PROFINET

The Industrie 4.0 Network

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Industrie 4.0 Initiatives around the world focusing on "the Future of Manufacturing"





Powerful networks





What is **PROFINET**?





PROFINET is the open Industrial Ethernet standard from PROFIBUS & PROFINET International (PI), Vendor neutral

PROFINET is based on Industrial Ethernet

PROFINET utilizes TCP/IP and IT-Standards

PROFINET is Real-Time Ethernet

PROFINET allows seamless integration of fieldbus systems

Traditional Automation Structure





Traditional Automation Structure





Installation Rules





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- 32 stations on one copper segment
- (RS 485), Repeater counts as device!
- Terminate each Segment (first and last node!)
- Notice Shielding on the connectors and when going in cabinet
- 10cm distance between cables higher 110V if not isolate with i.e. grounded metal plate, if not possible use FO!
- On high Baudrates, no Spurlines, no Cables shorter 1m
- Segment length depends on Baudrate!!

PROFINET – Flexible Architecture





PROFINET – Multi Protocol and Standardized Diagnostic

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PROFINET - More values for the customers with additional functionality

Features I-Device - PLC as Intelligent IO-Device PROFlenergy Redundancy - MRP – Media Redundancy Protocol 🚽 Topology view h Network viev 🗄 🔍 ± 100% -AWP – Advanced Web Programming **User-defined Web Pages** CPU317 Contro. CPU 317F-2 PN/. ethring-et200s ET200S Control IM151-8 PN/DP... PROFlenergy ethring-et200s... IM 151-3PN ethring-scalanc. SCALANCE XF20. Easy Expendability with new standards like OPC-UA





Increased Diagnostic – Reduce downtime, predictive maintenance

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Besides

Proven Fieldbus diagnostic, well known Diagnostic

... use of Standard-Ethernet-Diagnostic

- SNMP (Simple Network Management Protocol) integrated in the Devices
- Possibility to integrate into Network level on Plant Asset Management
- Free Diagnostic Tools like PRONETA, Smartphone Apps available

...on top we offer...

- Simple error localization with Topological View
- Web diagnostic running on the controller even with user defined WebPages!



PROFINET always requires a Device Name



Names instead of numbers

- Meaningful names for each station
- Device Name = IP Address set by engineering











TIA - Traditional





- 1. In case of other Ethernet based standards network separation applies.
- 2. Additional training and know how required (multiple networks).
- 3. Access to fieldbus devices always via controller (additional load and additional cost). Additional cost because of functionality at the controller level or even a hardware card for proxy function.
- 4. Controller Controller communication must be programmed, not very flexible.
- 5. Diagnostic must be programmed, not easy to integrate into a SCADA, HMI.
- 6. No wireless integration on IO Device and Engineering Level
- 7. No direct access to the Fieldbus Level.
- 8. No possibility to of a clear topological view.

Welcome to the Digitalization concepts





1. Web Access, flexible remote service, built in - no additional cost required

- 2. Safety integrated, Wireless. Now even Chinese national standard CB/T.
- 3. Firewall and Security in all levels of automation, engineering integrated in TIA-Portal.
- 4. Diagnostic and Asset Management integrated in the PROFINET standard, **free** diagnostic tools available.
- 5. Increased flexibility due to modular machine concepts and flexible network structures (star, ring, line)
- 6. Cloud Services.
- 7. High bandwidth allows to be a backbone for Big Data
- 8. Ready for Industrie 4.0 or IIOT
- 9. Fast Controller Controller communication without programming (1440 Bytes within 1ms) in realtime
- 10. Profiles to be open like PROFIsafe, PROFIenergy, PROFIdrive
- 11. OPC-UA also in the field, PROFINET is multiprotocol capable.

The communication systems of the classic automation pyramid doesn't reach the actuator and sensor level







The communication systems reaches only the IO-level and complex field devices

The simplest communications interface that takes you right down to the actuator/sensor level (field level)

IO-Link closes the communication gap in the automation system



... intelligent sensors and actuators are accessible to communication

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... bi-directional transfer of cyclic and acyclic data



IO-Link Association: Rapid growth of members in the last 2 years



More than 230 companies from the automation & communications industry

numatics.	AVENTICS B/		ANNEED	Passian for Sensors
BOSENBORS	BECKHOFF	Bihl + Wiedemann		BUXBAUM
codewerk		OMTROL" CO	NTRINEX	REATIVECHIPS"
ODATALOGIC	iaAl die	Entwickler	di-soric	DUOmetric
	elmos" en	mbeX	© E-T-A	FESTO
freescale	GEMLI Videa & More	Göhringer	C3 halstrup walcher	Manha
H M T		B CHaus	Hen electronic	Infineon
Q ² Development GmbH	KEB KE	YENCE	ARSYS 4	Leuze electronic
Iumberg sutomatio	Tedak at System	maxim integrated.	MP SA	MESOC Engineering
2 ⁴ microsonic		M& molex		OMROF
PATLITE.	PEPPERL+FUCHS	Decontact	RENESAS	Rexroth Besch Group
Rockwell Automation	SCHMALZ S	chneider		SENSIRION
SENSOPART	SICK SIEN	IENS OSM	C SONTE	SPANSION
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 IO-Link

- Positioned as an organization within the PNO (PROFIBUS user organization)
- Specialists come together (IO-Link company community)
- Competent manufacturers and technology providers from around the world
- Trade faires and conventions
- Independent of field bus
- IO-Link is a standard (IEC 61131-9)

Significant Growth of in installed IO-Link units





More than 7000 IO-Link products available

- Master modules for > 15 fieldbus systems
- Central masters
- Wide variety of sensors for > 35 sensor technologies
- actuator technologies

The <u>competence matrix</u> shows, which technologies, products and services each company provides for.



Want to integrate more? No Problem with PROFINET Gateways

MQTT

OPC UA Modbus TCP Modbus TCP **SIMATIC S7 PN/PN** Infrastructure/ **PROFIBUS** PROFIBUS **PN/MF*** controller Control building **BACnet** OPC UA level technology SIMATIC PROFINET PN/ **BACnet** Modbus TCP ET200SP MF LINK Ethernet-IP CAN/-open **Field level IE/Profibus Link** SIMATIC **PN/CAN LINK Modbus RTU SAE J1939** CAN/-open SIMATIC **M-Bus ET 200SP** PN/J1939 LINK SIMATIC CM CAN PN/M-Bus LINK Sensors, actuators **IO-Link** AS-i DALI Master Master **ET 200SP** CM 1xDALI *) MF: Multifunctionbus Coupler Legend: Link Modules Unrestricted © Siemens 2020

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R/H PROFINET Network configuration – Connectivity ET200 Stations





SIMATIC ET 200eco PN The next generation of rugged I/O in IP65/67



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Feature / Function

6 new ET 200eco PN modules:

- DI 8X24VDC
- DI 16X24VDC
- DQ 8X24VDC/0,5A
- DQ 8X24VDC/2A
- DIQ 16X24VDC/0,5A/2A
- CM 8x IO-Link + DI 4x24VDC

New features:

- S2-Redundancy
- Shared Device (Distribution of the outputs of a module to several controllers)
- MSI / MSO (Read access to inputs/outputs from up to 4 controllers)
- Clock sync. up to the channel
- High supply current up to 12A
- Single / Double assignment of channels via parameterization



Benefit

- Easier mounting & handling due to the possibility of mounting the modules directly on the machine outside the control cabinet
- Less planning effort due to standardization of the module width
- **Cost savings in warehousing** by combining the module portfolio
- Greater machine/plant
 transparency through MSI/MSO
 and detailed diagnostics
 - **More flexibility** through the parameterizable channel assignment of the ports
- **Higher machine availability** due to the possibility to operate the modules also in ring structures

SIMATIC ET 200SP for lighting control Simple integration of lighting controls into automation system





Feature / Function

Upgrade CM PtP for DMX 512 Use of the ET 200SP CM PtP as master module for lighting control with DMX 512 (Digital MultipleX 512)

 Typical applications: Stage and show lighting, large light shows, ...

CM 1 x DALI (Digital Addressable Lighting Interface) ET 200SP DALI Multi-Master module for connecting one DALI bus (per module) with up to 64 luminaires and 63 sensors

- Control of the connected devices via function blocks
- Integrated power supply up to 160 mA
- Typical applications: tunnels, hall lighting, shipbuilding, etc.

Benefit

Simple and cost-effective integration of lighting controls into automation:

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- Saves space in the control cabinet thanks to the small footprint of the ET 200SP
- Time savings in engineering due to simple parameterization and programming in the TIA Portal
- Saves space and costs for additional control units
- Scalability of the quantity structure due to the possibility of inserting several modules per station

SIMATIC ET 200SP





Feature / Function

CM 1 x CAN

ET 200SP module for integrating CAN/CANopen* nodes into the automation solution in confined spaces (e.g. for AGV-

systems, eCar charging stations, ...) *Implementation acc. to specification "CiA 301"

Benefit

- Compact and cost-effective solution for the connection of CAN / CANopen devices
- Time savings in engineering thanks to simple parameterization possibility in the TIA Portal
- Saves space in the control cabinet thanks to the small footprint of the ET 200SP

SIMATIC S7-1500 / ET 200MP – New products SIEMENS New products & features for better availability and minimum footprint Ingenuity for Life



Feature / Function

New modules with high channel density 64-channel digital modules:

- DI 64x24VDC BA (p-/m-reading)
- DQ 64x24VDC/0.3A BA
- DQ 64x24VDC/0.3A SNK BA (m-switching)
- DI 32x24VDC/DQ 32x24VDC/0.3A SNK BA

16-channel analog modules:

- AI 16xU BA
- AI 16xI BA

Active backplane bus / Hot Swapping By using the active backplane bus for the ET 200MP, hot swapping (module exchange at RUN of the PLC) is possible even with multiple modules. Up to **12** modules of S7-1500 / ET 200MP can be configured per station.

Benefit

- Optimized price-performance solution for price-sensitive applications
- Minimum footprint due to highest possible channel density
- Time saving for mounting through the tool-free assembly of shielding and use of TOP Connect

Highest machine / system

availability, since in the event of failure and replacement of one or more modules, the PLC and unaffected modules remain in operation.





SIMATIC ET 200 MultiFieldbus Interfaces for ET 200MP, ET 200SP, ET 200eco PN, Coupler



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Feature / Function

Products

- ET 200MP IM: IM155-5**MF** ST
- ET 200SP IM: IM156-6**MF** HF
- ET 200eco PN "Next generation"*
- **PN/MF** Coupler

Functions

- Support for PROFINET, EtherNET/IP and Modbus TCP
- Simultaneous communication with all protocols to modules of a station via the same cable
 (e.g. Standard I/O via EIP, F-IO via PROFIsafe, Energy Metering via MTCP)
- Engineering via MFCT (MultiFieldbus Configuration Tool)
- Support of Shared Device in MultiFieldbus configurations (Allocation of a station to several controllers)



Benefit

- Savings in costs and planning effort when designing machines/plants, since the same IO configuration can be used independently of the overarching controller
- High flexibility due to the possibility of access to the ET 200 station / modules from several controllers via shared device

PN/MF Coupler:

- Easy to configure deterministic
 data exchange, even across
 network boundaries, between
 SIMATIC and 3rd party controllers
- Simple integration of SIMATIC controls into existing machines / plants

Engineering – TIA Portal as central Engineering Tool





Additional SIMATIC tools – Overview of existing tools for automation tasks

PRONETA Free Download



Configuration of the PROFINET devices

- Adjust IP address and device name
- manual / automatic / mass operations

Offline / Online Comparison

- Reference from STEP7 project or PRONETA snapshot
- Incl. check of the ET 200 module configuration

Show details of all modules

Read and compare module configuration

IO test

- Automatically logging of IO signal changes
- Display device-specific diagnostics
- Create and export IO Check protocol

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SINETPLAN Download Trial



Simulation of the network load depending on topology and network nodes

- Report function with detailed results
- Validation of the PROFINET planning guideline
- Online scan function

Seemsless integration via API and Standards

- Import of the configuration with AutomationML
- Import of STEP7 & TIA Portal projects

Port-by-port simulation



PROFINET is 100% Ethernet PROFINET is the Industrie 4.0 Backbone



PROFINET is Ethernet

- PROFINET is the open Industrial Ethernet standard from PROFIBUS & PROFINET International (PI), Vendor neutral
- PROFINET is based on Industrial Ethernet and utilizes TCP/IP and IT-Standards even redundant (MRP), secure and Wireless real-time integration
- PROFINET is Real-Time Ethernet with cycle times as fast as 31.25µs
- PROFINET allows seamless integration of fieldbus systems, Investment protection
- PROFINET The Industrie 4.0 Network
 - OPC UA
 - Big Data
 - Plant Transparency with integrated Diagnostic and Energy Profile



One Standard for all application

Safety Application, even Wireless \rightarrow The answer PROFIsafe

Energy management for Plant Transparency → The answer PROFlenergy

Drive Applications \rightarrow The answer PROFIdrive



PROFINET completely for all Applications - Factory and Process Automation, Drives and Safety

Thanks for listening

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