

# PROFINEWS

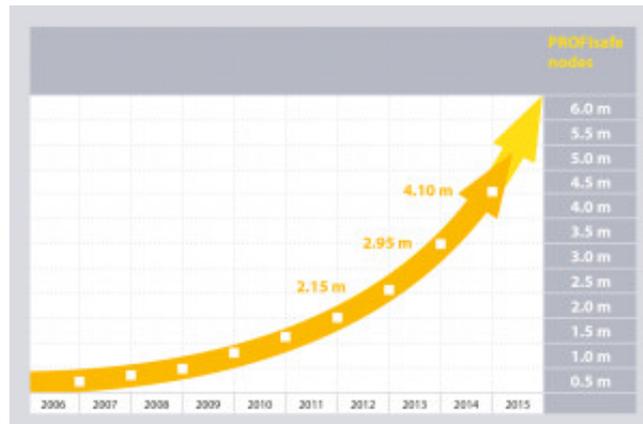
PROFINET and PROFIBUS News

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## Functional Safety Progress

It is great pleasure for me to give you the PROFIsafe Technology updates and its strong position in the market after the first introduction around 15 years ago. Functional safety gets more attention and provides the feasibility to implement safety in machines and at plants. Safety fieldbus communication makes the engineer's life easier by reducing the complexity of safety engineering and electrical wiring. With more than 4 million installed nodes PROFIsafe technology has established itself in the leading position in the network safety market.



This issue of PROFINEWS includes several

success

stories which show that PROFIsafe is actively used to fulfill safety requirements in industry.

So far a big step has been attained in establishing the PROFIsafe standard, but there is a lot more to do to educate users about the technology: exhibiting at industry trade shows, providing training, and conducting workshops. As the new Functional Safety standards (IEC 62061 & ISO 13849) are currently being merged, the importance of safety communication is unavoidable. This new era requires future automation projects to consider safety communication before engineering the machine, like the shift from safety relays to safety controllers (F-PLC).

The Ethernet based fieldbuses are gaining wider acceptance which adds extra momentum to safety protocols. Among all the safety protocols, only PROFIsafe has been well-received by many well-known OEMs due to its interoperability and easy integration.

PI is continuously working towards future demands of international customers' safety requirements. These demands are of foremost importance while continuing the PROFIsafe profile standards preparation.

In September, PI is going to conduct a Workshop at Oppenweiler, Germany, with two focus streams: OEMs and Component Manufacturers. Due to overwhelming response, the workshop is already fully booked. This is giving us extra motivation to organize more of such workshops worldwide in the near future.

Of course, international fairs like Hanover Fair and SPS/IPC/Drives Fair showed us that more visitors at our stand have great concern about safety communication and its implementation in all phases of machine building. By using the same infrastructure of PROFIBUS and PROFINET one's life is much simpler. This has been explained at the fair with the PROFIsafe live demo.

I am very eager to get your feedback and concerns in any form of communication to improve and develop the best in class safety fieldbus communication profile for the future demand of safety requirements in the wider range of industry segments.



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## Taking Responsibility for Safety and Security

The term 'security' alone causes a media storm – one glance at newspapers and online news sites is all it takes and everyone is in the thick of the discussion around cyber security. Automation and communication technology are not spared from this. This can sometimes create the impression that issues surrounding IT security are a new phenomenon. The experts of PI have concerned themselves for many years with the issue of secure operation of communication technology components, which by nature have always been tightly networked. Also new to the discussion is that the areas of safety and security are moving closer together.

This necessitates a delimitation between the two areas to start (not least because the same word is used for both in the German language). Plainly stated: while safety protects people from machinery or equipment, it is exactly the other way around with security. Machinery and equipment must be protected from an intervention that causes it to stop or puts it into a dangerous state.

At first glance, it seems problematic that IT security and functional safety are handled separately. In general, these are two different areas of expertise and their standards are therefore developed in different committees. Safety is addressed in standards and provisions such as the Machinery Directive of the European Union MRL 2006/42/EC, standards such as IEC/EN 62061 and ISO 13489 (for production automation) and IEC 61511 (for process automation), all subordinate to the basic standard IEC 61508. Security, on the other hand, is addressed in IEC 62443.

PI members have been involved in the standards development process for many years, so that the connections between safety and security have already been made by corresponding decisions of IEC TC44 and a clear procedure for addressing the two areas has therefore been defined. The machine manufacturer ensures that its machine meets the requirements of the Machinery Directive. The security requirements are defined by the specific risk analysis conducted by the user from which suitable measures can then be derived.

The delimitation is of help to users because it also clearly points out the responsibility. While the responsibility for the safety of the machine clearly lies with the machinery or equipment supplier, the owner must assume responsibility for the secure communication between machines, even across production locations.

### Safety by PI

In the area of safety, fifteen years ago PI laid the critical cornerstone for automation of safety-related machinery and equipment with the first PROFIsafe specification. The PROFIsafe solution is based on the "black channel" principle. Because of the close connection between safety-related and standard automation, safety-related and standard data are carried together on the same communication medium. This reduces the costs of devices and engineering and of operation of safety-related machinery and equipment.

The core of the principle is that safety-related information is packaged in a safe "PROFIsafe container". At an Emergency Stop, for example, the signal status of the safety sensor or Emergency Off pushbutton is

transmitted via a PROFIsafe frame to the safety controller where it is processed and then forwarded, for example, to a drive. After arrival of this frame in the drive unit, the requested safety reaction is triggered. Thus, for example, the drive is reliably switched to torque-free state with the STO (Safe Torque Off) safety function. In parallel with the safety-related traffic of the PROFIsafe frames, standard data are also exchanged over the same medium with the drive unit concerned and other devices, and the communication in the network meanwhile continues. Furthermore, new safety functions, such as Safely Limited Speed (SLS) can be implemented that allow new operating modes of machines, thereby improving their ergonomics and possible operation significantly. This has a further positive effect on safety.

Thanks to the high profile of the PI organization (PROFIBUS & PROFINET International) and its member companies, PROFIsafe succeeded quickly on the market and became the clear market leader. Both the number of device manufacturers and – more importantly – the number of applications with PROFIsafe is exceptional in comparison with other safety communication solutions. In the last year alone, a growth of 50% was recorded.

The black channel principle is now included in the IEC standards as the state of the art. PROFIsafe meets all requirements of these safety standards. Experts from many well-known companies in the PROFIsafe working group of PI analyzed additional error scenarios and mathematical error calculations and developed solutions for these so that PROFIsafe currently offers the highest possible level of safety-related communication. Among other things, machinery and equipment up to PL e as per ISO 13849-1 or SIL3 as per IEC/EN 62061 or IEC 61508 can be realized with PROFIsafe. PROFIsafe is used in many sectors, such as amusement rides, aerial railways, passenger transportation, synchrotrons (CERN), and many more.

### **Making use of existing solutions**

An interesting aspect of the PROFIsafe concept is that it also offers possibilities for connecting the requirements of safety and security together. Numerous systems, specifically many automation concepts



of aerial railways for example, are proving this.

This sector uses all of the applications defined by PI. First, the safe PROFIsafe communication between the bottom and top stations or the car that is used in a safety function. Second, the safe communication with higher-level operator control and monitoring systems. Finally, the remote diagnostics and maintenance of the system by its manufacturer. Errors that can occur again and again are, for example, denial of service through remote television cameras or malfunction due to frequency collision. Likewise, in the case of

remote diagnostics, falsified non-safety-related data can lead to incorrect instructions to operating personnel. While these errors are not automatically willful in nature, they do show how carefully the risks have to be assessed. For aerial railways, for example, the automation system is threatened, so to speak, at two places. First, the owner controls the system itself using a wireless connection. Second, the manufacturer engages directly in the system for maintenance or troubleshooting. In such applications each controller of these two areas are safeguarded using PROFIsafe. The radio transmission takes place in the "black channel" without a special security certificate. PROFIsafe has been approved for radio transmission from the start. Thanks to radio link hop planning and a minimum signal field strength, availability is also ensured for prevention of spurious tripping.

### **Robustness is a precondition for security**

PI gave thought early on to the problem of security not only technologically but also organizationally. For example, years ago PI developed a Security Guideline for PROFINET, which was completely revised at the end of 2013. This guideline addresses the topic of risk assessment, for example. Only on the basis of an analysis of this type can appropriate security measures be derived that are also economically feasible. The probability of a damage event and its possible consequences are evaluated for this, based on protection goals, weak points, and possible threats. The guideline is supplemented by a series of proven best-practice solutions.

Another point that is still underestimated is that use of robust devices is an essential precondition for security in automation. Behind this is the fact that in large networks, in particular, plant availability counts. Denial of service attacks, for example, exploit this by sending an enormous number of requests to the respective devices or servers in order to overload them. It is thus of great help if devices can always react as intended even with high network loads. For this reason, PI has developed the Security Level 1 Tester for the certification of PROFINET devices, which is free of charge for member companies. It can be used to simulate network load scenarios up to the level of denial of service attacks in advance. The network load-related test is already being required by various end users such as the automotive industry. This test is already integrated in the certification of devices according to the new PROFINET Specification Version 2.3 and must therefore be passed in order for a device to be certified. Users that purchase such a certified device can rely on having a correspondingly robust device.

The utilized PROFIsafe components recognize such cases by the time-out monitoring and put the system components concerned into safe state so that no safety problem can actually arise. The distributed architectures can be structured according to the risk analysis such that system components can continue to be operated without loss of production.

Outlook: Security cannot be solved with a single device, standard, or certification. However, it is useful to describe conceptual and organizational weaknesses in guideline documents so that targeted countermeasures can be taken. A majority of cyber attacks can be defended if the measures recommended by experts are also taken. It is also critical to recognize that no security measure is permanent. Rather, the problem of security is constantly changing and measures must be adapted to current developments. More than 1400 member companies of PI worldwide are committed to bringing their expertise to the development of secure and reliable communication solutions.

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Additional use cases for PROFIsafe can be found:

- [Disney Toy Story Midway Mania](#)
- [Disney Radiator Springs Racers](#)
- [Swedish Tower](#)
- [Steel Industry](#)
- [KUKA Reduces Machine Safety Components by 85% While Increasing Machine Safety](#)

More details about PROFIsafe can be found in the [Marketing Flyer: PROFIsafe](#) and [System Description: PROFIsafe Technology and Application](#).

Several videos are available:

- [MinutePROFINET: PROFIsafe & PROFINET](#)
  - [Safety with PROFINET](#)
  - [PROFIsafe in Process Automation](#)
  - [PROFIsafe in Discrete Automation](#)
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## Wireless Safety along the Ride Flight Path with PROFIsafe

### Fail-safe IWLAN communication controls the "Flying machines according to Leonardo da Vinci" in the Europa-Park amusement park

Flying machines built according to plans devised by Leonardo da Vinci centuries ago are one of the latest attractions in Germany's largest amusement park, Europa-Park, in Rust outside of Freiburg. Industrial automation technology with wireless and fail-safe Industrial Wireless Local Area Network (IWLAN) and PROFINET communication provides the required safety for the rail-guided "sightseeing flight." Da Vinci would be impressed!



Even though he was worlds ahead of his time, Leonardo da Vinci would not have imagined this in his wildest dreams: Several of his flying machines, accelerated by passengers with their feet and guided with wireless and fail-safe technology, flying through the Italian landscape in Europa-Park. How could he? After all, there was no electricity, no omnipresent wireless LAN, no Europa-Park, no ETF Ride Systems and no Siemens when Leonardo da Vinci was alive; these are all the key players involved in this success story.

### Interactive along the flight path



Figure 1: The family ride Volo da Vinci is an attraction in the Europa-Park; its safe operation was implemented for the first time with wireless PROFINET and PROFIsafe

Leonardo's biggest dream was to be able to fly. One of his ideas in this respect, the aerialscrew flying machine, is a precursor of modern-day helicopters. This invention has now become a reality at the Europa-Park – with the family attraction "Volo da Vinci" ((Figure 1)). The journey starts and ends in da Vinci's studio, where the master greets visitors personally and where they can view a collection of interactive models and designs. Visitors board the gondolas designed in the form of the aerial screw flying machine to start their rail-guided, 300 meter long "sightseeing flight" at an altitude of 7 meters over the Italian and German park section. Because there were no motors back then, passengers have to use their legs to help propel the flying machine. One gondola holds up to four passengers: Those who pedal faster will travel at higher speeds. Depending on the pedaling power, the basic speed of 0.6 m/s is continuously increased or reduced to stay in a range from 1.2 m/s to 1.8 m/s. The issue of safety comes up here: How can we prevent collisions and damage or injury under all conceivable scenarios?

### **Fail-safe automation and IWLAN communication**

This fun ride was realized by ETF Ride Systems of Nederweert, Netherlands. The flight path is almost completely automated with Siemens technology. The automation and safety concept was developed in cooperation with the operator, the manufacturer, and the German Technical Inspectorate, TÜV.

The main controller is a PROFINET-capable, fail-safe Simatic S7-300F PLC, located in the central control cabinet of the equipment room in the station. It communicates via an Industrial Wireless LAN system (IWLAN) in wireless and fail-safe mode with the Simatic ET 200S controllers and drives installed on the gondolas. In addition, different IWLAN access points along the path are connected to the main controller by means of a managed switch, Industrial Ethernet FastConnect modular outlets, and hybrid cables. Antenna segments of various lengths made from RCoax cables are routed along the entire path. These radiating cables emit the radio signal in a defined range to minimize possible interference.



Figure 2: Control box installed on gondola including fail-safe PLC, fail-safe frequency converters (right) and IWLAN client for wireless, fail-safe PROFINET communication

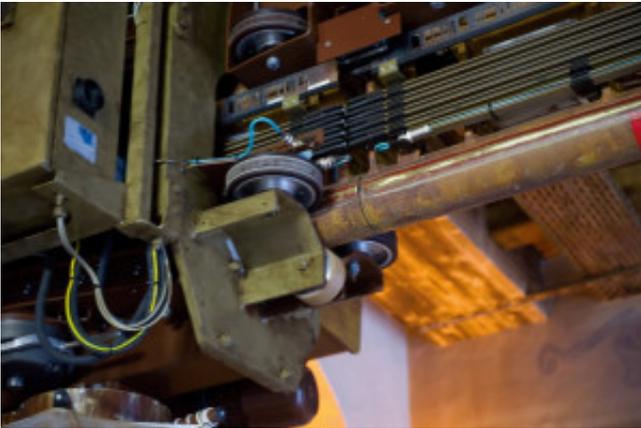


Figure 3: IWLAN antennas provide continuous wireless communication even at segment transitions. The Rapid Roaming function provides transfer times of less than 32 milliseconds between access points

Their counterparts in the distributed control boxes on the gondolas are IWLAN clients ((Figure 2)) with omnidirectional antennas which travel in short distances along the RCoax cable. One of these antennas is always operational, and the client selects automatically and without interruption the antenna with the better signal. This ensures uninterrupted communication, even during segment transitions or when traveling through the diverter gate ((Figure 3)) in the station.

The position of the gondolas is detected by code readers along the route and transmitted to the central safety controller via PROFINET and IWLAN. This safety controller checks the values for plausibility, monitors the specified minimum clearances and initiates the prescribed safety mechanisms via PROFINET and PROFIsafe profiles, if necessary. The maximum travel speed and the direction of travel are also centrally monitored. Sitop power supply units from Siemens supplied by contact conductors ensure reliable power supply to the equipment of the traveling components.

### **iFeatures for fastest possible transfers and continuous safety**

The iPCF capability of the IWLAN access points and clients is a key requirement for consistent real-time

communication and therefore approval for safety-related applications. This iFeature – meaning a function specifically designed for industrial use – makes use of the so-called industrial Point Coordination Function[1] and implements a seamless transfer of the mobile clients between two access points within no more than 16 milliseconds. This is more than enough time given the slow travel speeds of up to 1.8 m/s. This feature brakes the gondolas if they do not keep the specified minimum clearance or stops them when they do not keep the safety-related block zone distance, for example when a gondola fails, in order to prevent material damage or injury. This means that the entire system meets Safety Integrity Level SIL3 according to IEC 61508 as prescribed by TÜV.

The described IWLAN infrastructure provides a reliable connection between the main controller and the controllers installed on the gondolas. These consist entirely of interface modules in the form of a distributed I/O system with fail-safe CPU installed in small control boxes. The PROFINET I-device function provides easy integration and fast communication among all controllers, which means that each distributed controller can be PROFINET I/O controller as well as PROFINET I/O device. The gondolas are driven and, when necessary, stopped safely by distributed frequency converters with fail-safe control units. These are connected to motors driving the chassis as well as another motor for the rotary motion of the spiral rotor.

Among other things, the fail-safe frequency converter integrates the safety functions Safe Torque Off, STO, and Safe Stop 1, SS1. This means that the required safety mechanisms can also be implemented locally very quickly if the IWLAN communication were to fail. The STO safely prevents a start-up of the drive when passengers embark and disembark in a purely electronic and thus contactless manner. The safety function SS1 monitors the stop of the gondola drive when the safety-related block zone distance is not observed – all without motor encoder or other encoders and therefore very cost-efficiently.

The safety-related stop is usually initiated by the central CPU. If a gondola fails, all other gondolas are automatically stopped by the central processing unit. If IWLAN communication were to fail – which has not happened once so far – the distributed CPUs would shut down; the motor brakes would be applied in the case of a power failure.

The automation supplier has also provided a Simatic touch panel in the conductor cabin – the control room – connected via Industrial Ethernet for operator control and monitoring. This means that the operating states and positions of the gondolas are displayed during operation. It also lets you select and move individual gondolas to a specific destination, for example, to the maintenance/vacant position via the gate in the station and vice versa.

### **Problem-free from the start**

"Since we commissioned the Volo da Vinci last summer, the operation of the new and first IWLAN-based controller system in the Europa-Park has been better and more stable than we had anticipated for an initial application", says Markus Spoth, the head of electrical engineering. "So far, there has not been a single failure since the start-up phase that could be traced back to IWLAN technology", continues Spoth, "neither at high outside temperatures in the summer, wet weather in the fall nor cold temperatures in the winter. We are very happy with the solution and its implementation". If a failure should ever occur, however, the managed switch permits fast access and convenient troubleshooting by means of Simatic Step 7. Furthermore, there is the option of checking the status of the switch or sending out an alarm

automatically, for example, when a connector has been pulled. The PROFINET device is integrated in the controller network and has its own IP address. This means that remote access and web-based management, for example via VPN tunnel, are possible so that any potential problem can be quickly remedied with the help of the Dutch manufacturer [ETF Ride Systems](#).

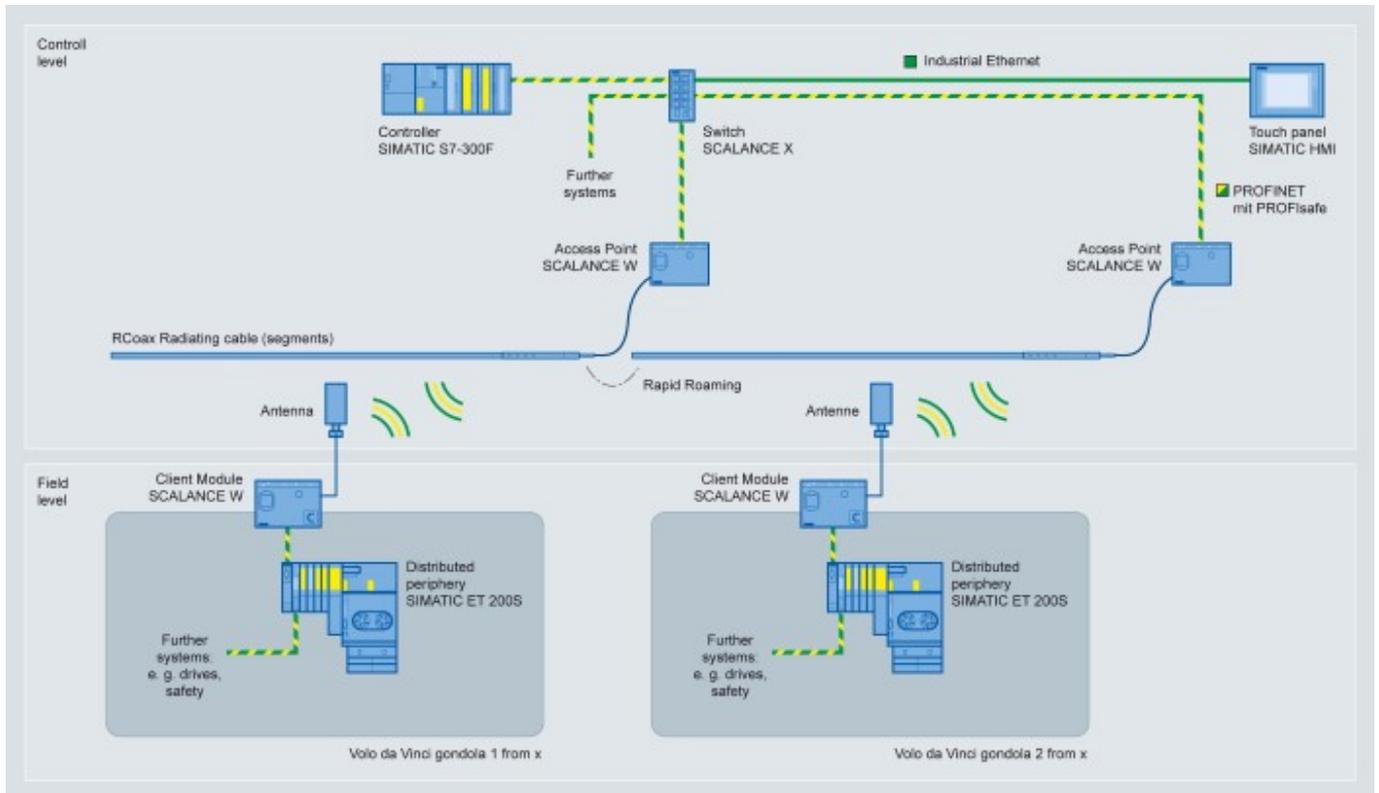


Figure 4: The automation concept for wireless, fail-safe communication developed in cooperation with all parties involved is based on the Scalance range of products from Siemens using PROFINET and PROFIsafe

[1] an expansion of the IEEE 802.11 standard

## Easy PROFIsafe integration for Fortress Interlocks

**How Fortress Interlocks integrated functional safety communication into their amGardpro series by using industrial communication solutions from HMS.**

UK-based Fortress Interlocks manufactures premium safety interlock systems for industrial applications. These interlocks are used to help prevent a machine from harming its operator or damaging itself. The interlocks stop the machine whenever certain states occur such as the opening of a door or the push of a button.

Fortress Interlock's customers come from many lines of business such as power



generation, steel making, automotive manufacturing, food and beverage processing, materials recycling and construction. With such a wide customer base, there is also a wide variety of demands for safety solutions – from purely mechanical door locks and trapped-key interlocks to advanced systems which need to communicate with industrial safety networks.

Fortress Interlocks' products are therefore very modular allowing the customer to design a personalized safety solution. In fact, the customer can do so right on their website where they can use a product configurator to put together different components into a fully customized solution.

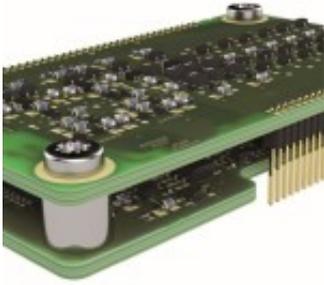
### **Increased demand for communication with safety networks**

Lately, Fortress Interlocks has seen an increasing demand for interlock solutions which are compatible with PROFIsafe – the safety standard used within PROFINET which is the preferred choice of many car manufacturers, especially in Germany.

“We've seen that the interest in integrated safety networks such as PROFIsafe, CIP safety and FSoE has been growing over the past few years,” says Rob Johnson, Senior Electronics Engineer at Fortress Interlocks. “We wanted to be able to offer a PROFINET solution relatively quickly which is why we turned to HMS. We knew that they had an integrated safety solution for PROFINET and PROFIsafe in place, and their flexibility fitted well with our modular approach. Also, we knew that they had solutions for CIP-safety and FSOE in the roadmap.”

### **How it works**

Fortress Interlocks decided to implement the IXXAT Safe T100 from HMS – an integrated



safety module which controls safe I/O signals. The IXXAT Safe T100 works together with the Anybus CompactCom communication module, also from HMS. The Anybus CompactCom is used to handle the unsafe network communication while safe I/O signals pass through the CompactCom (using the black channel principle) to the IXXAT Safe T100.

“The amGardpro solutions with PROFINET look exactly the same as our regular hardwired solutions, except for the fact that you have a PROFINET interface. This makes it very easy for the customer to simply plug in and use the solution,” says Rob Johnson.

### **Saving time with a pre-certified solution**

Developing a safety solution can be a time-consuming process since the certification requirements are rigorous, but with the Anybus CompactCom and IXXAT SafeT100, Fortress Interlocks could get a solution in place relatively quickly. “The TÜV precertification has certainly been a big help for us,” says Rob Johnson. “With the template material available from HMS, we could easily create the document required for the TÜV certification and did not have to go through the whole process from scratch.”

### **The results**

The cooperation with HMS has allowed Fortress Interlocks to move into a new technical area quickly with a lower capital investment. With the capability to offer safe communication with PROFINET and other industrial networks, Fortress Interlocks now has a competitive edge on the market.

After implementing the solution, Rob Johnson has a couple of tips for users wanting to implement functional safety: “Since the solution from HMS is modular, you can do things incrementally – you can start with implementing PROFINET and then add safety functionality later on. Also, make sure to use the support you get from HMS. For example they have detailed safety manuals which are very useful.”

As Fortress Interlocks’ amGardpro series is being equipped with safe I/O communication, Rob Johnson can look back on a successful implementation project. “The HMS team has been very helpful when integrating safety network communication into our solutions. We can focus on building best-in-class interlocks, while HMS products handle the communication with industrial networks.”

[IXXAT](#)

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## Success, to be continued

Windows 95 was just released and DVD's were announced as a new groundbreaking storage media, and the PIC – PROFIBUS Interface Center – was founded in Johnson City, TN. That was 1995. Now, 20 years later, we're still alive and kicking and busy as always.

Time to look back to what had been accomplished in the past two decades, and to look forward to what may come down the road. When we started, the big goal was to get PROFIBUS in a first automotive production installation – and we did. In the meantime, PROFIBUS and certainly PROFINET are the de-facto standard for the automotive industry, pretty much every car manufacturer is using it. Check. But the success didn't stop here. PROFI technology can be found from trains to power plants, wind turbines to waste water plants. You name it.

So what's the PIC contribution? We, as a team of technology experts, spend every minute of our work days to enable PROFI technology here in the US. Some things can't be counted, like the phone calls, emails and on-site support trips we did to help users and vendors with their PROFIBUS and PROFINET questions on a daily basis.

Others we have statistics for:

- 140 PROFItch Certified Network Engineer Classes were taught with well over 1,000 engineers certified in the US since 1999. That is over 1,000 experts available here in the US. Whether they use, maintain, design and engineer or develop – they build a strong foundation for the success of the technology.
- Almost 400 devices were certified at our test lab from dozens of different vendors. PROFIBUS and PROFINET. Masters and Slaves. Devices and Controllers. Any type of device you can think of. From tiny cameras to huge robots. That makes the technology a safe choice for any project.



During the past ten years, most of our activities shifted towards PROFINET. As of today we certified as many PROFINET devices as PROFIBUS devices. A third of the certified engineers are PROFINET engineers. The PROFINET Specification has reached a mature and rock-solid state with the current version V2.3. There is still work to be done on the standard, but mostly ‘under the hood’ and maintenance – new additions will be on the application side; examples are application profiles and enhancements for Process Automation. This is the PROFINET that paves the road of success for the next decade, at least.

As you can see, a lot had been accomplished by the PI Organization, PI North America, and the PROFI Interface Center, as we call the PIC today. We have many successes to celebrate and managed to go through a major technology innovation successfully. Ironically, Windows 10 was just released (are we going backwards now?), and the DVD is almost dead. But the PROFI technology is here to stay...



Torsten Paulsen is the manager of the PROFI Interface Center and has been involved in PROFIBUS and PROFINET technology since 1998.

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## Tech Tip: DHCP and PROFINET DCP

We often get the question: Why doesn't PROFINET use **D**ynamic **H**ost **C**onfiguration **P**rotocol (DHCP) for IP address assignment as DHCP is used extensively in the office?

Answer: DHCP could be used, optionally, but there are some differences you should know between DHCP and PROFINET DCP.

In our previous [article](#) on PROFINET **D**iscovery and **C**onfiguration **P**rotocol (DCP) we explained what it is and how it is commonly used. PROFINET devices are typically assigned device names and IP addresses using DCP which gives us an easy way to do local network management via the PROFINET IO controller and with the engineering tool. DCP is mandatory on every PROFINET device. But why not use DHCP for address management?

DHCP provides a similar method to handle address assignment and can be used in some

- DHCP can be used, but...
  - IP Addresses are bound to MAC
  - Reliance on available Server
  - Software Tools required for device replacement
  - Dynamic Addresses??
- DCP offers
  - Naming schema like DNS
  - Simple device replacement without tools like Engineering station
  - Static IP Addresses based on Engineering configuration

special installations. It requires the use of a DHCP server. A host (client) makes a request on boot up and the server hands out a 'leased' IP Address based on server settings. That's a problem, as DHCP relies on a server being available and supported by somebody, usually outside the scope of the automation application. What if IT has gone home for the night or the server is down for the latest security patch? Also, a software tool needs to be used to fix the IP address list or add devices to the DHCP server pool.

Another issue we often see is that the first letter in DHCP stands for "Dynamic" which means the IP address could change from its original value. This is not optimal, since PROFINET networks rely on static addresses based on the engineering configuration rather than addresses which can change. Since the IP address is leased it could also expire after a certain period and needs to be requested again. Is there always availability (for an address or server) and what about for device replacement?

DHCP also makes device replacement difficult since Ethernet Media Access Control (MAC) addresses are typically bound to the DHCP server. If replacing a device, a MAC address would change, thereby preventing the new device from obtaining an address and leaving the process dead in the water until someone reconfigures the DHCP server.

An advantage of PROFINET DCP is that it's available for the control engineer to use in the engineering tool or via the PROFINET IO controller which allows assigning device (host) names and IP addresses. So the address management is already local, available and controlled directly from the PROFINET application. IP addresses do not expire and are unique for every device based on its device name. This solution also makes device replacement possible without using tools for the network management.

In some special cases, a network component such as a managed switch might support DHCP if it's a non-critical device or function. For example to access the web page on the switch for diagnostics.

In conclusion, DHCP can only be employed if you are careful about it and realize its shortcomings for Industrial Automation applications. Check with the product vendor if you really need the DHCP service for a special purpose. In PROFINET systems, we recommend that you refrain from using DHCP and use PROFINET DCP for the easiest network management solution possible. From the PROFI Interface Center, find out even more about PROFINET at one of our [upcoming certified training classes](#).

This information was brought to you by the PROFI Interface Center, a PI support center in Johnson City TN, USA.

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## **PROFINET - Backbone of IIoT and Industry 4.0**

In August 2015, Rafael Koenig, Chairman of Profibus Australia, presented at the *Future Networks Forum*, part of the Westwick Farrow ACI Connect event, to an audience of automation, control, and instrumentation professionals, about Profinet's role in Industry 4.0 and the Industrial Internet of Things.

<https://www.youtube.com/watch?v=pQG-tU6LZM4>

The conference included an opening keynote by John McGuire, Global Industry Director of Aurecon, who talked about using data-driven customer insight to transform manufacturing, as well as a keynote about predictive asset optimization from IBM Analytics' Ross Collins.

### **Introduction to the Future of Industrial Production**

Koenig started his talk, titled "Profinet – Backbone of IIoT and Industry 4.0", with an introduction to Industry 4.0, which covers three aspects:

- Horizontal integration across value networks, creating new business models and ecosystems
- End-to-end engineering across the entire value chain, to integrate the product and production lifecycles
- Vertical integration and networked production systems for increased configurability and adaptability

The future of industrial systems, Koenig said, would see the combination of Information Technology and physical engineering, creating an "Internet of Things and Services". Needless to say, robust connectivity and network technology will play an essential role, providing the linkages that enable this vision.

### **Connectivity Requirements for the Future of Industry**

According to Koenig, the required connectivity solutions will be influenced by the particular requirements of an Industrial Internet of Things, which differs from the typical consumer IoT because it:

- Needs to be able to communicate with existing legacy systems
- Needs to support existing and legacy devices and standards
- Is mission critical
- Deals with a lot more data
- Features structured connectivity, rather than ad hoc connectivity

Given that Industry 4.0 and IIoT is about fast and dynamic production thanks to interoperable communications between devices, software, and systems, Koenig says any connectivity solution would need to successfully address the challenges of standardization, while bridging Fieldbus and Industrial Ethernet.

In fact, Koenig says, the linkage technologies behind Industry 4.0 and IIoT will need to move beyond pure data or communication interoperability, but allow for "semantic interoperability" – the transmission

of meaning and data, as well as security levels, between different information models.

One possible way forward is the OPC unified architecture (OPC UA), an IEC 62541 standard which maps the information models of multiple organizations.

## **Profinet: Addressing the Future**

In this aspect, Koenig claims Profinet is ideally suited for Industry 4.0 and IIoT. In fact, Profinet is essential for the operation of OPC UA, controlling and gathering data from devices within the production systems, and thus providing real-time data that OPC needs to process in order to function.

But Profinet also provides other benefits that will be essential for upcoming approaches to industrial networks:

- Unlimited node count for scalability
- Easy and familiar Ethernet cabling
- Full TCP/IP, Internet, and web compatibility
- Integrates all popular automation networks
- Strategic links with PROFIBUS

In particular, Koenig focused on the interoperability and security features of Profinet.

## **Interoperability**

Considering the various fields of application – Process, Motion, and Factory Automation, Koenig pointed out that Profinet provides the same standard across different industries – and in fact achieves both real-time and IT communications using the same cables.

For Process Automation applications that require response times in the range of 100ms, Profinet's exclusive TCP/IP layer enables this simple exchange of data. For Real-time applications like Factory Automation, Profinet's RT feature handles cyclic signal exchange of I/O data with response times in the range of 10ms. On the other end of the spectrum, Profinet also provides the Isochronous Real Time (IRT) communications needed by Motion Control applications, allowing a short and deterministic reaction time of up to 31.25  $\mu$ s, with a jitter of less than 1  $\mu$ s.

## **Security**

According to Koenig, Profinet's security guidelines address the requirements of future networks:

- provide security for systems without their own security functions
- allow real-time operation and deterministic behavior
- provide easy and cost-efficient integration of security functions
- able to withstand high data loads

The robust security measures allowed by Profinet means it is able to address the requirements of a

converged network, successfully balancing the priorities of business systems and automation systems for confidentiality, availability, and integrity.

The Future Networks Forum was moderated by Glenn Johnson, editor of What's New In Process Technology and [ProcessOnline.com.au](http://ProcessOnline.com.au). Besides Rafael Koenig, the forum also featured Steven Sischy, Managing Director of BECKHOFF Automation (EtherCAT), Daniel Hancock, Systems Technical Expert and Industrial Communications Specialist at Schneider Electric (ODVA) and Kaveh Fanian, Product Manager Pepperl+Fuchs representing the Fieldcomm Group.

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## IO-Link: Did You Know?

### Did you know that IO-Link protects against incorrect device replacement?

If a sensor has to be replaced, this is usually done at a hectic pace since the machine must go back into operation as quickly as possible. Often, there is no specially trained staff available for this task. For this reason, IO-Link takes a different course. Developed as an interface "by practitioners for practitioners", it has a variety of integrated options to maximize the ease and reliability of device replacement.

Sensors are becoming increasingly similar in terms of their construction. Sometimes it is difficult to tell the difference between pressure, temperature, and flow sensors. An IO-Link master, on the other hand, receives an exact identification from each device. This contains, for example, the manufacturer's name, product name, and product ID, which describe this sensor exactly. If a device that is not of the same construction is installed during a replacement, the master recognizes this and does not accept the device. The fault LED remains ON. If a sensor of the same construction is connected, it is accepted by the master without any further action and integrated into the data cycle. The machine resumes running immediately. If the sensor is a plug-in sensor, it can be easily replaced by instructed personnel. No intervention in the controller programming is needed.

The second possible case is replacement of an existing sensor by its successor model, which has already been equipped with a few additional features. The two devices are thus not compatible at first glance. The identifications in the master and in the new sensor are also different. IO-Link has a simple solution ready for this case as well. Since Version 1.1 of IO-Link, the master is able to ask the sensor whether it could go into a compatibility mode that simulates the behavior of the predecessor exactly. The master and sensor already work together again automatically. The system runs again.

[IO-Link](#)

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## Regional Events and Training

Following the PROFIsafe theme of this issue, PI has announced two courses being taught in Karlsruhe on the subject in October. In Italy, a PROFIBUS & PROFINET Day is slated to take place in Naples and an IO-Link Workshop is being offered in Bergamo. A similar IO-Link Workshop will be held in Minnesota, USA as well. ABB has announced two PROFIBUS trainings in Germany in November. The Middle East held its first PROFIday, which is shaping up to be a quarterly event.

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### PROFIsafe

#### **PROFIsafe Refresher Seminar October 8, 2015, in Karlsruhe**

PI is offering a PROFIsafe Refresher seminar in the English language. The main target group of this seminar are PROFIsafe certified designers needing an update within 3 years to prolong their certificate according to the PROFIsafe policy. More information and the registration form can be found [here](#).

#### **PROFIsafe Certified Designer Course October 13 to 15, 2015, in Karlsruhe**

The responsible PI working groups, in cooperation with TÜV, developed a training scheme, which is available to all interested PI members for their employees in charge of PROFIsafe and safety. This three day session (in the English language) comprises a written test at the end of each day. Experts having passed all tests will receive a TÜV certificate “Certified PROFIsafe Designer.” More information and the registration form can be found [here](#).

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### Italy

#### **PROFIBUS & PROFINET Day Naples, Italy - October 14, 2015**



PROFIBUS & PROFINET Day: the meeting dedicated to the latest technological developments in Industrial Communication. This year the Roadshow reached Verona (April 22) and Pescara (June 17) and is now almost ready for Naples. PI Italy experts will

discuss themes like Operation Excellence, Energy Efficiency, and Security. PI Chairman Karsten Schneider will be on hand to present future developments of the technologies. The event will be held in the stunning landscape surrounding the Gulf of Naples. For more information and to register go to [www.profi-bus.it](http://www.profi-bus.it).

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## **IO-Link workshops**

**Minnesota, USA - October 13, 2015**

**Bergamo, Italy - October 20th, 2015**

During the workshop you will learn about the functionalities of IO-Link, see and try available components, and learn the basic rules of using IO-Link. Members of the IO-Link Group will demonstrate how easy configuration is and much more. In between, there will be plenty of time for questions. The workshop will be held in the respective national language. Download the Italy workshop flyer [here](#). For registration and more information go to <http://www.io-link.com/en/UserWorkshop/NextWorkshops.php>.

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## **ABB Workshop Z2160 – PROFIBUS made easy**

**November 10, 2015 in Alzenau near Frankfurt/Main**

**November 12, 2015 in Hamburg**



This workshop teaches you PROFIBUS in both theory and practice from the field device to the controller. You will learn the basics of PROFIBUS so that the design, calculation, and commissioning of a bus system is no longer a challenge. In practical exercises you will learn on your own to select the right PROFIBUS network components and to calculate the bus topology. Another focus will be the start up of a small PROFIBUS application. [Registration Link](#).

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## **Middle East**

The Middle East Regional PI Association (RPA) hosted its first PROFIday in Kuwait where it was sponsored by PROCENTEC Netherlands, Indu-Sol Germany, and ASM Saudi Arabia. Marco Bekker from PROCENTEC spoke about PROFIBUS troubleshooting. Marco Freihöfer from Indu-Sol talked about the validation of PROFINET installations and systems. From ASM Process Automation, Ammar Atta discussed common PROFIBUS faults in the industry. Hands-on materials allowed participants to see them in reality. Ali Magboul, RPA Middle-East Chairman said that there will

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be quarterly events like this.

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## New Products

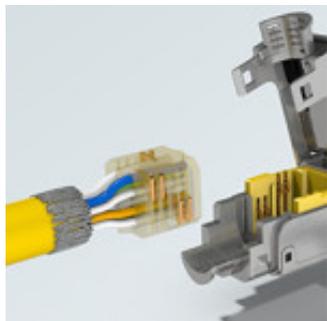
New products this month include: PROFINET connectivity for Banner Engineering vision systems and Murrelektronik safety I/O, conformity for HARTING Ethernet connectors, and a new Phoenix Contact PROFIBUS DP to PA coupler.

Click the headlines for details.



### [PROFINET connectivity for vision sensors](#)

Banner Engineering adds PROFINET communication to its iVu Plus series of vision sensors. Adding the PROFINET industrial protocol to these Ethernet-enabled vision sensors provides simple and robust communication channels to control and monitor the sensors from any controller that supports PROFINET. iVu Plus TG models can be configured to operate using four different sensor types: Area, Blemish, Match, and Sort.



### [PROFINET conformity declaration for connectors](#)

This conformity declaration certifies that all existing and new products for Ethernet applications from HARTING conform with the requirements for the use of PROFINET. The new products extend the PROFINET Portfolio to include the entire Ha-VIS preLink<sup>®</sup> cabling system, the *har*-speed M12 Press and Go connector as well as the new X-coded M12 plug.



### [IP67 Safety -installation for machine tools](#)

With the compact IP67 module MVK Metal from Murrelektronik, safety inputs and outputs can be connected directly to a Siemens Sinumerik 849D SL PROFINET CNC providing that the "safety integrated" function is activated. There is no need for a passive wiring in the control cabinet anymore. Safety data from various safety components are sent directly to the controls by the protocol. Using PROFINET/PROFIsafe ensures that safety-related data is transferred reliably. With the MVK Metal-Safety, high safety standards (SIL3 and PLe) can be fulfilled even without a safe control (F-PLC).



[New PROFIBUS DP to PA coupler link module](#)

The Phoenix Contact PROFIBUS DP/PA coupler/link transparently converts PROFIBUS DP to PROFIBUS PA, while providing detailed network diagnostics. It includes a communication interface module, PROFIBUS DP repeater module, and a PROFIBUS PA scope module that can help you easily determine physical layer problems in your network.

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