliable and timely delivery.

KUNBUS-IC – Compact DIL-32 module
Minimize your development effort and achieve cost and time savings for the product launch of devices with PROFINET or PROFIBUS interfaces. KUNBUS-IC provides an easy way to make your devices PROFINET- or PROFIBUS- compatible.

Our KUNBUS-IC modules not only have the necessary bus interface but also multiple interfaces for your controller. A UART interface (RS232, RS485, Modbus RTU) can be used to connect the KUNBUS-IC module for implementation of PROFIBUS or PROFINET in your controller. A shift register interface can be used for devices without a processor. A galvanic isolation of up to 1.5 kV between the bus interface and controller is also implemented in the module.

KUNBUS-COM – Our most powerful communication module
The KUNBUS-COM communication interface offers you a simple and cost-saving option to integrate PROFIBUS or PROFINET into your device without internal development effort.

Besides the UART interface (RS232, RS485, Modbus RTU) and the shift register interface, the KUNBUS-COM module also has a dual-port RAM interface. This allows the CPU of the module and the CPU of the control board simultaneous access to the shared memory.

Alongside the bus drivers, optocouplers, memory and the microcontroller, the KUNBUS-COM module contains both the plug connector for the Fieldbus/Ethernet connection as well as an ERNI SMC connector (32 pin) for the application or controller.

KUNBUS
industrial communication

KUNBUS-GW – Modular gateway
The KUNBUS gateways consist of two mounting rail modules equipped with a shared interface for the payload data. The payload data is exchanged over the internal bus via a plug-in jumper to which the two modules are connected.
This intelligent approach enables the KUNBUS gateway to be used very flexibly and to be reconfigured at any time.

KUNBUS-TAP 2100 – Diagnosis and monitoring of Ethernet-based networks
KUNBUS-TAP 2100 is a network monitor for monitoring all commonly used Industrial Ethernet protocols such as PROFINET.
With four probe ports this device enables logging of up to two Ethernet connections. As a result, it is possible to„center in" on a conspicuous device and to compare the input data and output data. The comparison using appended time stamps enables analysis of delay and CRC error.
An internal throughput delay of 0 µs makes the KUNBUS-TAP 2100 transparent for the data channels to be tested. A standard Gigabit Ethernet interface is used for the connection to a PC (Wireshark).

Customer-specific solutions
Standard solutions do not always fit the concept of our customers. That is why we also offer customer-specific solutions.
Our developers work hand-in-hand with our customers to find the best possible and most economical hardware and software solution. The proximity of our development to our manufacturing also guarantees fast and direct information flow, which benefits your products.
Once we have developed your product, the professional handover to manufacturing follows. We deliver you prototypes and first samples all the way to series products in a timely manner and in proven KUNBUS quality.

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www.kunbus.com

Functional Safety

Safety Design Packages + Development

Electronic development by the Competence Center

- ***Hardware development***
- ***Software development***
- ***Industrial communication***
- ***Functional Safety***
- ***Explosion-proof***

PROFIsafe

Accredited PROFIsafe Competence Center

The company

MESCO Engineering is your partner for innovative product development in the area of process and factory automation.

Our core competency is development of hardware and software. The combination of the technical fields of industrial communication, Functional Safety, and Explosion-proof is our strength.

Since 1990 we are offering our customers the up-to-date expert know-how, integrated solutions, and comprehensive consulting and development services ranging from concept to approval. Here an honest, transparent and partnership-like cooperation comes first.

Make use of our experience and know-how for your products.

Getting started: Consulting

- Technology consulting
- Functional Safety management
- Support for creation of requirements specification

Concept: Architecture

- Creation of safety concept
- System architecture
- Quality assurance measures

Development:
Design, implementation, prototyping

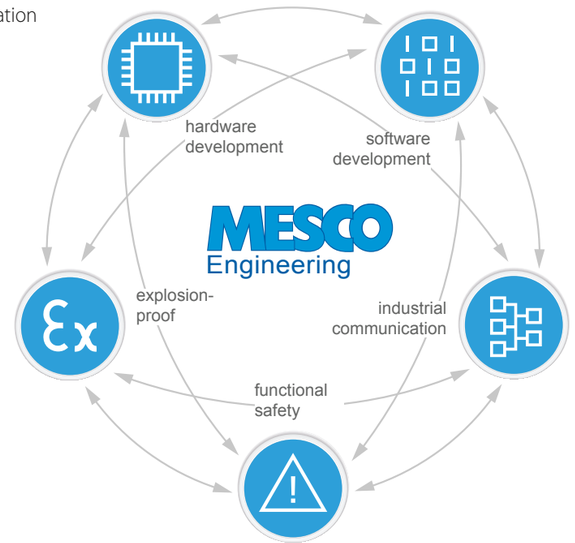
- Hardware and software development
- Prototyping
- Integration test
- Type test
- Support for production implementation

Testing: Verification

- Type test
- Integration test

Final step: Certification

- Continuous support up to certification of fieldbus and Functional Safety
- Support for international certification
- Cooperation with TÜV



...where ideas turn into success!

IEC 61508: Safety Design Packages

Your benefits

- Hardware and software development with flexible use of precertified Safety Design Packages
- PROFINET and PROFIsafe expert know-how
- Cost reduction through use of proven circuits + software
- Short time-to-market
- Reduced development risk
- Easy fieldbus certification
- TUV certification

We develop for you!

Our TUV-certified safety engineers and technicians will apply their expertise to your task.
Hardware and software development with flexible use of precertified Safety Design Packages for

- Drive technology
- Safety I/O
- Condition Monitoring

Design Package Safe Ethernet Protocols

- Proven circuits for Ethernet interfaces conforming to standards, Industrial Ethernet protocols with safety layer
- Black channel implementation on single protocol ASIC, multi-protocol ASIC, standard CPU, or FPGA

PROFIsafe · open SAFETY · CIP Safety · Safety over EtherCAT

Safety Design Package CPU: Safety kernel architecture

- Proven precertified circuits for functionally safe embedded electronics
- Supported architectures: 1- and 2-channel for SIL1 - SIL3 or PL d / PL e, CAT3 / CAT4
- Safety-related embedded application by hardware and software development service according to IEC 61508, IEC 62061, EN ISO 13849
- Safety parameterization and SoftPLC functionality

Safety Design Package for Embedded Applications

- Safety Functions for Drives: library for extended safety functions STO, SS1, SS2, SBC, SLS, SLP
- Safety I/O: Hardware and software package for 3 Safe Input, 1 Safe Output
- Condition Monitoring: Hardware and software package for safe signal processing

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Complete PROFINET Solutions from Molex

Providing more than connectors, Molex delivers complete interconnect solutions for a number of markets, including data communications, telecommunications, industrial, automotive, medical and consumer electronics.

The Molex Industrial division is specialized in harsh-environment technology for factory automation, power distribution, temporary lighting and infrastructure solutions. This includes also Molex Brad® solutions for industrial networks and fieldbus to communicate and gather information through communication software, network interfaces, Ethernet switches, smart gateways, diagnostic tools, cables and connectors.

Products

Brad® HarshIO PROFINET modules are a reliable solution for connecting industrial controllers to devices in harsh duty environments. Contained in an IP67 rated housing, Brad I/O modules can be machine mounted and are able to withstand areas where liquids, dust or vibration may be present. Thanks to Molex PROFINET IO Development Kits, the HarshIO PROFINET kit has successfully passed the PI IO-Device CC-B certification according specifications v2.3.

Molex applicom® IO Ethernet network interface cards provide powerful and simplified PROFINET RT data exchange to interface any custom application. The provided configuration software is an easy-to-use engineering tool allowing customers to configure complex (Modular) IO-Devices in one click, with integrated advanced diagnosis.
In order to provide a full PROFINET IO solution to customers, Molex portfolio includes a range of PROFINET certified cordsets, connectors, pass-throughs and switches for in-cabinet and harsh environments.

Custom Solutions

With Molex Brad PROFINET IO Development Kits (also called stacks), manufacturers can develop and market PROFINET more quickly. The stacks allow to design PROFINET IO-Controller products like PLC couplers, Panel PC's, robot controllers, or by using the IO-Device stack to develop slave devices such as I/O modules, robots, field instruments, regulators, etc. PROFINET IO stacks support any kind of hardware platform (little and big endian memory format) and are compatible with operating systems (real-time or not) like Windows®, VxWorks™, or Linux implementing multi-thread user applications. The deliverable development kit package includes: ANSI C-source code, electronic documentation, samples of implementation in various OS. Molex stacks allow manufacturers to develop Media and System Redundancy solutions PROFIsafe systems and also allow to reach CC-C (IRT) on dedicated hardware platforms. Molex partners with several semiconductor providers like Texas Instruments, RENESAS, PROFICHIP, Innovasic etc. to offer multi-protocol platform solutions.

Services

More than just providing technology packages and products, Molex helps customers to reach the market quickly by allowing access to the PROFINET experts. PROFINET & PROFISAFE certified engineers are participating to the PROFINET specification design and are also available to customers through the accredited Competence Center.
Available worldwide, the Competence Center provides trainings, services and support including trainings on stack integration. Trainings can be customized depending on customer's needs. The Molex Competence center can fully manage the integration of PROFINET capabilities into the manufacturer target system, providing in this case the benefits of Molex technology expertise. During all your product life cycle, the competence center is your partner to support or consider necessary evolutions of the product by providing you updated technology modules as well as keeping a close relationship.

The Molex Competence Center is also partnering with various local engineering and service providers to best support your integration projects.

For more information please contact
E-Mail: **profinet@molex.com**
Visit the Industrial Products section
on **www.molex.com**

Phoenix Contact Competence Center

Bundled PROFINET competence

For optimal support of PROFINET users, Phoenix Contact and the independent test lab and certification institute Phoenix Testlab provide their comprehensive know-how within the framework of the Phoenix Contact Competence Centers (PCCC).

No matter what PROFINET solution you are looking for: our specialists will support you with our know-how. The accredited PROFINET Competence Center at Phoenix Contact provides vendor-neutral support from development to plant modernization – starting from individual components to a complete system. In this way you harness the experience of a leading automation manufacturer for your development and application. A comprehensive training program is also offered.

Implementation

Phoenix Contact supports device manufacturers and solution providers during the development phase with products and services. For development of PROFINET controllers and devices, Phoenix Contact offers powerful technology components that are proven in use. The integration and porting is carried out in close cooperation with the customer and its specific applications.

The PROFINET controller stack features convenient context management of the communication connections (Application Relations, ARs) and comprehensive diagnostics. The optional addition of a PROFINET device component enables fast and direct communication between multiple PROFINET controllers. Typical applications for this are redundantly or hierarchically structured automation networks.

The PROFINET device chip TPS-1 reduces implementation time and expense to an absolute minimum. It offers device manufacturers the option of fast, easy, cost-effective integration of a PROFINET device interface as a single-chip solution at the price of a fieldbus interface. It supports Conformance Class C and can therefore be used for all performance classes of PROFINET devices.

Phoenix Contact provides support for integration of a PROFINET interface in all project phases through:

- Consulting and joint concept development
- Technology integration in a wide variety of platforms
- Support and maintenance
- Updates and Upgrades

Phoenix Contact provides corresponding technology components for the different PROFINET device types. You can thus implement and certify your PROFINET interface quickly.

Testing and certification

As an accredited test lab, Phoenix Testlab offers device manufacturers a flexible range of services for certification. Product requirements are validated using relevant standards already during the specification phase. This reduces the time-to-market.

To meet the high quality standards of customers, a specially developed controller simulation software is used as the test system. To assure the interoperability of the certified devices, a multi-vendor wall with different controllers and engineering systems is used as the test setup. All specified test cases are implemented professionally by trained engineers.

The certification tests based on IEC 61158 can be performed during development or as a final test. Once the PROFINET tests have been passed, the customer receives an official test report and can apply for a certificate for the device from the PNO. The PNO issues this certificate for three years.

User service

The focus of Phoenix Contact services is on solution -oriented application of PROFINET products.

The focal points are:

- Configuration
- Commissioning
- Service
- Plant modernizations
- Training courses

Phoenix Testlab guarantees a high test quality through specialized test engineers. Relevant standards form the basis for PROFINET certification tests.

Concept for a production system: The professionals at the Phoenix Contact Competence Center fully support their customers – starting with qualification measures and continuing with configuration to startup and maintenance of the system

The Phoenix Contact Competence Center is one of three PROFINET international training centers in Germany. This is where certified PROFINET installers and engineers are trained.

You can also become accredited as a PROFINET training center by Phoenix Contact. In this way, you can use your own certified trainers for training your engineering and service personnel.

www.phoenix-testlab.com
www.phoenixcontact.com

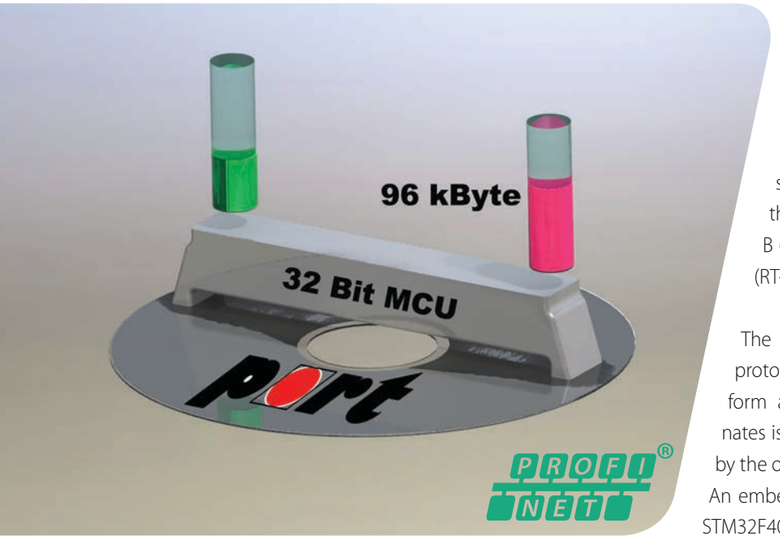
PROFINET – Single Port or Dual Port for Line Topology (Daisy Chain) support

by port – the embedded Experts

PROFINET not only for embedded systems but for powerful Linux or MS-Windows based systems as well

- ***32 Bit MCUs or CPUs, only 128kByte RAM for PROFINET required***
- ***With OS or running „bare metal“***
- ***32/64 Bit PC-Systems running Linux or MS-Windows***
- ***Quick-Start for Linux***

The embedded Experts port contributes to PROFINET developments with over 20 years experience in Industrial Networking. The portfolio offers various standard products as well as customer specific solutions in the field of hardware and software.



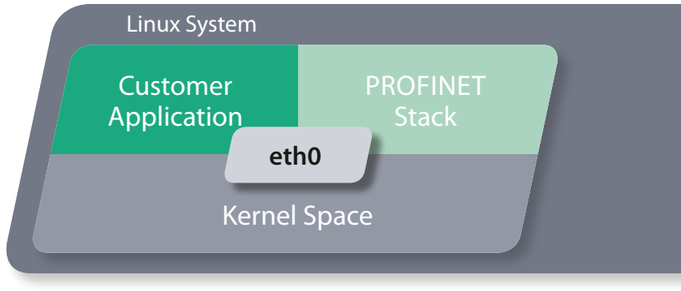
The PROFINET stack by port enables embedded systems for standard compliant communication using PROFINET specification 2.3. Supported are the Conformance Classes A and B (CC-A, CC-B) in Realtime Class 1 (RT-1).

The driver application adapts the protocol stack to the specific platform and/or the (RT)OS. This eliminates issues that would be introduced by the otherwise necessary portation.
An embedded CPU, as for example the STM32F407 can reliably deliver performace to run at 1ms cycle time.

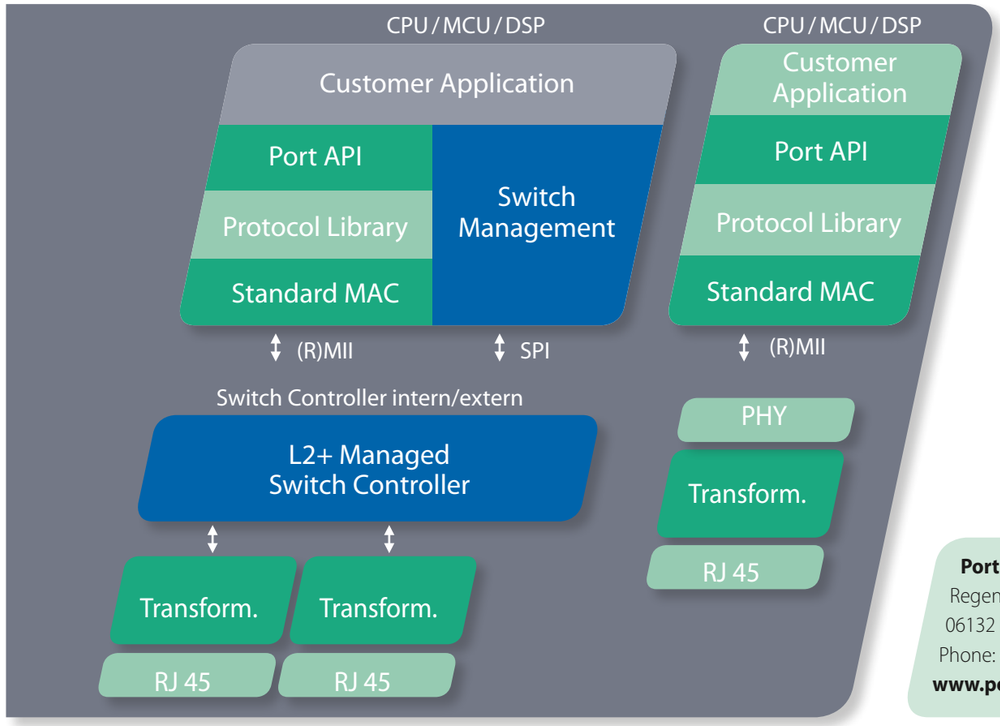
The use of the PROFINET Library is not only limited to embedded systems, also the powerful CPUs and the corresponding operating systems are supported. The advantage is the employment of the stack as regular application.

For Linux – the regular eth0 (example) is sufficient, the stack connects to the eth0 – done! This way cycle times down to 1ms can be achieved. Employing powerful Linux OS-based systems with enabled High Precision Timers and available Real-Time patches cycle times down to 1ms are possible.

Using a MCU/CPU-internal or external connected L2+ managed Switch Controllers (e.g. Micrel, Marvell, ….) enables for Line structure support in CC-B.
The corresponding driver also handles then the necessary, PROFINET specific Switch Management.



Various combinations from Switch Controller, CPU/MCU, OS/RTOS and TCP/IP Stack are possible.
PROFINET for Linux can support Line Structure as well.



Example: CPU/MCU in single Port or with external Switch Controller

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www.port.de

Renesas Electronics

Electronic components for PROFINET solutions

Renesas Electronics is the automation industry's preferred supplier of Industrial Ethernet solutions. From the PROFINET IRT certified, through the family of multi-protocol, real-time Industrial Ethernet Controllers, to the IO-Link controllers, Renesas' range of Industrial Automation products offers highly specialized devices that give developers significant freedom of choice.

TPS-1

ERTEC

Renesas R-IN

Development Tools and Support

IO-Link Remote Control Board

Renesas is the only independent semiconductor provider for the leading technology for PROFINET IRT designs. The Enhanced Real-Time Ethernet Controller (ERTEC) and TPS-1 devices enable developers to create PROFINET IRT compliant designs that are interoperable with equipment from the world's leading automation suppliers. In addition, the R-IN32M3 family of devices offer highly BOM optimized access to a variety of Industrial Ethernet flavors.

Beyond the PROFINET family of devices, Renesas offers the IO-Link controllers. The IO-Link protocol has been adopted by the world's leading sensor manufacturers and is set to become the de-facto digital serial communications standard for sensor and actuator applications.

Our dedication to the automation industry combined with our innovative capabilities in leading edge technologies makes Renesas a partner of choice for industrial automation.

IRT solutions

The ERTEC and TPS-1 devices from Renesas deliver superior real-time performance by including an intelligent hardware network switch on chip that performs the time slicing required for IRT. It creates the fast lane necessary to guarantee real-time performance. Renesas is the leading semiconductor supplier of a device that conforms to the PROFINET standard.

ERTEC is currently available in three versions, ERTEC200/ERTEC200P offering two Ethernet ports including PHY, and ERTEC400 offering four Ethernet ports. All are based on the Fast Ethernet (100Mbps) standard delivering high bandwidth for both real-time and non-real-time data.

The TPS-1 targets the peripheral applications and complements the existing ERTEC devices. The single chip solution supports a much easier implementation of PROFINET and optimizes the connection cost down to fieldbus level. The TPS-1 supports PROFINET RT and IRT standards.

Industrial Ethernet Controllers

ARM® based R-IN32M3 controllers with embedded real-time switch offer multiple routes to Industrial Ethernet. With the R-IN Engine they achieve the high-speed real time response and low power consumption for Industrial Ethernet Communication. The Real-Time OS Accelerator within the R-IN Engine ensures high speed task change and very fast interrupt response. As a result, the R-IN32M3 family of products can realize highly precise and stable CPU operation.

The RZ/T1 family controllers complements Renesas' industrial smart factory solution portfolio. As a Servo/Drives-Solution with encoder interface and connectivity, RZ/T1 features the ARM® Cortex®-R4F core, designed for real-time processing, low latency and a rapid response to interrupts. There is a tightly-coupled memory capable of definitive real-time response processing built-in, which ensures a high-speed access from the CPU without passing through the cache memory.

The RZ/T1 controllers also have a built in Renesas R-IN engine, responsible for handling the real-time Industrial Ethernet communication, therefore leaving lots headroom for customers' application.

IO-Link

Renesas Electronics introduced the industry's first IO-Link Master controller to incorporate a fully programmable microcontroller and a dual IO-Link Master transceiver on a single chip. Scalable and efficient implementation of multiple ports I/O module, with significant reduction in development time, cost and PCB design complexity is now possible with the µPD78F806x. While conventional solutions require a microcontroller, a transceiver circuit built around over 60 discrete components, or complex multiple and standalone transceiver ICs, Renesas' µPD78F806x reduces this components count down to a single integrated device. To complete the solution, an IO-Link protocol stack optimized for the device is made available via Renesas' software alliance partner. A Remote I/O Tool Box solution kit fully featured for multi-protocols I/O module systems development is available for easy valuation and prototyping.

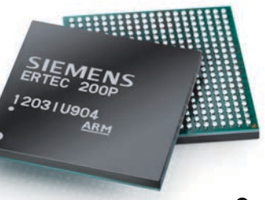
Renesas Eco System

Renesas offers an extensive set of evaluation boards including various protocol stacks from leading vendors. Furthermore Renesas' services and local support infrastructure help customers decrease their time-to-market as well as save development costs. Renesas' European organization includes engineering resources with focus on ESD and EMI design and analysis, qualification and failure analysis and product design as well as product support for industrial markets. Renesas is an active member of several working groups in PROFINET International contributing in PROFINET and IO-Link organizations. In addition we work closely with some of the industry's leading players to create new and innovative solutions and services for automation applications. Together with our partners, Renesas provides an exciting ecosystem through which we release new innovative products for the automation industry.

For more information please visit
www.renesas.eu/automation

PROFINET technology from Siemens

Would you like to integrate PROFINET in your field devices as easily as possible while achieving maximum performance? PROFINET technology from Siemens provides you with optimal performance capability and can be scaled to your exact requirements. You will receive full support throughout the product development cycle: from individual support to certification.



Technology from Siemens – innovative and proven time and time again

As an active member of PI, Siemens has been involved in advancing the development of PROFINET since the very start. Technology components from Siemens benefit from the know-how accumulated from many years of successful development work and have already been proven in the field in countless products. Siemens Competence Centers advise you in the selection of the right technology component for your device, offer you training opportunities, and support you during the entire development process up to and including certification.

On the way to the fastest PROFINET with the ERTEC 200P

The new ERTEC 200P (Enhanced Real-Time Controller) sets new standards for the communication performance of PROFINET. Designed for cycle times as short as 31.25 µs, the performance upgrade for PROFINET has been integrated in ERTEC 200P. With its fast ARM 9 CPU and integrated IRT switch, field devices with the most demanding performance requirements are possible.
The reduced chip size allows hassle-free integration in compact field devices. The CPU with clock frequency to 250 MHz allows integration of your own applications, eliminating the need for an external host CPU in many cases.

The right development package for every device

Regardless of whether you want to rely on existing hardware or develop a new device, the PROFINET development packages from Siemens offer a solution for every application.

	ERTEC 200P	ERTEC 200	ERTEC 400
Integrated IRT switch	2-Port	2-Port	4-Port
Integrated PHYs	X	X	X
Support for copper and fiber-optic cable	X	X	X
Minimum cycle time	31,25 µs	250 µs	250 µs
ARM CPU	ARM 926	ARM 946	ARM 946
Max. clock frequency	250 MHz	150 MHz	150 MHz
Assignable IOs, General-purpose IOs	max. 96	max. 45	32
Housing size	17x17 mm	19x19 mm	19x19 mm
Ball Pitch	0,8 mm	0,8 mm	0,8 mm

- **Development packages for ERTEC 200P and ERTEC 200/400**

The development packages include an evaluation board with a sample application so that commissioning can be completed within minimum time. The PROFINET stack is supplied as source code, including the open source real-time operating system eCos, all development tools, analysis programs, and documentation. Field devices with RT (Real-Time) and IRT (Isochronous Real-Time) can be implemented with the ERTEC ASICs.
The integrated switches allow field devices to be built with 2 ports (ERTEC 200 and ERTEC 200P) and 4 ports (ERTEC 400).

SIEMENS

- **Development package for standard Ethernet controller**
  This development package allows PROFINET devices with RT to be developed without the need for a special ASIC. An existing Ethernet interface can be used for integration of PROFINET. This PROFINET stack can be ported to any real-time operating system.
- **TPS-1**
  The TPS-1 ASIC provides a single-chip solution. Devices with RT and IRT can be implemented with the TPS-1. The TPS-1 provides an integrated switch, integrated CPU, and RAM for a PN stack.
- **PROFIsafe StarterKit**
  Fail-safe field devices can be implemented with the PROFIsafe StarterKit. Sample implementations are available for the PROFIsafe stack for easy connection to ERTEC platforms.

Competitive advantage with the PROFINET driver for controller

The PROFINET driver supports in-house developers who want to implement PC-based or embedded applications and need PROFINET controller functionality for that.
The PROFINET driver is suitable for simple applications. Your own solutions can be ported to various operating systems using the source code. No engineering tool is needed. Instead, the configuration is carried out via an open XML interface. Of course, easy configuration using the TIA Portal is also possible – without any license needed.
The PROFINET driver supports PROFINET with Real-time (RT) and achieves cycle times as fast as 1 ms when a real-time operating system such as Linux is used.
With the PC plug-in cards CP 1616 and CP 1604, Siemens also offers a simple solution for implementing PC-based PROFINET controllers for high-performance closed-loop control tasks. For motion control, CNC, and robot applications, the PN Gate is the ideal solution for easy implementation with clock synchronization.

Stay up to date

When you choose a development package from Siemens you will always stay up to date on the latest developments. You will receive all updates available for your development package free of charge.

Benefit from the reliability of certified field devices

A significant portion of PROFIBUS and PROFINET certifications come from the accredited test labs ComDeC in Germany, PIC in the USA, PIC in China, and AnfData in the Czech Republic. The certification ensures that devices in the field always conform to the demands of industrial environments. Device manufacturers are thus assured that their PROFINET devices installed worldwide do not require expensive service calls.

Service and Support – Our experience saves you time and money

With Siemens you receive the support you want:

- Individual consulting before purchasing a development package
- Free support by phone or e-mail during development
- Free evaluation kit training
- On-site support by arrangement
- Support for certification

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Softing's PROFINET Offer

As one of the first members of the PNO, Softing has long been active in the development of PROFINET. Our team of experts is highly qualified to provide you with solutions for a wide range of projects and to support you in all areas, ranging from consulting and development to pre-certification. Our products are known for combining ease-of-use with beneficial features.
You too can benefit from this!

Consulting services and seminars
– We share our knowledge with you!
Softing is an accredited PROFINET Competence Center and Training Center. In this regard, we offer consulting services as well as other services to manufacturers of PROFINET systems, starting with technology training all the way to preliminary testing for certification.
In addition, we provide Certified PROFINET Engineer training for commissioning engineers.

Portable protocol software – Communication software for existing hardware platforms
Softing offers portable and scalable protocol software stacks for customers that require integrating the PROFINET communication protocol into existing hardware platforms. Softing developed a questionnaire that will assist vendors with estimating the complexity of the integration effort. Our portable and (functionally) scalable stacks can be used on any suitable platform. The software implements PROFINET according to the specifications of the respective conformance class (RT/IRT) in three ways – as controller, supervisor, or device.

Softing's extensive experience in writing conformant protocol software is accompanied by stringent quality control measures to ensure interoperability. This fact is often pivotal in tipping-the-scale when device vendors are deciding on a reliable supplier.

FPGA-based communication interface – Are you looking for a flexible solution for integrating PROFINET into field devices?
An FPGA (Field Programmable Gate Array) can be adapted flexibly to different requirements by loading appropriate hardware functions (also referred to as IP cores). This pertains to communication functions and integration into the target environment. Our solution utilizes components from the Altera Cyclone FPGA family, but we also offer IP cores for Xilinx. A switch and a processor for processing the device stack are included as IP cores. This approach allows creation of compact and flexible communication interfaces.
We offer this solution in three versions: as a ready-to-use Module, as "Stack ready for FPGA" or as an integration package.

The ready-to-use module is the optimal choice if you do not want to develop your own hardware. Of course, Softing can adapt the form factor, hardware interface, etc. according to your requirements.
The integration package, which consists of IP cores, operating system, and stack, appeals to customers using their own hardware.
Both versions are being successfully used by customers today. In order to gain experience with the technology, an evaluation kit is also available.

Evaluation kit for PROFINET Device Stack

Communication modules
– Do you want to integrate controller functions into your applications?
We also offer a solution for this scenario, based on our controller stack, an FPGA-based hardware, and a configurator with integratable configuration library.

Reliable market introduction based on pre-certification
As an option, Softing offers pre-certification of your PROFINET device according to the official tests. This enables fast and smooth PNO certification subsequently at one of the accredited test labs. To guarantee trouble-free testing, Softing collaborates closely with several test labs. Reliable planning of market introduction is possible this way.

Diagnostics
– Insight into bus events and the future
Over 25 years of PROFIBUS experience has shown how the use of diagnostic tools can significantly increase the availability of suitable systems and devices!

Integration module with PROFINET Device Stack or Controller Stack

The findings regarding plant availability obtained with fieldbuses also apply to Industrial Ethernet.
For this, Softing offers mobile tools for commissioning and troubleshooting of PROFINET systems. The TH LINK PROFINET and TH SCOPE products ensure demand-oriented maintenance and performance monitoring.

You need...	We offer...
Consulting services for PROFINET	Seminars and consulting services
PROFINET software on existing hardware	Portable, scalable, and tested stacks for device, controller, and supervisor
Flexible and future-proof solution for integration of PROFINET in field devices	FPGA-based integration solution for existing hardware and as a module, customized to your specific requirements on request.
Solution for integration of PROFINET Controller functionality	Communication modules with configurator as library or with user interface
Confidence about the proper functioning of the PROFINET cabling and data exchange	Softing products cover requirements and applications for diagnostics throughout the network life cycle, from installation to commissioning to on-line operation.

An overview of our current offer is available on our website. We would be pleased to advise you personally.

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Lateral Thinking. Coaching. Implementing.

We master technology.
The technical experts at TMG have many years of development experience and ensure that new technologies are effectively and efficiently used. And implement these for you.

What we can do

For more than 25 years TMG Technologie und Engineering has very successfully supported national and international companies in the conception, specification, implementation and certification of development procedures in industrial communication technology. We master the following technology: PROFINET, PROFIBUS, IO-Link, as well as TCI, FDT and EDD, further field bus and industrial Ethernet systems.

Our technology products

We have developed our own technology components, which we make available to our customers. We offer communication stacks for PROFINET (Controller/Device), EtherNet/IP (Scanner/Adapter), PROFIBUS (Master/Slave), and IO-Link (Master/Device). We work with the leading semiconductor manufacturers to provide reference implementations and starter kits based on our software.

Time to Technology™ / Time to Market

We will help you to find the right time for your company to introduce new technology and ensure the right time for the market introduction. We will also support you with the integration of your field device into engineering software or process control systems.

Technologie
Management Gruppe
Technologie und Engineering

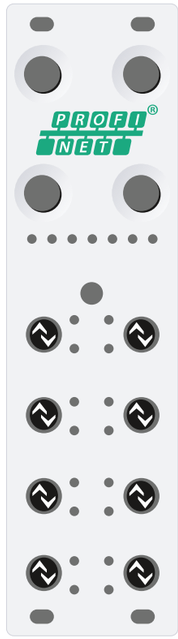
PROFINET

TMG TE has long standing experience in PROFINET technology. We realize protocol stack solutions and integrate PROFINET technology into devices of our customers. We are open and independent in the way of realization and help you to fi nd the best solution for your project plan as well considering the commercial aspects. We can support you sustainable from a simple In Design of a communication module to the point of a complex technology development.

In the process, we support you in all phases, starting with the preparation of your projects in Marketing and Product Management and continuing with the specification, basic technology selection, and development phases, all the way to certification and market introduction.

We have developed our own PROFINET device stack for Conformance Class B, which is designed especially for single-chip microcontrollers and enables especially favorably priced and small-scale implementations. We also offer other Industrial Ethernet protocols on the same platform. In connection with our IO-Link master stack, very high-performance, yet reasonably priced IO Systems can be realized. At the same time we have already implemented the mapping functions required for this and are participating in the corresponding standardization committees.

For higher-performance devices, we offer both device and controller stacks, which can be easily ported to different platforms. Additional Internet technologies such as TCP/IP and UDP communication, WEB Server, FTP, NTP, or even combinations with other Industrial Ethernet protocols are making the most of the opportunities of Ethernet. We have already implemented this in projects up to and including functional safety.



TCI Device integration with justifiable effort

The demand for more fl exibility in production and more diagnosis and functions for preventative maintenance can result in even simple actuators and sensors having communicative abilities. A very good example here is the development of IO-Link. These devices need a user interface which is comfortable and easy to operate. We also support you when integrating your PROFINET devices into engineering software through creation of the GSD and device descriptions such as EDD (e.g., for SIMATIC PDM), or we develop device tools based on FDT/DTM or your proprietary interfaces as a stand-alone solution or TCI. The Tool Calling Interface (TCI) is a simple software interface that enables you to start device tools directly from the engineering system (e.g., STEP 7).
Apart from directly linked device tools, technology such as EDDL and FDT can be used via the corresponding adaption software. TMG Technologie und Engineering began very early with the implementation of device tools on the basis of TCI. Our IO-Link device tool is therefore our reference implementation. As well for PROFINET TCI off ers an easy way to integrate existing device tools better or to develop new device tools with man ageable costs.

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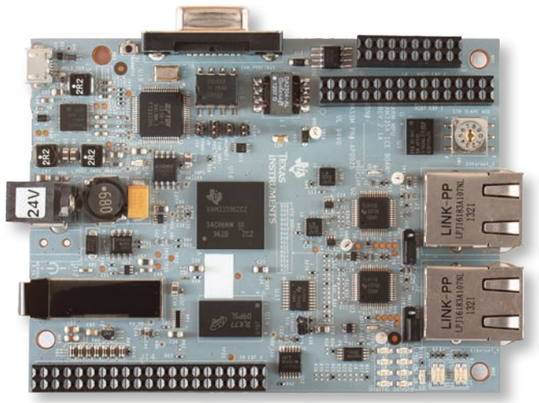
Texas Instruments simplifies industrial designs with multiprotocol, on-chip industrial communication

The Sitara™ processors provide efficient and scalable architectures for the entire Industrial Automation system, using the ARM® A-series of cores, including the Cortex®-A8, Cortex-A9 and Cortex-A15. All incorporating multiple industrial communication protocols on a single chip. Pin-to-pin and software-compatible devices in each family of processors, along with industrial hardware development tools, software and analog components, provide a total industrial system solution.



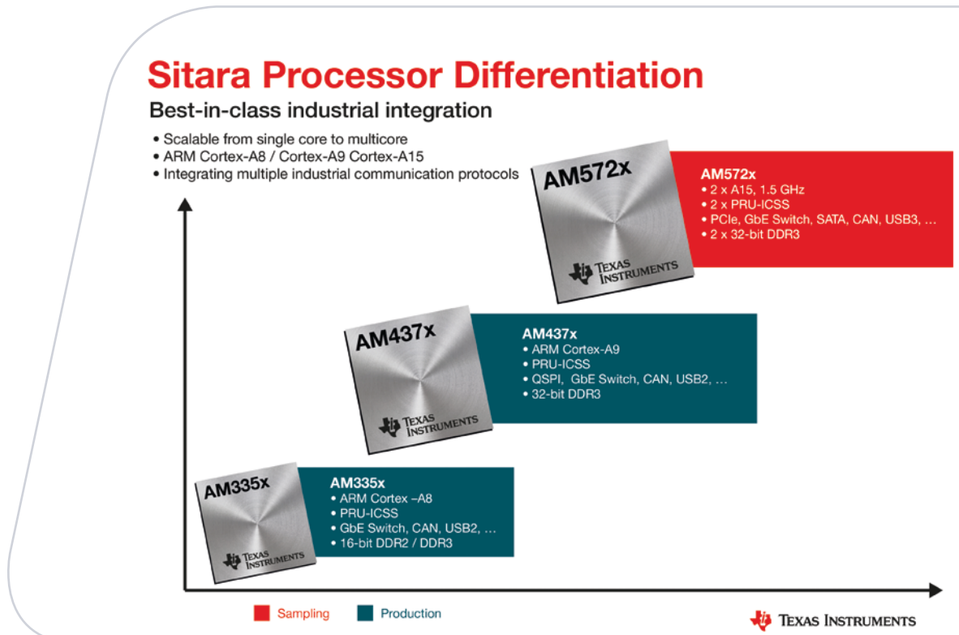
Using these solutions, developers can get to market faster with their industrial automation designs, including input/output (I/O) devices, human machine interface (HMI) and programmable logic controllers (PLCs).

Key features and benefits

- Multiprotocol Industrial Ethernet and Fieldbus communication protocols with master and slave functionality including:
  PROFIBUS®
  PROFINET®
- Certified PROFIBUS and PROFINET IRT V2.3 class C
- Unique Programmable Real-time Unit (PRU-ICSS) + ARM architecture eliminates the need for an external ASIC/FPGA to reduce system complexity and save on bill of materials (BOM) costs by more than 30 percent
- Scalable ARM Cortex-A8, Cortex-A9, Cortex-A15 processor platforms (Single Core 300MHz to Multi Core 1,5GHz) for many different industrial automation applications enables reuse with pin-to-pin and software-compatible devices
- Broad software support for Linux® and TI RTOS in addition to a variety of third-party RTOS offerings providing design flexibility
- Fully integrated solution including other key industrial peripherals such as CAN, 2-port Gigabit Ethernet switch, PCIe, USB+PHY, graphics acceleration and LPDDR1/DDR2/ DDR3 reduces BOM costs

Texas Instruments

Several HW development platforms are available, such as the AM3359 Industrial Communications Engine (ICE) (TMDSICE3359) for $189 USD. It is a pocketsized, cost-optimized and form-factor optimized reference design for I/O devices and sensors needing to add industrial communications quickly and easily.



TI offers the ability to complete an entire industrial system design with TI analog ICs, including industrial Ethernet and isolated CAN transceivers, motor drivers, temperature sensors and power management devices, plus wireless connectivity options to complement the Sitara ARM microprocessors.

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