

# Welcome

## **Presentación Profibus PA**

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

#### What is PROFIBUS-PA?

## Agenda

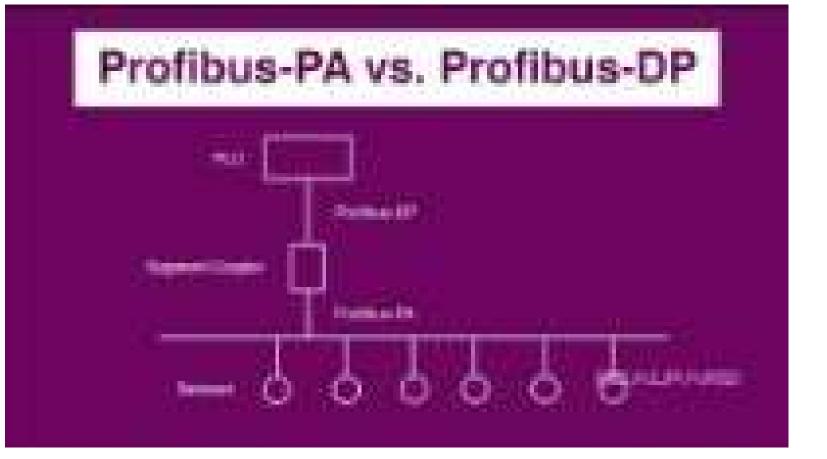


- Background on PROFIBUS-PA
- PROFIBUS-PA Field Devices manufacturers
- Process Automation Infrastructure Product Portfolio and Applications
- Axioline P the PROFINET / PROFIBUS-PA Proxy
- The Future of PROFIBUS-PA in Process





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





#### What is PROFIBUS-PA?

## **PROFIBUS-PA**

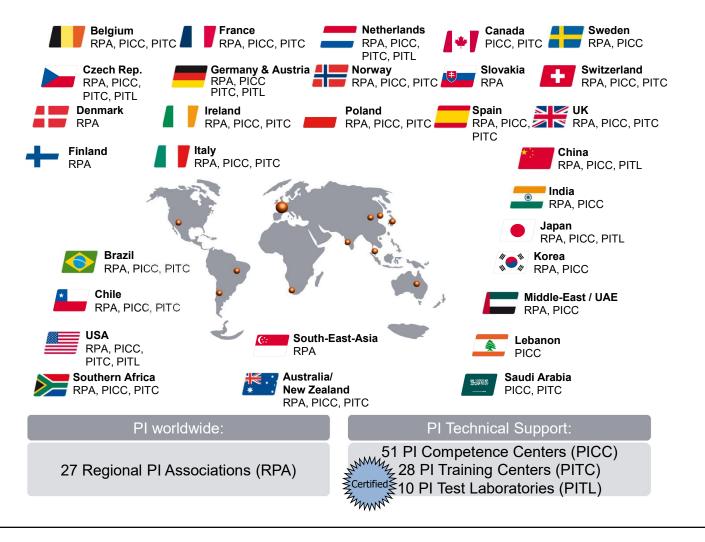


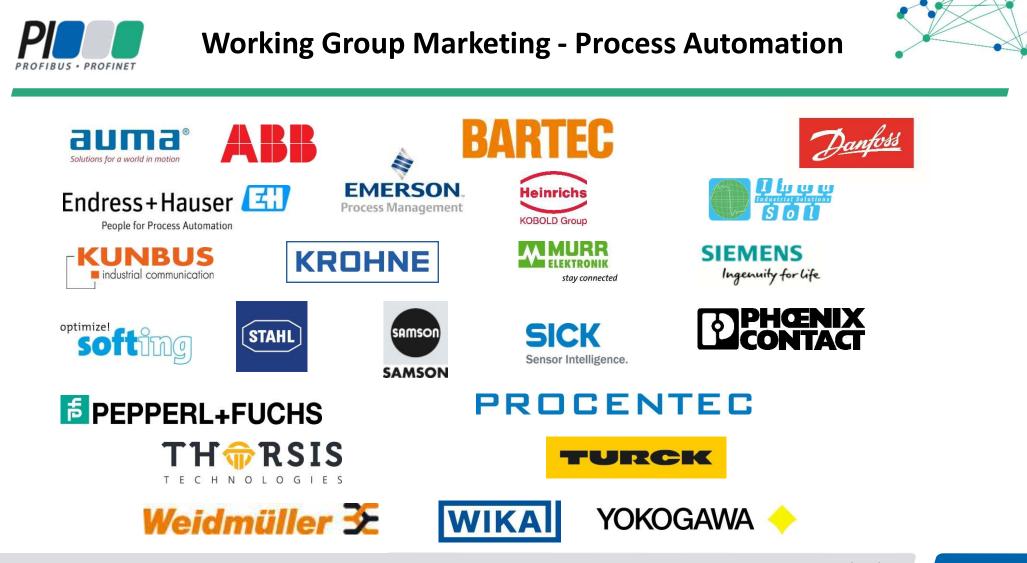
- PROFIBUS-PA (PROfessional Fleid BUS for Process Automation) is a 25 year old technology that connected digital Fieldbus devices to DCS and PLC systems.
- There are over 750,000 PA devices sold annualy globally, and over 12,000,000 million PA devices have been sold since its inception. The member companies belong to PI (Profinet Profibus International) 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

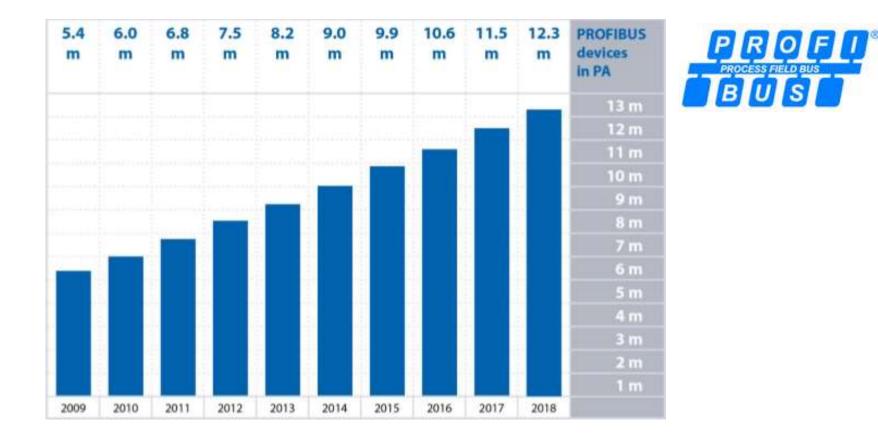




PI – Process Automation 2019



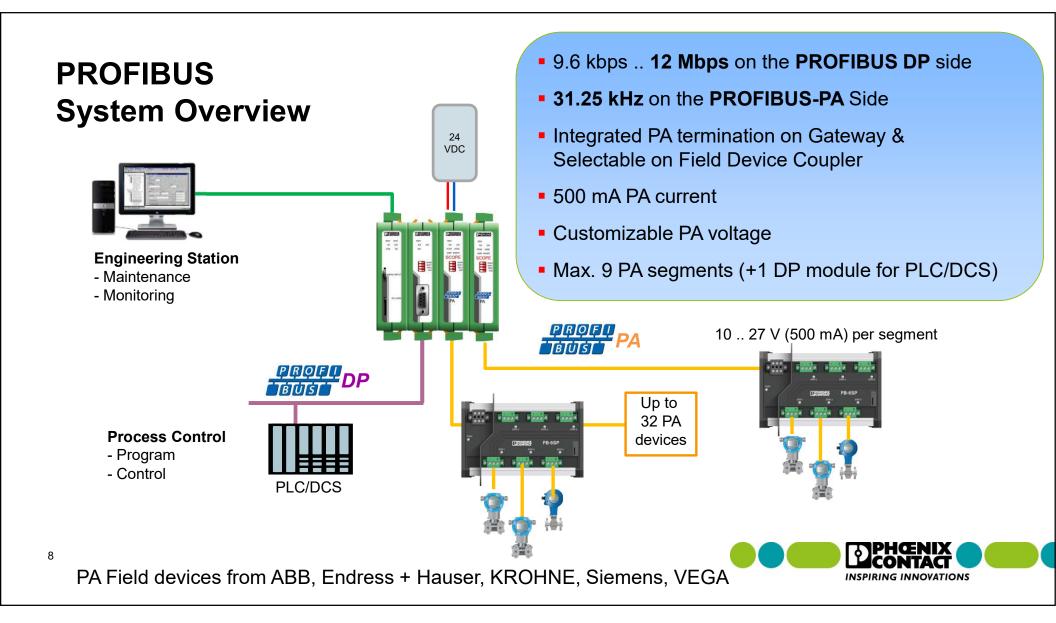
## **PROFIBUS-PA nodes sold worldwide**

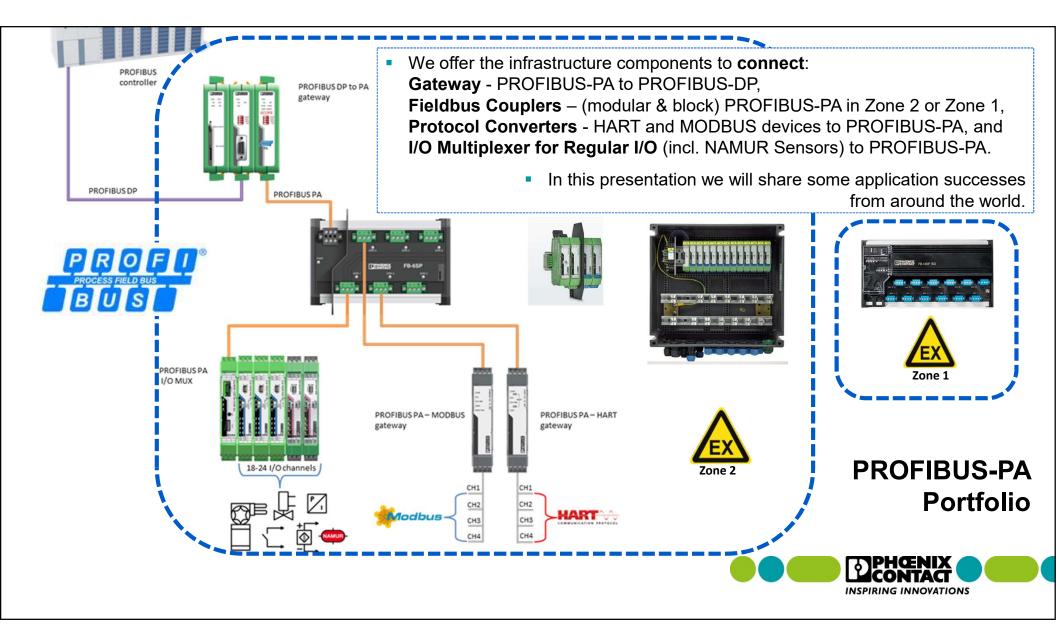


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PI Conference 2019

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## **Protocol Converter**

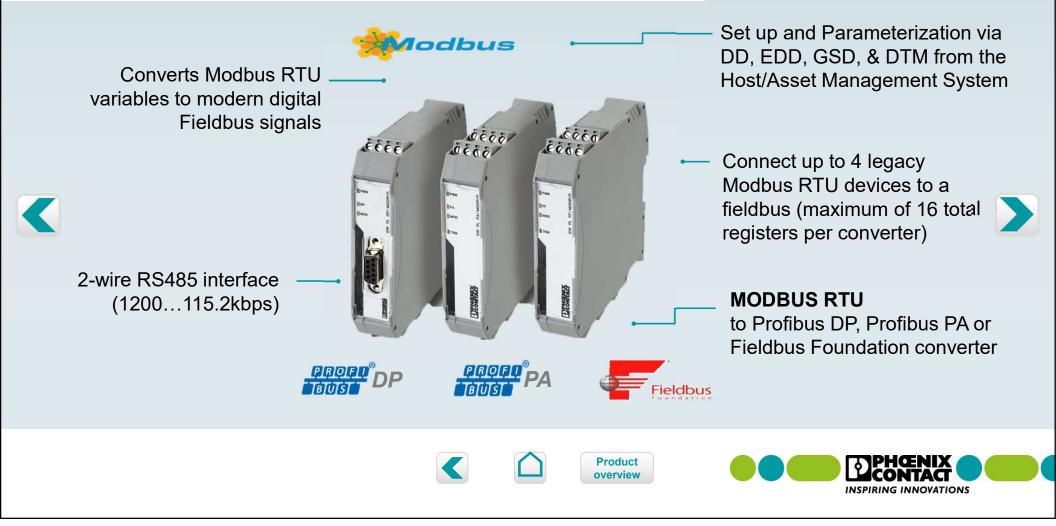


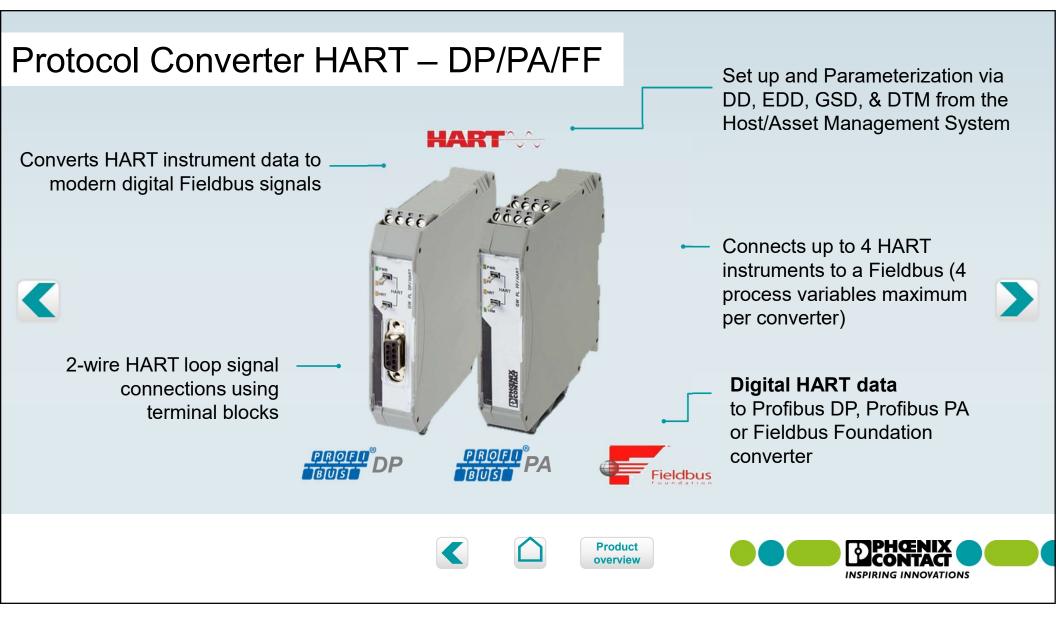
A **Protocol converter** is a device used to convert the protocol of one device to the protocol suitable for the other device or tools to achieve the interoperability. This is sometimes referred to as a gateway, although a gateway typically has higher functionality.





## Protocol Converter - MODBUS – DP/PA/FF





Protocol Converter								
	Field	245 <b>()</b>				PA		
	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	Combicon	Combicon	Combicon	Combicon	Combicon	Combicon		
Order number	2316363	2316364	2316365	2316360	2316361	2316362		
	Description Interface 1 Interface 2 Interface 2 Interface 2	Interface 1 connector       Combicon         Interface 2       HART FSK         Interface 2       Combicon	Image: ConstructionImage: ConstructionImage: ConstructionImage: ConstructionDescriptionModbus/RTU to FOUNDATION Fieldbus protocol converterProtocol converter capable of connecting four Modbus/RTU devices to a PROFIBUS PA networkInterface 1Foundation FieldbusProfibus PAInterface 1 connectorCombiconCombiconInterface 2HART FSKHART FSKInterface 2CombiconCombicon	Image: I	Image: Im	If second products of the second product of the second products of the second products of the second products of the second products of the second product of the second products of the second product		









# 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

2901535 RAD-DI4-IFS

2901539 RAD-DI8-IFS

2904035 RAD-PT100-4-IFS

2901533 RAD-DAIO6-IFS

2901536 RAD-DOR4-IFS

2901537 RAD-AI4-IFS

2901538 RAD-AO4-IFS

#### 4 NAMUR Digital inputs

- 4 Digital inputs
- 8 Digital inputs
- 4 PT100 inputs
- 1 I/O 2 Digital I/O
- 4 Digital relay outputs
- 4 Analog inputs
- 4 Analog outputs







## Application

## **Coal and Thermal Power**

#### **Customer Profile**

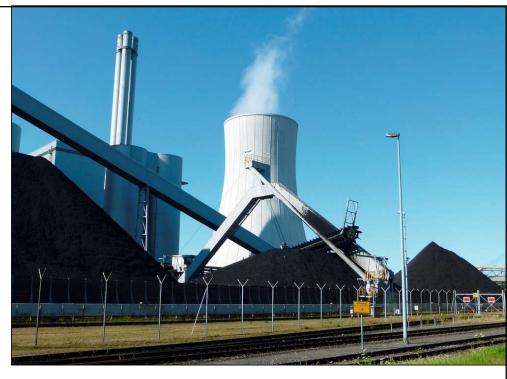
 A company is a state owned enterprise that is one of Asia largest thermal power generating conglomerate. The corporation has a total installed capacity of 53,561MW.

#### Application

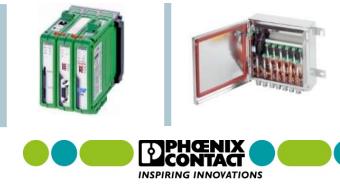
- MAC won the bid as Main Automation Contractor (MAC) for the expansion project
- Phoenix Contact partnered with MAC to promote the adoption of digital fieldbus technology to EU
- The expansion project is EU first venture implementing
   Profibus technology and Redundancy
- Phoenix Contact worked together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

#### Solution

- PROFIBUS DP/ PA Gateways
- FB-PA/SCOPE
- FB-DP-REPEATER
- FB-HSP-PLUG 6A Power Supply
- FB-12SP & FB-6SP
- Clip Safe Enclosures and Trabtech

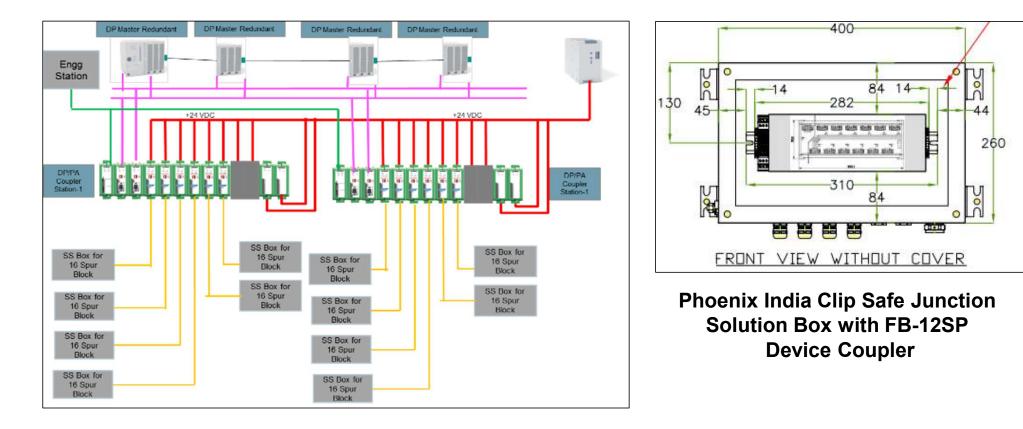


Product



- 20 systems with Redundancy
- 5 per system
- one extra on each system
- / redundant power
  - 90 modules total

## Coal and Thermal Power – NTPC (2)



Profibus Network Topology for ABB 800M System at NTCP



# 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 over 4 FB-PA/SCOPE with with P FB-DP-REPEATER/SCOPE DP Co

over 40 systems with PA & DP Connectivity

over 125

over 80 boxes

- FB-6SP Block Couplers
- FB1-S1-6SP-T-0-10-00-0-0
- Ethernet Infrastructure



Product



INSPIRING INNOVATIONS







## 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
- FB-PA/SCOPE

- over 175 pieces over 250 pieces
- FB-6SP Block Coupler

over 850 pieces



Product



## Application SO<sub>2</sub> SO<sub>3</sub> 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

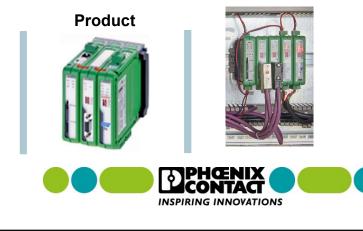
#### **Application**

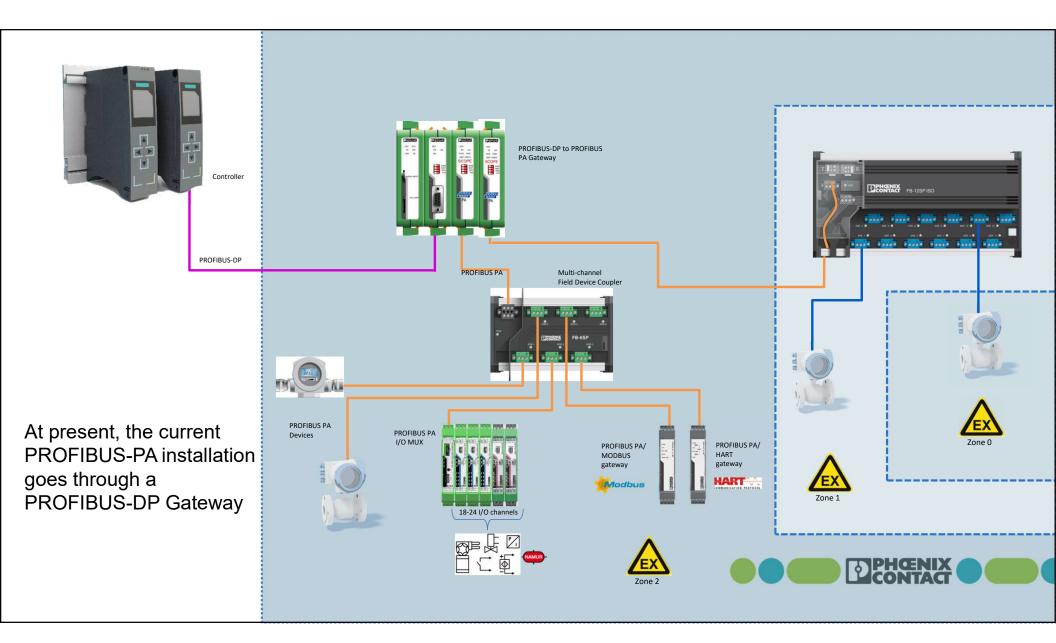
- Phoenix Contact was asked to provide a solution to allow the Coking plant to extend its lifetime by 20 years
- A PROFIBUS-PA Redundancy Scheme was needed to increase the availability and functionality of the installation
- A technical support to solve all requirements of customers, and using the diagnostic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

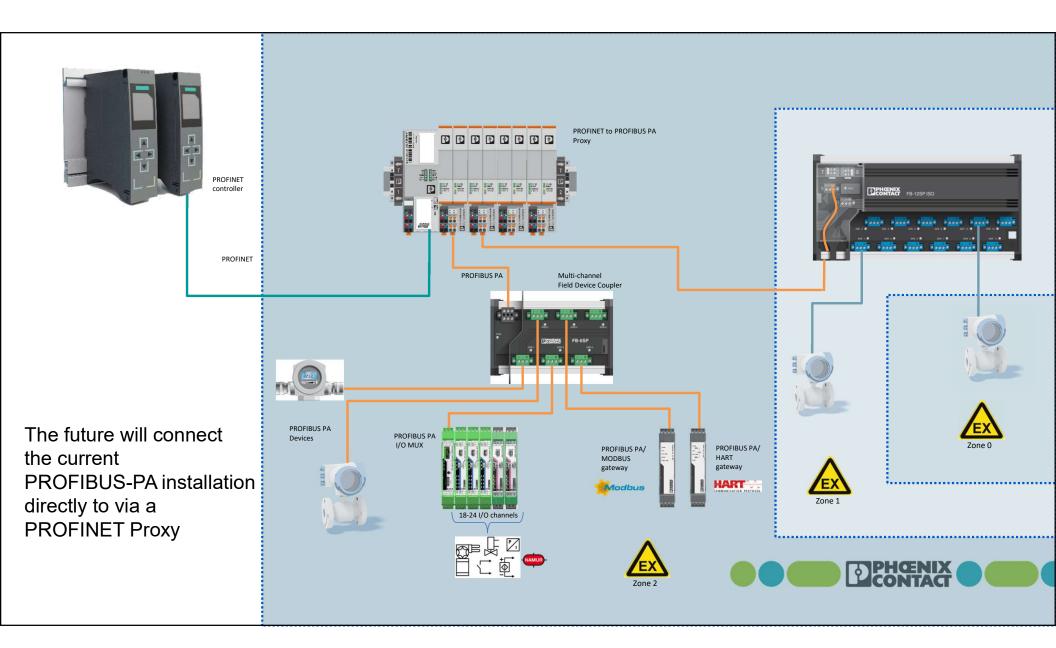
#### Solution

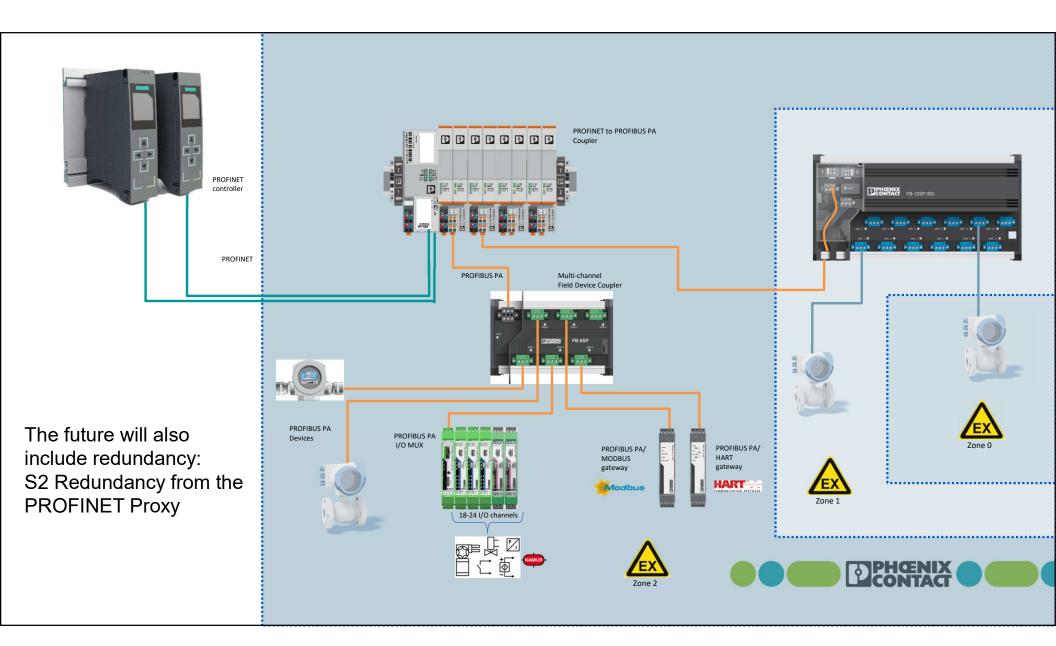
- PROFIBUS DP/PA Gateway with Redundancy
- Ongoing upgrades to all parts of the plant as the older systems is migrated to our new solution













## Axioline P Redundancy S2 PA / Proxy to PROFINET





## **Axioline P**

THE HIGH-AVAILABILITY I/O SYSTEM



### Axioline P



Click on a single title to skip to that topic. Click  $\widehat{}$  to return.

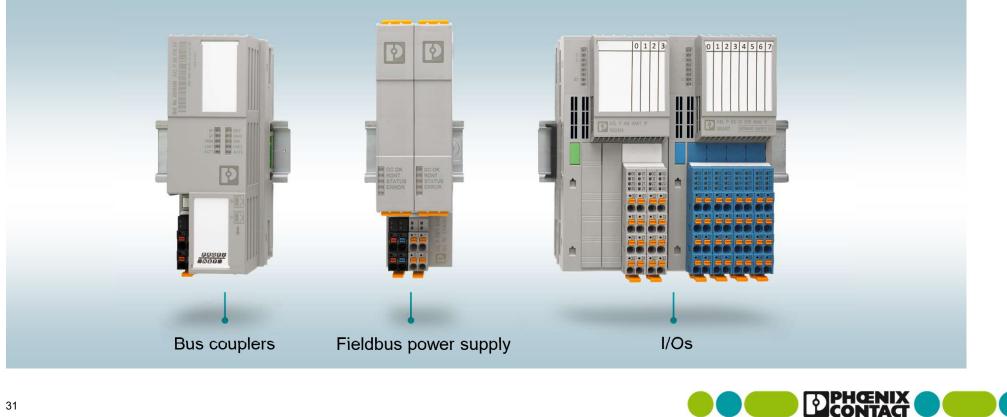




## Axioline P Dependable Process I/O



# Axioline P The high-availability I/O system



### Axioline P

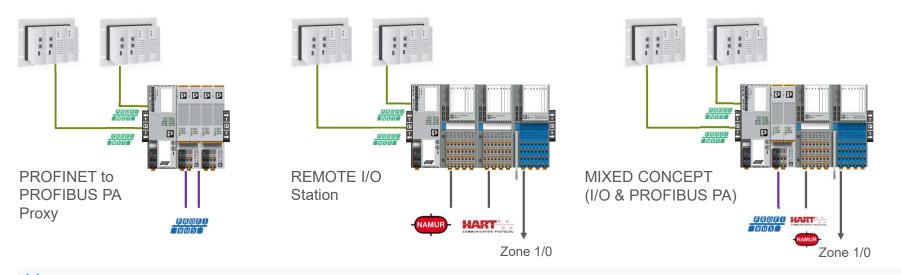
# **Basics**

## SYSTEM SPECS AT A GLANCE

TYPE	Modular remote I/O-system, IP20			
SYSTEM COMPONENTS	Bus coupler, Fieldbus power supply, I/Os			
SUPPORTED PROTOCOLS	PROFINET			III I the case
SUPPORTS REDUNDANCY	Yes			
TYPE LOCAL BUS	Ethernet-based, Hot-Swap capable, Powered Local Bus	1		
SUB-LEVEL COMMUNICATION	PROFIBUS-PA, HART, NAMUR			
AMBIENT TEMPERATURE	-40°C up to + 70°C	0	55 55 A	
INSTALLABLE EX-ZONE	Zone 2			
APPROVALS	ATEX, IECEx and UL EX approvals for Zone 2 installation	-		



## Axioline P Use Cases



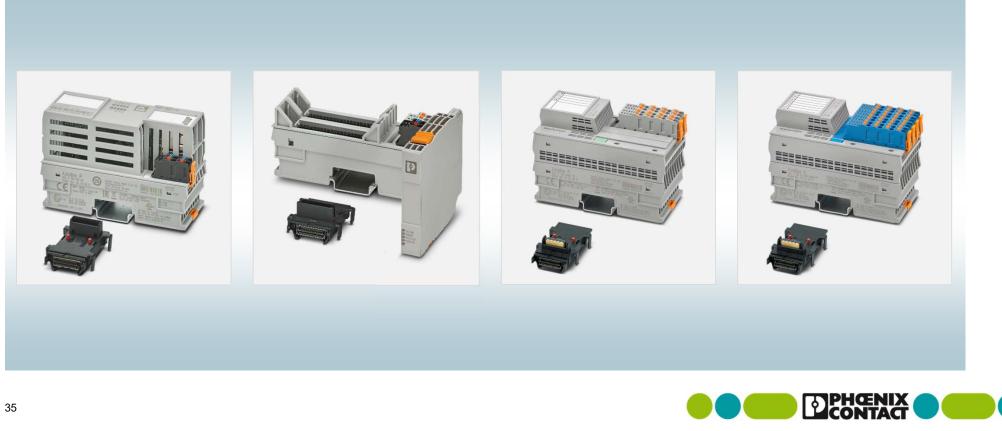
Axioline P can be connected directly to a distributed control system (DCS) in the form of a remote I/O system. PROFINET S2 system redundancy is supported, which ensures very reliable communication between the I/O station and DCS.







# Axioline P **Product details**



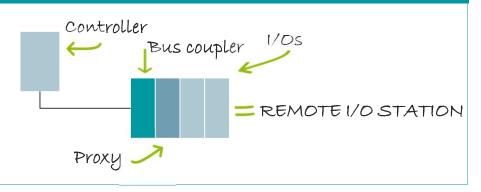


### Bus coupler

**Connect to a controller** 

<sup>44</sup>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 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		
PROFINET PROFINET	ADVANCED FUNCTION	FOR ONLY I/Os
PROFINET PROFINET	AXL P BK PN AF	AXL P BK PN
SUPPORTS PROXY & I/Os SUPPORTS ONLY I/Os	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

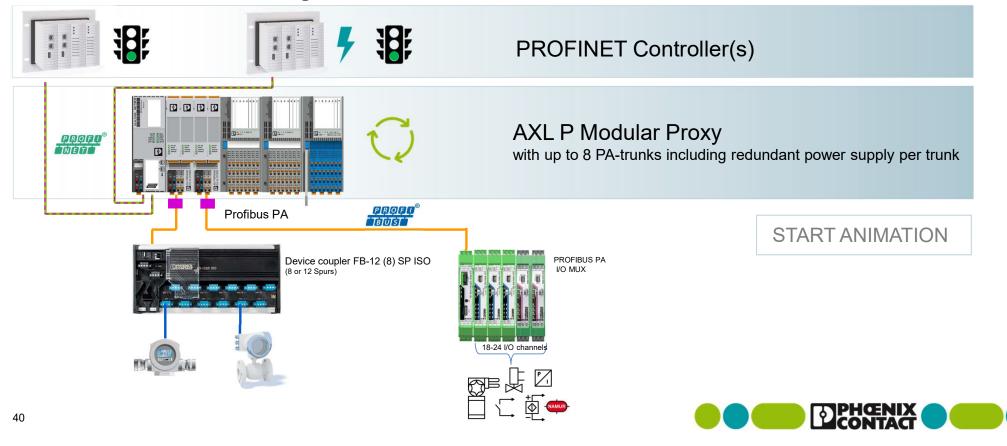
- Connects up to 8 modular and redundant PROFIBUS PA segments
- GSDML composer tool and FDI (Field Device Integration)





#### Bus couplers

## S2 - Redundancy



# Modular proxy **Portfolio overview – Fieldbus power supply**





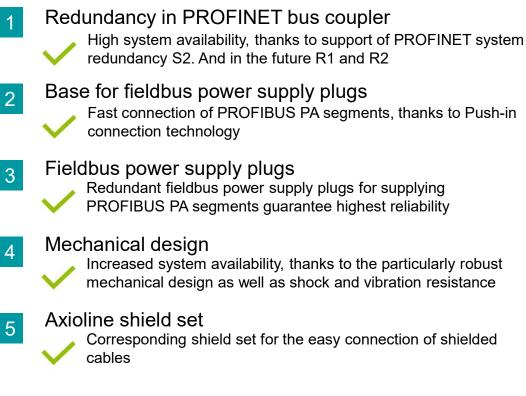


POWER DISTRIBUTOR	POWER SUPPLY PLUG
AXL P FBPS BASE	AXL P FBPS 28DC/0.5A
Axioline P local bus	PROFIBUS PA
For two power supply plugs	Provides 500 mA @ 28 V DC



#### Modular proxy

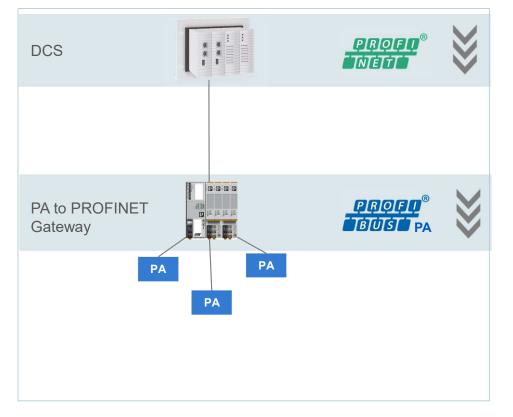
## **Components of the proxy solution**







## Modular proxy Interfacing to PROFIBUS PA



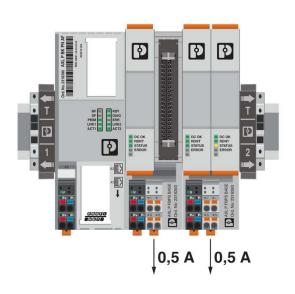
#### OUR SOLUTION

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

- 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



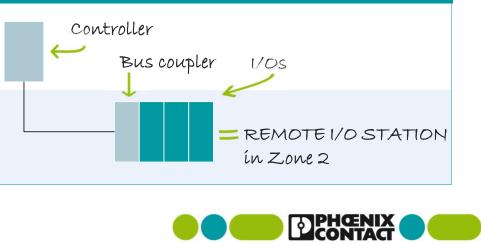


## I/Os

#### **Grey or Blue**

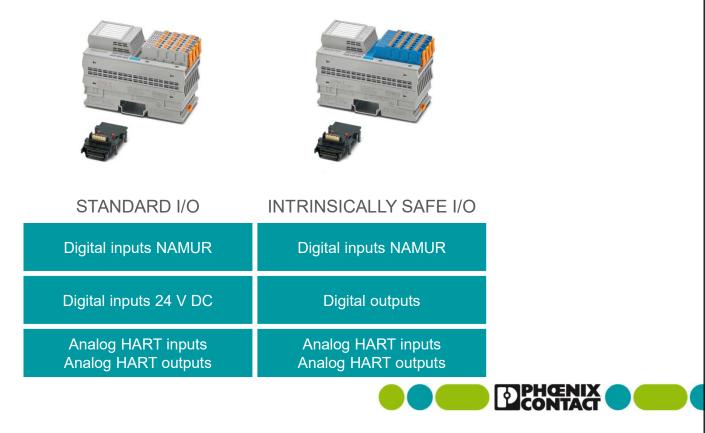
<sup>55</sup> Build up an I/O station by adding the required I/Os next to the bus coupler. Choose between intrinsically safe and non-intrinsically safe I/Os fitting to your application.<sup>77</sup>

#### Remote I/Os for Zone 2 installation



## I/Os Portfolio overview – I/Os





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#### I/Os I/O details

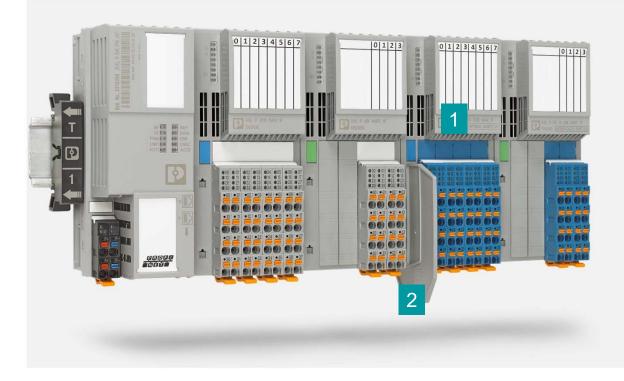


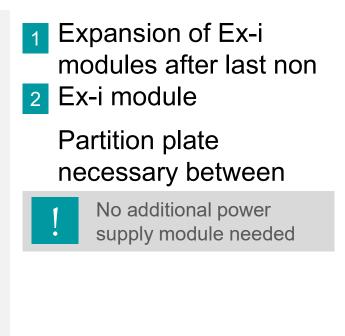


Additional modules can be added or removed without interrupting power to installed modules



## I/Os Easy expansion of Ex-i modules







### 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
AXL P EX IS DI16 NAM 1F	1052417



### 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
AXL P EX IS AI8 HART 1F	1052432



### 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





### I/Os **I/O details – DO4 SD**

#### DIGITAL OUTPUT FOR SOLENOID / ACTUATOR

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





## I/Os Portfolio overview – I/Os



16 NAMUR digital input signals for NAMUR proximity sensors



8 analog input with HART functionality



4 analog output with HART functionality



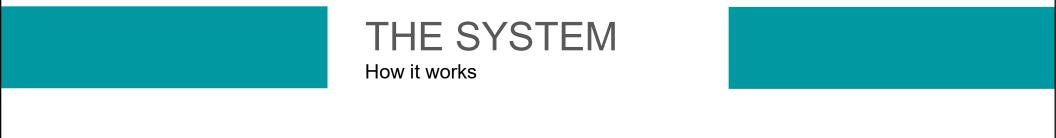
DO

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

AXL P DI16 NAM 1F	AXL P AI8 HART 1F	AXL P AO4 HART 1F	AXL P EX IS DO4 SD 24-48 1F
ArtNo.: 1052416	ArtNo.: 1052429	ArtNo.: 1052417	ArtNo.: 1087077
	AI		
16 NAMUR digital input signals for NAMUR proximity sensors, intrinsically safe	8 analog input with HART functionality, intrinsically safe	4 analog output with HART functionality, intrinsically safe	4 analog output to connect solenoid drivers, output characteristics: 21 V DC and 60 mA, intrinsically safe
AXL P EX IS DI16 NAM 1F	AXL P EX IS AI8 HART 1F	AXL P EX IS DI16 NAM 1F	AXL P EX IS DO4 SD 21-60 1F
ArtNo.: 1052417	ArtNo.: 1052431	ArtNo.: 1052417	ArtNo.: 1087078

AO







# Basics System configuration

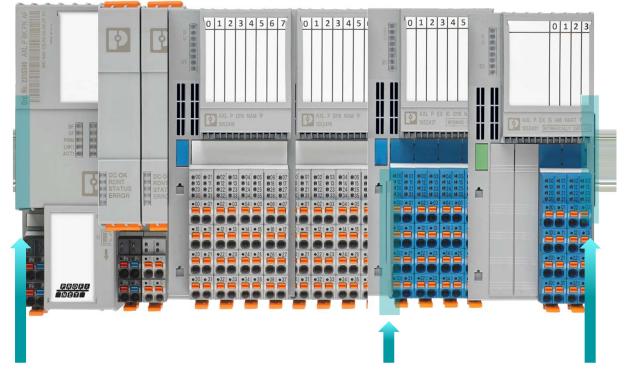




## **Ald Alter Constitutes a set of the and the and the and the alternative and the altern**

bus coupler. 2306202 AXL P/PERMARR

Please order separately!





#### Basics

## Data exchange - Local bus-

#### ADDITIONAL INFORMATION

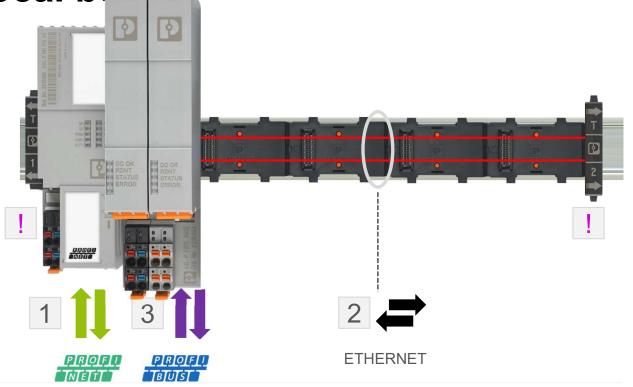


- 2-port PROFINET switch integrated in the bus coupler
- 2 c
- Ethernet-based local bus communication as a ring



3

- Term pairs necessary to close the ethernet ring
- 1-8 PROFIBUS PA segments for proxy functionality





#### Basics

## Power supply concept

#### ADDITIONAL INFORMATION



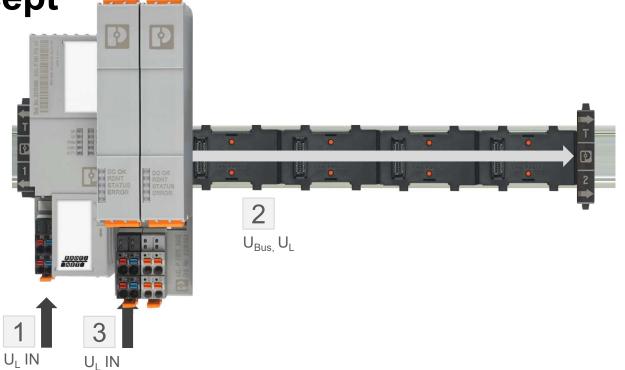
 $U_L$ : 24 V DC Must be supplied at bus coupler.  $U_L$  feed-in supplies 24 V DC to I/O modules along the local bus.



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



 $U_L$ : 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

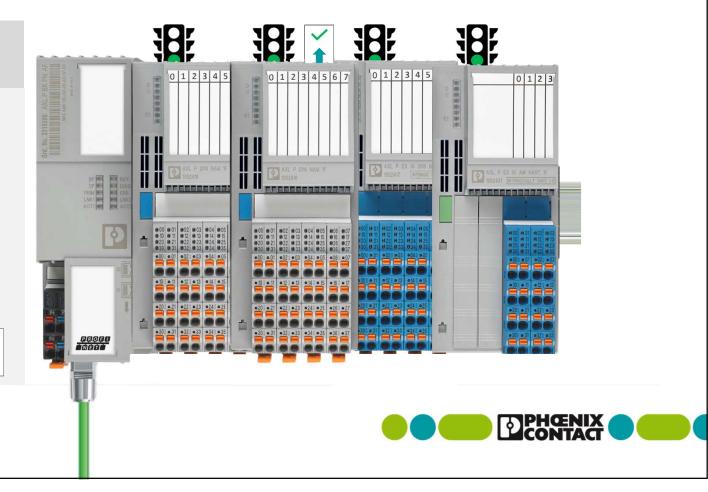
Status module 4: active



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All connected I/O modules are still in communication!

START COMMUNICATION

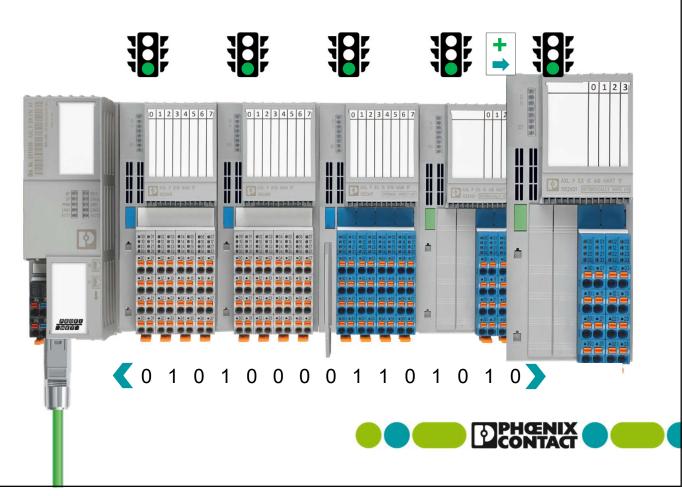


## Basics Hot Extend

#### 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
- ! A
- All connected I/O modules are still in communication!
  - Module added while station in communication and under power!



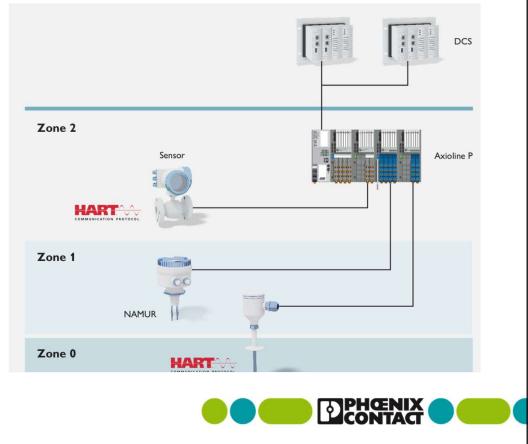
## THE APPLICATION

How to use it



## Application Reliable communication up to zone 0

<sup>44</sup>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.



## **Approvals**

(C)UL-EX LIS: Class I, Div. 2, EX ec IIC T4 Gc Groups A, B, C, D T4

**IECEx:** 

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IL, MERLI MCR-2 SUP, MORE MCR- REILI MCR-2 MPH CR-C, MONE MCR- RCR-2 U-U, MCR-2 N-U-U, MCR-2 N-U, MCR-		2-446-300, HIM HOL-2-444-300-71, HIM HOL-2-466-20 4-700, HIM HOL-2-670-70, HIM HOL-2-470-20 4-71, HIM HOL-2-670-70, HIM HOL-2-470-20 4-71, HIM HOL-2-670, HIM HOL-2-470-20 -71, HIM HOL-2-670, HIM HOL-2-470-20, HIM HOL-2-70- 4-77, HIM HOL-2-670, HIM HOL-2-470-70, HIM HOL-2- 5, HIM HOL-2-670, HIM HOL-2-670-70, HIM HOL-2- 100-70, HIM HOL-2-670, HIM HOL-2-670-70, HIM HOL-2- HIM HOL-2-670, HIM HOL-2-670, HIM HOL-2-670-70, HIM HOL-2- 100-70, HIM HOL-2-670, HIM HOL-2-670-70, HIM HOL-2- HIM HOL-2-670, HIM HOL-2-670, HIM HOL-2-670-70, HIM HOL-2- HIM HOL-2-670, HIM HOL-2-670, HIM HOL-2-670, HIM HOL-2- HIM HOL-2-670, HIM HOL-2-670, HIM HOL-2-670, HIM HOL-2- HIM HOL-2-670, HIM HOL-2-670, HIM HOL-2- HIM HOL-2-670, HIM HOL-2-670, HIM HOL-2- HIM HOL-2-670, HIM HOL-2-670, HIM H
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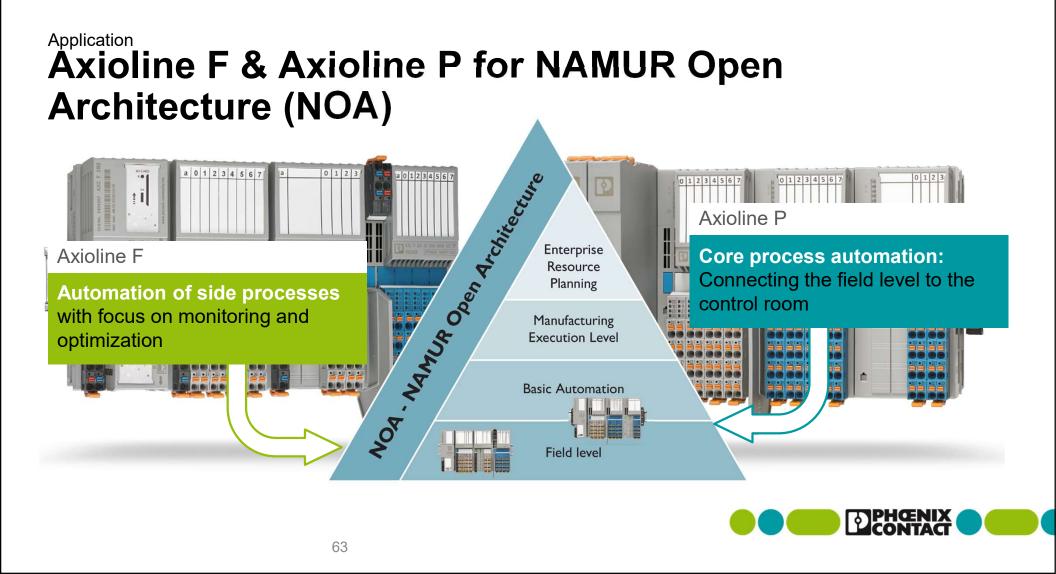
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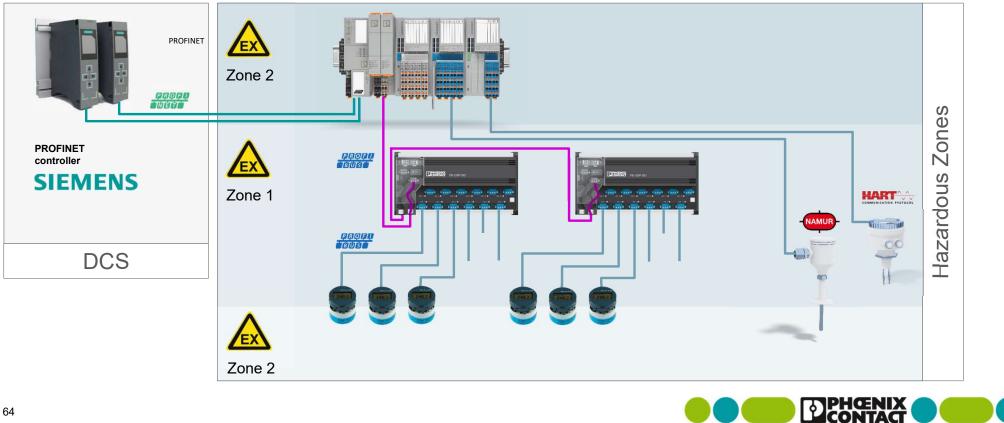
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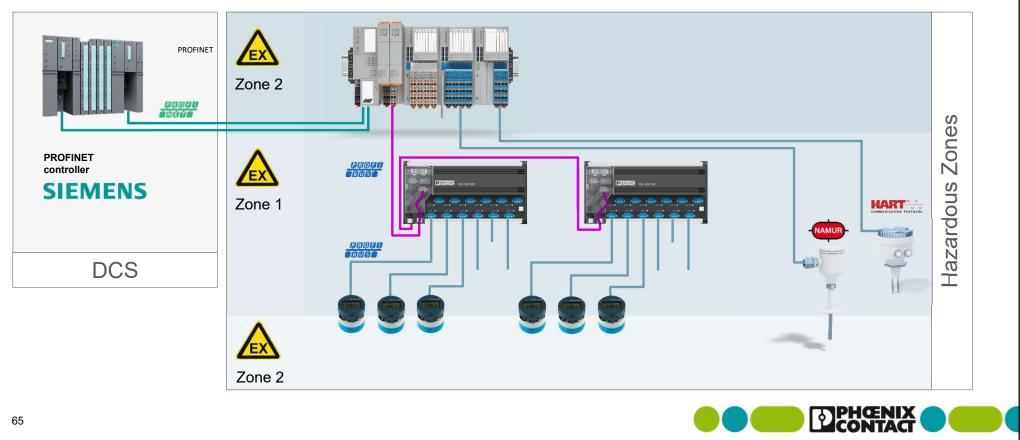




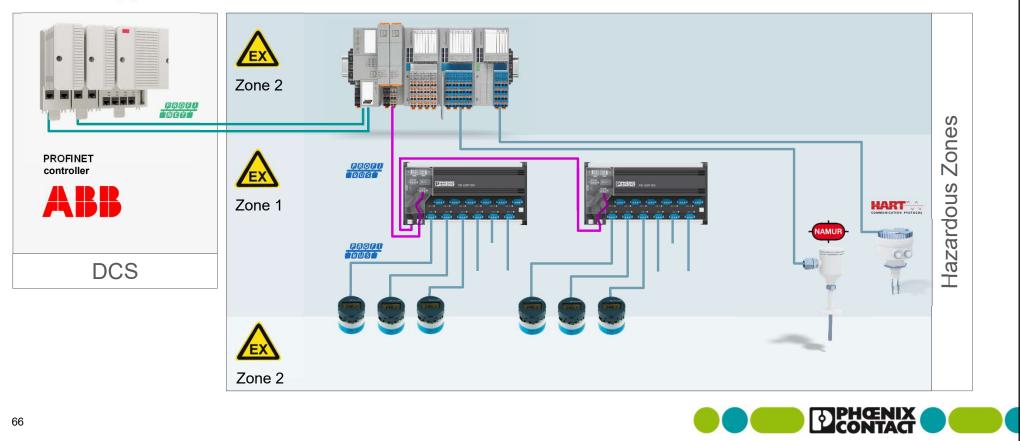
#### **Topology – Connection to various controllers**



#### **Topology – Connection to various controllers**



#### **Topology – Connection to various controllers**





Advanced Functionality

Example Axioline P Advanced Functionality S2 Redundancy



#### Easy diagnostics with FDT / DTM

iject.					<b>4</b> ×	AXL P BK PN	AF # Configuration			4 ⊳
vice tag HOST PC	Addres	ss 🕸 🛈	Û	Channel	Status	Device: Description:	AXL P BK PN AF Communication DTM		হ	PHEND
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🦸 MUX/HS/DIO-NAM	3			Segment 1	0	0.0.0	E8:6A:64:B5:54:09	0.0.0.0	0.0.0	
ABB ABB TTX300 PA	11			Segment 1	0	10.209.25.155	00:50:B6:9F:CC:1A	255.255.255.0	10.209.25.1	
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- Device Type Manager for Axioline P
- Alarm diagnostic configuration
- Standalone supervisor functionality
- NAMUR NE 107
- Vendor-specific DTM tunneling is possible



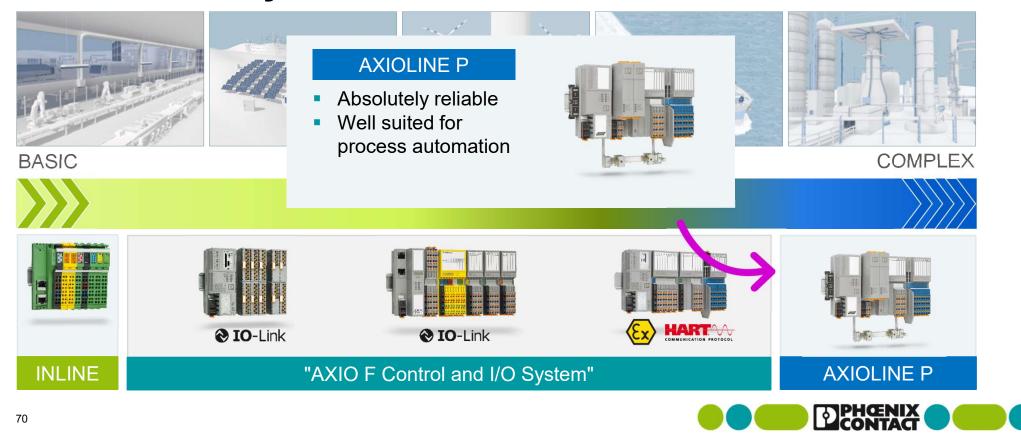
#### Easy to use GSDML composer

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Easy integration	n in a DCS or PLC system with one GS	DML file covering	

the complete Axioline P station



## Axioline P PLC and I/O systems



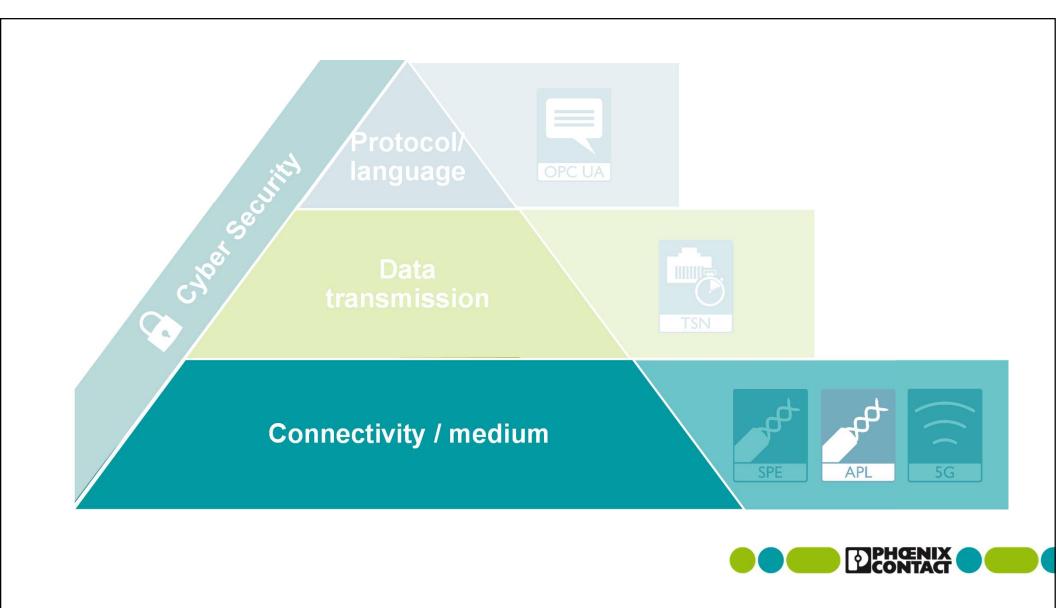


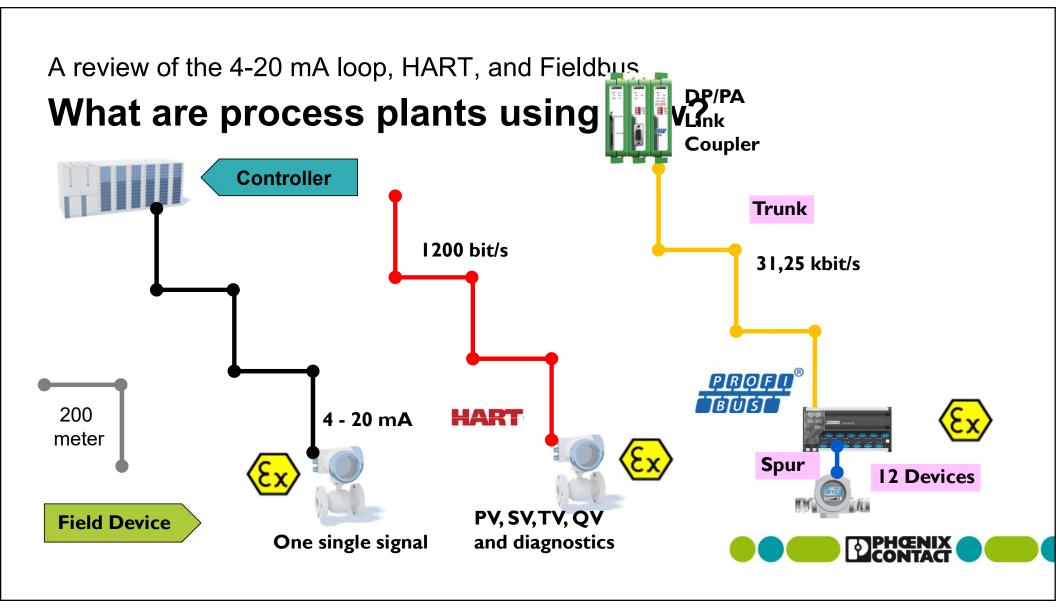
#### Axioline P



"Relevant technologies"
by addressing relevant trends









## Ethernet - APL What is it?





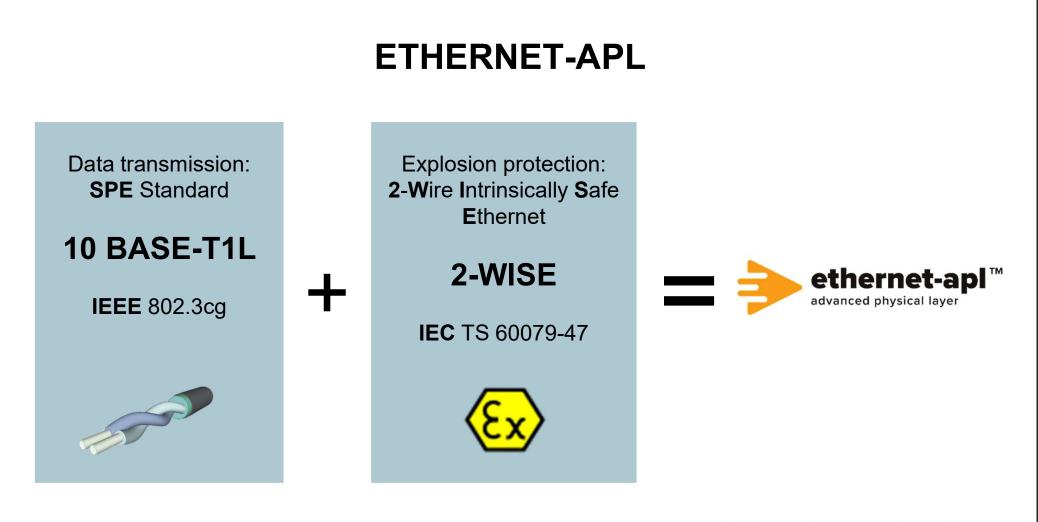
## **Ethernet to the Field Within Process Plants**





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



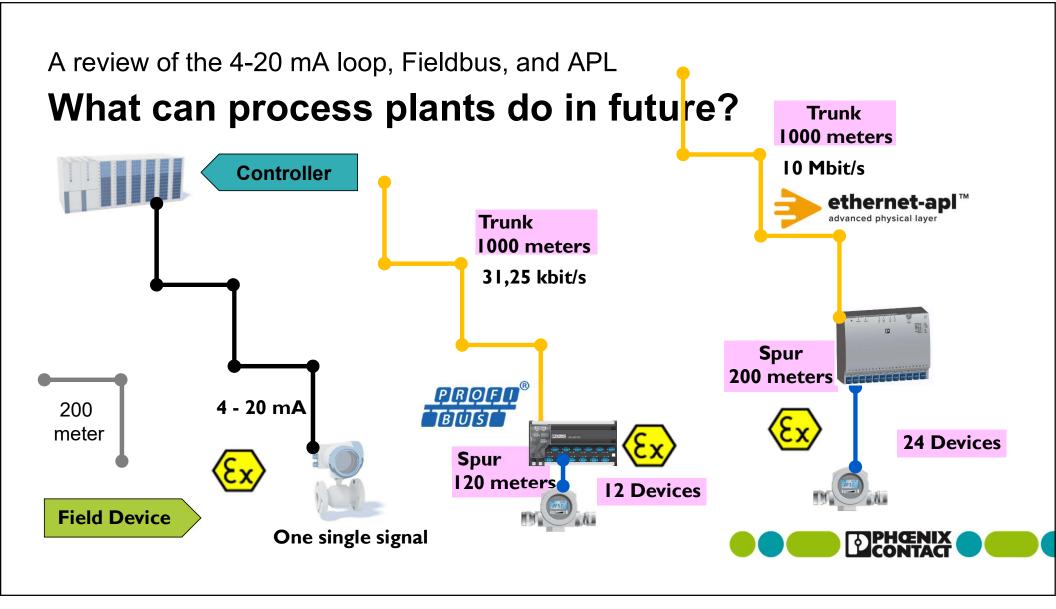


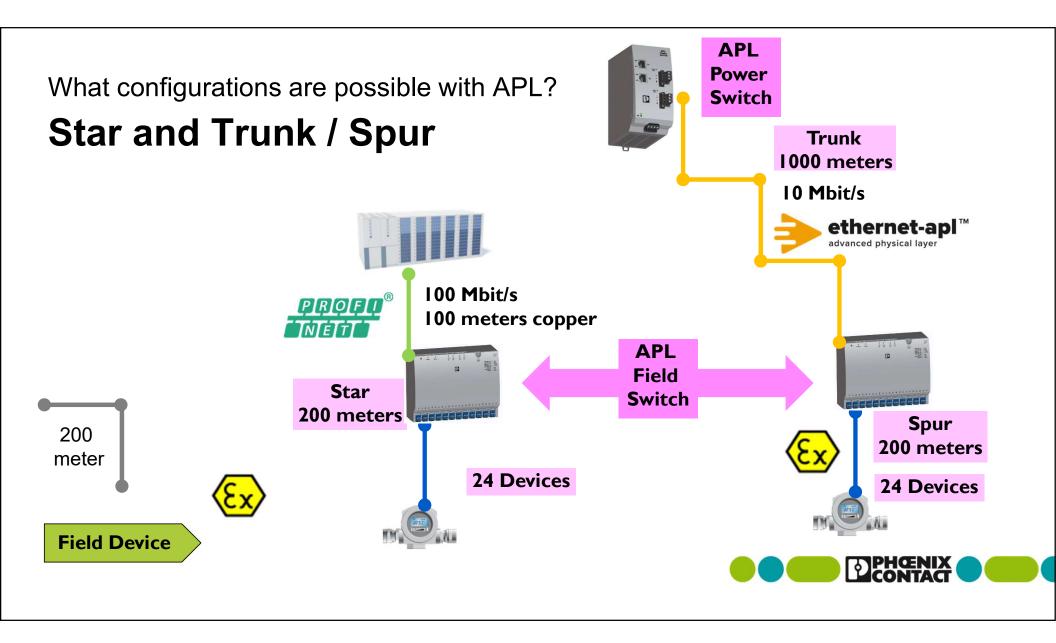


## **RELEVANT SPE STANDARDS – IEEE OVERVIEW**

		Description /		Rea	ach	
IEE	E project	Application	15 m	40 m	100m	1000 m
8	02.3bp	1000Base-T1 Automotive, Industrial, IoT				
80	02.3bw	100Base-T1 Automotive (Industrial, IoT)			]	
8	02.3cg	10Base-T1S				
80	2.3cg	10Base-T1L				
IEEE	E 802.3 bu	Power over Data Line (PoDL)	Reac	h according used SPE st	andard and cable specifi	cation









# Thank you

### Axioline P Profibus PA

THE HIGH-AVAILABILITY I/O SYSTEM

