PROFINEWS

PROFINET and PROFIBUS News

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PROFINET Enables Today’s and Tomorrow’s Machine Building

Already today machine builders are forced to construct new machines for the worldwide market which can produce things flexibly, adapted to customer demands.

PROFINET supports them with built-in TCP/IP communication, which is independent from special hardware or software modules in the devices or controllers. So communication between the overlaid production line control and the non-PROFINET devices is easily possible. It is easy to modify the machine function by a new parameterization; for example, of a vision system.

Not only during the production of the product is flexibility required, but also during the production of the machine itself. Machine builders often modify an overall concept depending on the customer requirements. This might happen during design, during installation, or even at the customer’s plant with the help of modularization.

PROFINET enables such modular concepts. The topology is flexible. Even the motion control synchronization portion of the network is open and available to non-PROFINET traffic. The engineering tool can be used for motion and standard I/O in the same project.

PROFINET offers functions beyond the basic requirements including PROFIsafe, PROFIenergy, and comprehensive diagnostics. Diagnostic features can prevent downtime to increase machine availability. High availability during the operation is necessary to offer competitive machines today and in the future. PROFINET defines the highest available standard.

Here is a short overview about the benefits of PROFINET in machine building:

YouTube Video

and also a nice example:

YouTube Video

You can also realize the benefits of PROFINET for your machines or your devices for machines!

Xaver Schmidt

Chair, PROFINET Marketing Working Group

Application Story: PROFINET in IIoT Deployment

 When you think about how to keep grain operations running smoothly with zero downtime and no undetected safety hazards or unnecessary operating costs, the Internet of Things is probably not the first answer that comes to mind. But that's the approach TempuTech used in developing a cloud-based system for Riceland Foods' grain facility in Jonesboro, Arkansas. The system is designed to provide continuous monitoring and actionable information to help operators proactively prevent problems by managing both grain and equipment conditions.

Read this Application Story to find out what they achieved

PROFINET enables the monitoring of hundreds of sensors to boost operations and safety, reduce downtime, and deliver operating intelligence for continuous improvements.

Understanding PROFIBUS Diagnostics

One of the many reasons for PROFIBUS' success over the years has been the ability of PROFIBUS diagnostics to pinpoint instrument problems in a running system. This tech tip's purpose is to give you a better understanding of the mechanics of how PROFIBUS diagnostics work and to show how the information is reported.

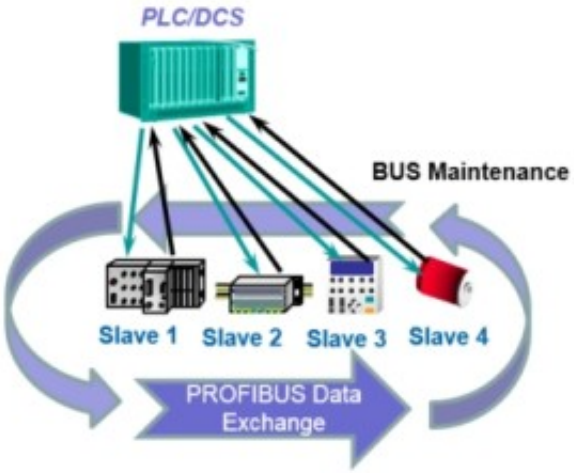


Figure 1

All PROFIBUS slave devices support the basic diagnostic message. The basic diagnostic message is available on request to any PROFIBUS Master, at any time. This message reports to the controlling Master, whether the device needs parameters or configuration, has parameter or configuration faults, the device mode, watchdog state, etc. It's all great information and it can help solve configuration and parametrization setup problems, but in a running control system, it is not very useful. The diagnostic messages that can occur during operation are far more interesting.

When the PROFIBUS Master is controlling the bus it is called Operate mode or Data Exchange mode. In Operate mode, the PLC/DCS sends output data and receives Input data to/from each slave device it is controlling. The Master exchanges data with each slave, does a small amount of bus maintenance and then starts over again. Figure 1 shows Data Exchange when there are no diagnostics to report.

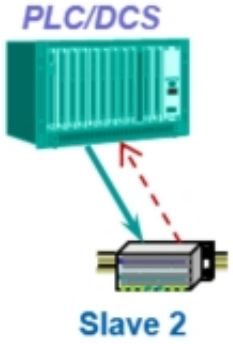


***Figure 2** Slave 2 has the read diagnostic bit set. The Master reads the bit along with the slave input data.*

When a slave device detects a change that needs to be reported to the PLC/DCS, it sets a bit that goes to the master along with the input data from that slave's inputs. The master takes the input data passed back and continues with his data exchange with all the other slave devices in the system. This is shown in Figure 2.

The next time that the slave with the diagnostic has its' turn in the I/O cycle, the master sends a "get diagnostic" telegram to the slave instead of outputs and the slave responds with the diagnosis instead of inputs. When the master reads the diagnosis, the slave turns off the bit that says it has a new diagnosis. The master then continues with data exchange to all the other slave devices. The next time through, the master performs data exchange with the slave, just like before. This is illustrated in Figure 3.

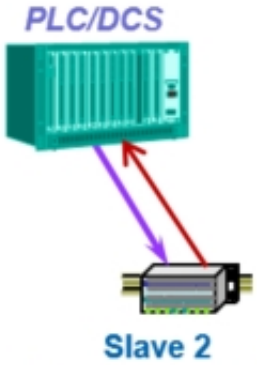


***Figure 3** The Master sends "read diagnostic" to the slave instead of writing outputs and reading input. The slave responds with the diagnostics. The next scan the Master goes back to normal data exchange with the slave.*

The Master only reads the diagnosis once. The diagnosis is read instead of performing a data exchange cycle with the slave. When the diagnostic situation changes again (or goes away) the slave sets the bit again and the master responds by reading the diagnosis. Doing the diagnosis in this way is designed to minimize the impact of diagnosis handling on

the PROFIBUS I/O update time.

John Swindall, PROFI Interface Center

IO-Link: Did You Know?

Did you know that the benefits of IO-Link are built on three pillars?

The tremendous success of IO-Link rests on three pillars whose value is clearly recognized no matter the industry sector: simplified installation, simplified parameter assignment, and diagnostics.

The *first* pillar is the simplified installation, which is reflected in the reduced control cabinet volume as well as in the use of three-core and unshielded standard cables in place of non-flexible special cables and application-specific wiring that predominated previously. IO-Link users can typically make use of a standard plug-in connection and cable even for complex sensors with multiple signals.

The *second* pillar is the simplified parameter assignment. The effort required for manual parameter assignment using local operator input elements on the sensor is generally always perceived as too great. With IO-Link, several options exist for drastically simplifying parameter assignment and even for automating it, if required.

The *third* pillar is provided by the diagnostics, which thanks to IO-Link allows a look all the way to the sensors and actuators, for the first time without additional costs for interfaces and cabling. Completely new applications are opening up in the process. Time will tell what changes this will bring about for status-based maintenance, in MES and SCADA systems, and even in ERP systems.

The continuation of this success story will be made possible through the close collaboration between the IO-Link Community and users. Open questions will be openly discussed and put into practice. Most recently, the aspect of usability has been singled out. This led to the formation of two working groups that are now developing sensor profiles for low-complex sensors and for measuring sensors in order to simplify and facilitate PLC programming across manufacturers.

IO-Link

20 Years of PROFIBUS for Silicon Manufacturing

Solland Silicon in Meran, Italy, is one of the leading companies in silicon manufacturing for the photovoltaic industry. The factory in Meran, Italy, belongs to the PUFIN Power Group and is a chemical manufacturing operation. They have used PROFIBUS since the 1990's and now use PROFINET as well.

Figure 1: Solland Silicon factory in Meran

Solland Silicon is one of the pioneers in the process fieldbus area and has been operating plants with PROFIBUS since the mid-1990s. Polycrystalline silicon is produced in Meran. A new ultra-modern plant expansion was made and put into service from 2008 to 2010. Based on positive experience, the company chose the field-proven PROFIBUS technology for this.

Figure 2: State-of-the-art silicon production at Solland Silicon

But first things first – some history:

During the last two decades Solland Silicon gathered experience with PROFIBUS and was able to generate significant competitive advantages as a result. The implementation of PROFIBUS at Solland Silicon began back in 1996 when it was selected as the process fieldbus for a pilot project.

Through the use of PROFIBUS, the following savings were anticipated compared to the use of conventional 4…20 mA technology:

- Configuration cost -30%
- Hardware: -70% (control cabinets, I/O cards, Ex-barriers, distributor boxes, cabling)
- Software: -40% (configuration)

Because the pilot project was successful, 4 distillation columns were upgraded from pneumatic and 4...20 mA technology to PROFIBUS just one year later. Because the overall control system at that time could only handle Modbus, a protocol converter from Modbus to PROFIBUS was used. The advantage of this gateway solution was that it enabled a subsequent upgrade of the overall control system to PROFIBUS without significant expense. Thus, the plants with PROFIBUS could easily be integrated into the existing

automation landscape step by step.

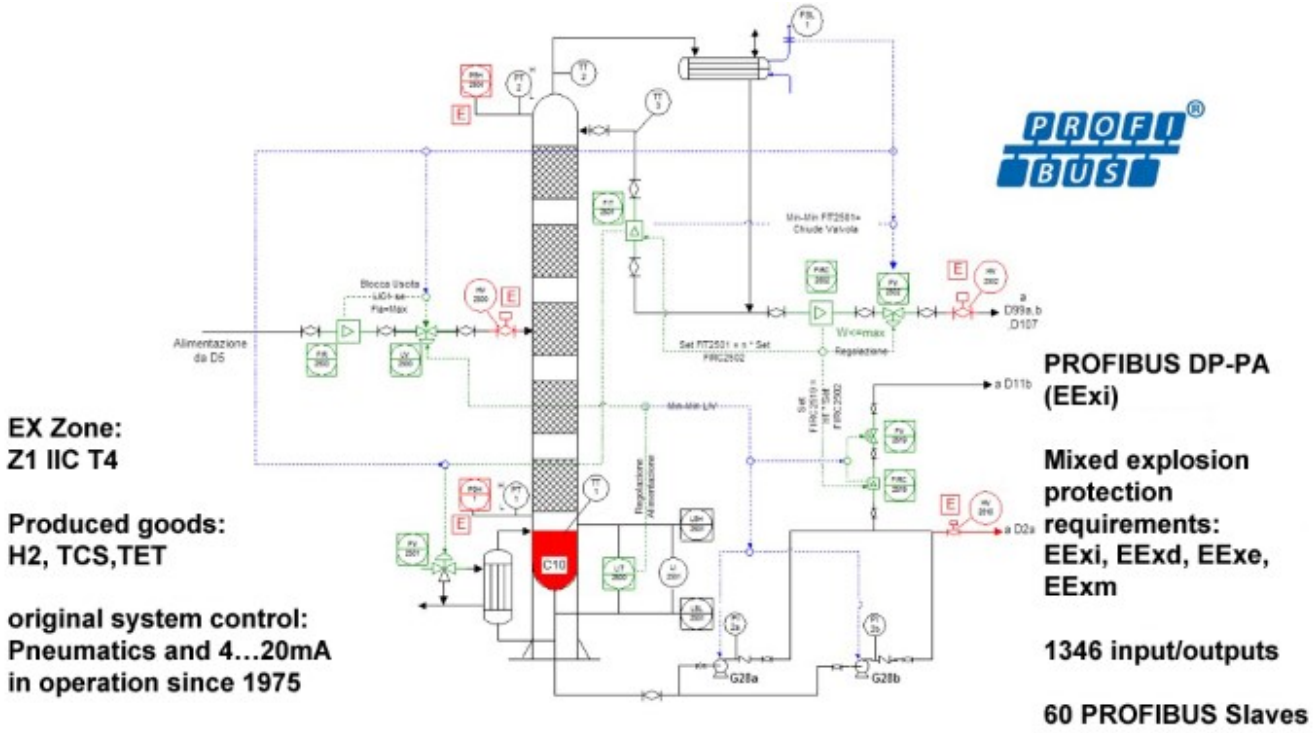


Figure 3: PROFIBUS system at Solland Silicon 1997

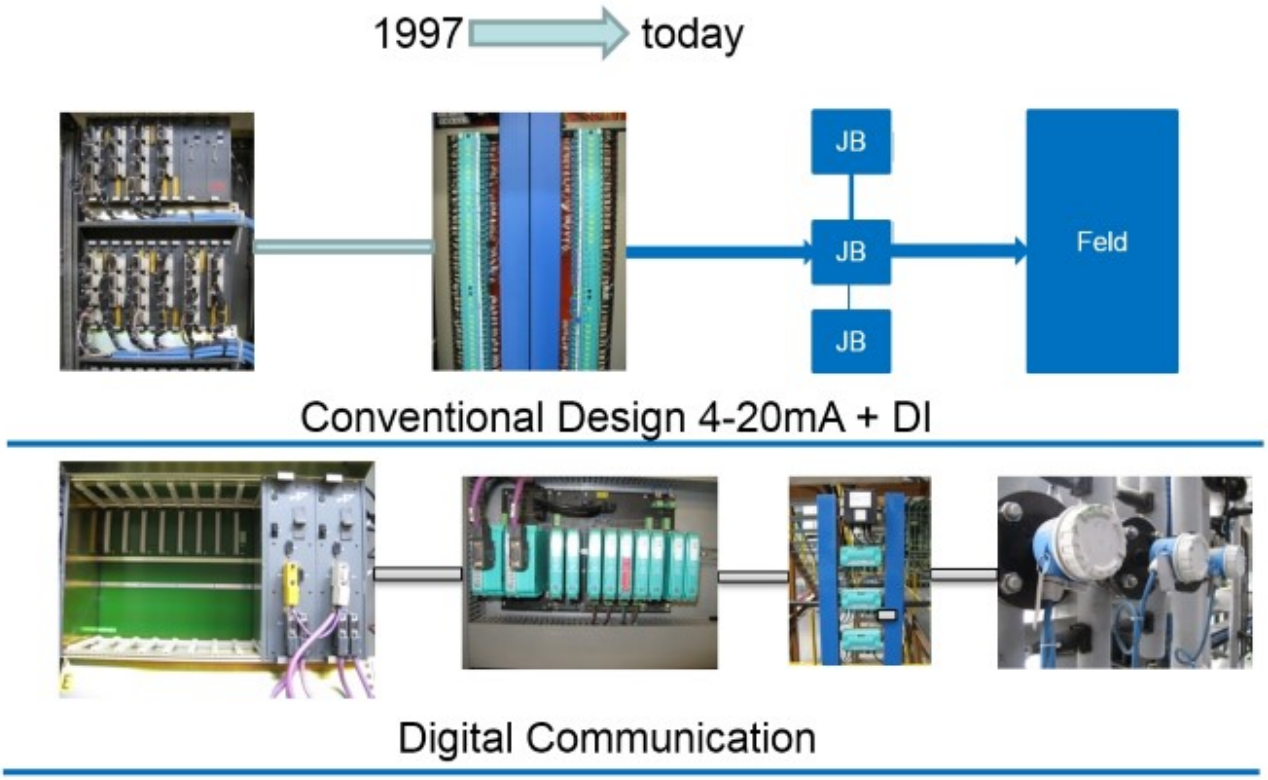


Figure 4: Digital vs. analog at Solland Silicon

In the years that followed, it was demonstrated that this PROFIBUS plant had long-term stability and was easy to maintain. When an extensive plant expansion was made to the Meran factory from 2008 to 2010, widespread use of PROFIBUS, including various redundancy concepts, was chosen based on the good experience.

Key data of the expansion:

- Time period 2008-2010
- Investment approximately EUR 250 million ($274,000,000)
- 14 new plants:
    - Distillation columns
    - Hydrogen purification plants
    - H2 and HCl compressors
    - Production of N2 (on-site)
    - New reactor hall
    - Cooling water plants for the reactors
    - Plants for recovery (condensation) of process gases (to -90°C)
- Highest demands for availability

Approximately 90% of the plants require an Ex version for Zone 1 or Zone 2.

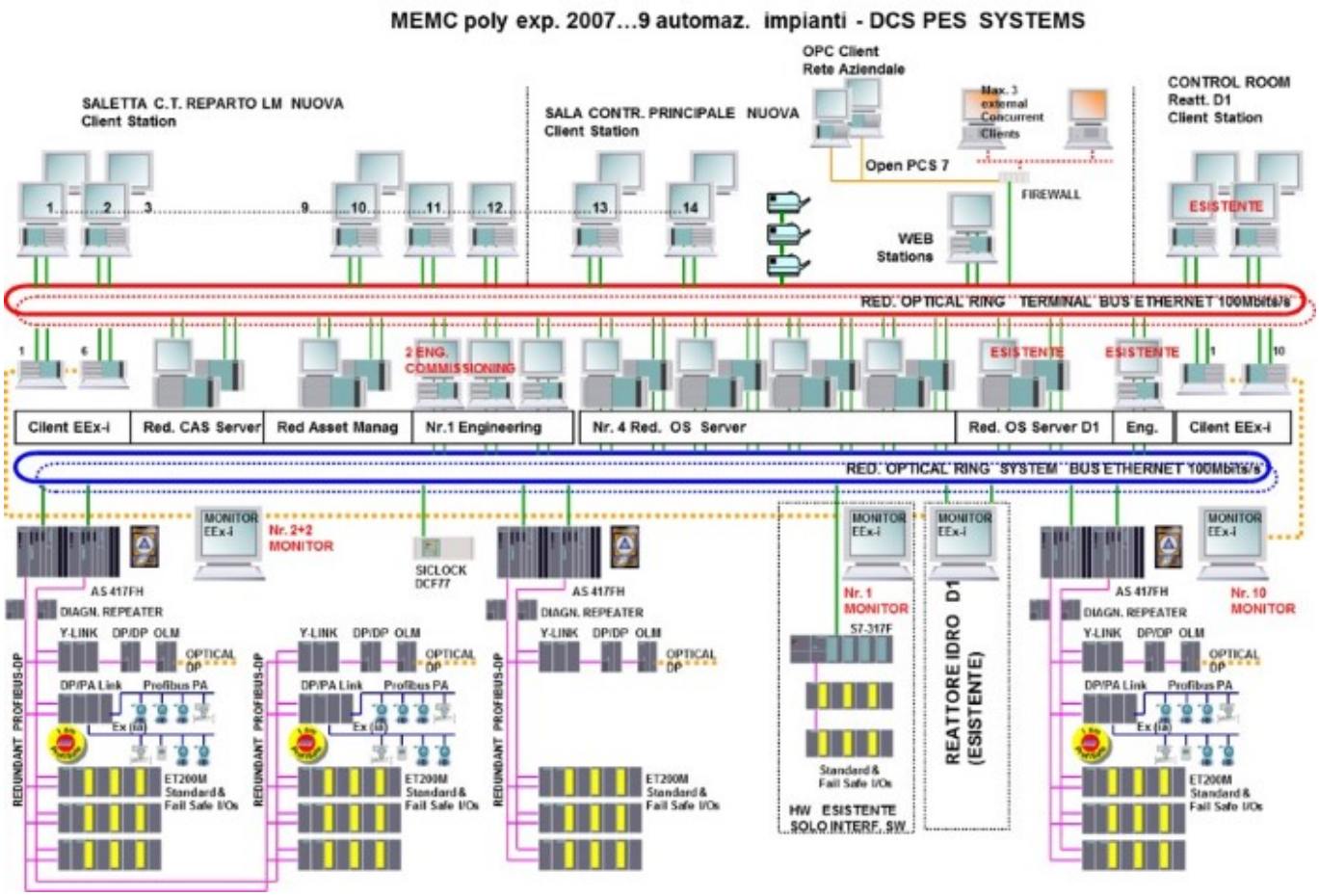


Figure 5: Excerpt of the implemented plant topology

SIL3-capable overall control systems were used for the plant control. Specifically, the ABB 800xA System with 13 control units with AC800M-HI (redundant) and the Siemens PCS7 System with 26 control units with CPU 417FH (redundant) are being used.

The controllers of the various packages (compressors, etc.) were connected redundantly to the overall control system with PROFIBUS DP. All transmitters (pressure, temperature, etc.) and actuators were implemented in PROFIBUS PA (except in the SIL loop).

For easy and efficient proof of explosion protection, the FISCO concept was used for configuring and implementing the PROFIBUS lines.

To ensure high plant availability, all PROFIBUS DP lines are implemented with redundancy. The PROFIBUS PA lines are also redundant down to the segment couplers (Pepperl+Fuchs, SK3).

The overview of the utilized network components shows that Solland Silicon was able, thanks to the open PROFIBUS, to use the most suitable products from various manufacturers – with excellent interoperability:

- Master: redundant, integrated in the overall control system
    - ABB 800xA with AC800M-HI (13 control units)
    - SIEMENS PCS7 S7-417FH (26 control units)
- Segment couplers: Pepperl+Fuchs SK3 (18+16 units) gateway redundant with diagnostic module, redundant modules for segment voltage supply
- Surge protectors (104 units): Overvoltage protection of the PB segments
- MFT (60 units) = Multi-function terminal: Disconnecting module between trunk and field barriers (for explosion protection Zone 1)
- Field barriers (320 units): Pepperl+Fuchs F2D0-FB-Ex4

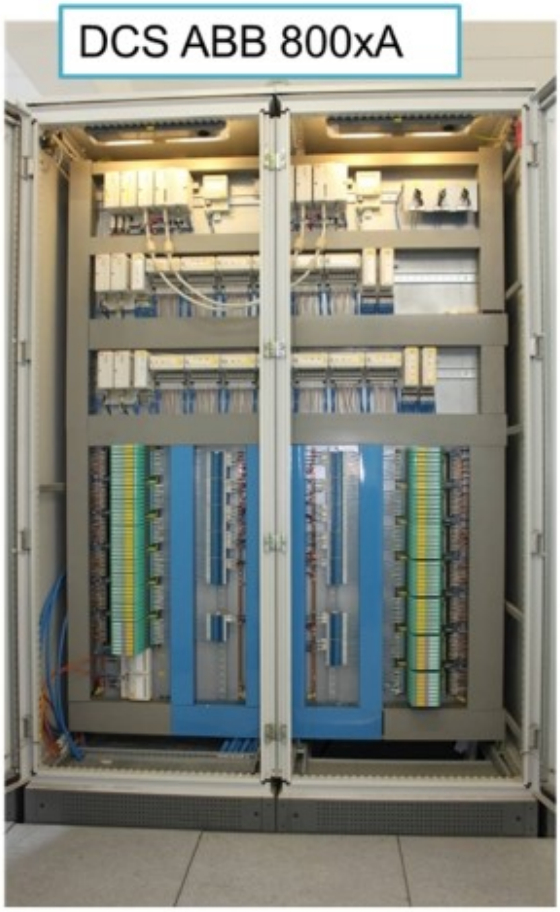


Figure 6: Automation unit

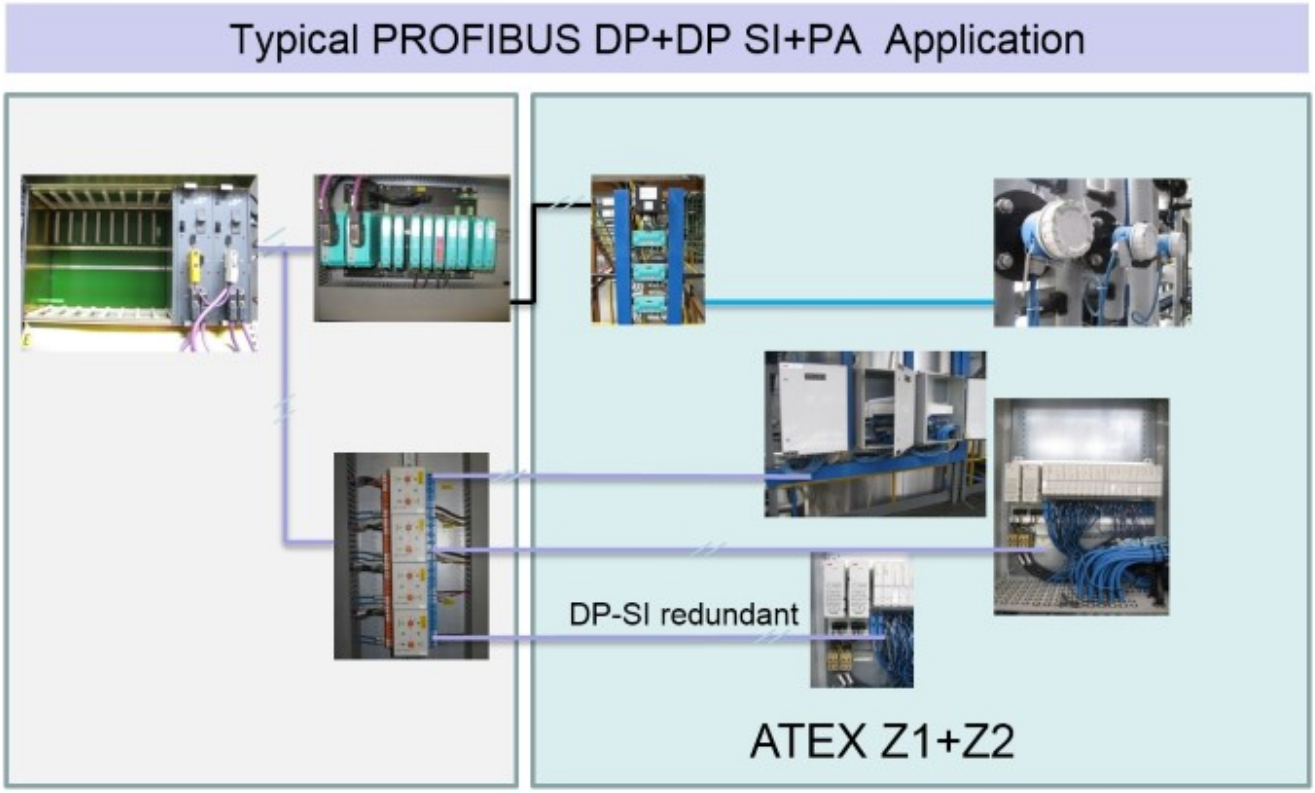


Figure 7: Typical PROFIBUS DP + DP SI + PA application

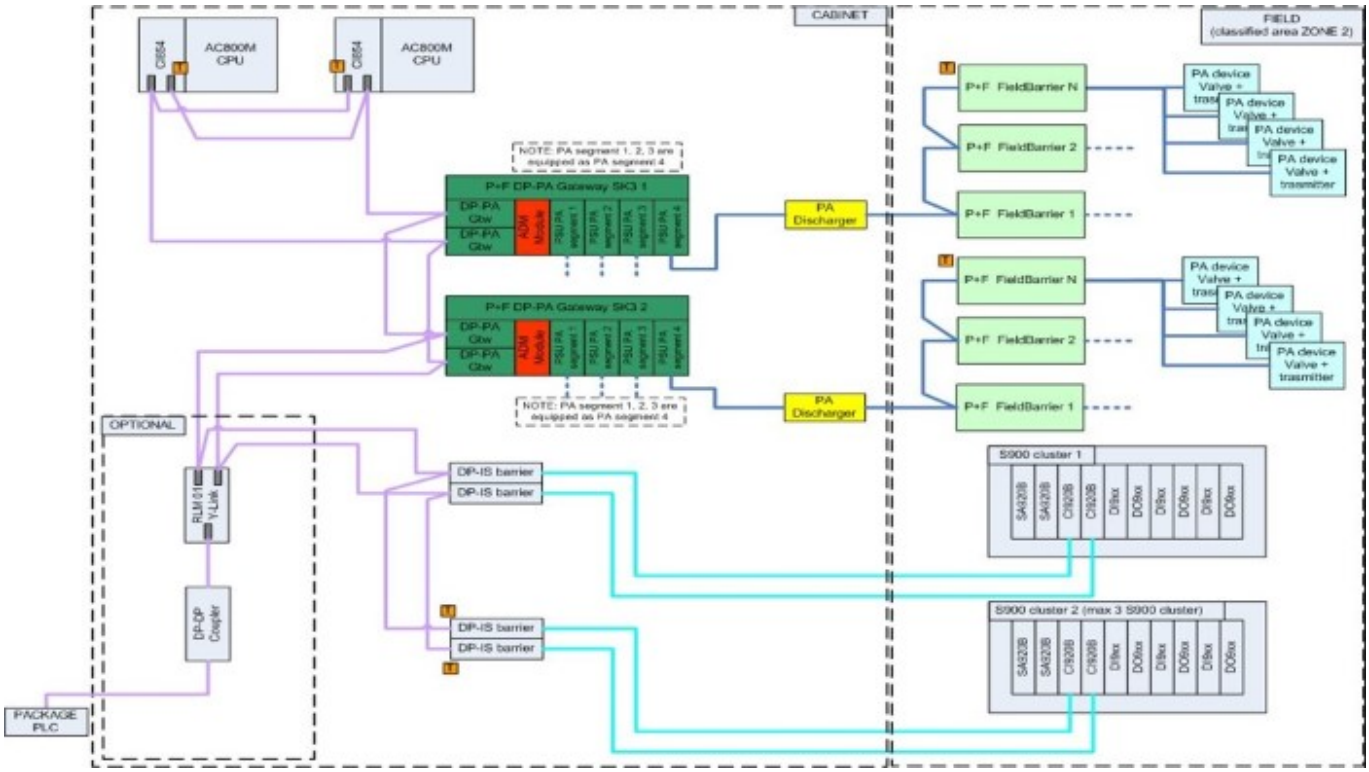


Figure 8: Detailed view of the PROFIBUS DP & PA topology

The same applies to the measuring technology used, since Solland Silicon was also able to select the most suitable devices from the portfolios of various manufacturers. In order to provide an overview of the plant complexity, the measuring points are listed in the following:

- Approximately 750 measuring devices in PROFIBUS PA
- Approximately 60 PROFIBUS DP slaves
    - 12 inverters for drives up to 315 kW
    - 24 remote I/Os in PROFIBUS DP with barriers
- 3500 DI/DO (std. and safety)
- 2600 PROFIBUS signals with remote I/O

For smooth operation of the plant, Solland Silicon makes use of the numerous advantages of the PROFIBUS fieldbus technology. The overall control system software and other software tools (E+H FieldCare) use DTM technology, which facilitates configuration and expands the diagnostic capabilities conveniently from the control room.

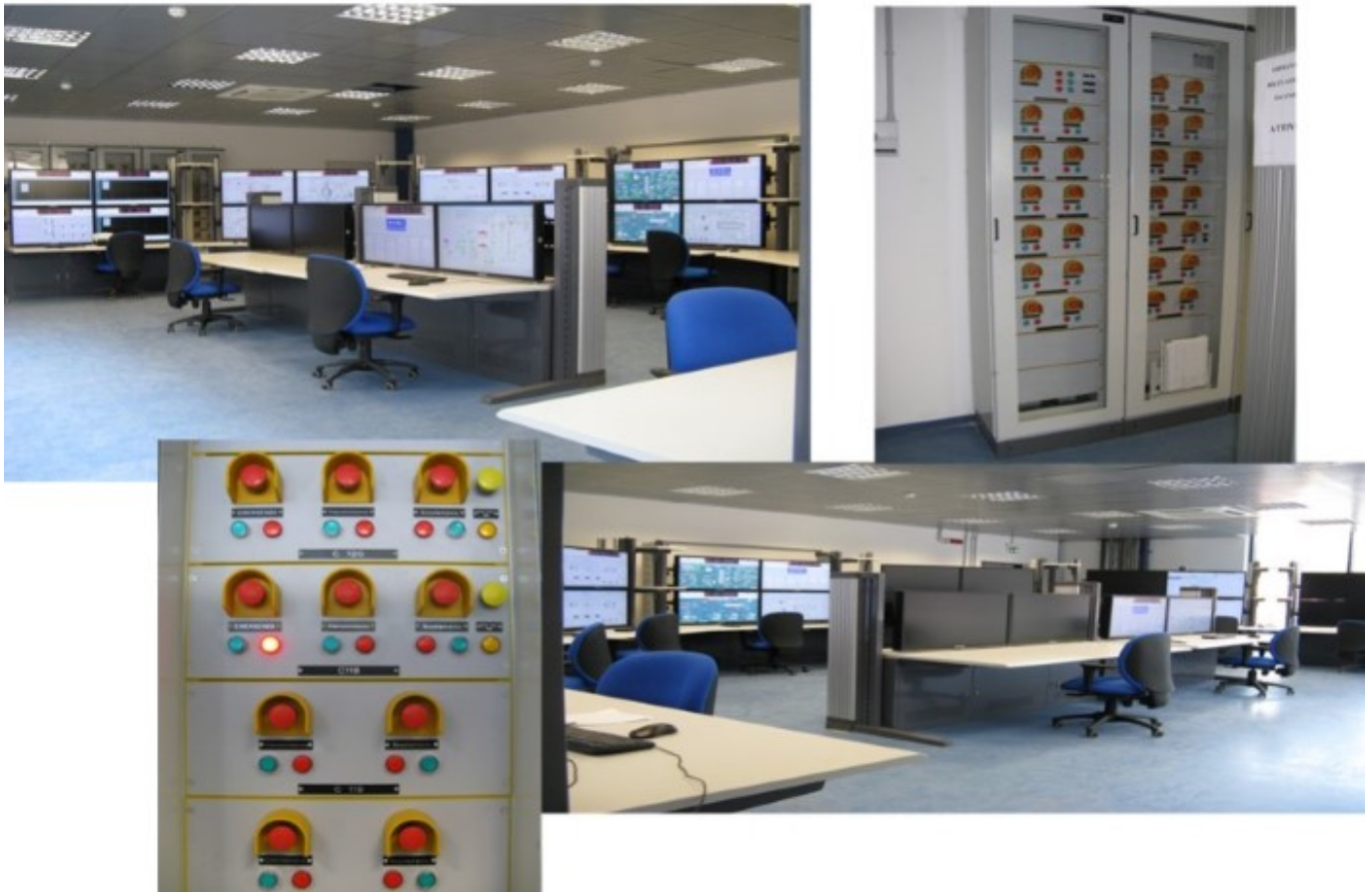


Figure 9: New control room

The monitoring of the signal quality (physical layer) of the PROFIBUS network (using P+F ADM module in SK3) permits a periodic, fast check of the health of the physical bus characteristics, which enables predictive maintenance:

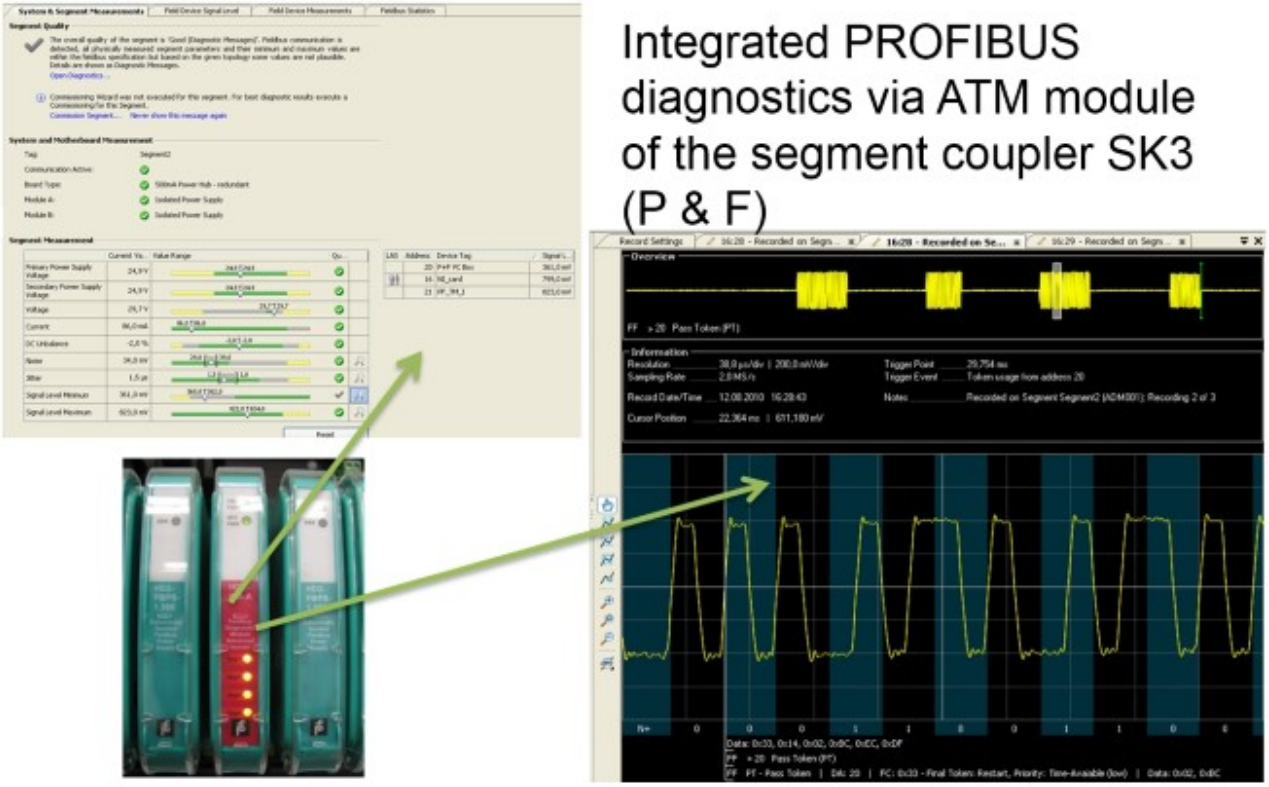


Figure 10: Physical layer diagnostics

After 20 years of experience with PROFIBUS in its South Tyrol factory, Solland Silicon has found that PROFIBUS DP and PA have proven to be very reliable and that its expectation regarding cost savings have been met for the new plants (configuration cost: -30%, hardware: -70%, software: - 40%)!

The use of the DTM technology enabled a further quality improvement during configuration, parameter assignment, and diagnostics of the slaves and the network. The use of the FISCO concept made it much easier to prove explosion protection and also gave Solland Silicon flexibility for plant expansions and changes.

Moreover, the failure rate of components is very low and the replacement of defective devices is very easy. Solland Silicon has also discovered that troubleshooting and plant maintenance is much more effective and efficient than before, because modern tools greatly simplify the work of the plant operators and maintenance personnel.

Through the redundant implementation of the PROFIBUS DP lines, Solland Silicon was able to ensure very high plant availability over the years.

And the story continues: Initial applications with PROFIsafe and PROFINET have been implemented and are already in active operation at the factory in Meran. As the next step, the Motor Control Center (MCC) and Power Control Center (PCC) will now be equipped with PROFIBUS in order to take advantage of the benefits of digitalization there.

Acknowledgement: We are very grateful to Mr. Georg Pichler (Automation Manager at Solland Silicon) and the Solland Silicon company for the information and images provided.

PI Update: PI Meeting Report, Still Free eBook, Audi Video, Social Media

It has been a busy month for PI. There was the annual international PI meeting in Ireland. *Catching the Process Fieldbus* free eBook has been downloaded over 500 times since it was announced in last month's PROFINEWS. There is a new video with PROFINET user Audi complimenting PI. And social media rolls on.

PI Meeting News and Statistics

The annual international PI meeting was recently held in Ireland. It was five solid days (and nights) of PROFINET and PROFIBUS. Here are a few observations that are of general interest.

Michael Bowne

Mike Bryant, Executive Director of PI North America, has been Deputy Chairman of PI (international) since PI was formed by the Regional PI Associations 20 years ago. Having decided that it was time for younger representation, Mike resigned and our own Michael Bowne was elected the new Deputy Chairman. Mike remains Executive Director of PI North America.

A report from the PI Support Center showed the increasing number of PROFINET product certificates awarded. Last year there were 330 and this year there will be even more.

More numbers: Regional PI Associations (RPAs) represented included Australia, Belgium, Brazil, China, Germany, Ireland, Italy, Japan, Korea, Middle East, Netherlands, North America, Norway, Poland, South Africa, Sweden, Switzerland, and the UK. Some of these represent multiple countries; for example, the Australian RPA also includes New Zealand, the Middle East includes eight countries, and PI North America includes the US, Canada, and all of Latin America except Brazil. That's 28 countries not including Latin America. (PI North America fostered the new RPA in Chile and supports the new PI Competence Centers in Bolivia and Peru.)

PI Ireland did a superb job of having everything planned very well, especially since they were originally expecting about 65 total attendees and had over 90.

The most interesting statistic: 9 km versus 27 km. One of the PICCs presented their approach to checking

a mixed network at a medium sized process plant. The plant had a PROFINET backbone with some PROFIBUS devices integrated via proxy. There were 230 PROFINET devices and 71 PROFIBUS devices. They used 9 km of cable versus the 27 km of cable if it had been an all-PROFIBUS network. Imagine what the km of cable would be for a hard-wired, point-to-point approach!

Catching the Process Fieldbus

Catching the Process Fieldbus: An Introduction to Profibus for Process Automation is a great starting point for learning about PROFIBUS for process. It's still free and available in multiple formats here.

Audi Video

YouTube Video

Social Media

Recent blog posts have included

- Why Use a Fieldbus?
- 5 Questions about PI North America Answered
- PROFINET Student Tips

Plus a less-formal, first-person account of the PI Meeting. Stop by the blog every Tuesday for an update or subscribe using RSS.

Watch all the MinutePROFINET videos in sequence using this playlist:

https://www.youtube.com/playlist?list=PLUSa_QKaMpeLpDjcylu1fgLHmDFCxDsiN

Follow on Twitter for twice-a-weekday updates (and the occasional weekend off-topic tweet): @AllThingsPROFI.

Training and Events: PROFINET across North America, ACHEMA fair in Germany

All dates for the remaining 2015 North America PROFINET one-day training classes are finalized. We've added an additional class to be held in Toronto too. Find a class in your area. In event news, the process-industry-focused ACHEMA fair will take place in Frankfurt, DE on June 15-19.

Free One-Day PROFINET Training

If there is no class in your area, or you are unable to make it, take a webinar instead.

City	Date
Denver, CO	6/16/15
Toronto, ON	7/23/15
Chicago, IL	8/27/15
Tampa, FL	10/6/15
Louisville, KY	10/20/15
Detroit, MI	11/5/15
Raleigh, NC	11/17/15
Seattle, WA	12/2/15

ACHEMA 2015

Every three years in Frankfurt, the ACHEMA show is held. It is the leading international trade fair for the process industry. PROFIBUS & PROFINET International (PI) will be present in Hall 11.0. You can find

us from 15 to 19 June 2015 at booth C 43 with our Field Communication Lounge. PI will be joined by 30 co-exhibitors presenting their equipment related to PROFIBUS and PROFINET. Exhibition highlights include a live demo of PROFIBUS and PROFINET for Process Automation. The demo shows the easy device replacement and diagnosis according to NE107 and the associated user benefits. The presentation is completed with information regarding FDI.

Detailed information here

Regional News

The famous PROFINET book by Manfred Popp is now available in Japanese. Read the abstracts for the upcoming PROFIBUS Conference in the United Kingdom. A new white paper has been released in Australia regarding industrial communications enabling the Industrial Internet of Things.

Japan

Japanese PROFIBUS Organization (JPO) translated the new version of *Industrial Communication with PROFINET* into Japanese. The book in Japanese has been available since May 12, 2015. JPO has organized PROFINET seminars regularly for years.

PROFINET product testing began in Japan in 2014. JPO expects more companies will develop PROFINET products more easily with the support of the Japanese PROFINET book.

Order a copy of the book

United Kingdom

Here is a sample list of the abstracts from some of the presentations that will be given at the PROFIBUS Conference in Straford-upon-Avon, June 23-24.

- The way forward for HART users
- Essential quality criteria for planning and validation of PROFINET networks
- Future trends and their impact on the networks of the future.
- PROFINET is widely accepted and well proven in plant engineering
- Find out why PROFIBUS became the preferred water industry serial communications protocol
- Do you want to go beyond reading about PROFINET and have a go using it
- Advances in Newspaper Printing with PROFINET and PROFIdrive
- Shedding light on PROFINET node development
- PROFINET in action at a major plant of AUDI
- Preparing for the “factories of the future”

Register for the Conference

Australia

This paper argues the customer benefits and solution competence of fieldbus and Ethernet network technologies through an approach encompassing technological innovativeness, knowledge resource development, skills availability, open vendor strategy and a unique relationship-based “Profibus & Profinet Community” approach.

Read the White Paper

Member News

There is member news this month from HMS and Softing. HMS announces a collaboration with Xilinx to deliver next generation industrial networking solutions. Softing has published a White Paper discussing PROFINET network diagnostics.

HMS

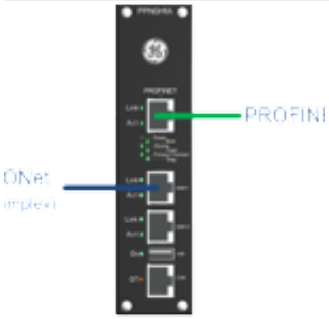
HMS, a Xilinx Alliance Program Member, is adapting the Anybus technology to the FPGA and Zynq platforms, with the aim of enabling Xilinx customers to implement all popular Industrial Ethernet protocols, such as Profinet, and others. The objective is to form the first one-stop-shop solution for industrial communication IP cores on Xilinx and leverage Anybus's platform concept for a new level of integration and productivity. Read More...

Softing

The use of TCP/IP-based communication changes the character of industrial networks. The comprehensive plant-wide planning of the diagnostic tasks to be performed provides key benefits to PROFINET users looking to minimize the failure risk of their production plant and increase the efficiency of their maintenance work. A thorough acceptance test for the PROFINET network provides a sound basis for the future smooth operation of the plant. Read More...

New Products

GE adds PROFINET to a safety controller, HMS adds PROFIdrive to their solution set, Softing introduces a new PROFIBUS subsystem, Siemens adds device detection to its server software, Teledyne DALSA adds PROFINET to its vision camera, and TR Electronic adds PROFINET MRP to its absolute encoders.



GE

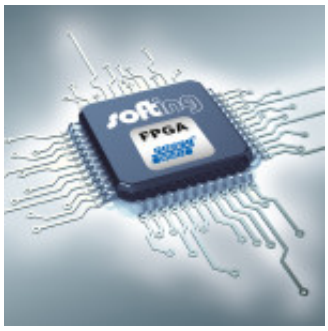
GE is constantly evolving their DCS and Safety system software, ControlST, to improve customer experience, enhance plant operation, and keep pace with advancements in technology. In V05.04.00C, several major features are being introduced including support for linking PROFINET I/O devices to MarkVIe controllers with PROFINET V2.2 I/O connectivity.

Read more about the MarkVIe controls platform here...

HMS

The extension to the new Anybus CompactCom 40-series enables drives manufacturers to comply with common profile specifications such as PROFIdrive, and others. Different networks have different standards for how to communicate with a drive (for example, to tell the drive to operate at a certain speed). These so called “drive profiles” or “motion profiles” are supported by the Anybus concept through a Profile Driver Package — a software stack which is implemented into the drive during development.

Read more here...



Softing

Softing Industrial Automation is introducing a new PROFIBUS slave subsystem that can be fully loaded into an FPGA. The solution consists of a VHDL-designed PROFIBUS controller and processor on which runs the entire protocol software. The PROFIBUS slave subsystem supports DP V0 and DP V1 and is available for Altera FPGA Cyclone-Series III, IV, V and SoC.

Learn more here...

Siemens

With its new V13 Sinema Server software release, Siemens is simplifying the monitoring of industrial networks. The new software automatically detects all Profinet and Ethernet devices within a network, and enables a clear visualization of them in a web browser. Version 13 is also able to directly read out information from Simatic Controllers (Simatic S7-300 / S7-400) and connected Profinet devices.

Read the full Press Release here...

Teledyne DALSA

Teledyne DALSA announced its next generation BOA™2 Smart Camera featuring higher resolution

imaging, dual-core processing and embedded iNspect™ Express application software. The embedded iNspect Express application software supports standard factory protocols, such as Profinet for interfacing with complementary factory products and control networks.

Learn more here...

TR Electronic

TR Electronic, is proud to announce the debut of its new Media Redundancy Protocol (MRP) equipped Linear and Rotary encoders. As the demand for robustness and reliability of control networks increases in the manufacturing and automation industries, so does the demand for technologies which can enable end users to meet this fast growing need. Media Redundancy Protocol integrates into a ring topology PROFINET network.

Read more...

HMS collaborates with Xilinx

HMS Industrial Networks AB (HMSN.ST) announced today that it is collaborating with Xilinx (NASDAQ: XLNX) to deliver next generation industrial networking solutions. HMS's latest industrial network IP is based on the leading Anybus technology for Xilinx® FPGA and SoC devices. HMS is the worldwide leader in Industrial network technology and has connected more than three million devices to industrial networks in demanding applications with its Anybus technology. Xilinx® Artix®-7 FPGAs and Zynq®-7000 All Programmable SoCs integrate state-of-the-art FPGA technology with dual-core ARM® Cortex(TM)-A9 MPCore(TM) processors, giving developers a powerful and flexible basis with high performance embedded processing power and hardware acceleration.

HMS, a Xilinx Alliance Program Member, is adapting the Anybus technology to the FPGA and Zynq platforms, with the aim of enabling Xilinx customers to implement all popular Industrial Ethernet protocols, such as Profinet, and others. The objective is to form the first one-stop-shop solution for industrial communication IP cores on Xilinx and leverage Anybus's platform concept for a new level of integration and productivity.

"We are very excited about having Anybus on Xilinx products. The industrial communication market is very fragmented when it comes to protocols, and many next generation product platforms require the support of multiple networks. We are looking forward to our Zynq-7000 All Programmable SoC customers getting a proven, flexible and reliable communication solution that appreciably improves time to market for their new products," says Christoph Fritsch, director of the industrial, scientific and medical business segment at Xilinx.

"Co-operation with Xilinx allows HMS to further integrate into new technical platforms. FPGAs remain extremely popular in industrial products, so the proposed combination of Xilinx's Zynq All Programmable SoCs and HMS's Anybus technology will create an unbeatable combination in providing performance, flexibility and short time-to-market for demanding industrial applications," says Staffan Dahlström, CEO of HMS. "We see the Xilinx co-operation as a great complement to our existing Anybus offer of chips, bricks and modules for industrial communication. This new solution will increase the reach of Anybus into more applications and will provide new market opportunities for HMS."

HMS expects the Anybus technology to be available for Zynq All Programmable SoC customers during the second half of 2015.

Diagnosis of PROFINET Networks - Softing

PROFINET is an established communication standard in industrial automation; in the majority of cases, the development and installation of PROFINET networks presents no problems. If a diagnosis of the PROFINET network is needed, however, many users venture into new territory: For example, the plant commissioning procedure often does not include acceptance testing of the PROFINET networks, and plant operators and maintenance staff are looking for clear best practice guidance on how to monitor PROFINET networks during operation, how to reliably keep them up and running, and how to react quickly and efficiently if problems occur. The reason for this situation lies in the profound changes brought about by the shift from traditional fieldbus systems to PROFINET or, more generally, to TCP/IP-based industrial communication. The first part of this article addressed organizational aspects of these changes. The second part will now discuss technical issues and describe the appropriate PROFINET diagnostic tasks and tools for the different life cycle phases of the network.

Blind Flight or Efficient Maintenance?
Diagnosis of PROFINET Networks

Tasks of PROFINET diagnosis

As detailed in the first part of the article, the tasks – and thus the requirements on the diagnostic tools employed – differ depending on the phase of the plant life cycle and the users involved. These factors determine the required set of diagnostic tools and the necessary functionality.

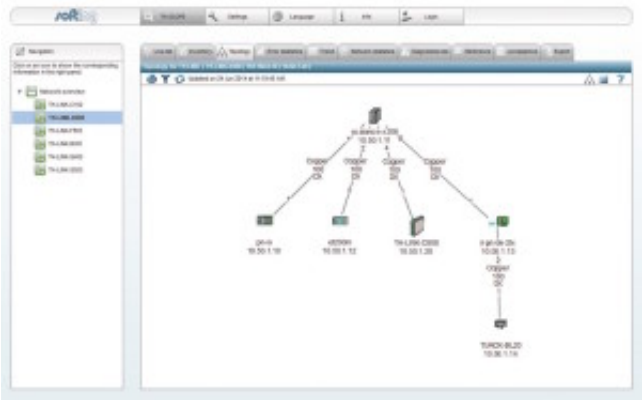
	Installation	Commissioning	Operation
Cable test	X		
Acceptance test		X	
Continuous monitoring		X	
Troubleshooting	X	X	

Table 1:
The individual phases of a plant's life cycle require different diagnostic functionalities for PROFINET networks.

Cable validation

A key task in the installation phase is to ensure correct cabling. Testing every single cable that is used would involve too much effort, however. Therefore the focus is on checking all important network cables, which is primarily cables that are used as the backbone and that are permanently integrated and difficult to replace, as well as custom cables. Standard cables can generally be used without special verification. A useful tool for the validation and certification of Ethernet cabling, e.g. during acceptance testing, is the WireXpert 500 IE product from Softing Industrial Automation.

Support during commissioning

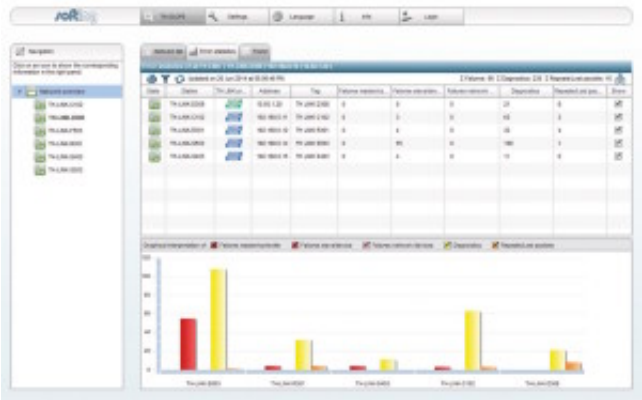


Once installation is complete, the next phase in the plant’s life cycle is the commissioning phase. Here the diagnostic tasks are aimed at detecting general configuration and communication faults in the installed PROFINET network, and documenting the network and the acceptance test in order to minimize the residual risk of network failure during operation of the plant. The configuration faults to be detected include, for example, device names that are used in the controller, but not assigned to any device in the network. During acceptance testing, documents are issued that detail the current characteristics of the PROFINET installation and serve as evidence and as a basis for future comparisons. One of these documents is the network topology representing the nodes connected to the network. Selectable filter settings allow adjustment of the size, layout and level of detail (see Figure 1). Another document in this phase is the inventory list which contains a complete, detailed list of all devices. An acceptance test report automatically summarizes all the individual results of the acceptance test. The last step in this phase is the reference measurement with a record of the network status that was rated as “good” in the acceptance test. This record provides a basis for future comparison with the current network status during operation of the plant, and is a useful aid in troubleshooting if network problems occur.

Depending on the situation, it may also be advisable to run a network load test as part of commissioning. This test examines the behavior of the installed network (utilization, number of frame errors, etc.) under load and differs from load or stress tests for single devices, in which the robustness and the conformity with device standards are typically assessed in a laboratory environment.

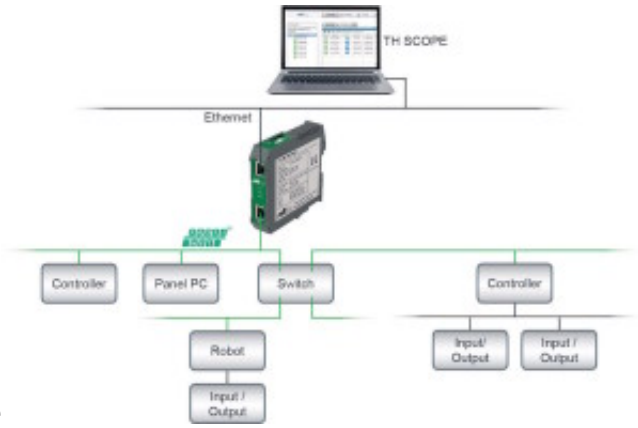
Network diagnostics during operation

While the plant is running, plant operators need an overview of the plant-wide status. Diagnostics in this phase are aimed in particular at ensuring a high plant productivity and avoiding costly downtime. The focus is on the continuous monitoring of the PROFINET communication and on the efficient support of users in the case of emerging problems or network failure. During continuous monitoring, key characteristics such as the current network load and the number of error packets are monitored. In this way, negative influences on the PROFINET data exchange can be eliminated, for example, when replacing an Ethernet device or expanding a decentralized I/O system. If a specified limit value is exceeded on the monitored network, the user is automatically notified.



For many maintenance tasks and for finding typical faults that are common during operation, users do not need special IT knowledge. The employed tools provide the necessary functionality, such as an aggregated view of the overall network, network communication statistics, and maintenance and troubleshooting advice in plain text. The tools also detect cable problems, device drop-outs and broken connections. An example of fault statistics can be seen in Figure 2.

During plant operation, users are also faced with “network management” tasks. A typical task, for example, is to update the firmware in all devices of a particular device type. Using suitable tools, the users can quickly see at a glance if all devices are discovered after the update and if they have been updated to the correct firmware version.



The key components for acceptance testing and network diagnostics in this phase are the TH LINK PROFINET and TH SCOPE products from Softing Industrial Automation (see Figure 3). Designed specifically for maintenance staff and plant operators, these tools can be used without in-depth IT or Ethernet knowledge. The TH LINK PROFINET gateway provides access to the PROFINET network independently from the controller or control room. The gateway can be integrated at any time, without interfering with the operation of existing installations. It requires neither configuration nor development work. The TH SCOPE software application is used for the monitoring and maintenance of the PROFINET networks used. It processes the data acquired by the TH LINK PROFINET and displays it in the form of graphs. This solution enables local and remote access, and also provides a browser interface. Third-party tools can be integrated into the diagnostic solution through the SNMP or OPC standards. The BC-200-ETH Industrial Ethernet Tester can be used additionally in order to perform network load tests.

Troubleshooting complex problems

During commissioning or operation of the plant complex faults, such as a large number of error frames on a particular port, may occur without apparent cause. Troubleshooting these problems usually requires in-depth knowledge and expertise in communication and information technology, as well as special tools for locating, identifying and correcting the fault. In many cases, for example, users may need to perform a frame analysis of the communication. This can be done with additional tools, such as temporary taps in combination with the Wireshark software.

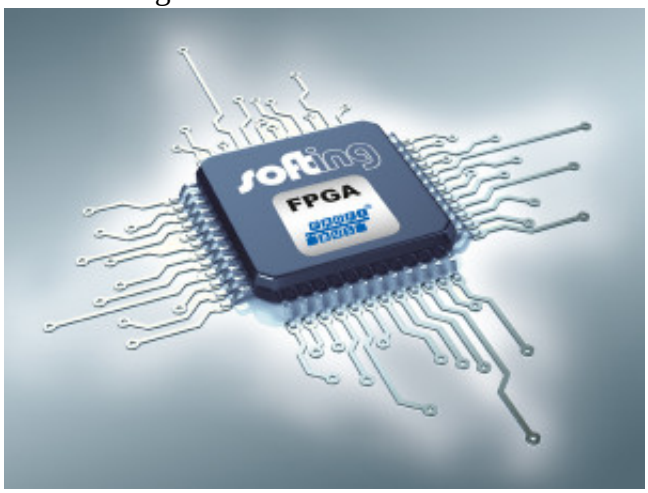
Summary

The use of TCP/IP-based communication changes the character of industrial networks. The comprehensive plant-wide planning of the diagnostic tasks to be performed provides key benefits to PROFINET users looking to minimize the failure risk of their production plant and increase the efficiency of their maintenance work. A thorough acceptance test for the PROFINET network provides a sound basis for the future smooth operation of the plant. Softing offers a complete portfolio of products for PROFINET network diagnostics, ranging from installation and network acceptance testing to continuous network monitoring during plant operation.

Softing's Complete PROFIBUS DP slave in FPGA

Softing Industrial Automation is introducing a new PROFIBUS slave subsystem that can be fully loaded into an FPGA. The solution consists of a VHDL-designed PROFIBUS controller and processor on which runs the entire protocol software.

With Softing's new PROFIBUS Slave architecture, device developers can take advantage of



a subsystem which is immediately executable, since the protocol software has already been ported to the processor. The integration task is limited to the realization of the device application, of which an example is included as source code.

Very compact solutions can be obtained when the application software is housed in the FPGA, for example on another loadable processor. But it is also possible to connect the PROFIBUS subsystem to an external microcontroller.

According to Christian Braeutigam, Product Manager Industrial Communication at Softing Industrial Automation, the flexibility of the FPGA technology allows optimum adaptation to the task at hand. “The device manufacturer can choose type and size of the FPGA in a way that it fits the PROFIBUS DP slave as well as his application-specific logic and, where appropriate, the application processor. Since the PROFIBUS controller is embodied as IP core, there is no dependence on a specific bus controller ASIC.”

The PROFIBUS slave subsystem supports DP V0 and DP V1 and is available for Altera FPGA Cyclone-Series III, IV, V and SoC. Manufacturers who need to support further communication protocols such as PROFINET, EtherNet/IP, EtherCAT, Powerlink or Modbus/TCP with their devices, particularly benefit from Softing’s FPGA approach, since the available communication subsystems all have the same application interface and thus can be easily replaced.

Softing

MRP Equipped PROFINET Devices from TR Electronic

TR Electronic, an industry leader in rotary and linear position feedback, is proud to announce the debut of its new Media Redundancy Protocol (MRP) equipped Linear and Rotary encoders. As the demand for robustness and reliability of control networks increases in the manufacturing and automation industries, so does the demand for technologies which can enable end users to meet this fast growing need.

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TR Electronic has combined the existing hardware reliability of its Optical, Magnetostrictive, and Laser positioning encoders, with the added MRP intelligent redundancy concept, to ensure position feedback is received at the controller. Media Redundancy Protocol integrates into a ring topology PROFINET network. Along with the assistance of external industrial switches and direct MRP integrated PROFINET devices such as those from TR Electronic, communication can now be maintained to the controller even with a communication line break or device malfunction.

An MRP Manager assumes the role of redundancy manager automatically. In the case of a communication line break, the redundancy manager reconfigures the ring network to maintain communication to the controller with a minimal reconfiguration time of 200ms. This type of redundancy configuration allows for significant reduction in downtime. Communication for the various tasks is maintained and production can continue with repairs not required immediately.

For safety related applications where Functional Safety is a high priority, TR Electronics’ Cxx75M SIL3 rated encoder equipped with PROFIsafe via PROFINET and the added MRP protocol yields way to a new, higher level redundancy, ensuring critical positioning feedback is maintained.

“Communication in safety related applications is critical. Anything which can be done to ensure communication up-time is an added benefit. MRP is an additional mechanism within the communication architecture which adds another layer of redundancy for the process.” – Tristan Pawluch, Applications & Training Supervisor, TR Electronic.

TR Electronic