



Digitalization
Industrie 4.0
Smart Production
E-Mobility
Smart Energy
Energy Efficiency
Smart Infrastructure
Smart Buildings
Renewables

Ing. Antonio Gordillo / MKT PHOENIX CONTACT / 12 AGO 2021

Welcome

Presentación Profibus PA



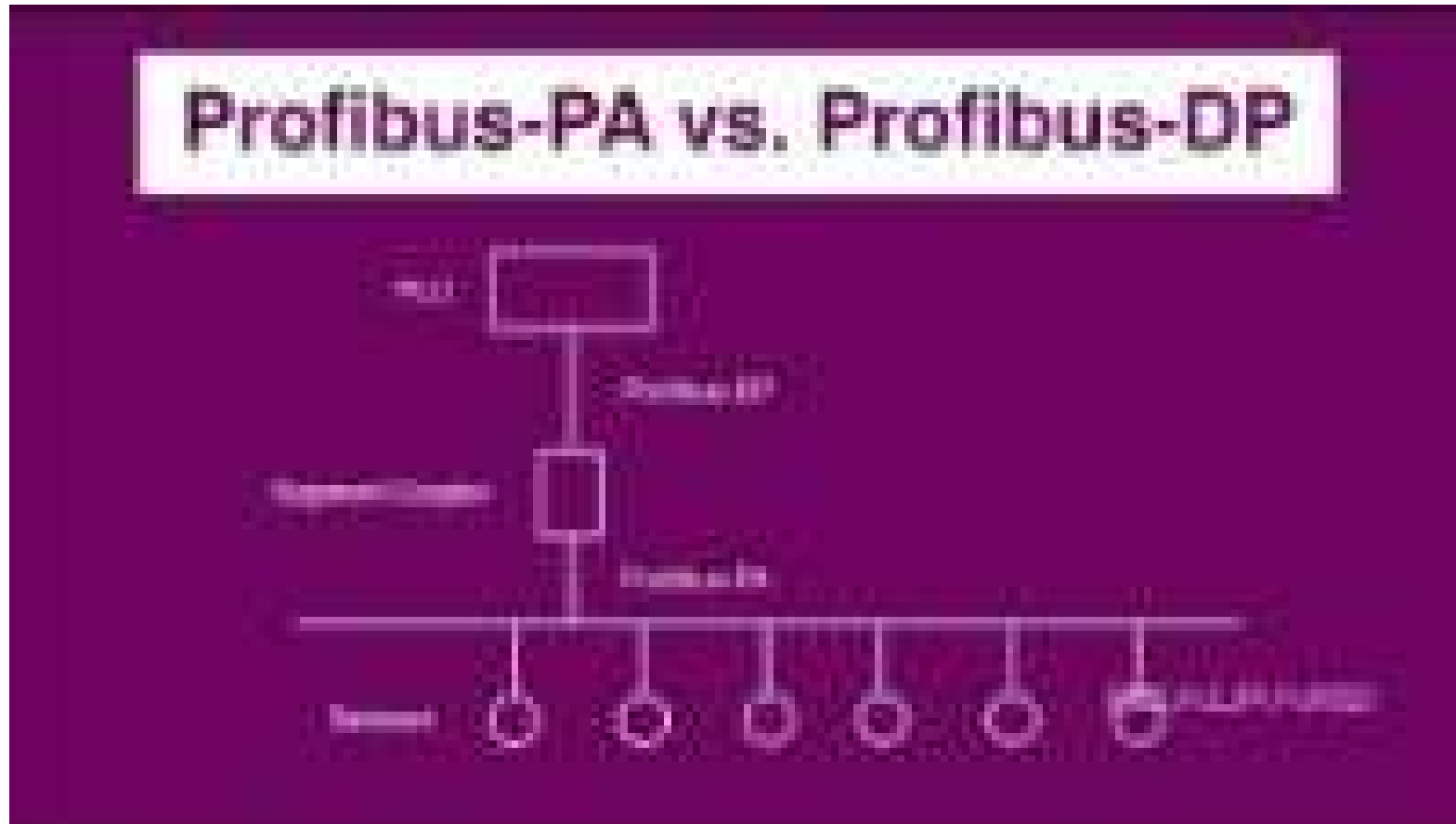
What is PROFIBUS-PA ?

Agenda

- Background on PROFIBUS-PA
 - PROFIBUS-PA Field Devices – manufacturers
 - Process Automation Infrastructure
Product Portfolio and Applications
 - Axioline P - the PROFINET / PROFIBUS-PA Proxy
 - The Future of PROFIBUS-PA in Process
-



¿Qué es Profibus PA y en qué se diferencia de Profibus DP



What is PROFIBUS-PA ?

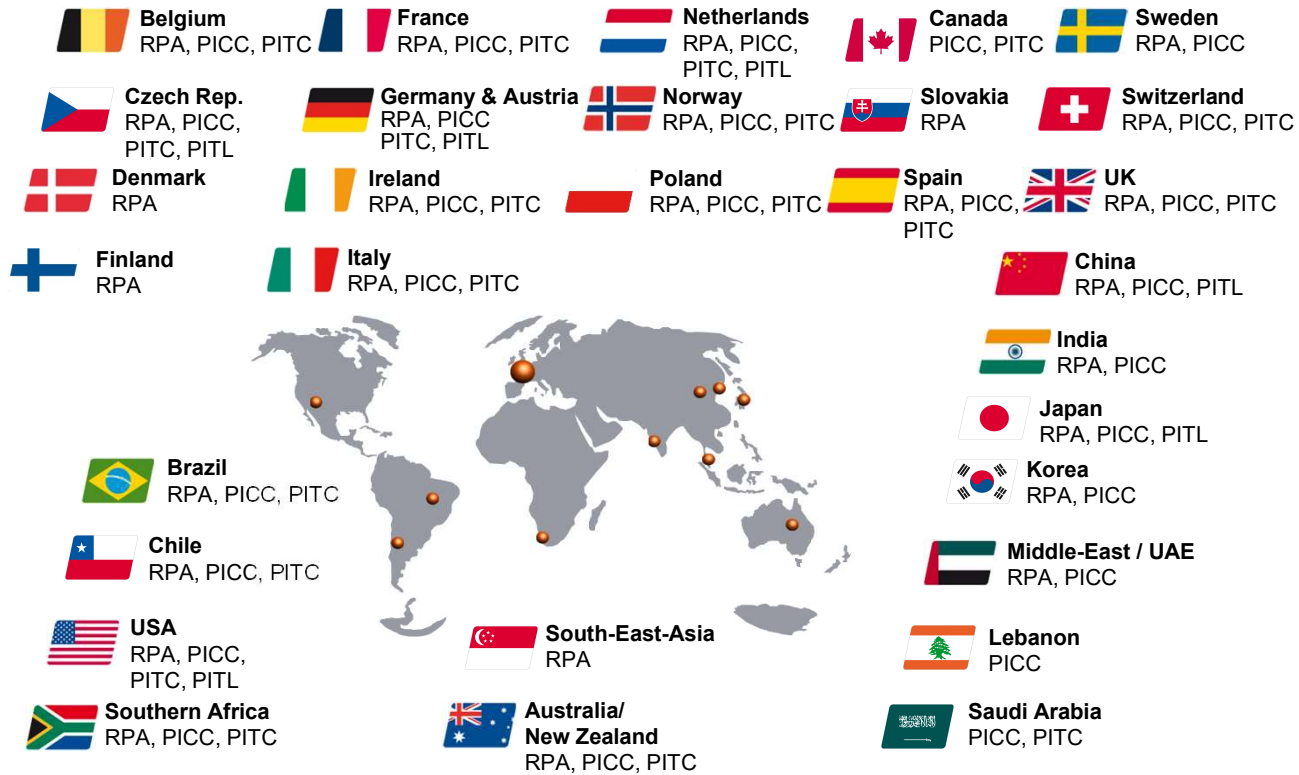
PROFIBUS-PA



- PROFIBUS-PA (**PRO**fessional **Field BUS** for **P**rocess **A**utomation) is a 25 year old technology that connected digital Fieldbus devices to DCS and PLC systems.
- There are over 750,000 PA devices sold annually globally, and over 12,000,000 million PA devices have been sold since its inception. The member companies belong to **PI** (**P**rofinet **P**rofibus **I**nternational) and represent leading companies in the field of Process Automation.
- PI host numerous activities across the globe, and Phoenix Contact is active many of those events too.
- In 2004, Phoenix Contact announced **PROFINET** as its Ethernet backbone for **INTERBUS**. We are a significant supplier of PROFINET components and systems in Factory and Process Automation .
- The physical layer infrastructure products can be used in both **PROFIBUS-PA** and **FOUNDATION Fieldbus** systems since they share the same physical layer of **31.25 kHz** signal.
- We have products specific to **PROFIBUS-PA** since a positive trend of PA has emerged for 20+ years now.



PI Worldwide Support



PI worldwide:

27 Regional PI Associations (RPA)

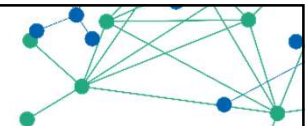
PI Technical Support:

51 PI Competence Centers (PICC)

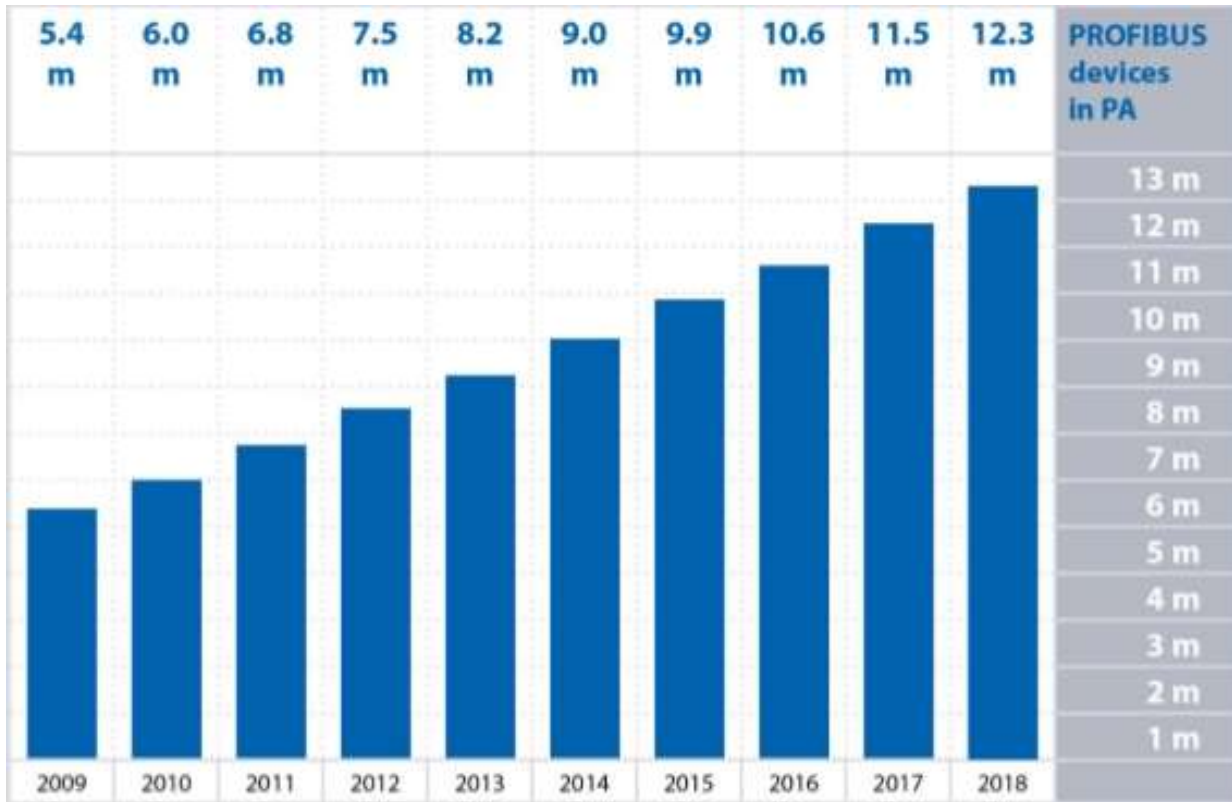
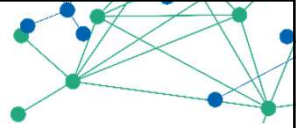
28 PI Training Centers (PITC)

10 PI Test Laboratories (PITL)





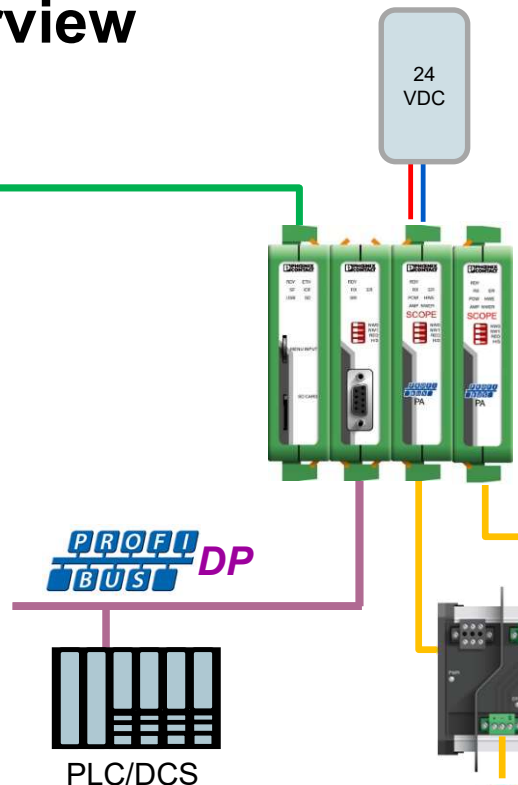
PROFIBUS-PA nodes sold worldwide



PROFIBUS System Overview



Engineering Station
 - Maintenance
 - Monitoring



Process Control
 - Program
 - Control



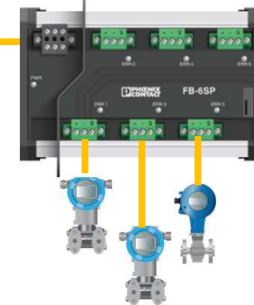
PLC/DCS

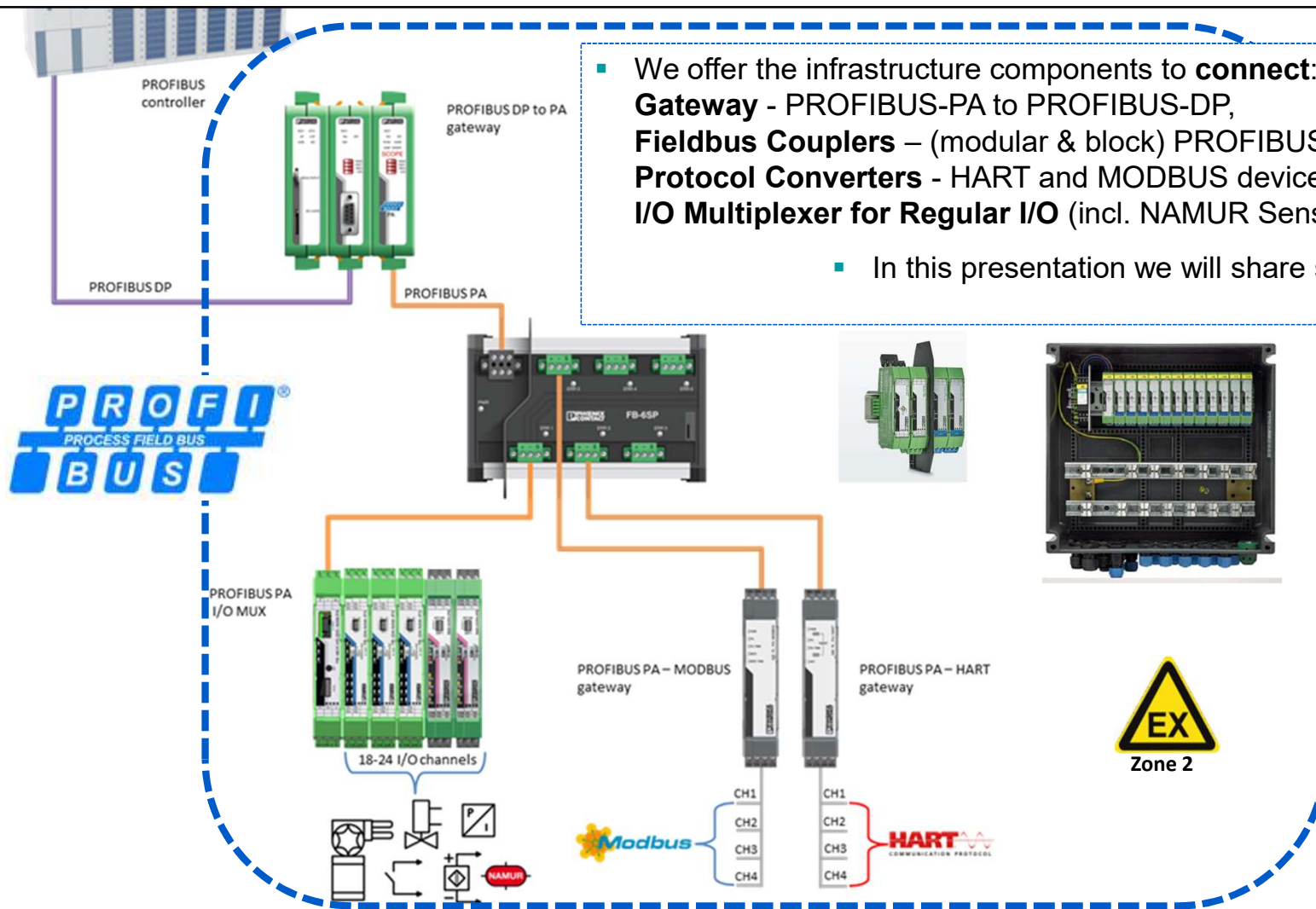
- 9.6 kbps .. 12 Mbps on the **PROFIBUS DP** side
- 31.25 kHz on the **PROFIBUS-PA** Side
- Integrated PA termination on Gateway & Selectable on Field Device Coupler
- 500 mA PA current
- Customizable PA voltage
- Max. 9 PA segments (+1 DP module for PLC/DCS)

PROFIBUS PA

10 .. 27 V (500 mA) per segment

Up to 32 PA devices





PROFI
PROCESS FIELD BUS
BUS

- We offer the infrastructure components to **connect:**
Gateway - PROFIBUS-PA to PROFIBUS-DP,
Fieldbus Couplers – (modular & block) PROFIBUS-PA in Zone 2 or Zone 1,
Protocol Converters - HART and MODBUS devices to PROFIBUS-PA, and
I/O Multiplexer for Regular I/O (incl. NAMUR Sensors) to PROFIBUS-PA.
- In this presentation we will share some application successes from around the world.



PROFIBUS-PA Portfolio

Protocol Converter



A **Protocol converter** is a device used to convert the protocol of one device to the protocol suitable for the other device or tools to achieve the interoperability. This is sometimes referred to as a gateway, although a gateway typically has higher functionality.



[Product overview](#)

Protocol Converter - MODBUS – DP/PA/FF



Converts Modbus RTU variables to modern digital Fieldbus signals

Set up and Parameterization via DD, EDD, GSD, & DTM from the Host/Asset Management System



Connect up to 4 legacy Modbus RTU devices to a fieldbus (maximum of 16 total registers per converter)



2-wire RS485 interface (1200...115.2kbps)



MODBUS RTU to Profibus DP, Profibus PA or Fieldbus Foundation converter



Product overview



Protocol Converter HART – DP/PA/FF

Converts HART instrument data to modern digital Fieldbus signals

Set up and Parameterization via DD, EDD, GSD, & DTM from the Host/Asset Management System



Connects up to 4 HART instruments to a Fieldbus (4 process variables maximum per converter)



2-wire HART loop signal connections using terminal blocks

Digital HART data to Profibus DP, Profibus PA or Fieldbus Foundation converter



Product overview

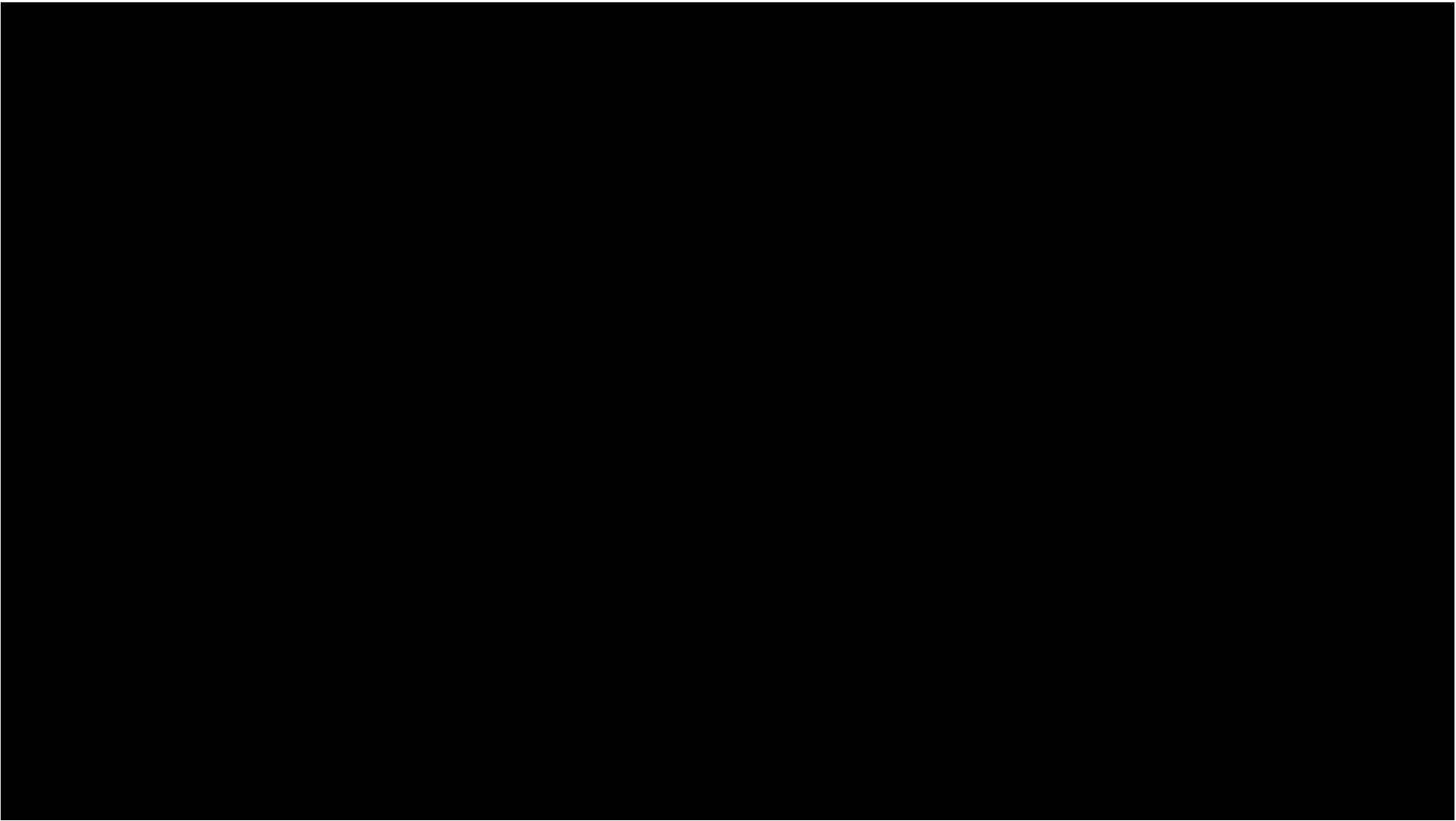


Protocol Converter



	GW PL FF/MODBUS	GW PL PA/MODBUS	GW PL DP/MODBUS	GW PL FF/HART	GW PL PA/HART	GW PL DP/HART
Description	Modbus/RTU to FOUNDATION Fieldbus protocol converter	Protocol converter capable of connecting four Modbus/RTU devices to a PROFIBUS PA network	Modbus/RTU to PROFIBUS DP protocol converter	Protocol converter capable of connecting four HART (4-20 mA) devices to a Foundation Fieldbus network	Protocol converter capable of connecting four HART (4-20 mA) devices to a PROFIBUS PA network	Protocol converter capable of connecting four HART (4-20 mA) devices to a PROFIBUS DP network
Interface 1	Foundation Fieldbus	Profibus PA	Profibus DP	Foundation Fieldbus	Profibus PA	Profibus DP
Interface 1 connector	Combicon	Combicon	D-SUB 9, Combicon	Combicon	Combicon	D-SUB 9, Combicon
Interface 2	HART FSK	HART FSK	Modbus RTU	HART FSK	HART FSK	HART FSK
Interface 2 connector	Combicon	Combicon	Combicon	Combicon	Combicon	Combicon
Order number	2316363	2316364	2316365	2316360	2316361	2316362



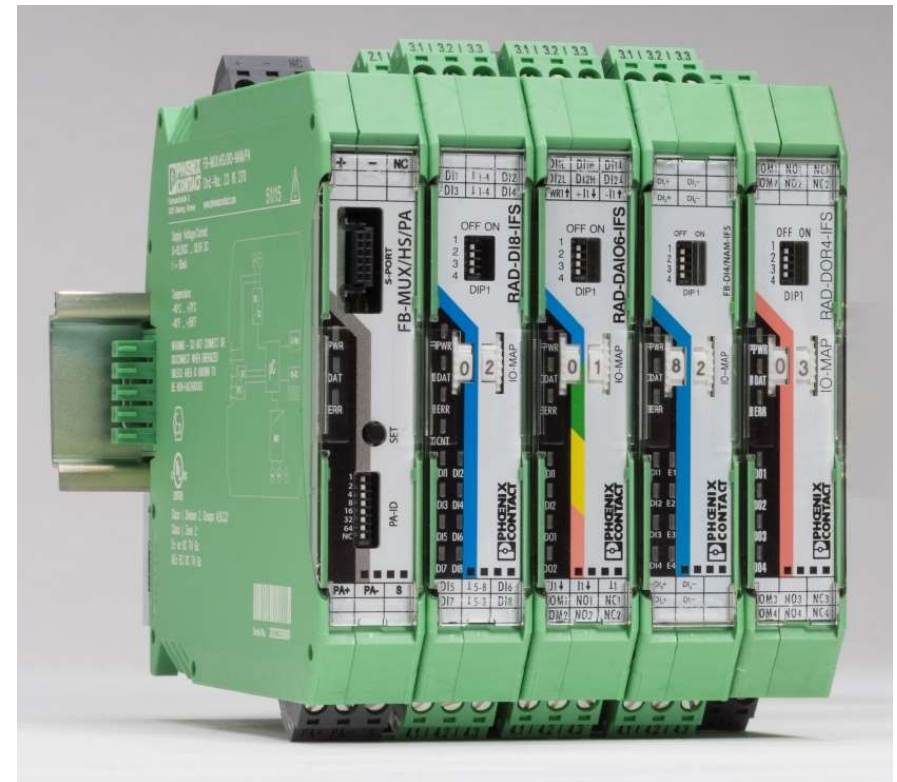


Fieldbus I/O

PROFIBUS-PA I/O Multiplexer

5 PROFIBUS-PA Profiles exist with specifically defined head stations:

- 2316270 FB-MUX/HS/DIO-NAM/PA
- 1005331 FB-MUX/HS/AI/PA
- 1005330 FB-MUX/HS/AIOTEMP/PA
- 1005329 FB-MUX/HS/DAIO/PA
- 1005332 FB-MUX/HS/DI24/PA



Fieldbus I/O

PROFIBUS-PA Multiplexer I/O Modules

- **2316275 RAD-NAM4-IFS** **4 NAMUR Digital inputs**
- 2901535 RAD-DI4-IFS 4 Digital inputs
- 2901539 RAD-DI8-IFS 8 Digital inputs
- 2904035 RAD-PT100-4-IFS 4 PT100 inputs
- 2901533 RAD-DAIO6-IFS 1 I/O 2 Digital I/O
- 2901536 RAD-DOR4-IFS 4 Digital relay outputs
- 2901537 RAD-AI4-IFS 4 Analog inputs
- 2901538 RAD-AO4-IFS 4 Analog outputs



Application

Coal and Thermal Power

Customer Profile

- A company is a state owned enterprise that is one of Asia largest thermal power generating conglomerate. The corporation has a total installed capacity of 53,561MW.

Application

- MAC won the bid as Main Automation Contractor (MAC) for the expansion project
- Phoenix Contact partnered with MAC to promote the adoption of digital fieldbus technology to EU
- The expansion project is EU first venture implementing **Profibus** technology and **Redundancy**
- Phoenix Contact worked together as a global team to demonstrate automation expertise in the power industry

Solution

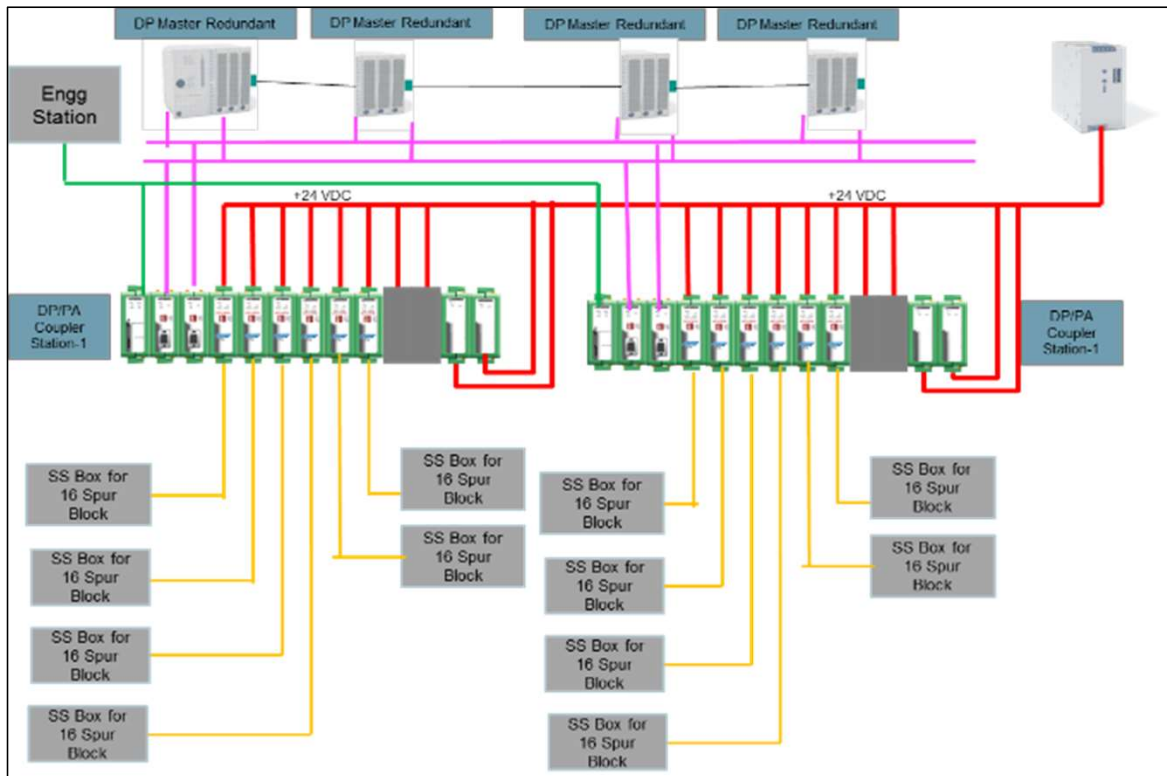
- | | |
|-------------------------------------|----------------------------|
| ▪ PROFIBUS DP/ PA Gateways | 20 systems with Redundancy |
| ▪ FB-PA/SCOPE | 5 per system |
| ▪ FB-DP-REPEATER | one extra on each system |
| ▪ FB-HSP-PLUG 6A Power Supply | redundant power |
| ▪ FB-12SP & FB-6SP | 90 modules total |
| ▪ Clip Safe Enclosures and Trabtech | |



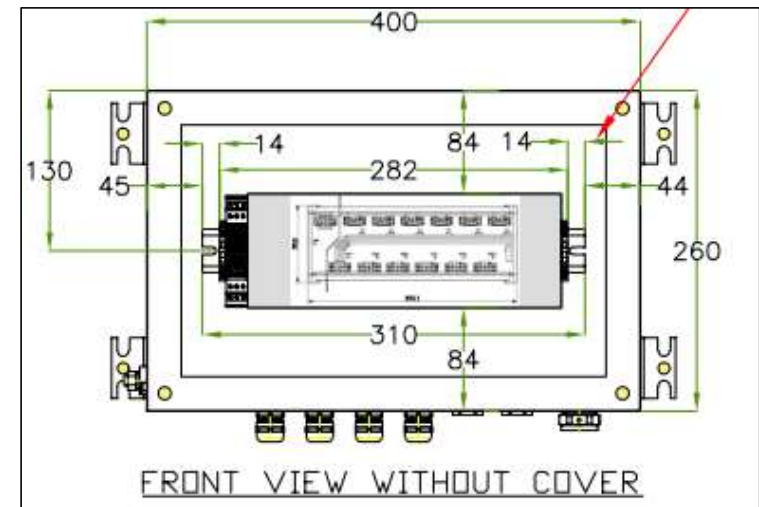
Product



Coal and Thermal Power – NTPC (2)



Profibus Network Topology for ABB 800M System at NTPC



Phoenix India Clip Safe Junction Solution Box with FB-12SP Device Coupler

Application

Water Project

Customer Profile

- A municipality in a Country building a state of the art water treatment facility to reclaim water and treat it according to the new regulations imposed by the state.

Application

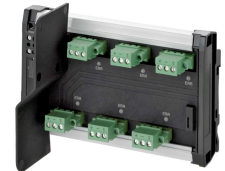
- State has recently imposed stricter regulations on treating water that is reintroduced into water ways
- Multiple Engineering companies across the country have contributed to the design of the \$1.6 billion facility with planned completion in 2023
- Control platform is Rockwell Control Logix PACs

Solution

- PROFIBUS DP/ PA Gateways
FB-PA/SCOPE with
FB-DP-REPEATER/SCOPE over 40 systems
with PA &
DP Connectivity
- FB-6SP Block Couplers over 125
- FB1-S1-6SP-T-0-10-00-0-0 over 80 boxes
- Ethernet Infrastructure



Product





Application

Power Plant

Customer Profile

- Country has been working with his Government to supply automation solutions for power plants

Application

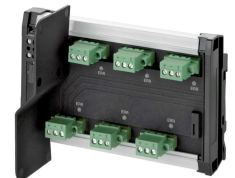
- Phoenix Contact approached MAC Electric to offer the Profibus Complete portfolio
- Phoenix Contact launched the Profibus DP to PA Gateway in 2015 together with a complete Profibus-PA automation solutions
- Business opportunity currently continues YTD with several project wins over the past four years

Solution

- FB-HSB-DP/PA Gateways over 350 systems
- FB-DP-REPEATER over 175 pieces
- FB-PA/SCOPE over 250 pieces
- FB-6SP Block Coupler over 850 pieces



Product



Application

SO₂ SO₃ Plant

Customer Profile

- A Chemical Company.... Good relationship with Phoenix Contact
- Phoenix Contact developed PA products based on their needs

Application

- Phoenix Contact provided the **Modular Coupler** as a box-build solution from PxC Combinations
- Phoenix Contact sold the **PA I/O Multiplexer** into this plant to allow all I/O to be sent via a PROFIBUS-PA cable
- Business is repeated as plant with high Sulphur content damages field devices and electronics

Solution

- Box Builds of Modular Couplers repeat business
- Box Build of PA I/O Multiplexer repeat business



Product



Application

Coke Plant

Customer Profile

- A European company

Application

- Phoenix Contact was asked to provide a solution to allow the Coking plant to extend its lifetime by 20 years
- A **PROFIBUS-PA Redundancy Scheme** was needed to increase the availability and functionality of the installation
- A technical support to solve all requirements of customers, and using the diagnostic features of the DP/PA coupler was able to show added value to the application

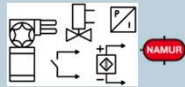
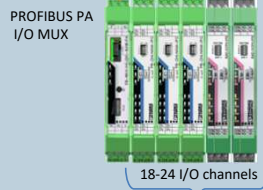
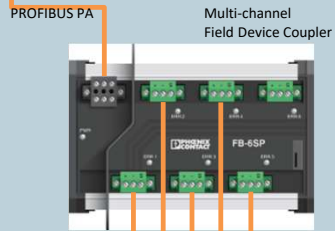
Solution

- PROFIBUS DP/PA Gateway with Redundancy
- Ongoing upgrades to all parts of the plant as the older systems is migrated to our new solution



Product



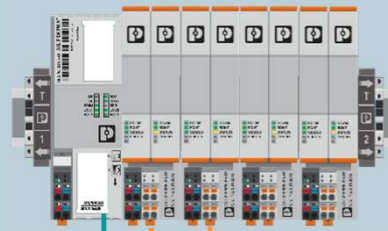


At present, the current PROFIBUS-PA installation goes through a PROFIBUS-DP Gateway



PROFINET controller

PROFINET



PROFINET to PROFIBUS PA Proxy

PROFIBUS PA

Multi-channel Field Device Coupler

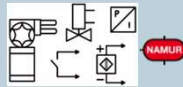


PROFIBUS PA Devices

PROFIBUS PA I/O MUX



18-24 I/O channels



NAMUR

PROFIBUS PA/ MODBUS gateway



PROFIBUS PA/ HART gateway



Zone 1



Zone 0

The future will connect the current PROFIBUS-PA installation directly to via a PROFINET Proxy



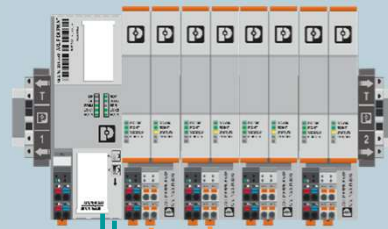
Zone 2





PROFINET controller

PROFINET



PROFINET to PROFIBUS PA Coupler

PROFIBUS PA

Multi-channel Field Device Coupler



PROFIBUS PA Devices

PROFIBUS PA I/O MUX



18-24 I/O channels



NAMUR

PROFIBUS PA/ MODBUS gateway



PROFIBUS PA/ HART gateway



Zone 1



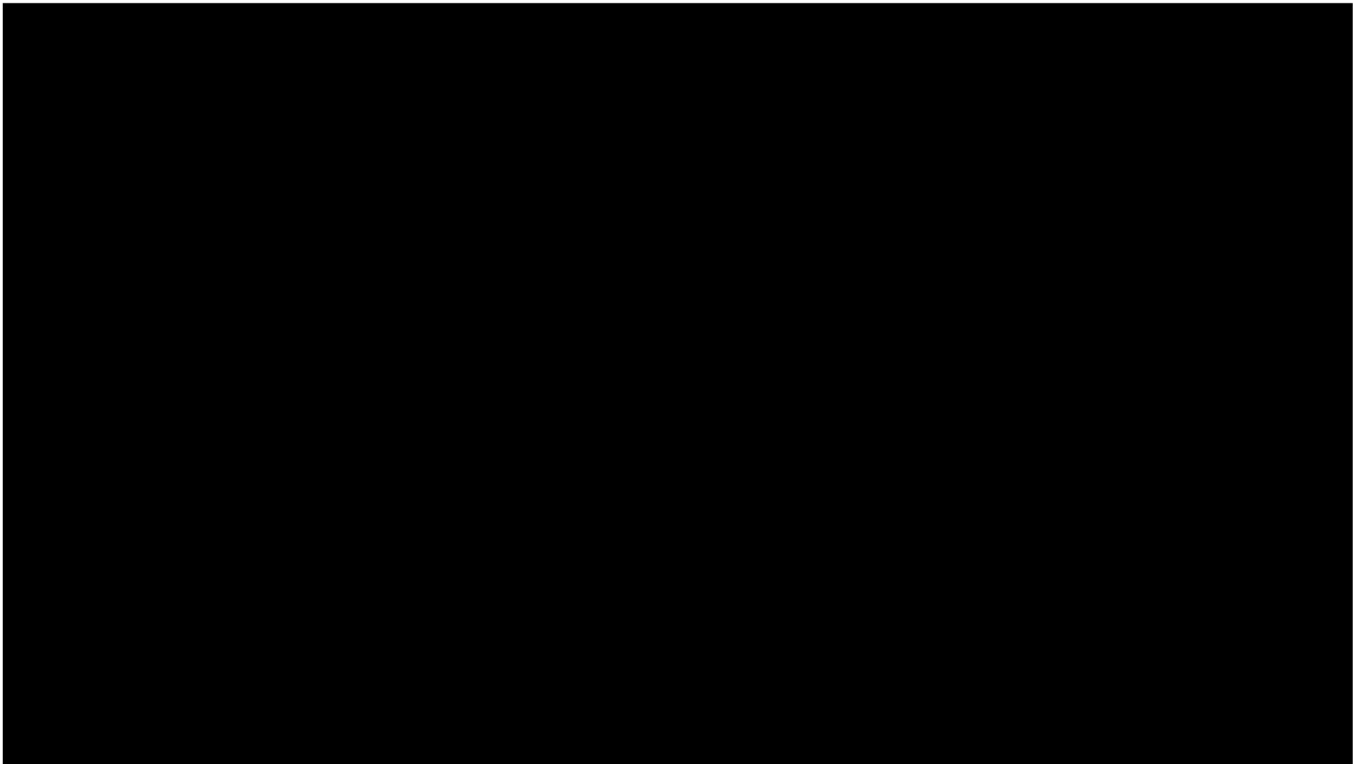
Zone 0

The future will also include redundancy: S2 Redundancy from the PROFINET Proxy



Zone 2





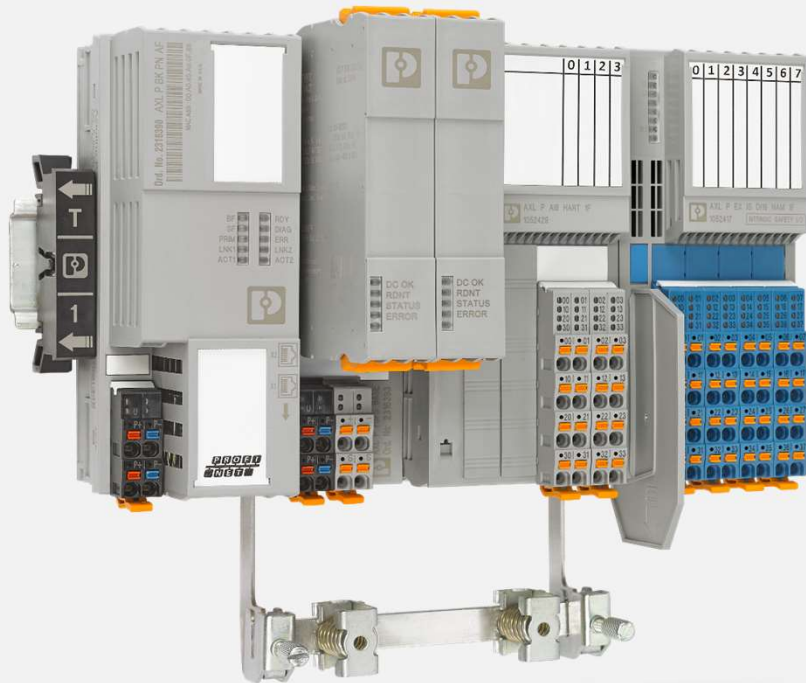
Axioline P

Redundancy S2

PA / Proxy

to PROFINET

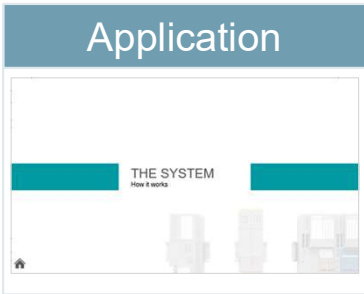
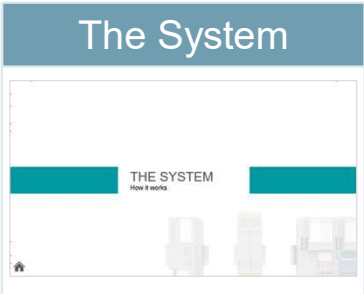





Axioline P

THE HIGH-AVAILABILITY
I/O SYSTEM

Axioline P



i Click on a single title to skip to that topic. Click  to return.

Axioline P

Dependable Process I/O

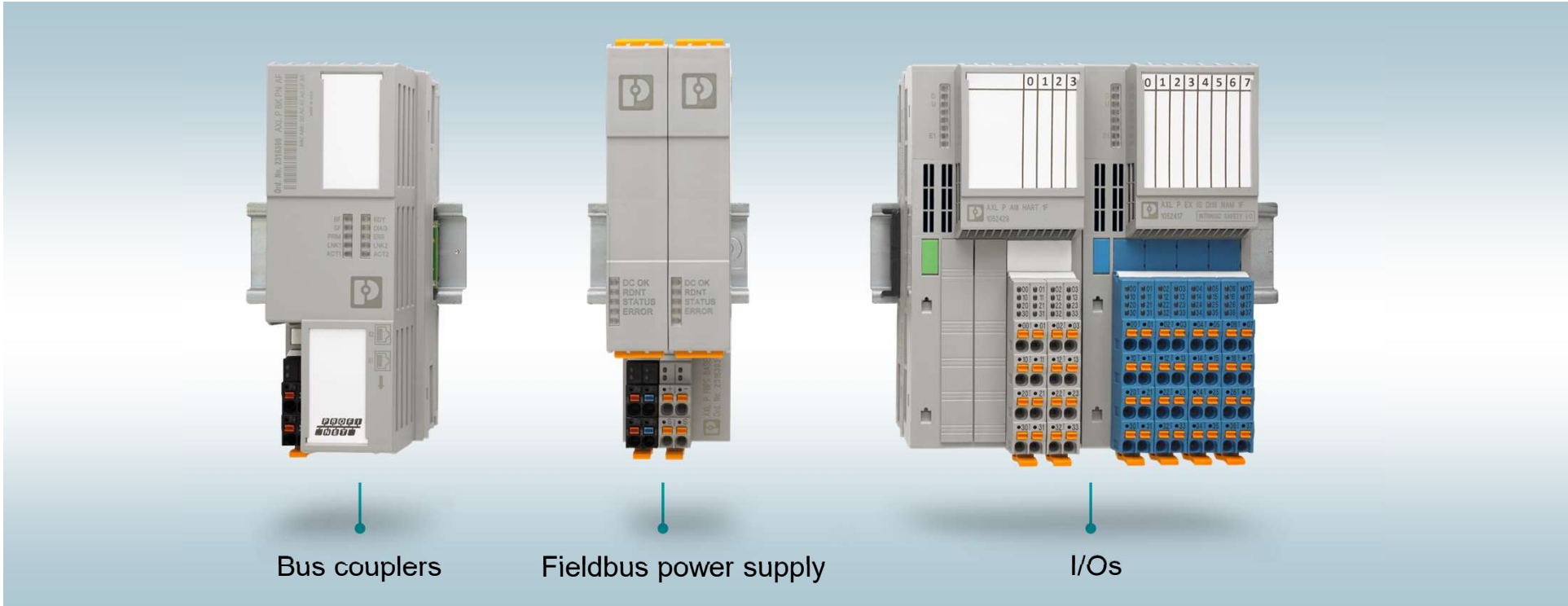


Modular I/O platform for hardened process applications where up-time is critical with signal connectivity in both Ex and non-Ex areas.

This presentation informs you about our high-availability I/O system **AXIOLINE P**.

Axioline P

The high-availability I/O system



Axioline P

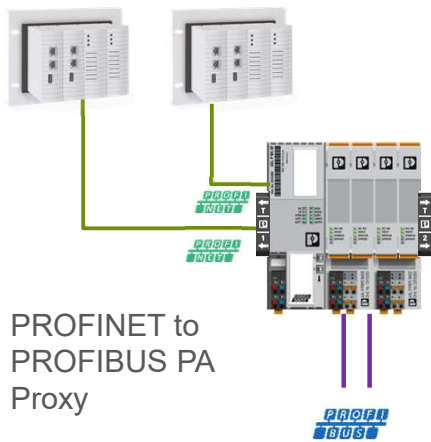
Basics

SYSTEM SPECS AT A GLANCE

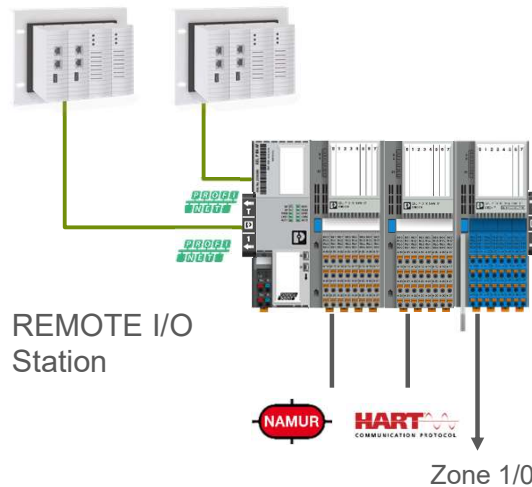
TYPE	Modular remote I/O-system, IP20
SYSTEM COMPONENTS	Bus coupler, Fieldbus power supply, I/Os
SUPPORTED PROTOCOLS	PROFINET
SUPPORTS REDUNDANCY	Yes
TYPE LOCAL BUS	Ethernet-based, Hot-Swap capable, Powered Local Bus
SUB-LEVEL COMMUNICATION	PROFIBUS-PA, HART, NAMUR
AMBIENT TEMPERATURE	-40°C up to + 70°C
INSTALLABLE EX-ZONE	Zone 2
APPROVALS	ATEX, IECEx and UL EX approvals for Zone 2 installation

Axioline P

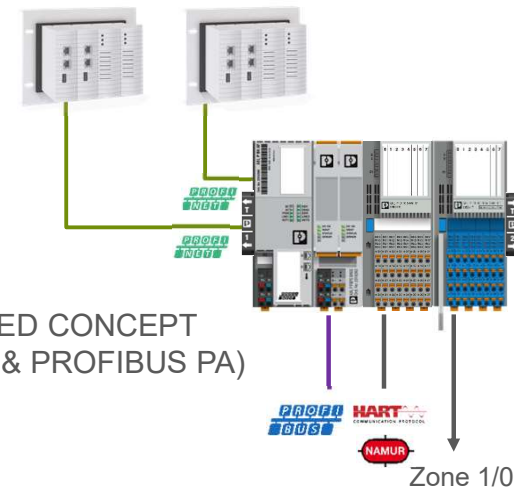
Use Cases



PROFINET to
PROFIBUS PA
Proxy



REMOTE I/O
Station



MIXED CONCEPT
(I/O & PROFIBUS PA)

“ Axioline P can be connected directly to a distributed control system (DCS) in the form of a remote I/O system. PROFINET S2 system redundancy is supported, which ensures very reliable communication between the I/O station and DCS. ”

PORTFOLIO

Product details



Axioline P

Product details



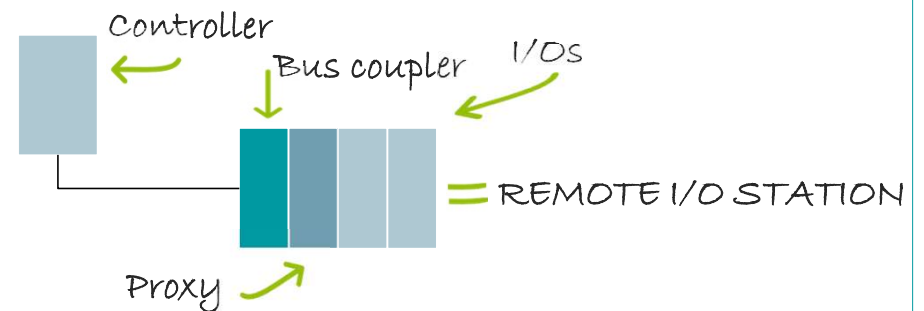


Bus coupler

Connect to a controller

“Use the Axioline P bus couplers to connect an Axioline P station to a DCS or a PLC. Choose between connecting only I/Os or I/Os in combination with a PA proxy functionality.”

Bus coupler for a remote I/O solution



Bus couplers

Portfolio overview



ADVANCED FUNCTION

FOR ONLY I/Os

AXL P BK PN AF

AXL P BK PN

PROFINET

PROFINET

SUPPORTS PROXY & I/Os

SUPPORTS ONLY I/Os

Bus couplers

Features – bus couplers for PROFINET

COMMON FEATURES

- Two Ethernet ports with integrated switch
- PROFINET RT
- MRP (Media Redundancy Protocol)
- SRL (System Redundancy Layer) S2, (ready for R1 and R2)
- DTM (Device Type Manager)
- Hot swappable and hot extendable
- Wide temperature range (-40°C to +70°C)



Bus couplers

Features – bus couplers for PROFINET

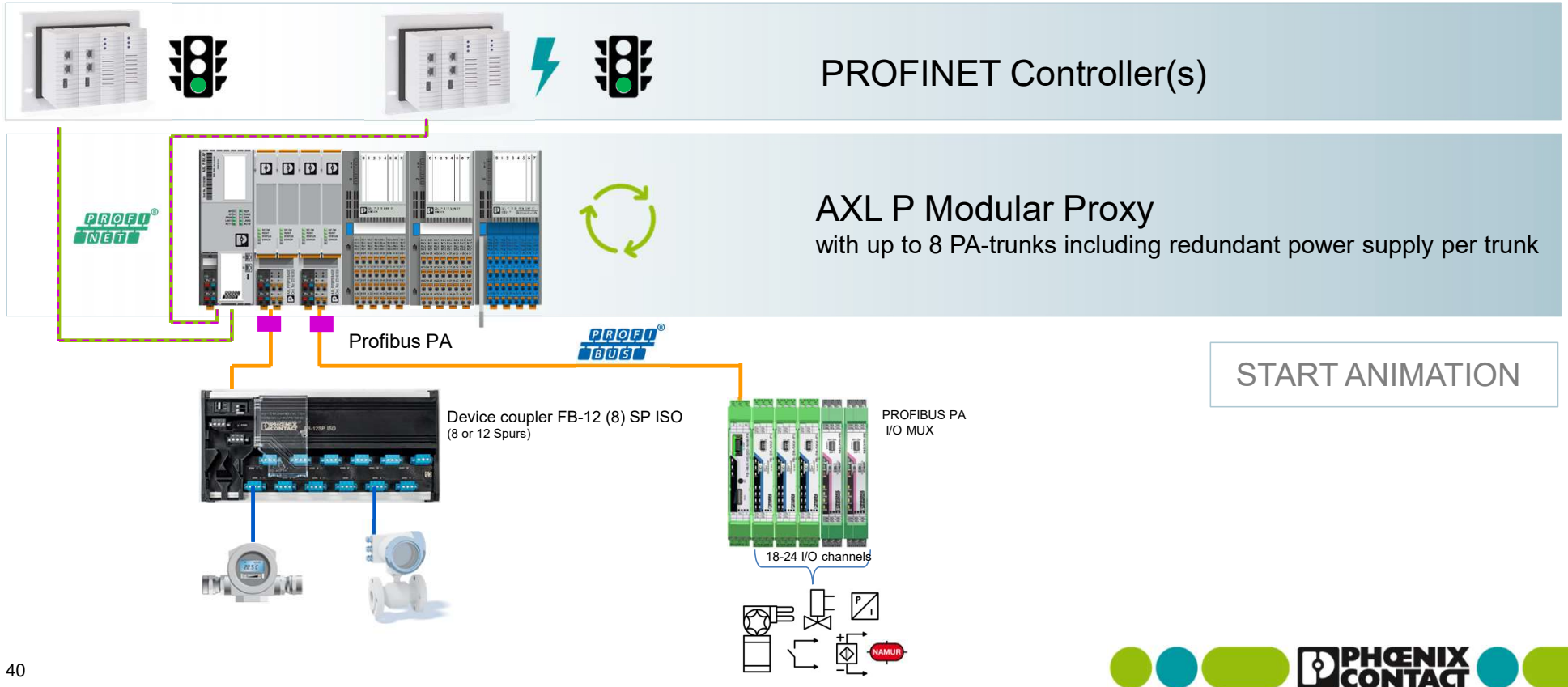
ADVANCED FUNCTIONALITY OF AXL P BK PN AF

- Connects up to 8 modular and redundant PROFIBUS PA segments
- GSDML composer tool and FDI (Field Device Integration)



Bus couplers

S2 - Redundancy



Modular proxy

Portfolio overview – Fieldbus power supply



POWER DISTRIBUTOR

AXL P FBPS BASE

Axiline P local bus

For two power supply plugs

POWER SUPPLY PLUG

AXL P FBPS 28DC/0.5A

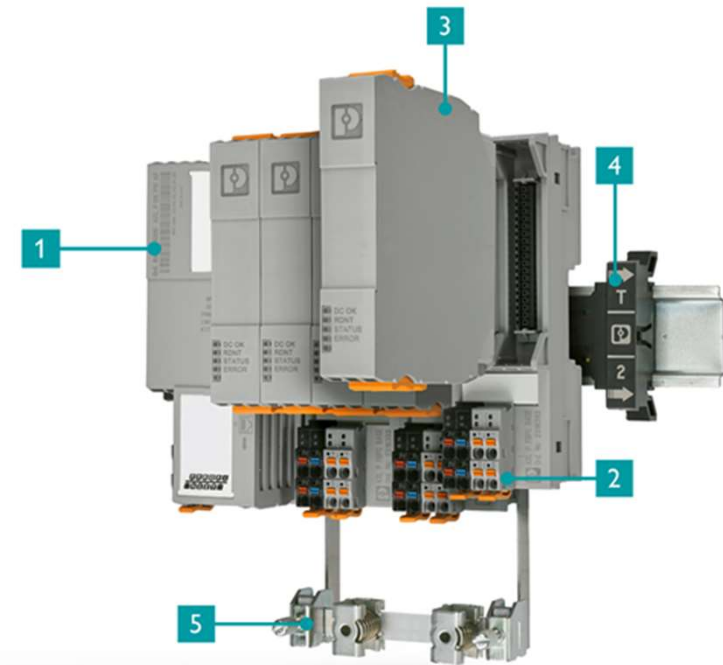
PROFIBUS PA

Provides 500 mA @ 28 V DC

Modular proxy

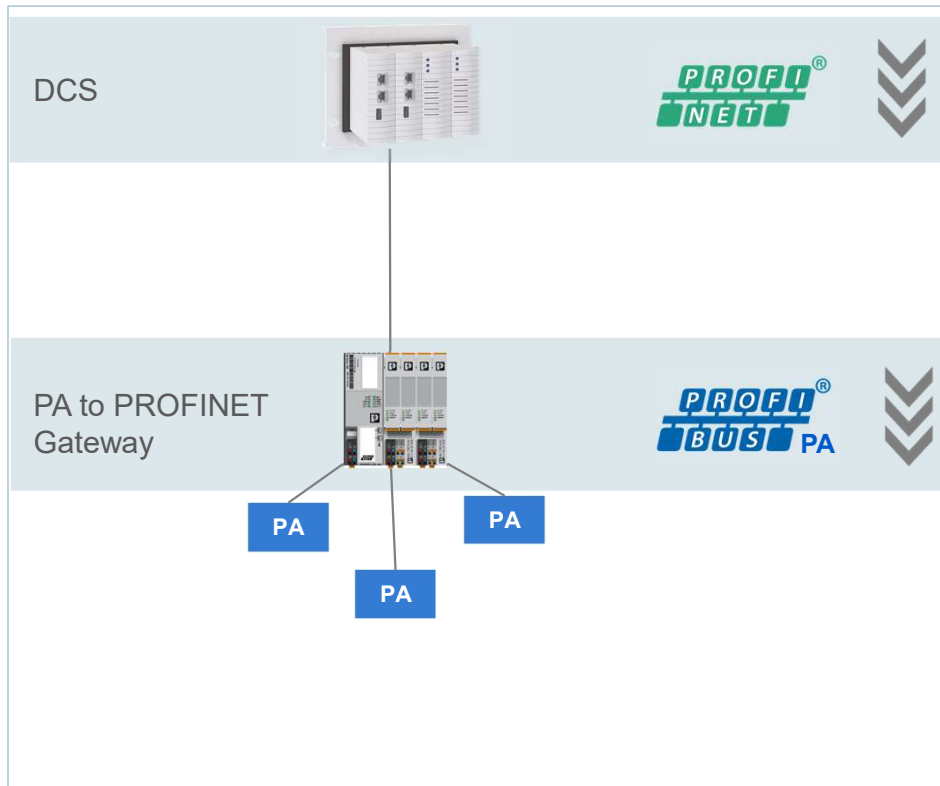
Components of the proxy solution

- 1** Redundancy in PROFINET bus coupler
 - ✓ High system availability, thanks to support of PROFINET system redundancy S2. And in the future R1 and R2
- 2** Base for fieldbus power supply plugs
 - ✓ Fast connection of PROFIBUS PA segments, thanks to Push-in connection technology
- 3** Fieldbus power supply plugs
 - ✓ Redundant fieldbus power supply plugs for supplying PROFIBUS PA segments guarantee highest reliability
- 4** Mechanical design
 - ✓ Increased system availability, thanks to the particularly robust mechanical design as well as shock and vibration resistance
- 5** Axioline shield set
 - ✓ Corresponding shield set for the easy connection of shielded cables



Modular proxy

Interfacing to PROFIBUS PA



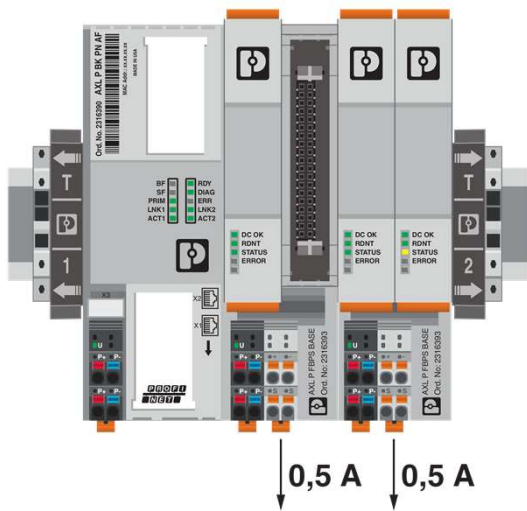
OUR SOLUTION

Use of the Axioline P modular proxy as a gateway from PROFIBUS PA to PROFINET

- ✓ Direct connection of PROFIBUS PA segments to Ethernet saves time and additional interfaces
- ✓ Efficient modernization of systems and the combination of proven fieldbus technology with today's and tomorrow's digitalization

Modular proxy

Power supply redundancy



You can supply a PROFIBUS PA segment with power using a single fieldbus power supply module.

High failsafe performance and process reliability can be achieved by installing two power supply modules in a single base and thus supplying a PROFIBUS PA segment redundantly. The local LED indicator on the power supply module provides the status of the module and redundancy.

confidential



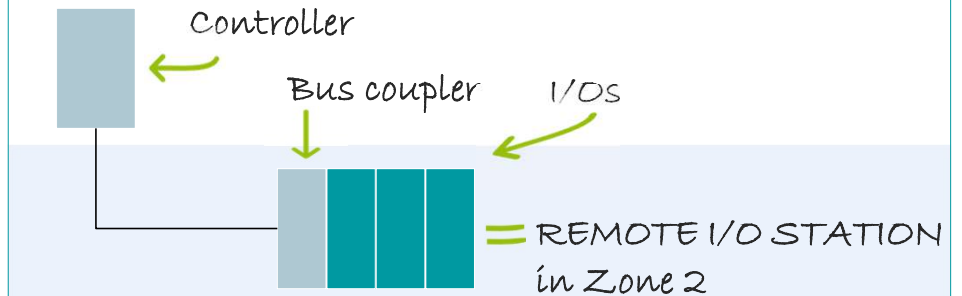


I/Os

Grey or Blue

“Build up an I/O station by adding the required I/Os next to the bus coupler. Choose between intrinsically safe and non-intrinsically safe I/Os fitting to your application.”

Remote I/Os for Zone 2 installation



I/Os

Portfolio overview – I/Os



STANDARD I/O

INTRINSICALLY SAFE I/O

Digital inputs NAMUR

Digital inputs NAMUR

Digital inputs 24 V DC

Digital outputs

Analog HART inputs
Analog HART outputs

Analog HART inputs
Analog HART outputs

I/Os

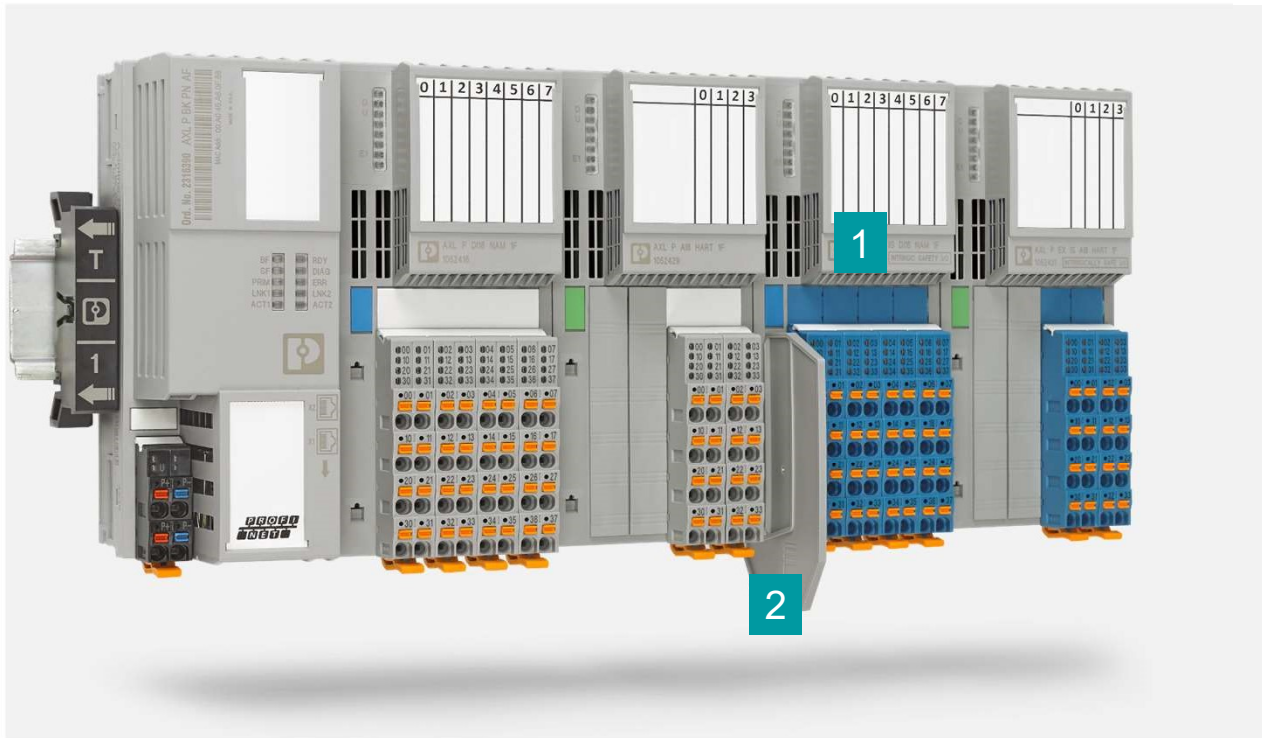
I/O details



Additional modules can be added or removed without interrupting power to installed modules

I/Os

Easy expansion of Ex-i modules



- 1 Expansion of Ex-i modules after last non
- 2 Ex-i module

Partition plate
necessary between

! No additional power supply module needed

I/Os

I/O details – DI16 NAM

DIGITAL INPUT FOR NAMUR SENSORS

- 16 channels
- For 2-wire NAMUR sensors acc. to EN 60947-5-6
- Also known as a supervised input, since Input Module can also detect short circuit, or open circuit in the loop.
- Intrinsic safe and non-I.S. versions

AXL P DI16 NAM 1F	1052416
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AXL P EX IS DI16 NAM 1F	1052417
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I/Os

I/O details - AI8 HART

ANALOG INPUT FOR HART SENSORS

- 8 channels
- 4...20 mA
- For 2-wire loop powered passive transmitters
- our Input module powers the loop.
- HART Functionality can be deactivated on module
- Compliant to HART Standard Versions 5, 6, or 7
- Intrinsic safe and non-I.S. versions

AXL P AI8 HART 1F	1052429
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AXL P EX IS AI8 HART 1F	1052432
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HART
COMMUNICATION PROTOCOL

I/Os

I/O details – AO4 HART

ANALOG OUTPUT FOR HART ACTUATORS

- 4 channels
- 0/4...20 mA
- HART Functionality can be de-activated on module
- Compliant to HART Standard Versions 5, 6, or 7
- Intrinsic safe and non-I.S. versions

AXL P AO4 HART 1F	1087079
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AXL P EX IS AO4 HART 1F	1087082
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I/Os

I/O details – DO4 SD

DIGITAL OUTPUT FOR SOLENOID / ACTUATOR

- 4 channels
- 21V @ 60 mA or 24V @ 48 mA
- Intrinsically safe

AXL P EX IS DO4 SD 24-48 1F 1087077

AXL P EX IS DO4 SD 21-60 1F 1087078



I/Os

Portfolio overview – I/Os

DI



16 NAMUR digital input signals for NAMUR proximity sensors

AXL P DI16 NAM 1F

ArtNo.: 1052416

AI



8 analog input with HART functionality

AXL P AI8 HART 1F

ArtNo.: 1052429

AO



4 analog output with HART functionality

AXL P AO4 HART 1F

ArtNo.: 1052417

DO



4 analog output to connect solenoid drivers, output characteristics: 24 V DC and 48 mA, intrinsically safe

AXL P EX IS DO4 SD 24-48 1F

ArtNo.: 1087077

DI



16 NAMUR digital input signals for NAMUR proximity sensors, intrinsically safe

AXL P EX IS DI16 NAM 1F

ArtNo.: 1052417

AI



8 analog input with HART functionality, intrinsically safe

AXL P EX IS AI8 HART 1F

ArtNo.: 1052431

AO



4 analog output with HART functionality, intrinsically safe

AXL P EX IS AO4 HART 1F

ArtNo.: 1052417

DO



4 analog output to connect solenoid drivers, output characteristics: 21 V DC and 60 mA, intrinsically safe

AXL P EX IS DO4 SD 21-60 1F

ArtNo.: 1087078

THE SYSTEM

How it works



Basics

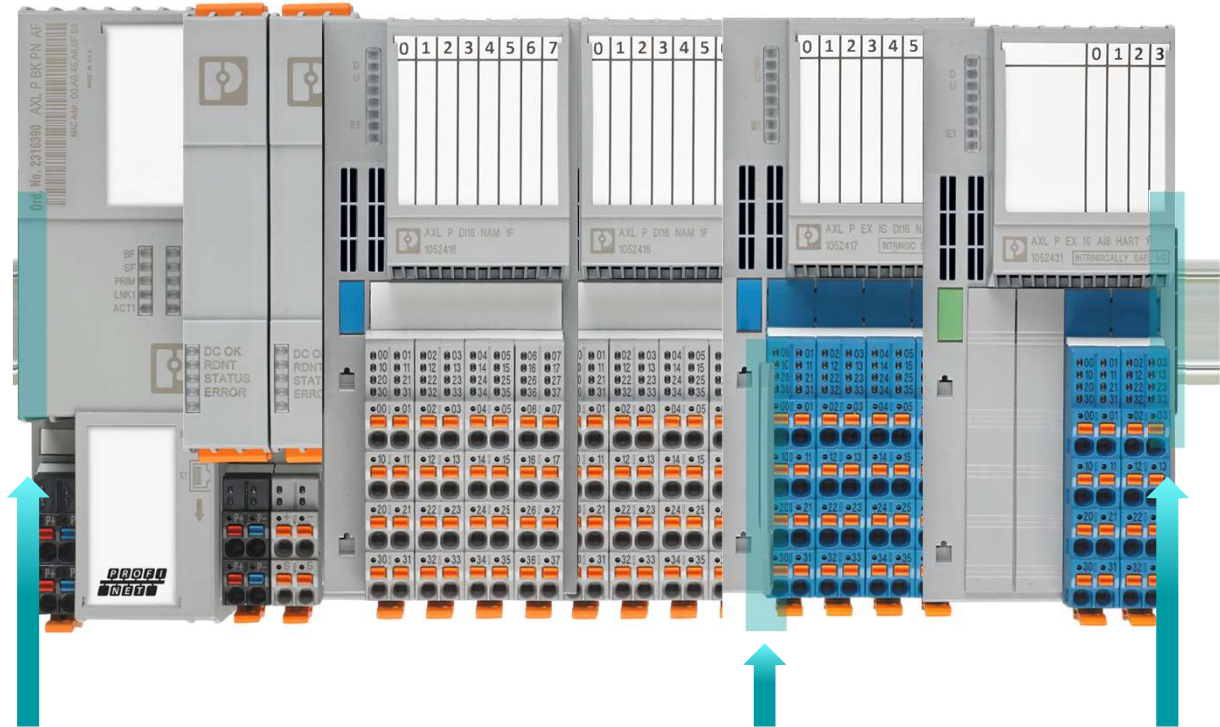

System configuration

i ADDITIONAL INFORMATION

3. Add the terminal block by the first bus rail base. Start with the bus coupler.

2306202
AXL P/PE/EX/R/R

Please order separately!



Basics

Data exchange - Local bus

i

ADDITIONAL INFORMATION

1

2-port PROFINET switch integrated in the bus coupler

2

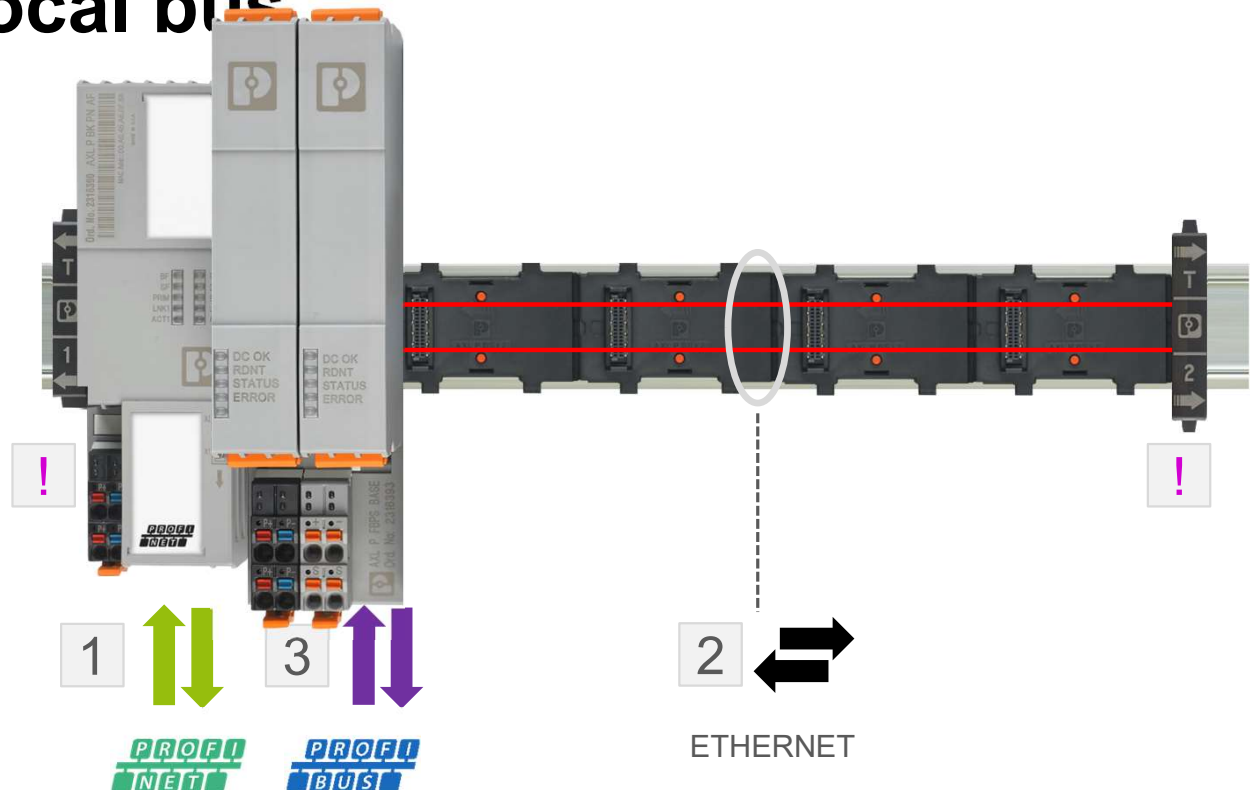
Ethernet-based local bus communication as a ring

!

Term pairs necessary to close the ethernet ring

3

1-8 PROFIBUS PA segments for proxy functionality



Basics

Power supply concept

i

ADDITIONAL INFORMATION

1

U_L : 24 V DC Must be supplied at bus coupler. U_L feed-in supplies 24 V DC to I/O modules along the local bus.

2

U_{Bus} , U_L : Supply and logic bus for I/O modules is generated from the U_L feed-in at the bus coupler.

3

U_L : The PROFIBUS PA trunk also requires external 24 V DC, U_L feed-in.



Basics

Hot Swap

LOCAL BUS STATUS:




Status module 1: **active**

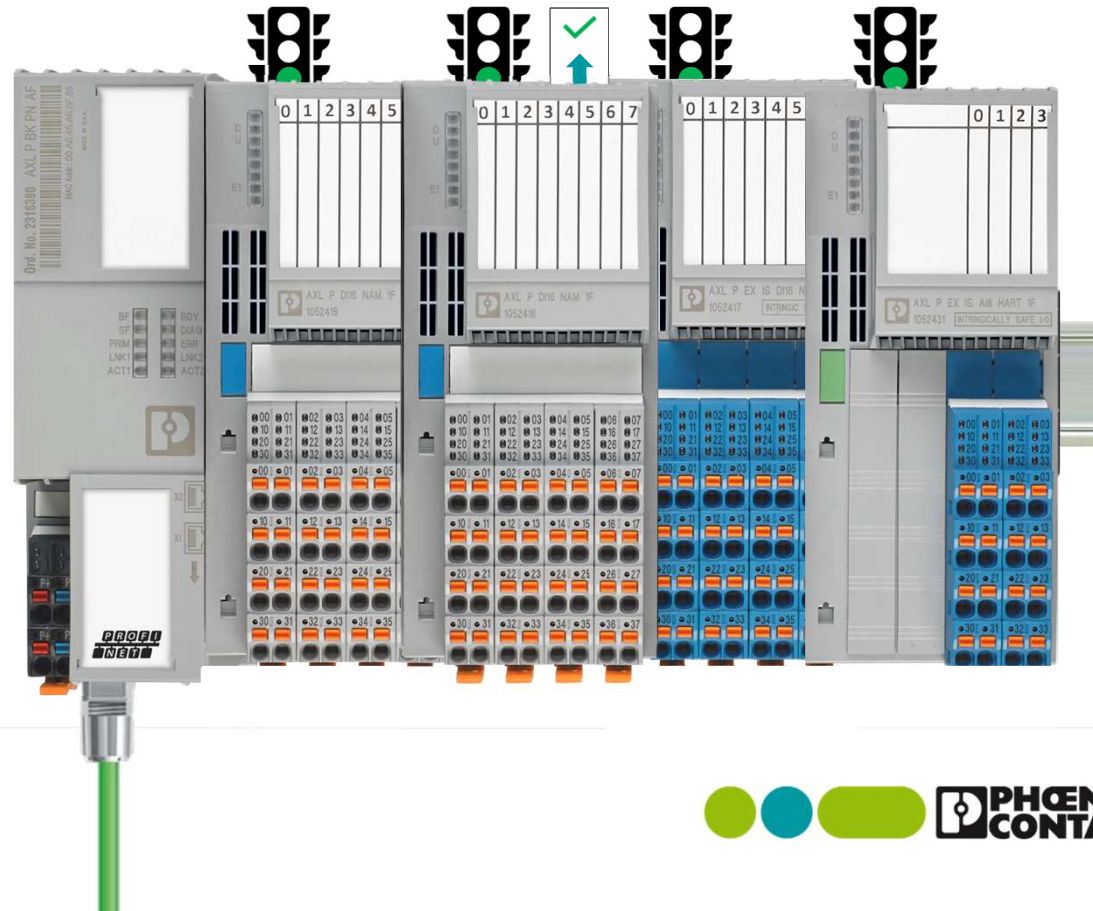
Status module 2: **inactive**

Status module 3: **active**

Status module 4: **active**

 All connected I/O modules are still in communication!

START COMMUNICATION



Basics

Hot Extend

LOCAL BUS STATUS:



Status module 1: **active**

Status module 2: **active**

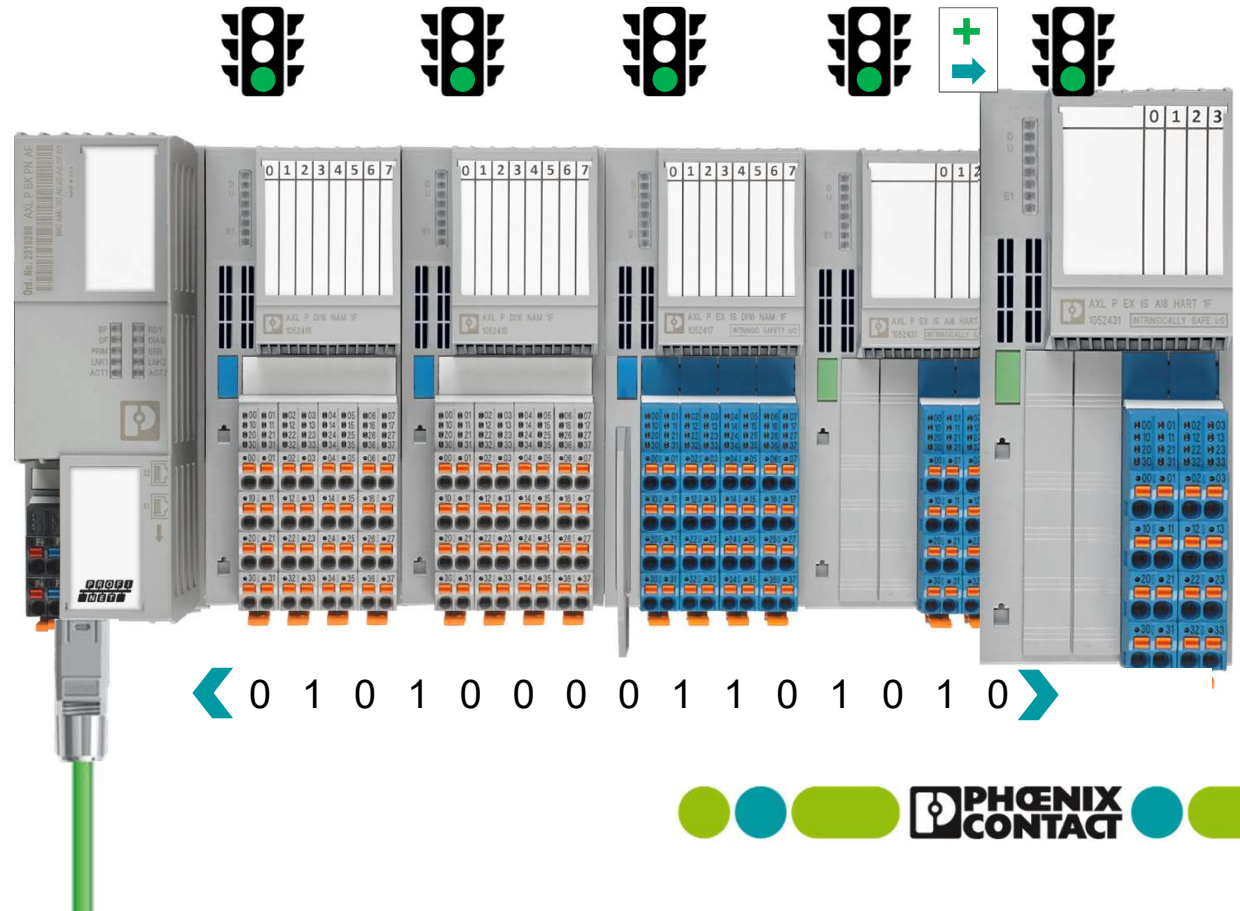
Status module 3: **active**

Status module 4: **active**

Status module 5: **ready to configure**

! All connected I/O modules are still in communication!

! Module added while station in communication and under power!



THE APPLICATION

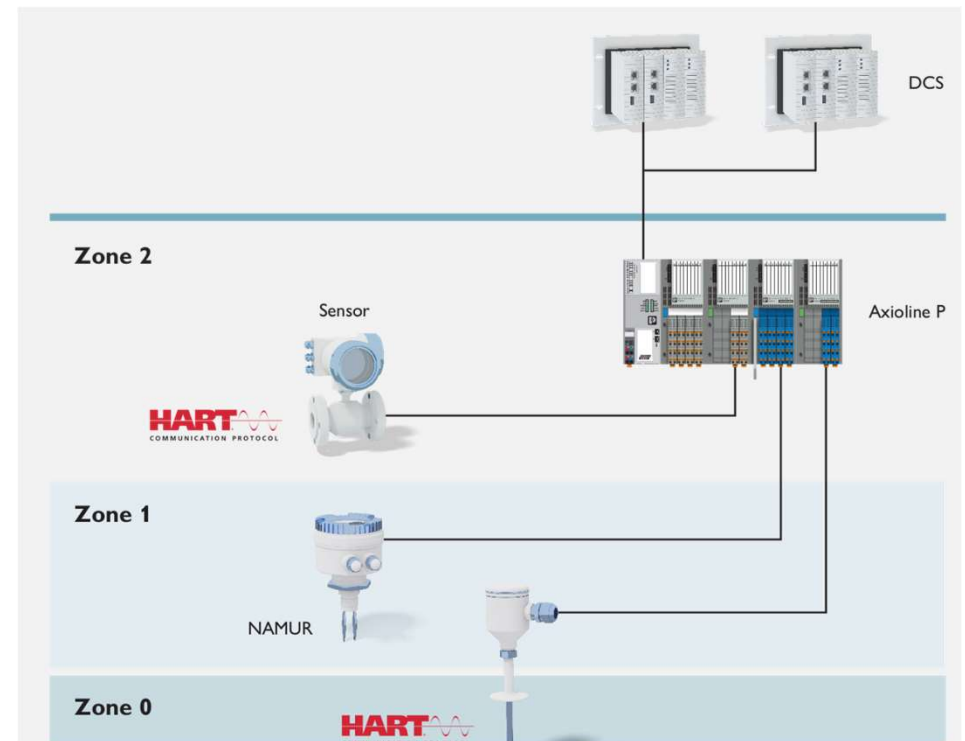
How to use it



Application

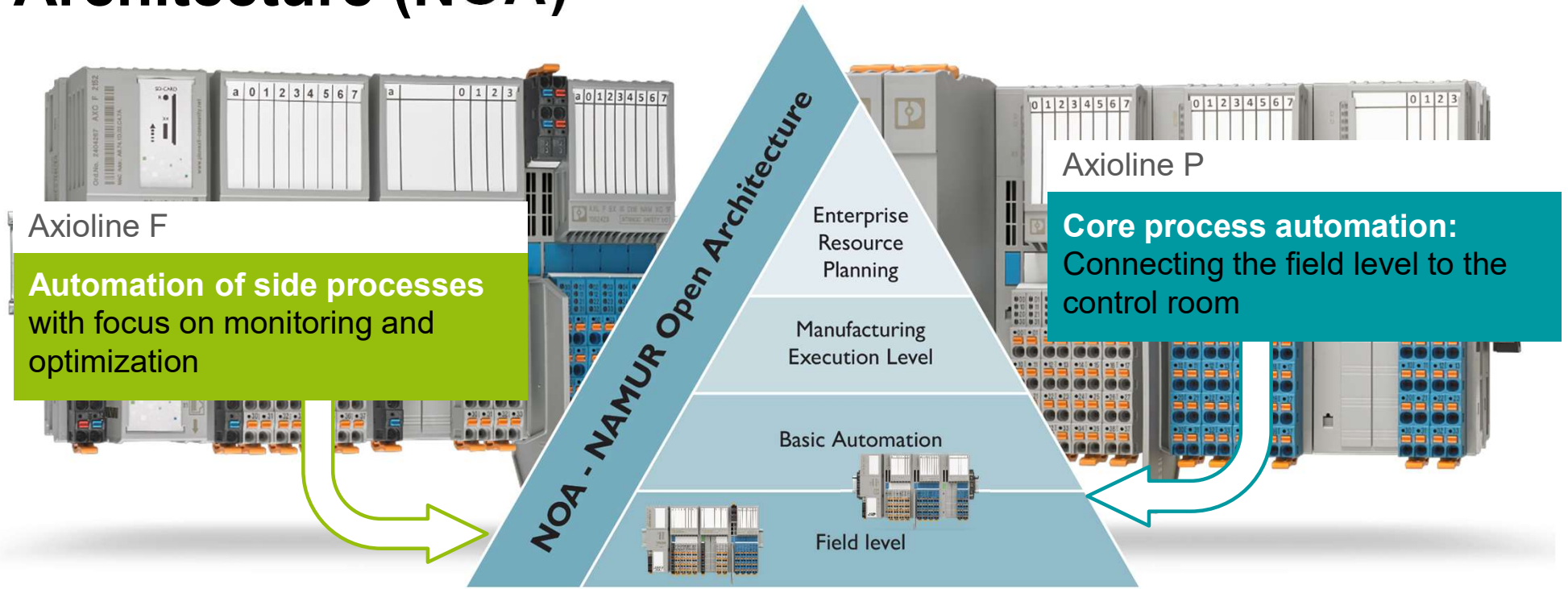
Reliable communication up to zone 0

“You can install Axioline P directly in zone 2 as a remote I/O system. PROFINET S2 system redundancy is supported, which ensures reliable communication between the I/O station and DCS or PLC. It has the ability to connect sensor and actuator signals to zones 1 and 0.”



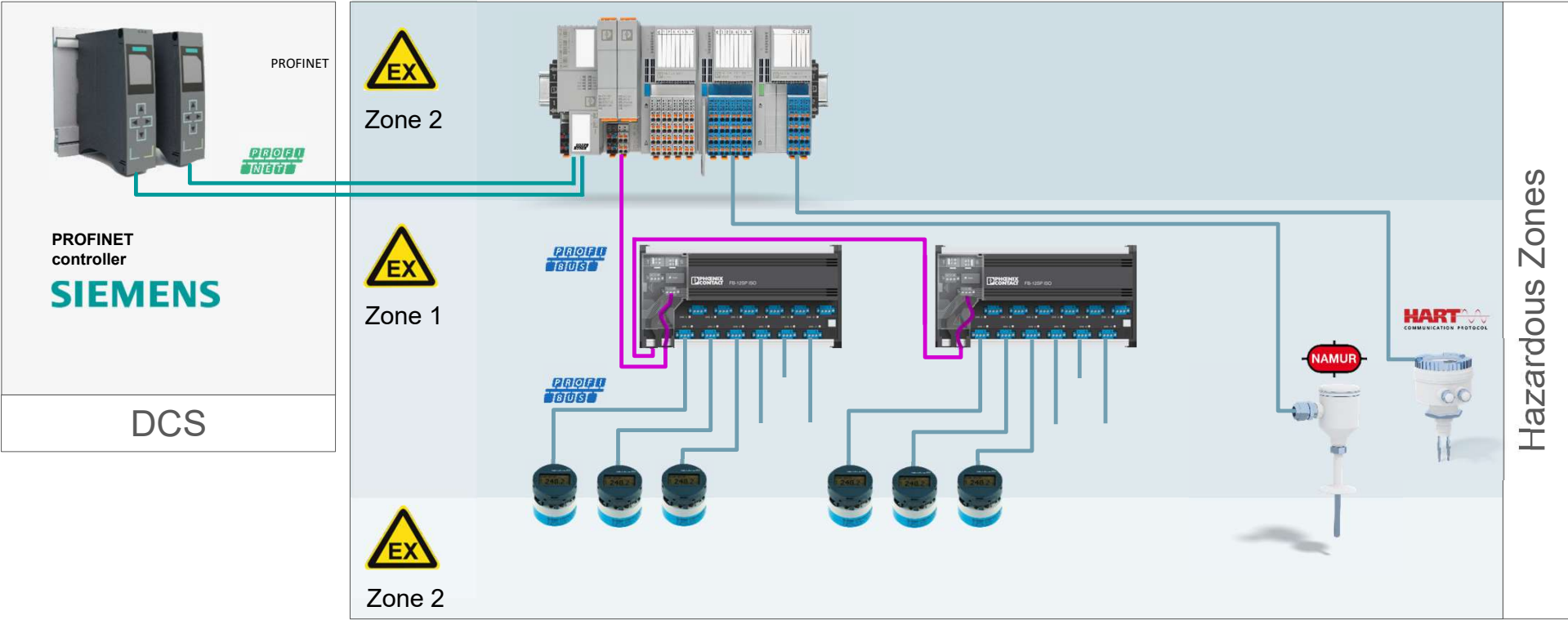
Application

Axioline F & Axioline P for NAMUR Open Architecture (NOA)



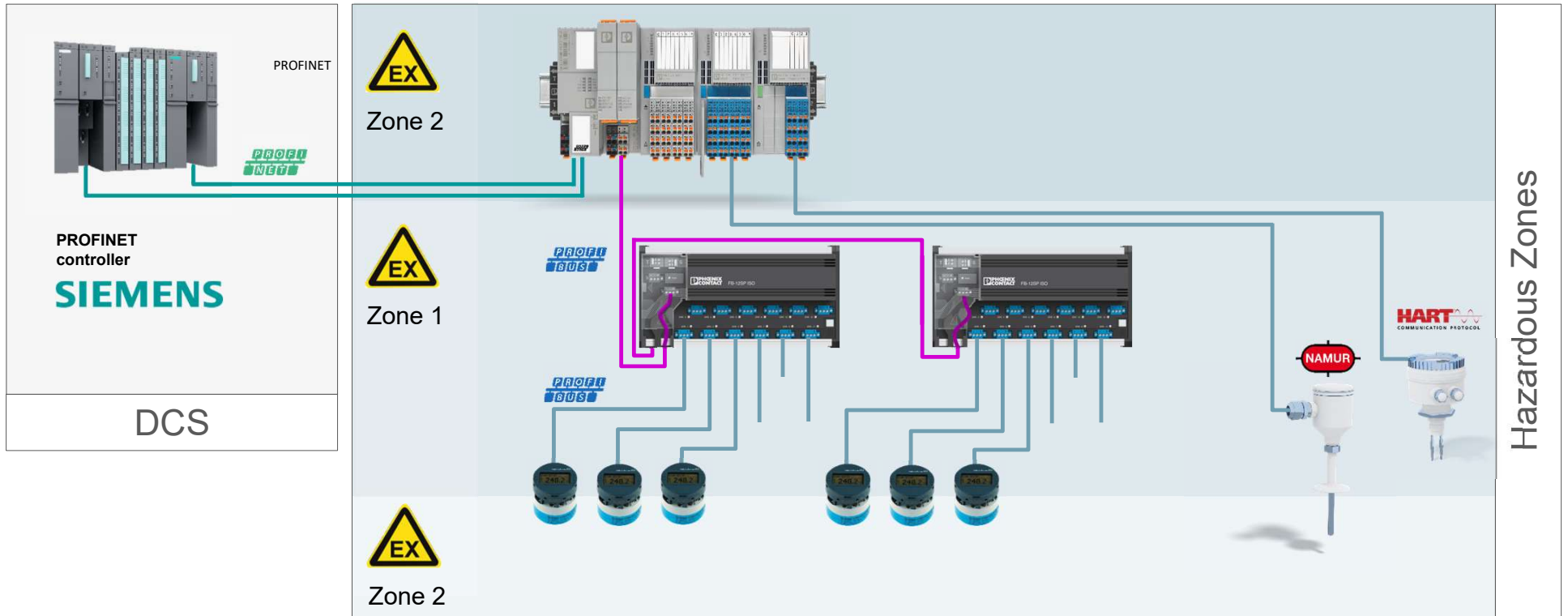
Application

Topology – Connection to various controllers



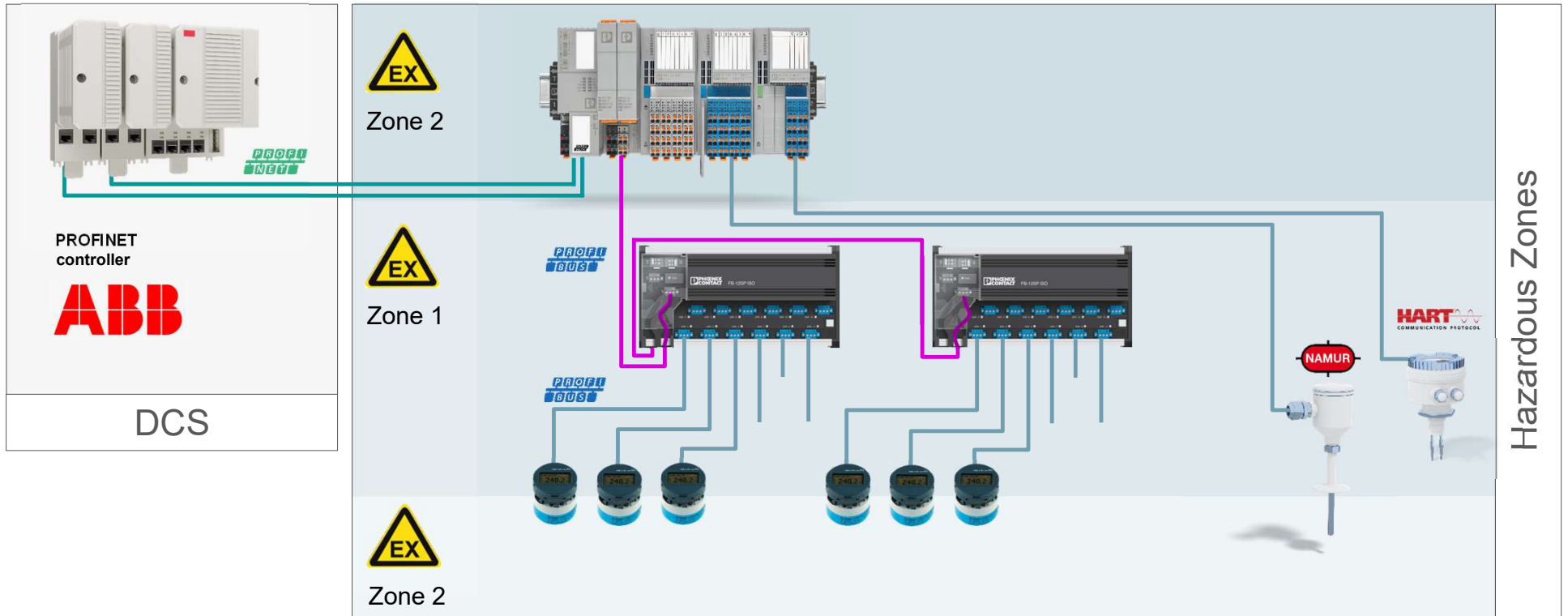
Application

Topology – Connection to various controllers



Application

Topology – Connection to various controllers



Axioline P

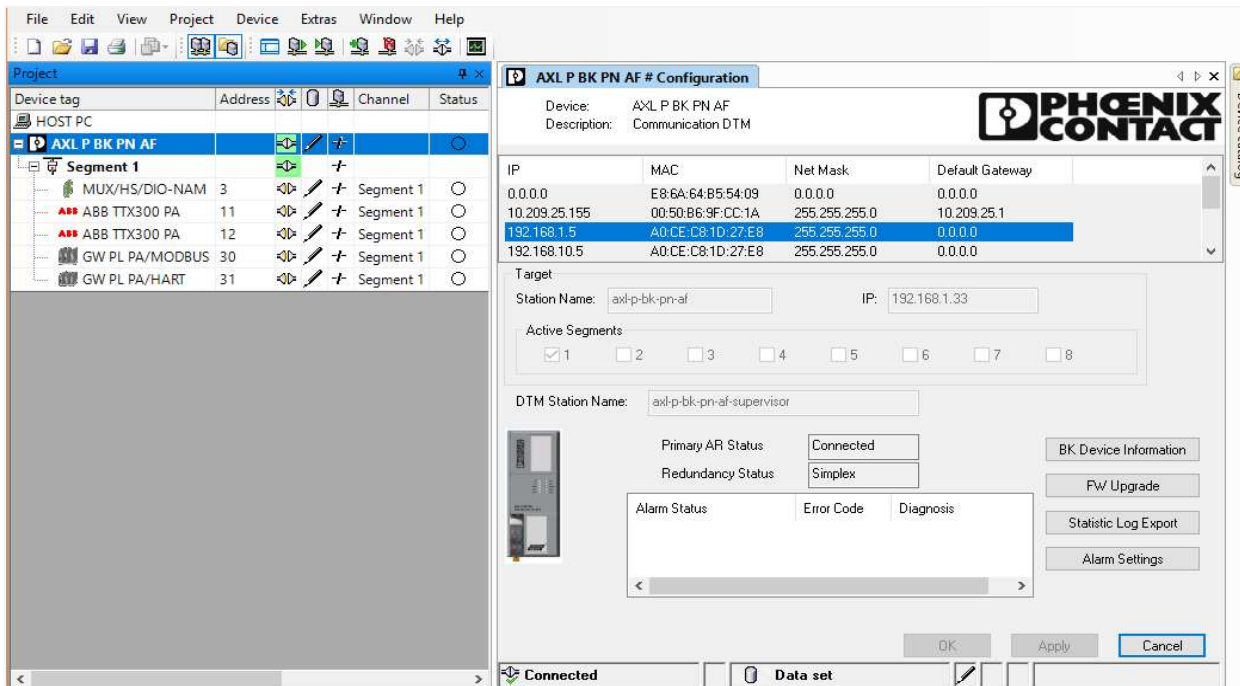
Advanced Functionality



Example Axioline P Advanced Functionality S2 Redundancy

Application

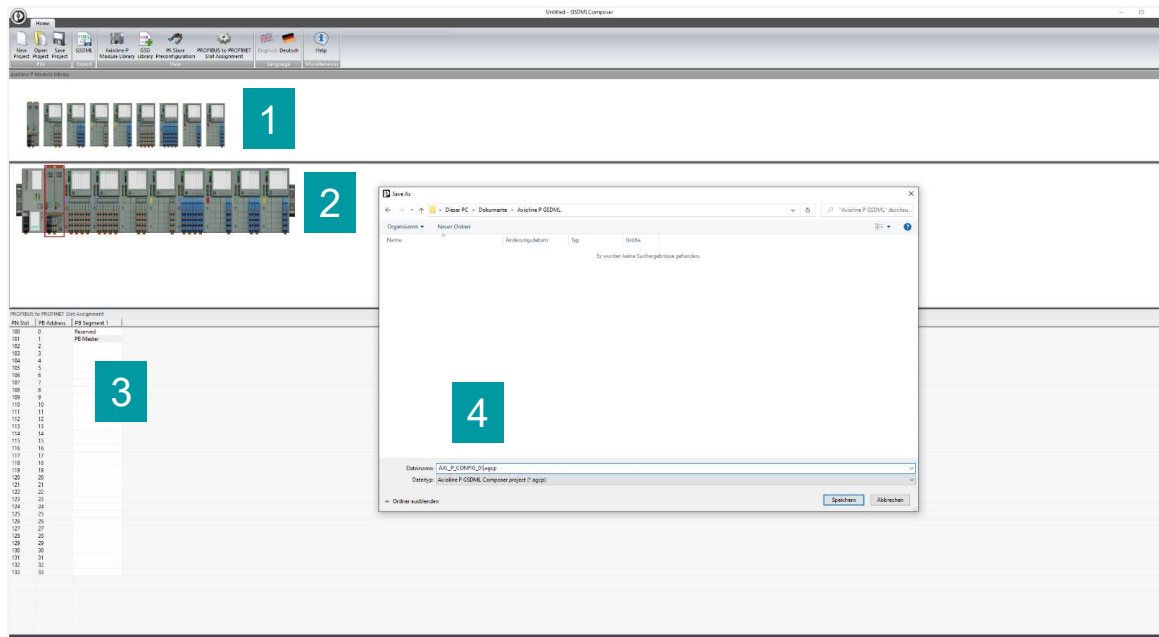
Easy diagnostics with FDT / DTM



- Device Type Manager for Axioline P
- Alarm diagnostic configuration
- Standalone supervisor functionality
- NAMUR NE 107
- Vendor-specific DTM tunneling is possible

Application

Easy to use GSDML composer



- 1 Axioline P module selection
- 2 Visual representation of Axioline P station
- 3 PROFIBUS to PROFINET slot assignment
- 4 Exported GSDML file composed by the tool



Easy integration in a DCS or PLC system with one GSDML file covering the complete Axioline P station

Axioline P

PLC and I/O systems



BASIC



AXIOLINE P

- Absolutely reliable
- Well suited for process automation



COMPLEX



INLINE



IO-Link



IO-Link



Ex HART COMMUNICATION PROTOCOL



"AXIO F Control and I/O System"



AXIOLINE P



Axioline P

“Relevant technologies ”

by addressing relevant trends



5G



TSN



**SPE &
APL**



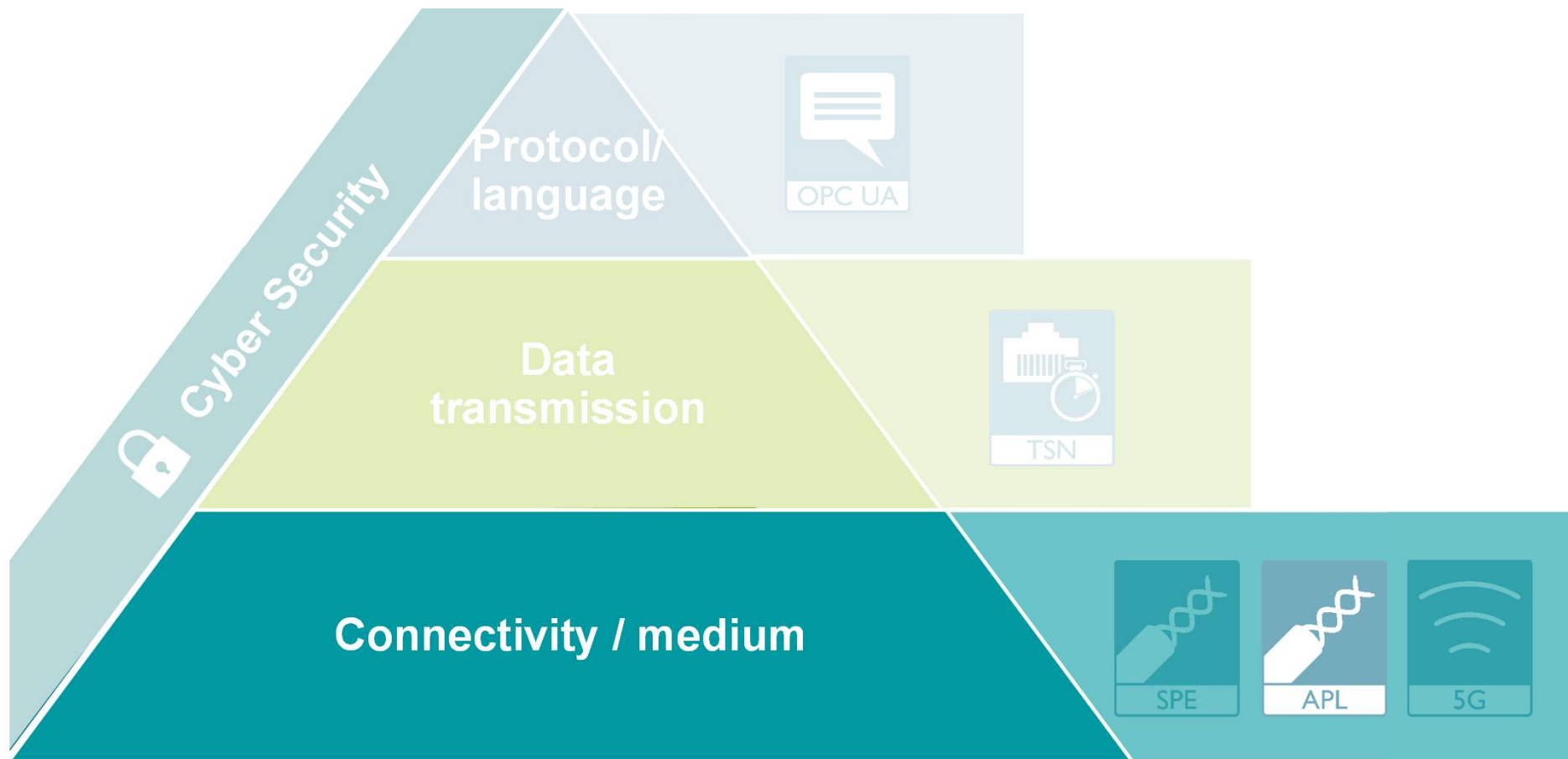
**OPC
UA**



**Edge &
Cloud**

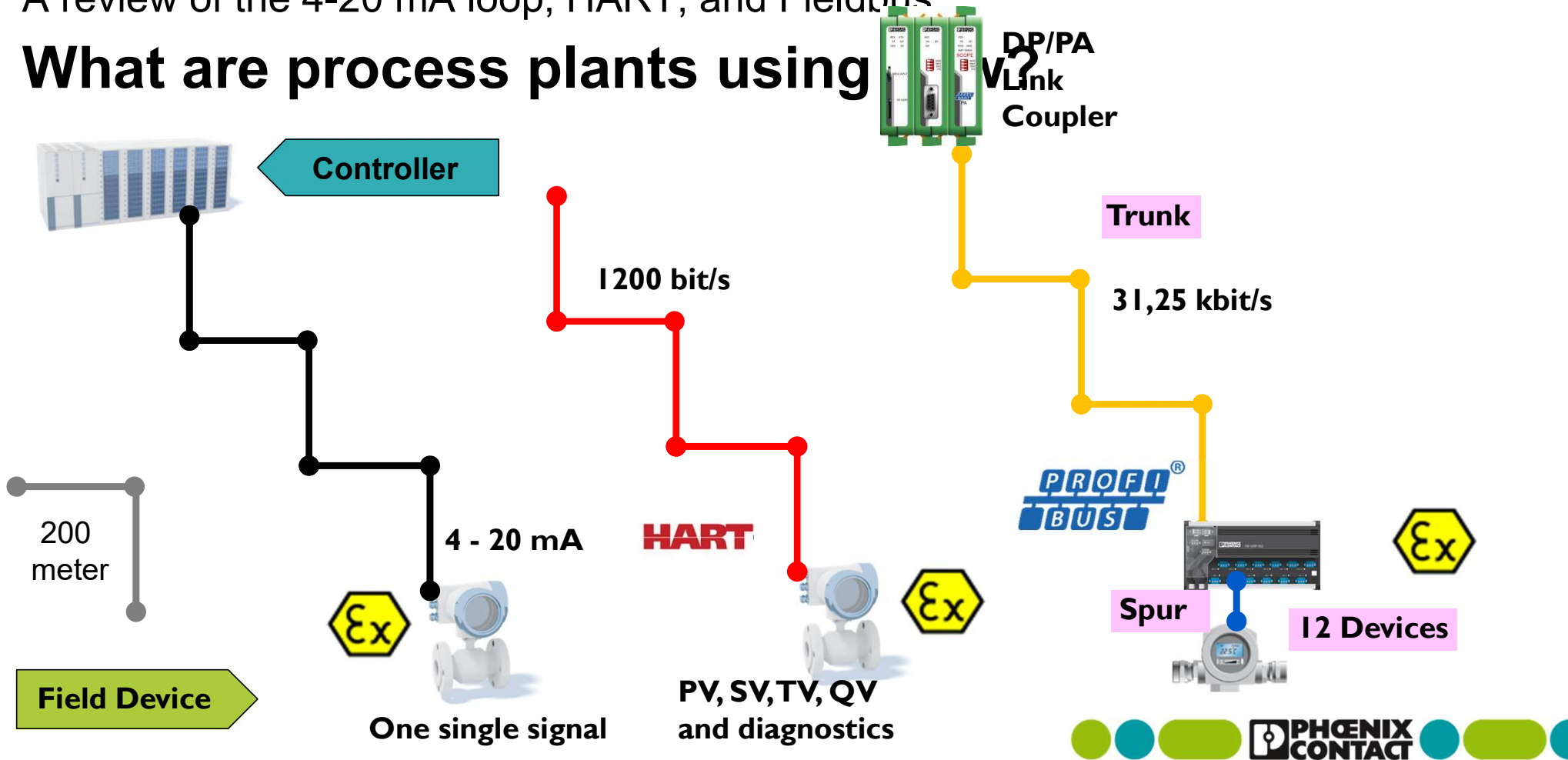


**Cyber
Security**



A review of the 4-20 mA loop, HART, and Fieldbus

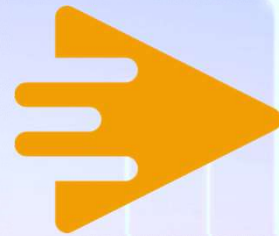
What are process plants using v?





Ethernet - APL

What is it?



ethernet-aplTM
advanced physical layer



Ethernet to the Field Within Process Plants

Standards
Development
Organizations



Member
Companies





Technology, that enables
Ethernet communication
over 2 wires instead of 4 or 8
with **intrinsic safety** into the
hazardous environment

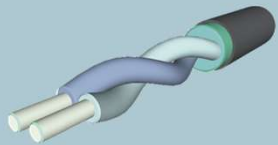


ETHERNET-APL

Data transmission:
SPE Standard

10 BASE-T1L

IEEE 802.3cg



+

Explosion protection:
**2-Wire Intrinsically Safe
Ethernet**

2-WISE

IEC TS 60079-47



=



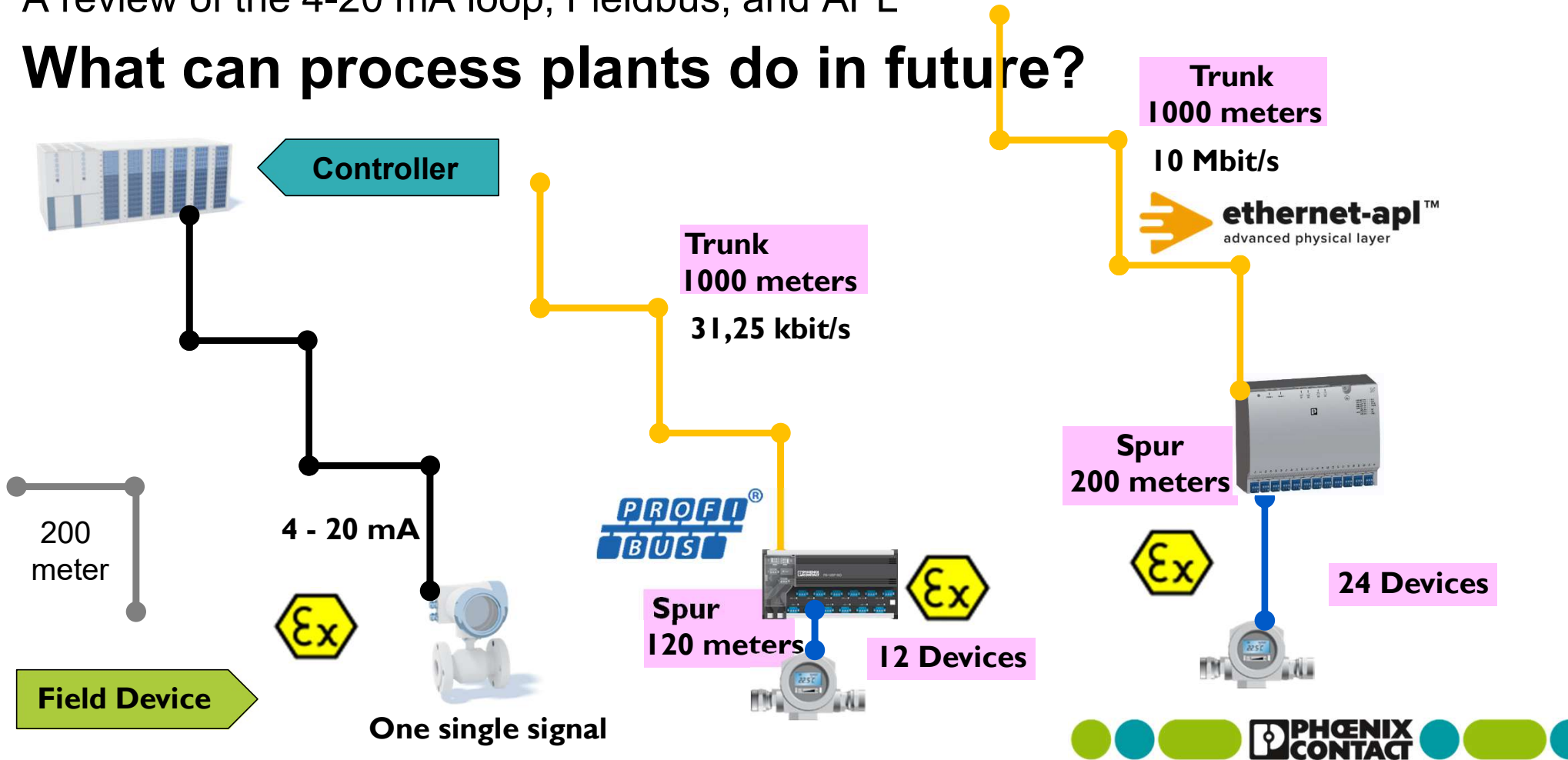
ethernet-apl™
advanced physical layer

RELEVANT SPE STANDARDS – IEEE OVERVIEW

IEEE project	Description / Application	Reach			
		15 m	40 m	100m	1000 m
802.3bp	1000Base-T1 Automotive, Industrial, IoT	[Bar from 15m to 40m]			
802.3bw	100Base-T1 Automotive (Industrial, IoT)	[Bar from 15m to 40m]			
802.3cg	10Base-T1S	[Bar from 15m to 15m]			
802.3cg	10Base-T1L	[Bar from 15m to 1000m]			
IEEE 802.3 bu	Power over Data Line (PoDL)	Reach according used SPE standard and cable specification			

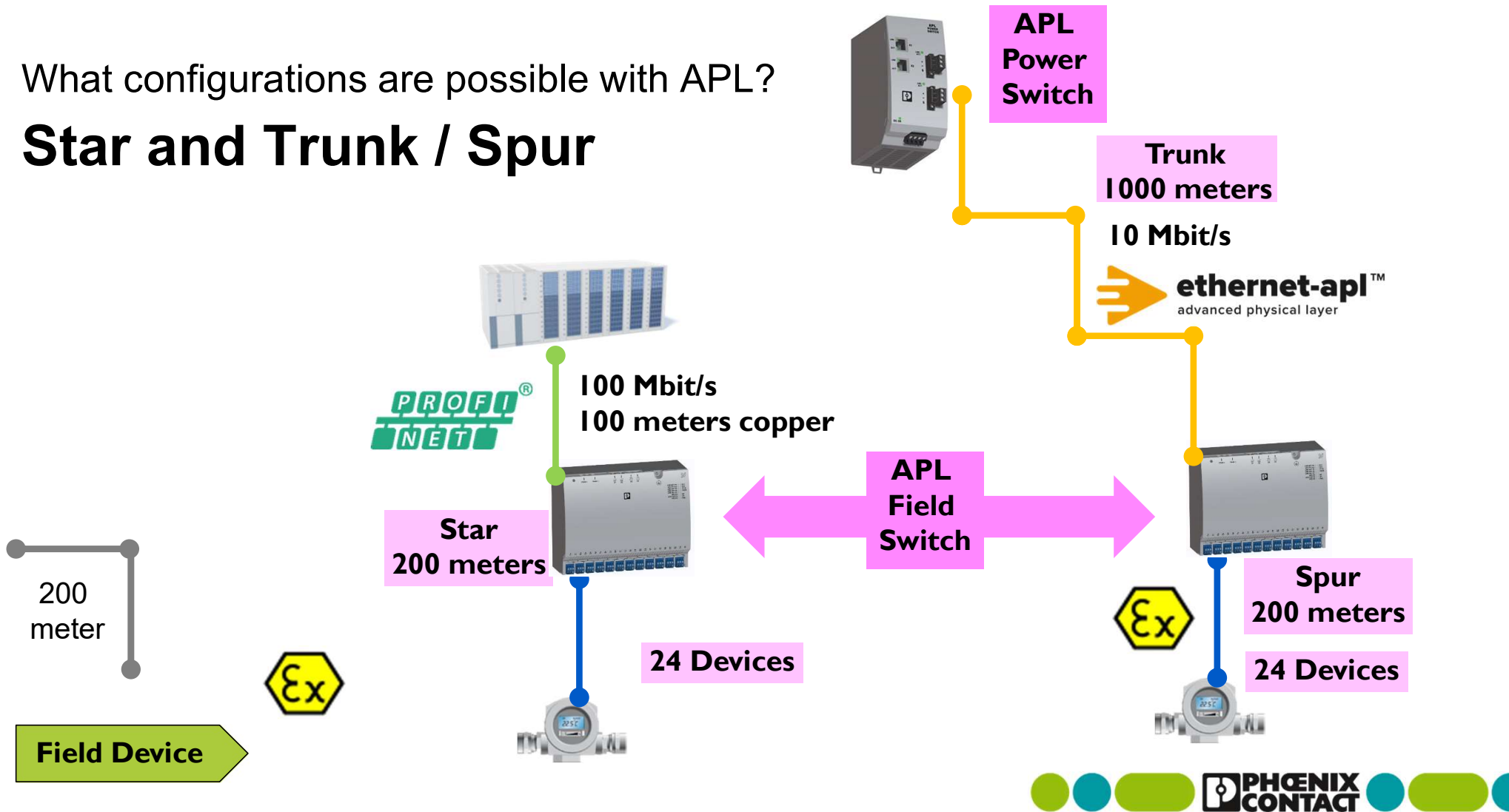
A review of the 4-20 mA loop, Fieldbus, and APL

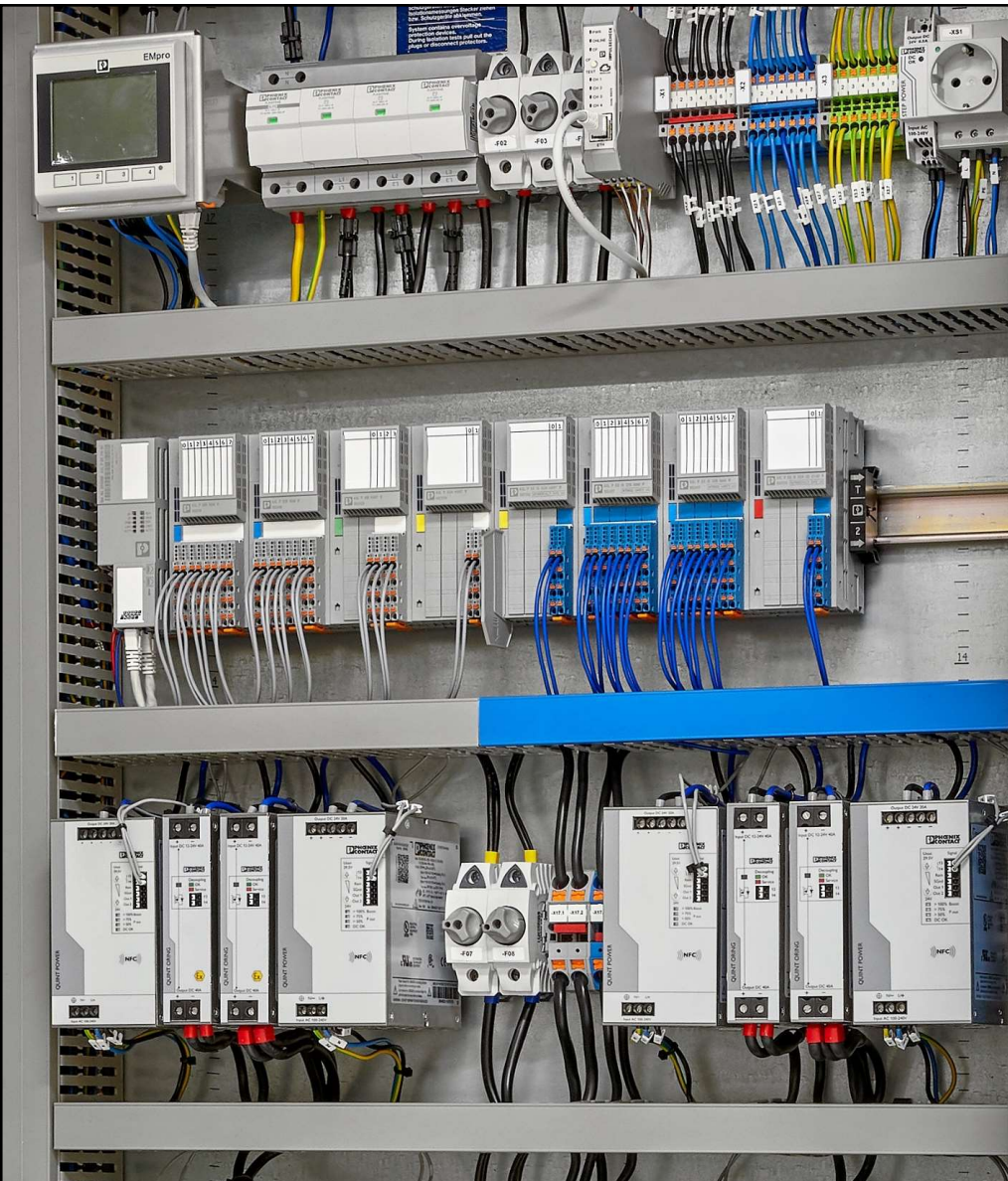
What can process plants do in future?



What configurations are possible with APL?

Star and Trunk / Spur





Thank you

Axioline P Profibus PA

THE HIGH-AVAILABILITY
I/O SYSTEM

