From the PIC

Since the beginning, real-time capabilities and determinism was an often a widely discussed topic with Ethernet in industrial applications. Today there are a lot of different approaches to solve this issue. Early in the game, PROFINET introduced its real-time mechanisms by bypassing TCP/IP and therefore dramatically speeding up protocol processing. This results in ultra-low jitter for the cyclic communication without the need for any special hardware. To further strengthen its position in motion control applications PROFINET offers additional measures for determinism. One is bandwidth reservation, to make sure the real-time data always gets access to the network when needed. And second, scheduling, which is generally speaking the optimization of bandwidth reservation. With scheduling, the reserved time window will be kept at the absolute minimum to not waste any bandwidth. Both technologies are commonly referred to as IRT (isochronous real-time). Using IRT, there is enough bandwidth even for the most demanding applications like metal forming machines or large printing presses. With IRT, the user doesn’t need to care about network performance. It is a given. While there are other high-speed Ethernet protocols for motion control, only PROFINET covers it all. PROFINET addresses safety, wireless, process application, etc. It is a truly all encompassing Industrial Ethernet. Can your motion control network do the same?

Dynamic Forming

Automation of metal forming machines using PROFINET

Real-time communications for synchronizing all processes is becoming ever more critical, even in forming technology

The automation of metal forming machines makes very high demands on control technology, but should also make use of open and homogeneous communications technology. With Isochronous Real Time (IRT), Profinet permits quick and deterministic control loops. In addition it supports modular machine concepts together with homogeneous communications through to the company management level.
The control of hydraulic drive technology metal-forming machines is one of the most demanding motion control applications. Amongst other things, it demands quick and precise control of rams and bed cushions together with a distance, time or process-dependent use of speed and pressure profiles.

Travel movements in pressure-controlled hydraulic presses are very demanding because of the "flying transition" from position regulation to pressure regulation. In the instant when the tool strikes the workpiece, an extremely dynamic progression of forces occurs, which must be regulated using the bed cushions. Depending on the demands, it may be necessary to follow a pre-defined pressure profile. Technologically oriented automation systems such as the PC-based Simotion P controller or the drive-based Simotion D controller have standard functions for positioning a hydraulic cylinder, the balance between hydraulic and electrical axes, the flying transition from position regulation to pressure regulation and back again, together with pressure regulation to a pre-defined pressure profile. The necessary sensors and actuators are then connected via modular peripheral stations. In the case of the Simatic ET 200S the decentralized peripherals system is fitted with scalable high-speed modules appropriate to the application, thus permitting cycle times down to a minimum of 250 microseconds.

Quick signal processing
Many machines used in forming technology demand in addition to high-performance hydraulic regulation precise and quick sensing of digital inputs together with precisely timed or precisely positioned switching of digital outputs. When designing the digital input modules, a compromise must then always be found between an interference-proof signal sensing with input filters on the one hand and a quick signal scanning in the μs-range for quick response times on the other hand. Ideally the input delay can be parameterized to suit the demands. This is what the Simatic ET 200S's decentralized peripherals system offers. Quick digital output modules synchronized with the controller can be triggered with cycle times considerably less than a millisecond. The position reference is available from a cam control system, which the Simotion controllers regard as a technological object for each cam output.

By configuring the application, the IRT telegrams can implicitly be determined in advance and the appropriate configuration of data generated. Using an algorithm, the optimally timed arrangement of the individual telegrams for each network section can be determined with regard to the configured topology. This means a switch is able to forward IRT telegrams from the input port to the output port and then to the destination device with minimum transfer time.

Advantages of Profinet in forming technology
- High product quality and productivity thanks to optimized machine cycles based on short and deterministic real time cycle times.
- Quick response to changes in markets and customer requirements using modular machine concepts.
- Reduction in operating costs based on comprehensive networking of the production plant on the basis of a single bus system.
- High machine / plant availability thanks to extended diagnostics and maintenance facilities.
- The networking of order receipt, production planning, manufacturing and logistics means that production is flexible and can be adjusted to current demands at any time.

Modular machine concepts
In addition, Profinet permits modular and scalable machine concepts. Electrical and hydraulic axes alike can be synchronized with each other using virtually any number of controllers via controller-controller cross traffic. Modular machine concepts offer for instance substantial advantages for conveyor belts, by chaining the individual processing machines. The extension capabilities mean that even equipment with large numbers of axes can be accepted – at a cycle time of 500 μs, about 70 axes can be driven synchronously using Profinet with IRT as a basis.
**Better drive with PROFIdrive**

Standardized communications to drives

The PROFIdrive international standardized drive profile creates a uniform interface, which also includes the status model of the drives. This makes for quicker development of machines, improves the maintenance characteristics and increases the investment security – particularly when PI-certified devices are used.

PROFIdrive is a standardized logical interface to the drive level, which is applicable irrespective of the manufacturer. It facilitates engineering, particularly for work-intensive, time-critical projects and life-cycle phases such as creation of user programs, commissioning or diagnostics.

It covers the syntax and semantics of communications with the drives, such as the meaning of each control bit and the definition of which status bit is associated with it. PROFdrive can be used without any modifications worth mentioning with both Profinet and also Profinet, which offers outstanding scalability for communications links and saves time and costs for all concerned. The standardized drive profile means that system software and user software are independent of the brand and type of the drive devices that are installed.

The PROFIdrive profile also satisfies the agreed demands of leading users organizations, such as Open, Modular Architecture Control (OMAC), and is explicitly recommended as a drive interface in the OMAC guidelines.

Wide range of applications

PROFIdrive ensures an exceptionally wide range of applications. Six application classes are defined within the profile. These support the usual drive applications – from rpm control right through to decentralized synchronized motion control with electronic line shafts, and also the use of standard drives with distributed technological functions (e.g. winders) or positioning control within the drive itself.

This versatility accommodates the needs of machine and plant building. The standardization agreed upon by the user associations also contributes significantly to the very high acceptance by end users. It means not only that an old drive can be replaced without problems with a newer version, but a drive can be replaced even with one from another manufacturer. In addition it means that uniform diagnostics and maintenance methods can be applied to all drives for all machines in a production plant, even if they originate from different machine or drive manufacturers.

As well as the operational simplification by uniform service characteristics – at any rate as far as diagnostics, remote maintenance and software-side correct operation go – the investment security is also increased. Thanks to the market leadership of Profinet and Profibus, together with the international standardization in IEC 61800-7, machine programs, once written, can remain stable over the long term.

Excellent dynamics with Dynamic Servo Control (DSC)

A basic problem with the use of decentralized drives is the dead times for transmission of setpoint values and actual values which arise with any form of cyclical communication. Depending on the demands of the drive duty, the Profidrive profile communications therefore use quick cyclical or even synchronous cycle transmission systems. These are available for both Profinet and Profibus. For extreme demands such as those placed on the dynamics and stiffness of the position control circuits by high-productivity production machines, the profile for application class 4 (central motion control) contains the Dynamic Servo Control option. Here an additional feedback network exchanges correction values within the drive and control. These values offer very wide-ranging compensation for even the very small dead times created by fast bus cycles.

**Safety with PI certificate and investment protection**

Although the PROFIdrive profile is standardized internationally to IEC 61800-7, like all guidelines this allows a certain latitude for interpretation, so the attribute "PROFIdrive-compatible" is not an absolute guarantee of the complete implementation of the Profidrive functionality, such as is required for problem-free interoperability. The institution "Profibus & Profinet International" (PI) has therefore defined tools such as the PROFIdrive profile tester, and has also set up independent test committees which check and certify the conformity of drives to the PROFIdrive profile in accordance with uniform guidelines. The security enjoyed as a result of fully complying with the standardized drive interface is offered only by devices that are PI certified.

PROFIdrive offers machine operators investment security, since their drives will be compatible with the controls even in the future. Machine manufacturers with only basic knowledge and using minimal effort can quickly achieve an economic and technically high-performing drive solution.

For automation solutions based on Simatic, Sinumerik and Simotion for instance, the engineering system organizes and realizes the entire communications within the automation solution as a system service – thereby conforming to the PROFIdrive profile. The user then benefits even more from the advantages of an efficient, standardized data exchange and associated engineering.

### PROFIdrive – the advantages

- **International Standard IEC61800-7**
- Uniform configuration across all drive applications from ease of rpm inverters right through to highly dynamic servo-drives.
- This includes safe drives (Profisafe).
- Scalable communications with Profinet and Profibus.
- Guaranteed interoperability ensured by certification in independent test laboratories.
Focus on Development: PROFINET IO

Entry made easy:

Develop your own Profinet IO device in just two days

Industrial Ethernet, and here especially Profinet, have made their successful entry into the world of automation. The systems excel in many applications, providing simplified vertical integration in ERP (Enterprise Resource Planning) and MES (Manufacturing Execution System). They also make the deployment of wireless devices as well as diagnostics over the network much easier. Consequently, a number of Profinet IO devices are already available on the market. However, those who want to develop their own device must still overcome some hurdles. A development kit complete with a compact user guide now greatly facilitates the approach to this topic. This enables even inexperienced users to develop their first Profinet IO device in just two days.

Development kits minimize the learning curve for new software and hardware design. For some time, Siemens has been offering the ERTEC 200 Development Kit (DevKit) for developers of Profinet IO devices (Fig. 1). Now, a recently graduated associate of the Industrial IT Institute, Lippe and Höxter University of Applied Sciences, Germany, tested its usability and also created a user guide that will greatly facilitate the access to this topic for developers.

Powerful package

The DevKit supports users and device manufacturers with the design and test of their Profinet hardware and software applications. The kit contains all components that are needed to design a Profinet IO device with Real Time (RT) and Isochronous Real Time (IRT) capability, including: CP1616 Communications Processor in the form of a PCI card that is used as Profinet controller in PC-based systems. It enables the control of Profinet devices. The core of the development kit: The EB200 Evaluation Board as a Profinet device that enables the development and test of the ERTEC software (Fig. 2). The development board can be used in a PC or in standalone mode outside a PC as a Profinet device. The kit also includes ten ERTEC 200 templates for the development of user-specific hardware (Fig. 3). Each of these controllers features two Ethernet ports and an integrated intelligent network switch, which permits multiple devices to be chained. The Fast Ethernet standard (100 Mbps) is also supported. An ARM 964 processor that is also integrated in the controller handles all communication tasks. It also provides excess processing power so that no additional processor is required for the connection of basic sensors or actuators.

Figure 1: The DevKit supports device manufacturers with the development and test of their own Profinet hardware and software applications

Figure 2: The core of the development kit is the EB200 Evaluation Board as an IO device. It enables development and test of the software for the ERTEC processors.

Will the development kit live up to its promise?

A graduate from the Institute of Electrical Engineering and Information Technology of the University of Applied Sciences at Lippe and Höxter has put the DevKit to the test, proving its suitability for the relatively easy creation of Profinet IO devices. Prof. Dr.-Ing. Jürgen Jasperneite (Fig. 4) is the director of the Industrial IT Institute and maintains close relationships with the industry. The primary field of research of his institute includes scientific aspects in industrial communications and signal processing. “The DevKit project materialized within the context of a cooperation agreement with Siemens in the field of Profinet,” reports Jasperneite. “Its goal was the creation of a user guide for the existing development kit that would allow the quick implementation of a Profinet device on the basis of the supplied Siemens evaluation board.” A graduate who had just successfully delivered his thesis at the Institute was entrusted with the task. His field of study and the subject of his thesis provided the necessary knowledge.

Creating an IO device step by step

The first milestone of the project consisted in getting the supplied sample applications to run in the development environment. Subsequently, the graduate used the development kit and the supplied examples to design his own Profinet device. Contacts at Siemens as well as the Profinet-seasoned researchers of the Industrial IT Institute were available to solve any problems. The main task was to process and convert the experience gained into a user guide that would greatly accelerate the learning curve for an inexperienced developer to design a corresponding Profinet device. “The key challenge of the project was to filter the flood of information and create a compact guide in the form of step-by-step instructions that enable a developer to create a device,” explained the supervising professor.

The result is impressive: On 73 pages, the developers are introduced, in the form of step-by-step instructions, to the use of the DevKit and learn how to develop their own Profinet device. In a first step, it is described how the hardware and software is installed and the involved components are interconnected. The supplied sample device is then put into service. Now developers can use the supplied examples to develop their first own EB200-based device. Integration of the devices into a system requires a device master file (GSD) that describes the properties of the device in XML format. This file, too, can be created very easily by means of the examples from the DevKit and the valuable information from the user guide.

Tried and tested

The project, however, was only completed after undergoing stringent testing. Another graduate of the Institute, who has not been involved in the project until then, was chosen to verify the usability of the user guide. He had a basic Profinet and embedded systems knowledge gained in courses at the university, which created a similar background as for an industrial hardware developer who would have a general knowledge but is required to get acquainted with this new, special area of expertise. The test person managed to develop a corresponding device within two workdays. His conclusion: “I would have never succeeded without the user guide, or at least not nearly as quickly.” Whoever wants to venture into the development of a Profinet IO device should not shy away any longer: With a little bit of Profinet background, the DevKit and the user guide, it is easy to make a successful entry into this field and to achieve notable results within a very short period of time.

Figure 3: The ERTEC 200 integrates two Ethernet ports as well as an intelligent network switch.

Figure 4: Authors Prof. Dr.-Ing. Jürgen Jasperneite (left), Dipl.-Ing. (FH) Nora Crocoll (center), Dipl.-Ing. (FH) Christoph Rötter (right)
New Products

PROFIBUS PA Diagnostic Monitor

The PROFIBUS PA Diagnostic Monitor, BC-230-PB, is designed to analyze the operation of a live PROFIBUS PA segment without interfering with its operation. It is powered by the fieldbus so no battery or external power source is required.

- Automatic segment test with an OK/BAD indication without operator intervention
- Detects short circuits between signal wires and/or cable shield
- Sends complete reports via USB to PC displayed as Microsoft® Excel chart
- and more …

Many of the products and services developed by Softing since the company was founded in 1979 have become reference standards throughout the world. For example: Most current PROFIBUS diagnostic tools are modeled after Softing’s very first PROFIBUS Analyzer package developed in the early 1990s.

Today, Softing is still the undisputed market leader for network diagnostic products and is the only vendor

- with a complete set of novel PROFIBUS diagnostic tools in its portfolio that are extremely powerful, yet very easy to use
- that is a manufacturer and direct supplier (not a distributor/reseller) of diagnostic tools within the US market

www.softing.com

I/O module with CPU functionality and Profinet connection

The Siemens Industry Automation Division has added a new interface module with CPU functionality to the Simatic ET200S product family of distributed I/O devices: the IM151-8 PN/DP CPU handles control tasks and communications functions via Profinet. The module is also available in the fail-safe version IM151-8 PN/DP F-CPU.

With the new IM151-8 PN/DP CPU module that has the performance power of a Simatic S7-300 CPU 314, users can implement distributed structures on Profinet. The Profinet communication interface with three ports for linear bus topologies and programming device functions is onboard and can be expanded with a Profibus DP master module. As a Profinet IO Controller, the new interface module supports the real-time properties RT (Real Time) and IRT (Isochronous Real Time) and can control up to 128 IO Devices. Since it supports other open TCP/IP-based communication methods, the flexible module is also available for other application options.

The fail-safe version IM151-8F PN/DP F-CPU has an expanded RAM of 192 KB. It can be expanded centrally and in distributed configurations with standard and fail-safe modules. Fail-safe communication is handled on the basis of PROFIsafe. The module is certified up to SIL 3 in accordance with IEC 61508, for use up to SIL 3 in accordance with EN 62061 and PL e in accordance with EN ISO 13849-1.

http://www.automation.siemens.com/profinet

I/O module with CPU functionality and Profinet connection
New Products

ProfiTrace 2
The ultimate PROFIBUS analyzer

Troubleshooting and maintenance tools for PROFIBUS had their own history and evolution. It started with simple bus monitors in the 90s that were based on PC cards to the more advanced analyzers in the beginning of 2004 that were based on USB and could offer statistics for an overview about the “health” of the installation. A giant leap forward is the incredible ProfiTrace 2. Finally, analysis of the signal quality, bus monitoring, topology scan, reporting and master activities can be carried out simultaneously on the same USB hardware. The technician can check and troubleshoot the complete PROFIBUS network with 1 software package and 1 piece of hardware. This results in an enormous reduction in equipment, weight, costs and required knowledge.

Integrated oscilloscope
The oscilloscope is used for the inspection of the signal quality. It runs immediately displaying all signals that are measured. The time base and voltage levels can easily be adjusted. By double-clicking on the devices in the Live List, the oscilloscope triggers on the respective device and only displays its signals. This is a perfect mode to inspect the signal quality for individual devices. By measuring the width of the reflections, the tool indicates the distance to the “problem”. A powerful feature of the oscilloscope is the Bit Interpretation Engine. It displays the bits that ProfiTrace detects on the bus. The end user can compare this with the signals that are measured with the oscilloscope and make a judgment about the signal quality (glitches).

Bar graph
The Bar graph illustrates an average amplitude level of the signals from all available devices. It is a helpful utility to get an overall signal quality of the network. The average signal amplitude should be around 5 V. When there is bus problems the Bar graph will display irregular Voltage levels and the color of the bars will change.

Topology scan
ProfiTrace has the capability to generate the topology of the PROFIBUS network without shutting down the installation! The Topology scan creates a clear network drawing that contains the location of the devices and length of the cable that links them. It is a simple procedure: connect ProfiTrace to the working installation and with just 3 mouse clicks, the topology is generated. The topology is very helpful for troubleshooting. The oscilloscope can indicate what the distance to the problem is and the topology scan can pinpoint where you geographically have to look.

DP-V0/V1 Master
ProfiCaptain is a PROFIBUS DP-V0/DP-V1 class 1 and 2 master that has been designed for applications like: I/O tests, commissioning, parameterization and demonstrations. It fills the gaps that other products leave open and makes working with PROFIBUS a lot easier, faster and more fun. The main platform is a configuration environment in which the user can setup his slaves with the respective modules and parameters. For this master there is also an API available for programmers who would like to develop their own master application (DLL).

Reporting
The reporting feature creates a detailed report that contains the electrical signals of all devices, their faults, the topology, bar graph and administrative information. On the front page it gives a conclusion if the installation is approved or not. On the web you can find the manuals, brochures and download the software for evaluation or update:

www.procentec.com/profitrace2

ProfiCore Ultra is the required hardware to use ProfiTrace 2. It translates PROFIBUS to USB and vice versa. It has an isolated RS 485 interface and is equipped with a high speed digital oscilloscope that is able to capture bus signals running at 12 Mfps. It can also be used on PROFIBUS PA installations with the PA Probe Ultra. The ProfiTrace 2 software that runs on the ProfiCore is very user friendly and easy to use. Next to the message recorder, search and trigger menus, it has lots of powerful features:

Live List and Statistics
The Live List is a matrix that lists all the available devices. It is directly visible which devices are ‘troublemakers’. With different background colors the status of the devices is displayed. The Live List can also generate the product name of the devices when a diagnostic message is captured (synchronized with the GSD library).

The statistics matrix is the most decisive feature of the analyzer. This field can really indicate how healthy the installation is. It displays all the important information that a user, especially a maintenance man, is really interested in: retry messages, fail-outs, cycle time, diagnostic messages, etc. The user does not have to inspect messages or do difficult operations to ensure the quality of the installation.
PROFI People

RC Systems – PI Training Center

RC Systems, Johnson City, Tennessee, owned by Ron Mitchell, has been accredited as a PI (PROFI International) Training Center for PROFIBUS DP and PA. Ron recently retired after twenty-four years with Texas Instruments and Siemens where he was involved in automation product development and marketing with over fifteen years of communication experience. The last ten years with Siemens, Ron was a member of the PROFIBUS Interface Center (PIC) in Johnson City where he was extensively involved in PROFIBUS promotion and support. Working in conjunction with the PTO, he has given dozens of PROFIBUS seminars in North America. Ron was one of the original developers of the PROFIBUS Certified Engineer Class, which is now offered in many countries from Europe to Asia to South Africa, and taught the class for the PIC for six years. Ron is the author of the ISA book “PROFIBUS: A Pocket Guide”.

RC Systems offers a wide range of services for PROFIBUS vendors and users:

• Product development advice
• Network architecture design
• On-site certification trainings
  – Certified PROFIBUS Network Engineer
  – Certified PA Engineer
• On-site maintenance & troubleshooting training
• Installed network analysis and troubleshooting

Ron can be contacted for information or quotes for consultations, trainings or installation troubleshooting at:
Phone: 423.914.6641
E-mail: ron@rc-systems.biz

At the beginning of the year 2008, Torsten Paulsen joined the PROFIBUS Interface Center (PIC) team. He will support both PROFINET and PROFIBUS by promoting the technology, teaching Seminars, and helping vendors and users with related issues. Prior to coming to the PIC, Torsten was employed almost 7 years with Siemens Automation & Drives in Nuremberg, Germany, working in different groups, including the Automotive Group and the SIMATIC HMI Product Management group. Most recently, he was responsible for the Product Management of Siemens SIMATIC Mobile Panel wireless, the first wireless HMI Mobile Panel with wireless Safety functionality (PROFIsafe) and PROFINET communication. Torsten earned a Diploma / MS in Electrical Engineering / Information Technology from the University of Stuttgart, Germany. As part of his study, he already worked a half year with the PIC in Johnson City in 1998/99, working on the development of PROFIBUS Demo Software.

New! PROFINET Certified Network Engineer Classes!!

The PROFI Interface Center (PIC), in conjunction with the PTO, is proud to announce that we now offer a PROFINET Certified Network Engineer course.

This class is an intensive 4.5-day training program conducted by the PIC in Johnson City, TN. In this hands-on training you will dive into the installation, operation, and maintenance of PROFINET products and networks.

Attendees passing a test will receive an official PROFINET Certified Network Engineer certificate.

Class Syllabus

– Ethernet Basics
– PROFINET CBA Description
– PROFINET IO Description
– Network Security
– Hand-on Exercises
– Certification Test

Class Details

Breakfast and lunch provided
PIC Hosted dinner
PROFINET development training by qualified instructor
24 Personal Development Hours
Course materials provided
Confirmation will be sent to attendees by PTO
Discounted hotel rates available

For current class schedules and to register please visit: www.us.profinet.com

If you have questions:
Contact Lynne Froehlich
480-483-2456 or lynne.froehlich@profinet.com

Torsten Paulsen
PROFI Interface Center

Ron Mitchell
RC Systems
**PROFINET FAQs**

**Q:** PROFINET Advantages  
What advantages does PROFINET have over other TCP/IP based protocols like HTTP, FTP, SMTP and others?  

**A:** Keep in mind that TCP/IP (OSI layers 4 & 3 respectively) was designed for Internet based communications and for the office world and layer 7 protocols such as HTTP, FTP, SMTP and others. The timeouts and retries which are employed by TCP/IP are too burdensome (10-30 seconds!) for real time applications which require a low jitter (determinism of the data transfer). Enter PROFINET, which was designed for industrial use by employing a real time channel for time critical data like process values and alarms which bypasses TCP/IP (using layer 2 Ethernet frames), while still keeping TCP/IP for the diagnostic functions or configuration (layers 4 & 3). PROFINET gives you the best of both worlds as it uses a Producer / Consumer model to also give you 200Mbits bandwidth possible for the I/O data using full duplex connections. On PROFINET both devices can talk to each other simultaneously as each device can be both a producer and a consumer. The producer always sends its output while the consumer always receives the input data on both sides via a full duplex link. This is not possible with TCP/IP which uses a client / server model. Based on the client server model, TCP/IP applications always talk half duplex because they use a request / reply message stream. With TCP, the client always has to request data from a server, and in turn the server sends that data. Also then the data must be acknowledged, which takes more time, and this even occurs if you use 100 Mb / full duplex Ethernet cabling, making your cabling design not work to its full potential!!! Bottom line, to get your application and network to really run at its full potential, get PROFINET, which was designed as an Industrial Standard in IEC 61158 and gives you true determinism and the lowest jitter money can buy… PROFINET is networking for all of your automation tasks!

**Q:** Checking Data by frames  
How does PROFINET check the data is transferred if it only uses layer 2 Ethernet? Is there an acknowledgement (ack) of the data? What if the Ethernet data gets lost?  

**A:** First off, Ethernet at the data link layer offers a CRC (Cyclic Redundancy) Check of the data. As the Ethernet frame passes through the network, the CRC is checked in a store in forward switch or by the device itself. If the CRC is good, the frame is processed, if it is bad, the frame is discarded. This might seem terrible that you could have data loss from Ethernet, but PROFINET adds functionality at layer 7 to take care of this by relying on speed and a watchdog of the data. Most PLC control applications run their cycle at 20ms or more for the Process application. Since PROFINET is operating faster than this by sending data in 1-10 ms intervals, the PLC program won’t detect a loss of data, because the latest data will be there when it’s needed. Also, there is a watchdog which will go into effect if the data is missed for more than 3 cycles triggering an alarm from the I/O Device or I/O Controller. For example, if the data cycle was set to 1ms and either the controller or the device doesn’t see any data for 3 ms (3 x 1ms), there would be an alarm set in the device. Also, in the previous FAQ we talked about how PROFINET uses a producer / consumer based. Based on this each producer provides status codes of the data if it is sourcing. If the consumer takes this data and uses it, it provides status codes that the data was consumed properly in its data sink. So each producer and consumer acknowledges the data was processed for each PROFINET 10 Cycle. But this is contrary to the way TCP handles acknowledgments. With PROFINET, this is handled bi-directionally since PROFINET takes advantage of full duplex and is therefore much different than a TCP acknowledgement which has to be handled in a separate message transaction explicitly.

**Q:** Where can we get more info?  
Our company will be installing PROFINET and PROFIBUS equipment in our factory soon. Can you tell us where we can get more information or training on PROFINET and PROFIBUS for our maintenance personnel and engineer techs?  

**A:** You definitely came to the right place for training! The PROFI Interface Center is a fully qualified PITC (PI Training Center) and accredited by PI (PROFIBUS and PROFINET International) based on strict guidelines of the competence centers for proper operation of a PTC. We have Certified Network Engineer training classes on both PROFIBUS and PROFINET technology, which are week long courses, are in-depth and provide hands on and practical knowledge to your control engineers and maintenance personnel. The classes are not to be taken lightly as there is a test at the end of the week to test comprehension of the course material. If the engineer passes, they receive a certificate stating they are a certified PROFIBUS or PROFINET engineer! We also offer PROFIBUS installers classes and developer training and support. You can read more about the classes or sign up by going to us.profinet.com and go under the training -> Certified training classes link!  


If you want to inquire about training you can also contact us directly by using the PIC contacts at the end of this newsletter.

**Q:** Detecting noise in PROFINET installations  
In PROFINET I can use PROFIcore to detect noise issues in my network. How can I detect noise in my PROFINET installation?  

**A:** Since PROFINET is Ethernet, we can look at the question "How do I detect noise in an Ethernet network?". There is good news and bad news. First the bad news: in Ethernet, we use switches to connect all the different devices together. They create point-to-point connections. You can’t just hook up a device similar to PROFIcore or another scope and look at the electrical signal to detect noise. You would need to hook it up at every single connection between 2 switches separately. Now the good news: you don’t have to go through this hassle! If you use managed switches, they come with all kinds of diagnostic information. To detect noise, the CRC errors are what you are going to watch. In a proper PROFINET installation there should be none. Zero. Yes, really, not a single CRC error should occur. If you have one or more, you have a noise problem. Either, because of a bad cable (test it with a cable tester) or you didn’t ground your system well enough. Please note, in the old days. CRC errors could happen because of collisions on the network. But since we use switched Ethernet, there are no collisions. So CRC errors mean trouble. To find CRC errors, simply open the web management of your switch by typing the IP-Address of the switch in your browser. You usually find the CRC errors in the statistics page of the switch. See Figure 1 below for an example:  

Another option is to use SNMP and access the CRC errors from there to display it in a HMI screen. The good thing is that this information is stored in the switch. If you experience issues, you can look through your switch diagnostics for CRC errors. Of course it is a good practice to check for CRC errors before something bad happens.

How can you prevent CRC errors from happening? First of all, check your cable for proper, solid connections. Sometimes a poorly connected wire can cause interruptions and therefore CRC errors. Cable testers are cheap and worth every penny spent. Just look out for a regular Ethernet 100base-T tester. It is best, if it has a remote unit as well, so you don’t have to remove the cable. You can leave it where it is, once it is installed.

Of course shielding is important in industrial environments and PROFINET recommends grounding on both ends. If you fear ground loops, you can use drain wires or go with fiber optics, to avoid EMI and ground loops all together.

Just a quick note on unmanaged switches: of course you can use them in a PROFINET installation, but they don’t give you this type of diagnostic information. Worse, some unmanaged switches even discard corrupted packets, so you wouldn’t even notice them at all. Our advice is to use as many managed switches as you can.

![Figure 1: Statistics page](http://us.profibus.com/training.aspx?pagetype=certified)
To allow you easy and direct access to PROFIBUS and PROFINET technology, the PROFI Interface Center (PIC) was established in Johnson City, TN. The PIC works closely with the PTO (formally known as PROFIBUS Trade Organization) and serves as the technical resource.

The PIC team provides you with many services including seminars, integration support and device conformance testing for PROFIBUS and PROFINET. In addition, it supplies development products and assists you in developing devices. The PIC is accredited through the PTO as an official PROFIBUS test lab for DP Slave and Master Certification and as an official PROFINET test lab for PROFINET Device Certification. It also serves as an official Competence Center for both PROFIBUS and PROFINET.

The PIC team has a wide range of experience in the setup and configuration of PROFIBUS and PROFINET networks. We can assist you with your system. It is also possible to use our equipment to evaluate your device during the development phase and prior to certification testing.

Our service is your ticket to success!

In an effort to save you time, you should contact one of our experts with your questions. Of course, you can always use the PTO as a point of contact, too. You can reach Lynne Froehlich (Administrative Director), Mike Aldridge (Technical Director), Mike Bryant (Executive Director), and Carl Henning (Deputy Executive Director) at (480) 483-2456.

Contact us by email: profibus.sea@siemens.com, or call (423) 262-2576
Visit our website at www.sea.siemens.com/pic

To allow you easy and direct access to PROFIBUS and PROFINET technology, the PROFI Interface Center (PIC) was established in Johnson City, TN. The PIC works closely with the PTO (formally known as PROFIBUS Trade Organization) and serves as the technical resource.

The PIC team provides you with many services including seminars, integration support and device conformance testing for PROFIBUS and PROFINET. In addition, it supplies development products and assists you in developing devices. The PIC is accredited through the PTO as an official PROFIBUS test lab for DP Slave and Master Certification and as an official PROFINET test lab for PROFINET Device Certification. It also serves as an official Competence Center for both PROFIBUS and PROFINET.

The PIC team has a wide range of experience in the setup and configuration of PROFIBUS and PROFINET networks. We can assist you with your system. It is also possible to use our equipment to evaluate your device during the development phase and prior to certification testing.

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All articles contained are written by members of the PIC staff unless otherwise noted. To submit article ideas or success stories, please email us at: profibus.sea@siemens.com