

I/O system for field installation (IP65/67)

AXIOLINE E

PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline E

Agenda

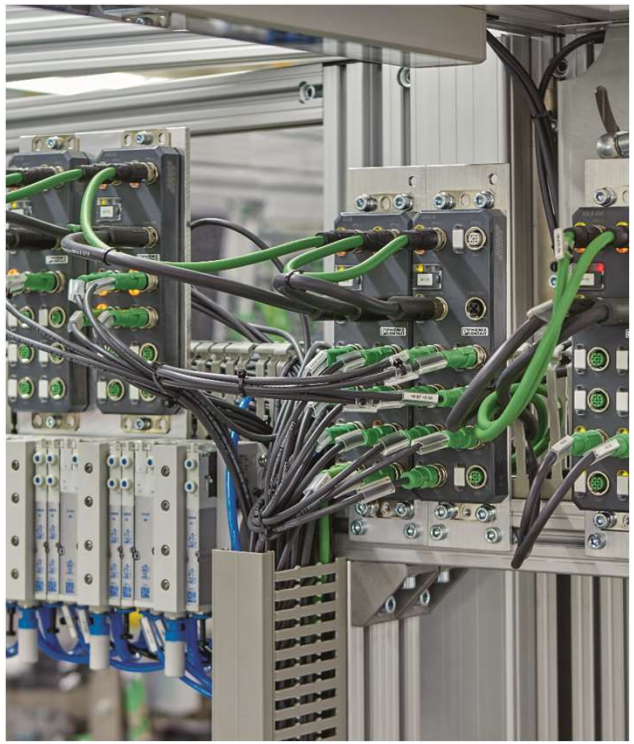
General



Axioline E basics



Axioline E IO-Link basics



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AXIOLINE E is the decentralized I/O system for automation tasks on machine and system engineering under harsh environmental conditions.

General

I/Os and IO-Link



EVERY NETWORK, EVERY ENVIROMENT

“By the support of all major networks and due to its two types of housing Axioline E is versatile in many applications. The use of IO-Link allows a wide range of digital and analog functions in combination with converters and I/O boxes.”

INSPIRING INNOVATIONS

General

Robust

ALLWAYS RELIABLE

“Axioline E has a particularly robust housing with IP65/67 protection. The electronics are therefore especially protected against environmental influences such as shock and vibrations as well as electromagnetic radiation.”



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General

Easy

SAVES YOU TIME

“The high current carrying capacity of the M12 power connectors allow easy and reduced wiring. The clear LED signaling as well as the individual marking options underline the simple handling of Axioline E.”



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General

Portfolio overview











Axioline E		Axioline E IO-Link
Digital in / out, IO-Link master		Digital in / out, analog in / out, temp
Plastic	Metal	Plastic

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BASICS

Axioline E

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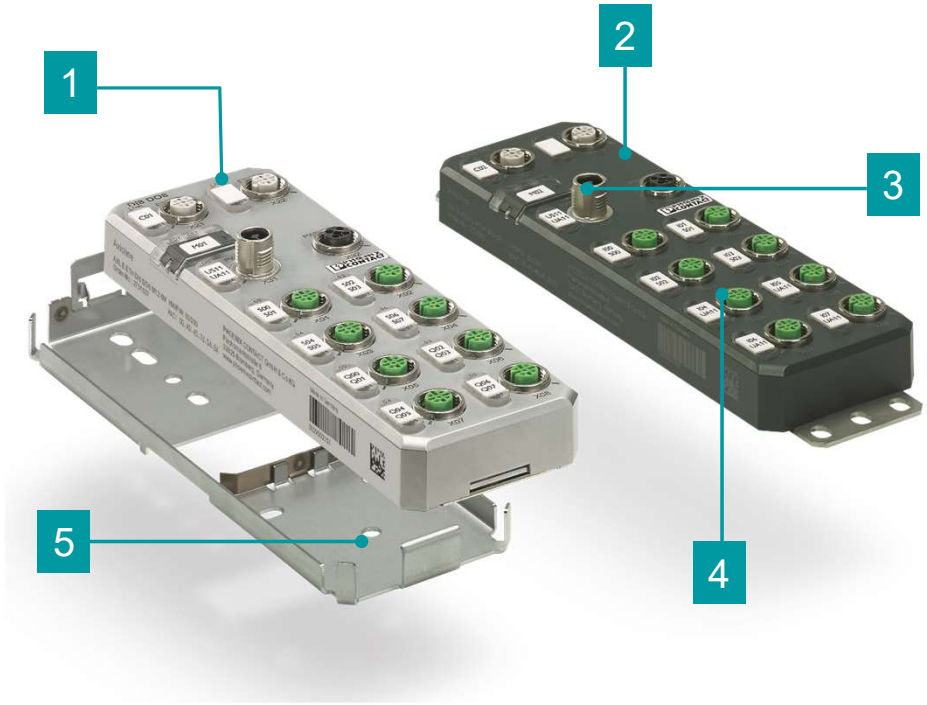
Features



1. Clear signaling
2. Robust mechanical design – increased system availability, thanks to the particularly robust mechanical design as well as shock and vibration resistance
3. Easy supply – high current carrying capacity and simple supply concept, thanks to M12 power connectors
4. Intuitive installation, thanks to color-coded M12 connections
5. Tool-free device replacement when using the mounting plate

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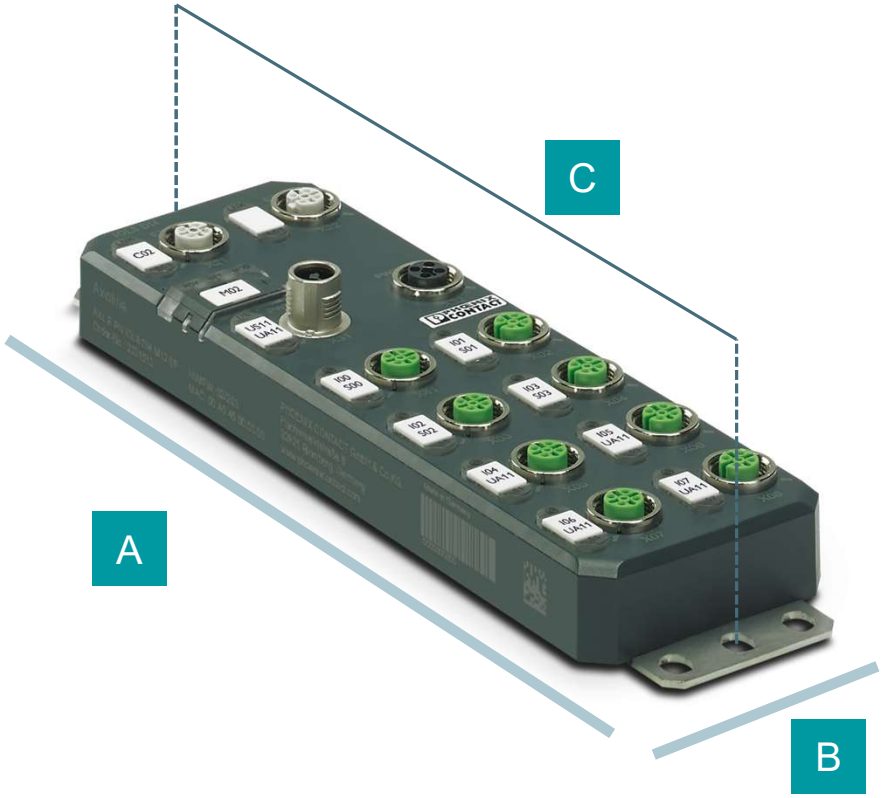
Dimensions & protection class



A	HEIGHT	212 mm (incl. fixing clips)
B	WIDTH	60 mm
C	DRILL HOLE SPACING	198.50 mm

IP65/67

All Axioline E devices are classified according to the protection classes IP65 and IP67

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I/O functions & protocols

I/O FUNCTIONS

- **DI16**
  16 digital inputs
- **DIO16**
  16 digital in- or outputs (configurable)
- **DI8 DO8**
  8 digital inputs and 8 digital outputs (500 mA)
- **DI8 DO4**
  8 digital inputs and 4 digital outputs (2 A)
- **IOL8 DI4**
  8 IO-Link ports (4x type A, 4x type B) and
  4 digital inputs

PROTOCOLS

- PROFINET
- Profibus
- Ethernet/IP
- EtherCAT
- Modbus TCP
- Sercos

i I/O FUNCTIONS CONSISTENTLY AVAILABLE FOR ALL PROTOCOLS

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Axioline E basics

Portfolio

Function / Network		DI16	DIO16	DI8 DO8	DI8 DO4-2A	IOL8 DI4
PROFINET		Plastic 2701510 Metal 2701516	Plastic 2701511 Metal 2701517	Plastic 2701509 Metal 2701515	Plastic 2701512 Metal 2701518	Plastic 2701513 Metal 2701519
EtherNet/IP		Plastic 2701493 Metal 2701488	Plastic 2701494 Metal 2701489	Plastic 2701492 Metal 2701487	Plastic 2701495 Metal 2701490	Plastic 2701496 Metal 2701491
EtherCAT		Plastic 2701521 Metal 2701526	Plastic 2701522 Metal 2701528	Plastic 2701520 Metal 2701525	Plastic 2701523 Metal 2701529	Plastic 2701524 Metal 2701531
Modbus		Plastic 2701533 Metal 2701538	Plastic 2701534 Metal 2701539	Plastic 2701532 Metal 2701537	Plastic 2701535 Metal 2701540	Plastic 2701536 Metal 2701541
sercos the automation bus		Plastic 2701544	Plastic 2701545	Plastic 2701542	Plastic 2701546	Plastic 2701547
PROFIBUS		Plastic 2701498 Metal 2701505	Plastic 2701499 Metal 2701506	Plastic 2701497 Metal 2701504	Plastic 2701502 Metal 2701507	Plastic 2701503 Metal 2701508

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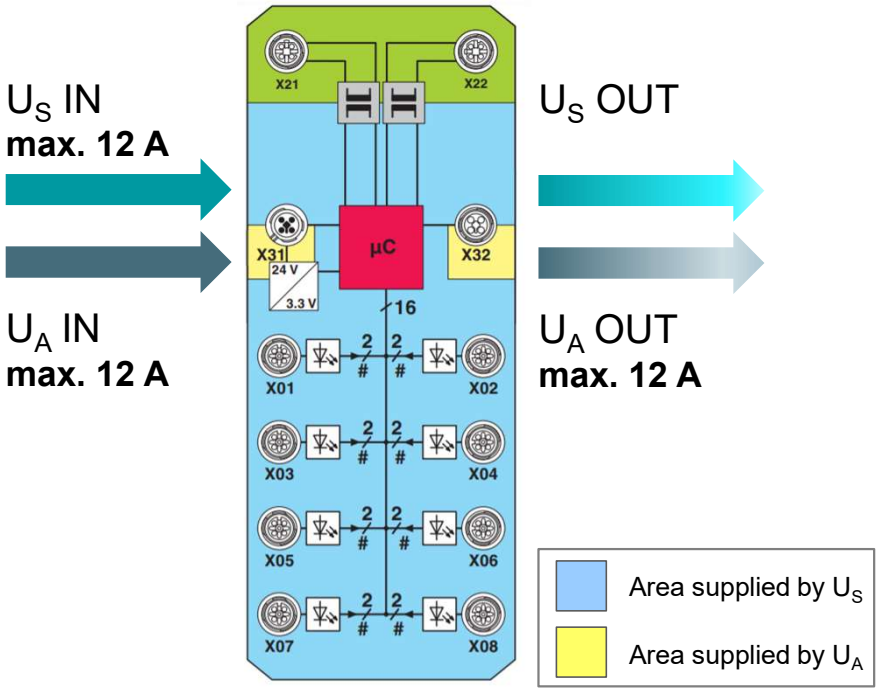
Power supply concept AXL E DI16…



Sensor current supplied by U_S

Digital inputs (U_S)

- Sensor current: typ. 75 mA (per channel)
- Total sensor current: max. 1.2 A (per device)

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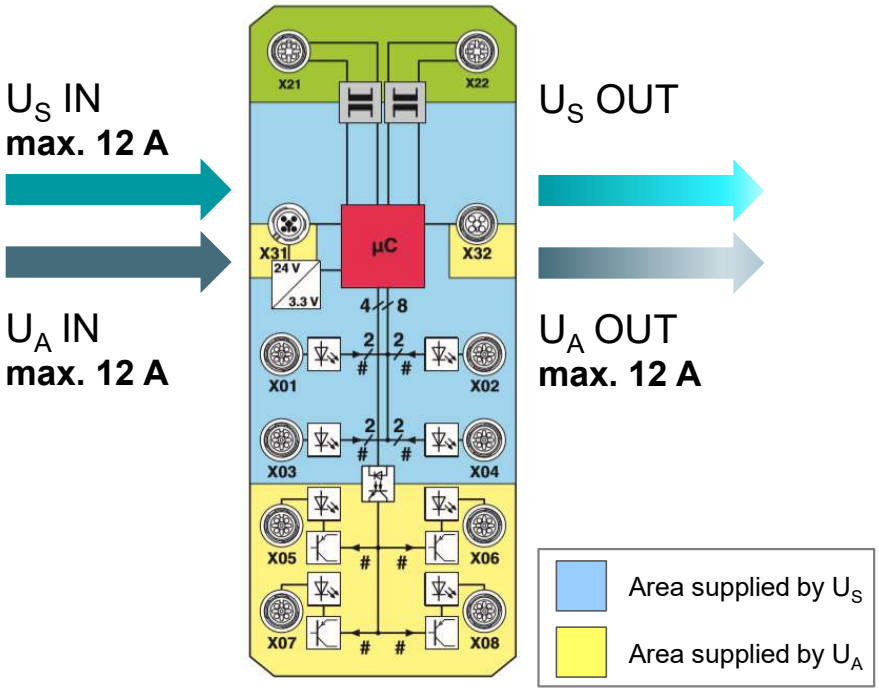
Power supply concept AXL E DI8 DO4…



Sensor current supplied by U_S

Actuator current supplied by UA

Digital inputs (U_S)

- Sensor current: typ. 75 mA (per channel)
- Total sensor current: max. 0.6 A (per device)

Digital outputs (U_A)

- Max. output current: 2 A (per channel)

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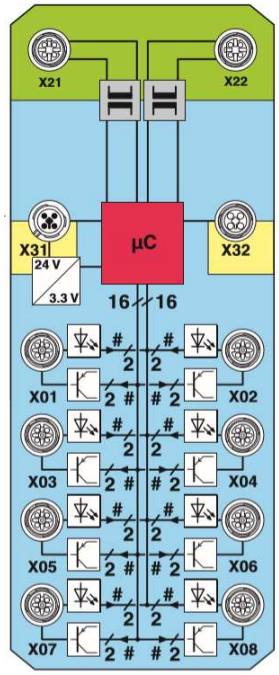
Power supply concept AXL E DIO16…

U_S IN
max. 12 A

U_A IN
max. 12 A



U_S OUT
max. 12 A

U_A OUT
max. 12 A

Area supplied by U_S

Area supplied by U_A

Sensor AND actuator current supplied by U_S

Digital inputs (U_S)

- Sensor current: typ. 75 mA (per channel)
- Total sensor current: max. 1.2 A (per device)

Digital outputs (U_S)

- Max. output current: 0.5 A (per channel)

Confidential

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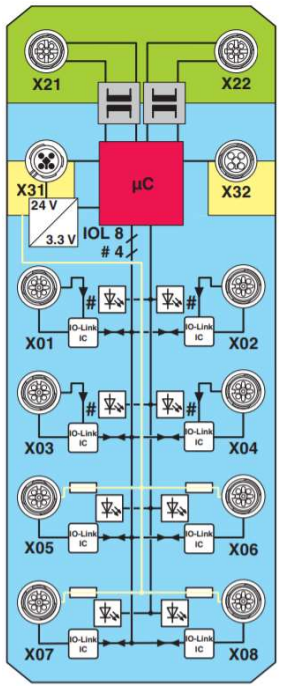
Power supply concept AXL E IOL…

U_S IN
max. 12 A

U_A IN
max. 12 A



U_S OUT
max. 12 A

U_A OUT
max. 12 A

Area supplied by U_S

Area supplied by U_A

IO-Link Ports type A and sensor current supplied by U_S

IO-Link Ports type B supplied by UA

Nominal current for every IO-Link port…

... 150 mA at C/Q (pin 4):
Max. of 1.6 A over all 8 IO-Link C/Q and L+ cables

… 200 mA at L+/L- (pin 1 and pin 3):
during startup, up to 1.6 A for short periods

… max. 2 A at UA (IO-Link B ports, pin 2 and pin 5)

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M12-Power accessories (coding:T)



ASSEMBLED CABLES

SAC-4P-M12…T..

Straight, angled

ALL DETAILS



CONNECTORS

SACC-M12…T-4CON…

Straight, angled

ALL DETAILS



Y DISTRIBUTOR

SAC-4PY-MT/2XFT VP

-

ALL DETAILS



DISTRIBUTOR BOXES

SACB-4/T-L-8FUSE…

Optional diagnostics

ALL DETAILS

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Assembled cables SAC-4P-M12…

- Easy and safe: 100% electrically tested plug-in components
- High-performance: DC connectors for up to 12 A and 63 V DC
- Protection against incorrect connection using special T-coding
- Our standard: robust halogen-free PUR cable
- Conductor cross section: 4x 1,5 mm²
- Shielded, unshielded
- Cable lenght: 0.3 m to 10.0 m



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Power connectors SACC-M12…T-4CON…

- Safe use in the field, thanks to a high degree of protection
- Screw connection: proven connection technology for a large selection of different conductors
- High-performance: DC connectors for up to 12 A and 63 V DC
- Protection against incorrect connection using special T-coding
- Conductor cross section 0.75 mm² ... 1.5 mm² (without ferrule)
- Unshielded
- Pg9, external cable diameter 6 mm ... 8 mm



Male, straight



Male, angeled



Female, straight



Female, angeled

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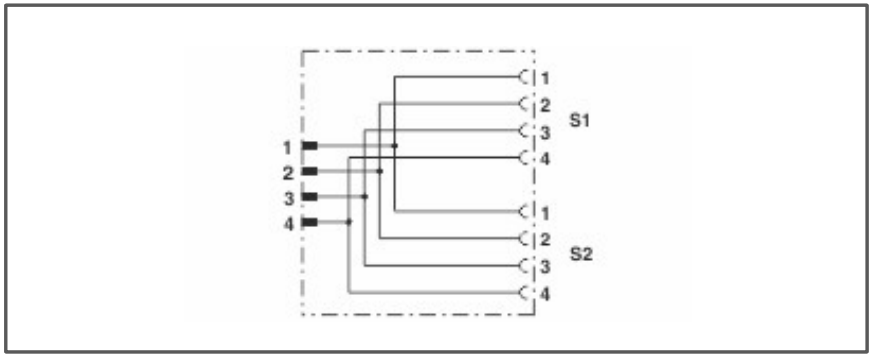
Y distributor SAC-4PY-MT/2XFT VP

- M12 male auf 2x M12 female
- High-performance: DC connectors for up to 12 A and 63 V DC
- Protection against incorrect connection using special T-coding
- Unshielded





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Distributor boxes SACB-4/T-L-8FUSE … CT AXL

- Power distributor with 4 x M12 T-coded
- Current carrying capacity per I/O signal: 10 A
- Current carrying capacity per slot : 2x 9.25 A (at 40 °C)
- Max input current: 70A
- Two separate current paths (U_S, U_A)
- Internal fuse for each current path
- Optional: with diagnostics



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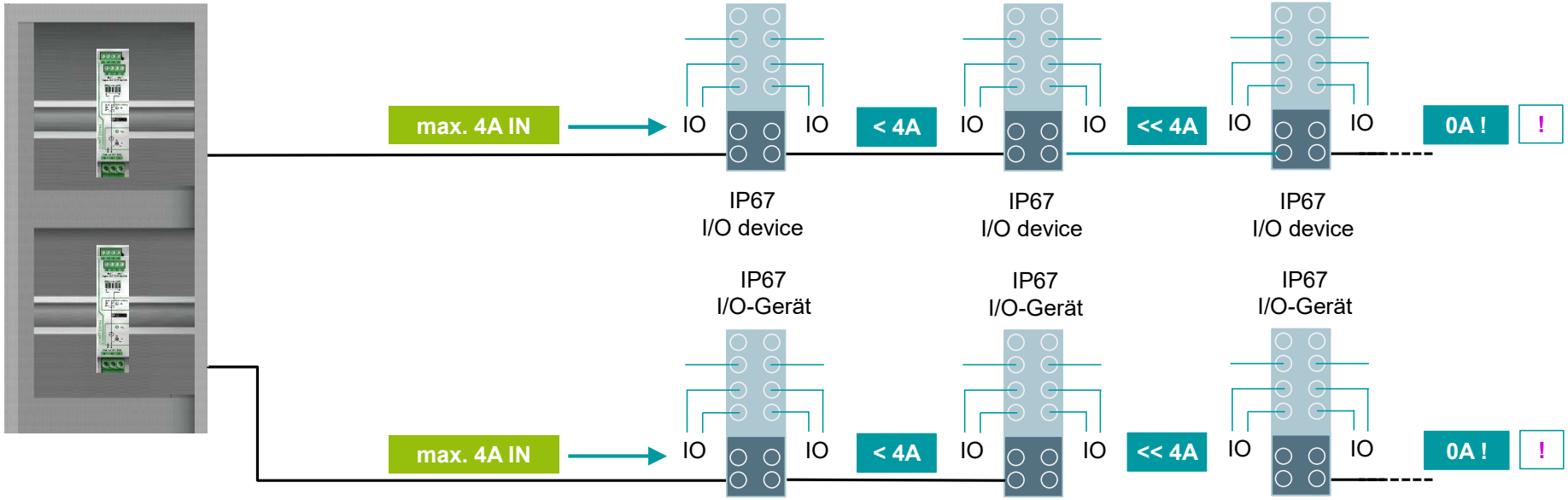
Usual dezentralized installation



INSUFFICIENT MODULE SUPPLY! ADDITIONAL POWER SUPPLY NECESSARY!

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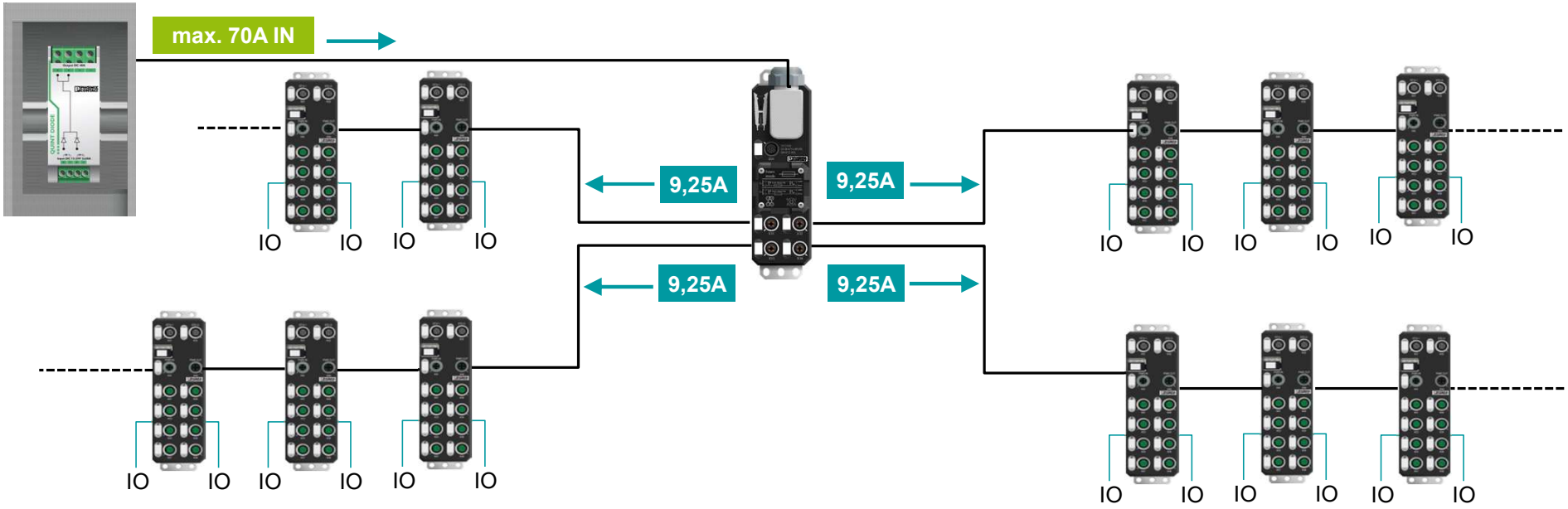
Decentralized supply concept with a distributor box



OPTIMIZED DECENTRALIZED SUPPLY CONCEPT !

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Diagnostic LEDs: Power supply

US		Communications power/sensor voltage is present
		Sensor voltage overload
	OFF	Communications power/sensor voltage is not present or too low

UA		Actuator voltage is present
	OFF	Actuator voltage is not present



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Diagnostic LEDs: Communication

LINK ETH1/ ETH2		Connection is present at port 1/2
	OFF	Connection is not present at port 1/2
ACT ETH1/ ETH2	blink	Data transmission is present at port 1/2
	OFF	Data transmission is not present at port 1/2
RDY		The device is ready for operation
	OFF	The device is not ready for operation



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Protocol-dependent displays

Protocol	COM1	Function	COM2	Function	Addres-switch
Profinet	BF	Profinet communication / hardware watchdog trigger	SF	Profinet diagnostics / hardware watchdog trigger	No
Ethernet/IP	NET	Network status	MOD	Device status	Yes
Modbus	NET	Network status ok /not ok	-	-	Yes
Sercos 3	S	Sercos communication	SD	Sub Device Informationen	Yes
EtherCAT	RUN	EtherCat specific operating status	ERR	Error / specific operating status	Yes
Profibus	BF	Slave communication	SF	diagnostics / device error	Yes

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BASICS

Axioline E IO-Link

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Axioline E IO-Link

I/O functions & types

I/O FUNCTIONS

A **DI8 / DI16** (2 separate articles)
8 digital inputs / 16 digital inputs

A **DO8**
8 digital outputs (500 mA)

B **AI1-I / AI1-U** (2 separate articles)
1 analog input (current / voltage)

B **AO1-I / A01-U** (2 separate articles)
1 analog output (current / voltage)

B **RTD 1**
1 temperature input RTD

C **TC4**
4 analog TC inputs (types K/J)

TYPES

A



I/O box

B



Analog converter

C



TC converter

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IO-Link devices – Digital communication



IO-Link I/O box for digital Signals

- IO-Link specification V1.1.2 compatible
- Connection to IO-Link master with M12 connectors
- Connection of digital sensors / actuators with M12 connectors
- Degree of protection IP65

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Axioline E IO-Link

Fast, robust and easy



1. Easy wiring – only one cable connection necessary for communication and power
2. Clear signaling
3. Robust mechanical design – increased system availability, thanks to the particularly robust mechanical design as well as shock and vibration resistance
4. Intuitive installation, thanks to color-coded M12 connections

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IO-Link devices – Analog communication





Converter for analog Signals to IO-Link

- IO-Link specification V1.1 compatible
- Connection to IO-Link master with M12 connectors
- Connection of analog sensors / actuators with M12 connectors
- Straight or rectangular design
- Degree of protection IP65

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IO-Link devices – Analog communication



Converter for analog Signals to IO-Link

- IO-Link specification V1.1.2 compatible
- Connection to IO-Link master with M12 connectors
- Connection of thermocouples type K with push-in technology
- Degree of protection IP54

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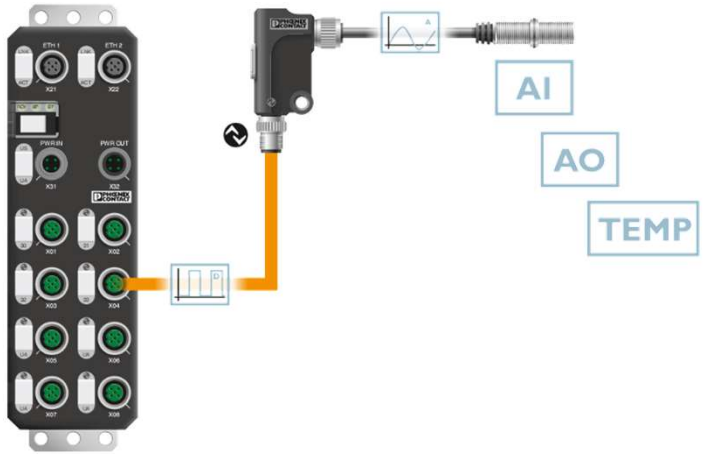
IO-Link-Devices - Analog communication

- Capture and output analog signals via IO-Link and analog converters
- M12-connection method for direct assembly at sensor or acuator

Advantages:

- ✓ No longer need of shielded cables due to digital data transmission
- ✓ Enhanced EMC behaviour
- ✓ Needs-based use of analog function at the device
- ✓ One end device for all signals will reduce storage cost



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Axioline E IO-Link

Portfolio – IO-Link Devices

	IOL DI8	IOL DI16	IOL DO8
	2702658	2702660	2702659

	IOL AI U	IOL AO U	IOL AI I	IOL AO I	IOL RTD
	Gerade 2700336 Gewinkelt 2700273	Gerade 2700350 Gewinkelt 2700278	Gerade 2700338 Gewinkelt 2700275	Gerade 2700351 Gewinkelt 2700282	Gerade 2700352 Gewinkelt 2700305

	IOL TC 4
	2702983

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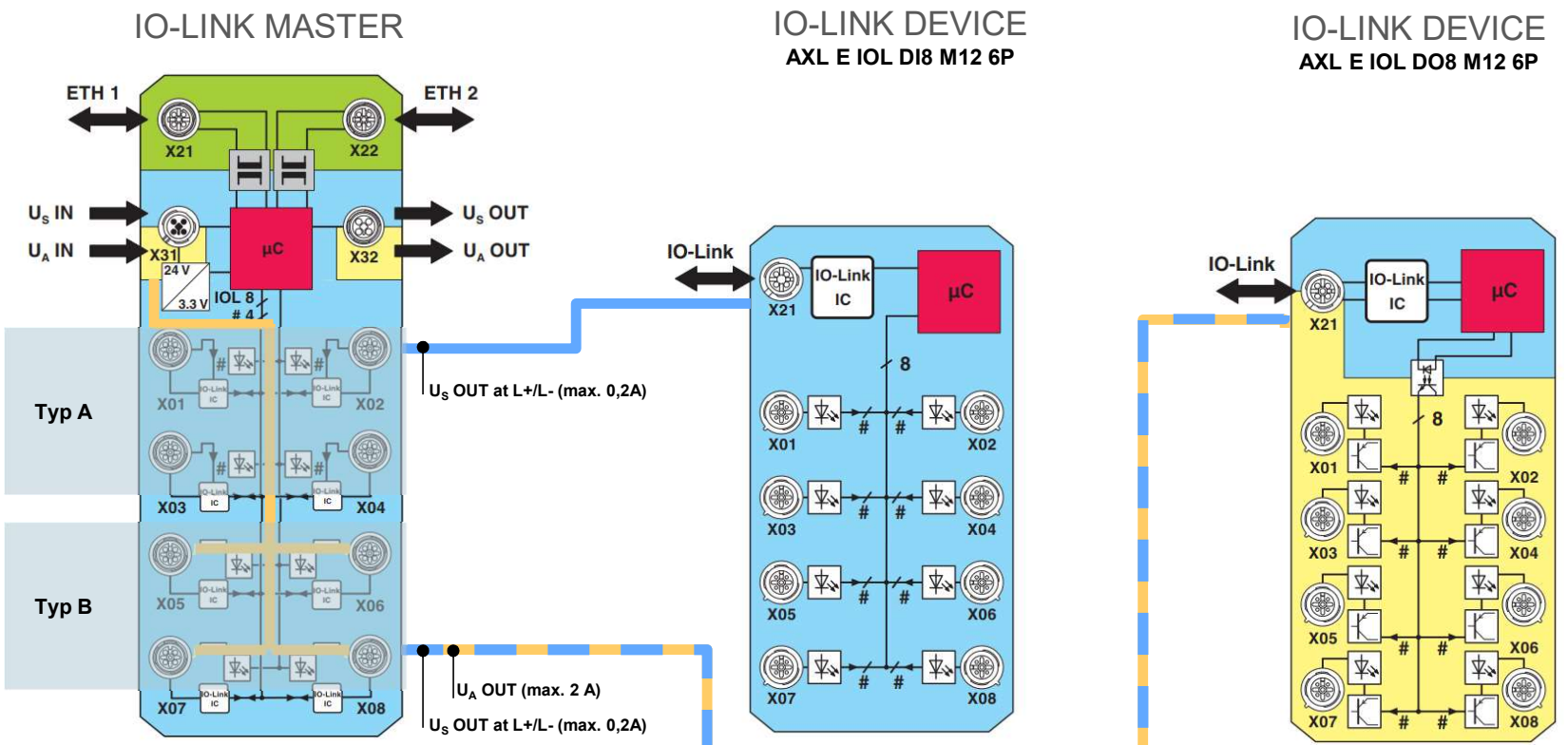
Axioline E IO-Link

Power supply concept IO-Link



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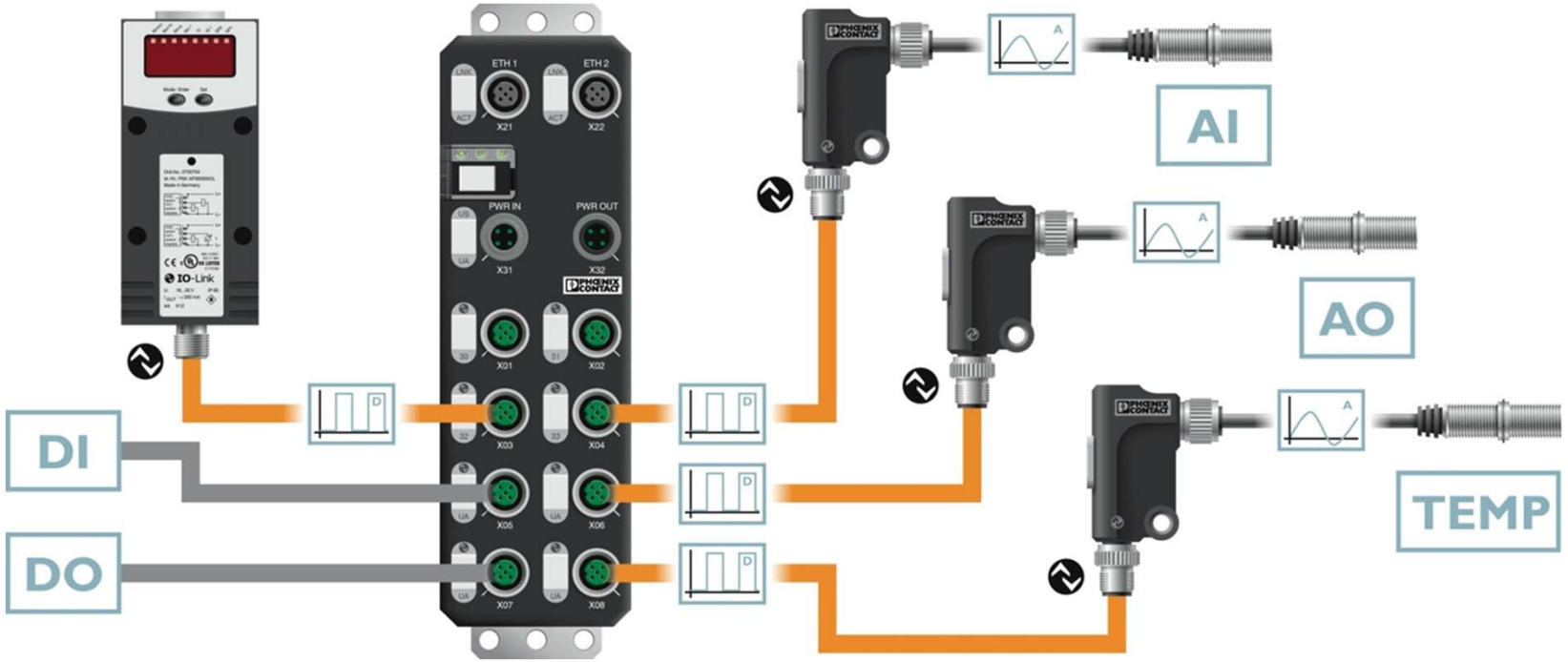
Axioline E IO-Link

One device – numerous possibilities



IO-Link as a basic technology

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Configuration possibilities IO-Link master

Configurations*	DI	DO	IO-Link
IOL8 DI4	4	0	8
DI12	12	0	0
DI4 DO8	4	8	0
IOL4 DI8	8	0	4
IOL4 DI4 DO4	4	4	4
IOL2 DI4 DO6	4	6	2
IOL2 DI8 DO2	8	2	2
IOL6 DI4 DO2	4	2	6

* This overview does not display every configuration

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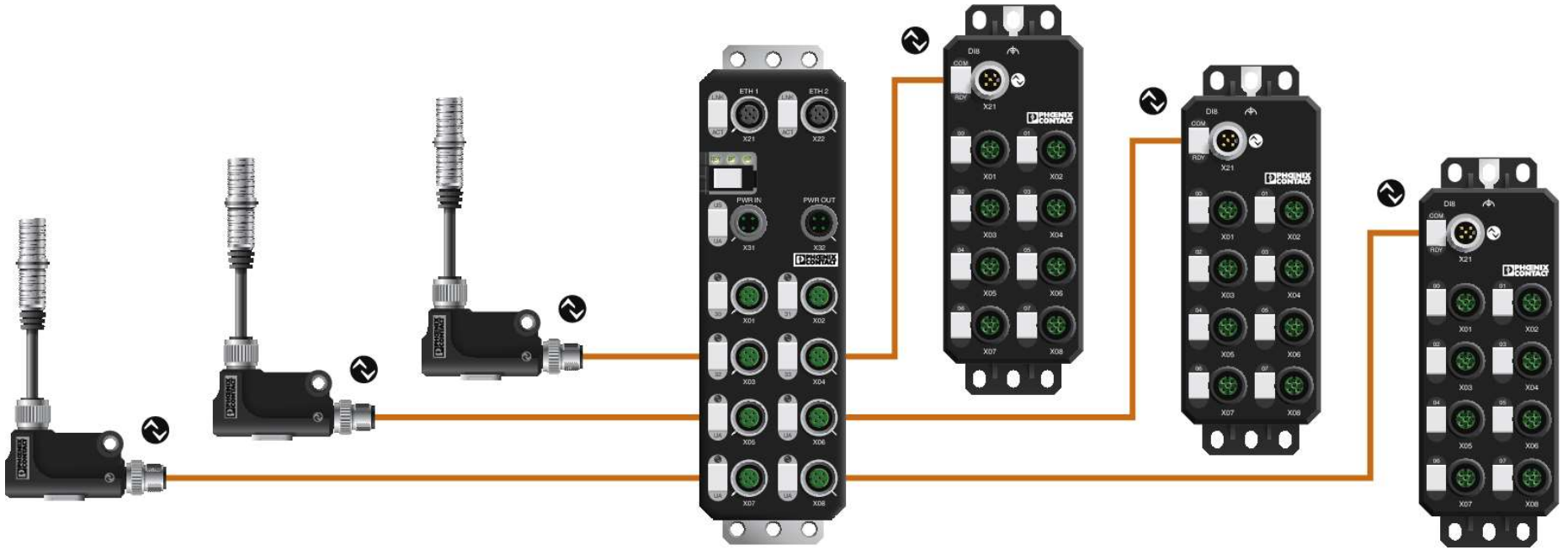
Axioline E IO-Link

Modularity in the field



IO-Link devices extend the functional scope of an Axioline E device

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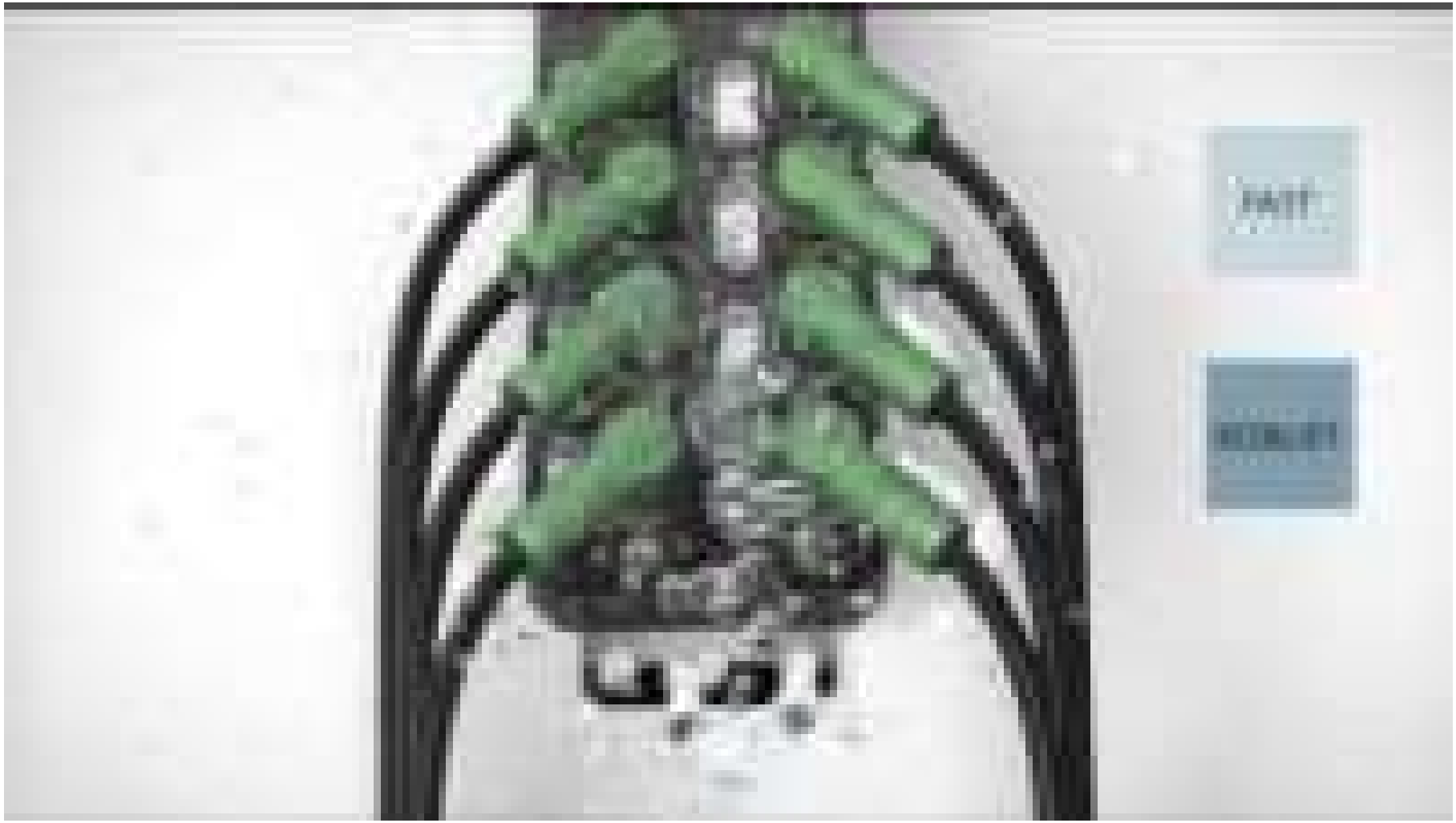

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Thank you

I/O system for field installation (IP65/67)

AXIOLINE E

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The
Modular Automation System

IT‘S YOUR CHOICE

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Agenda

- The modular automation system: basic idea
- Controls
- Bus couplers
- Axioline Smart Elements
- Axioline F: standard modules
- Axioline F: modules for special environments
- The modular automation system: solutions
- Scope of applications



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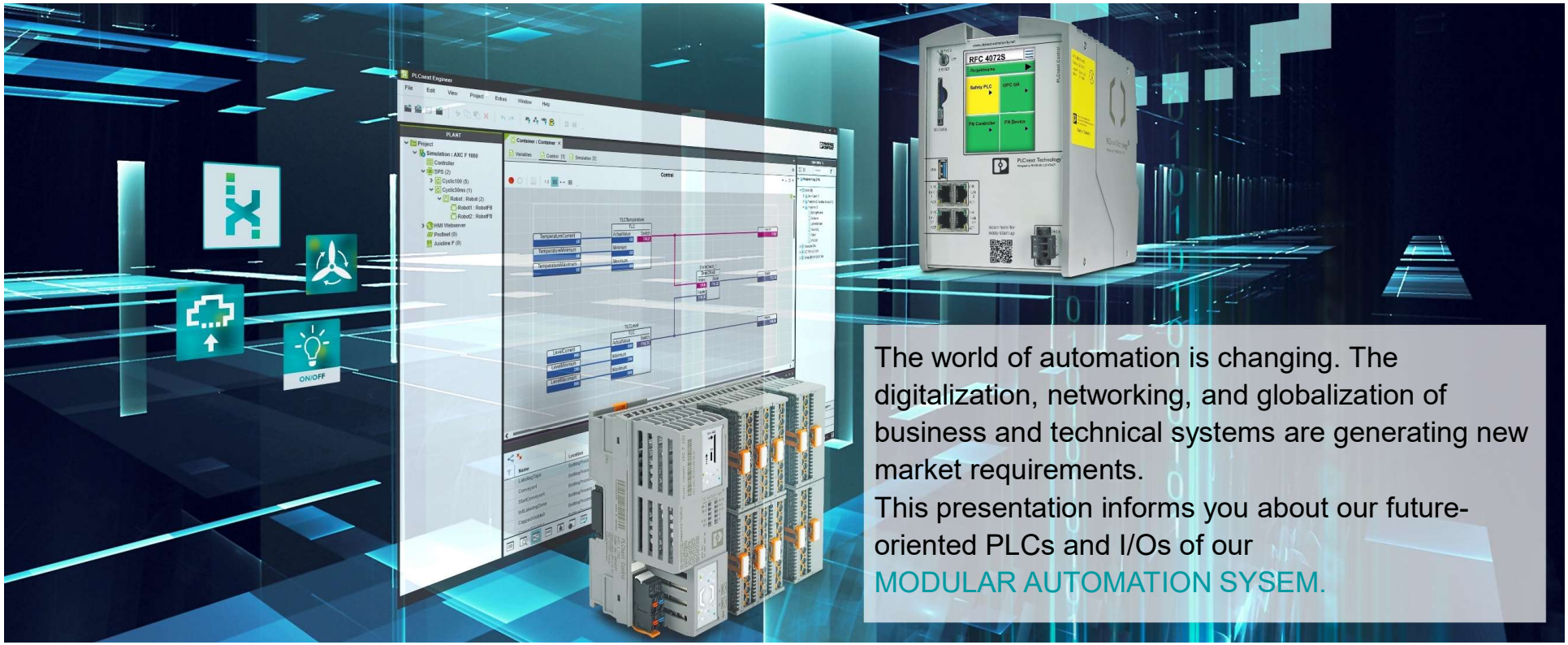
The modular automation system: basic idea

Open to the future



The world of automation is changing. The digitalization, networking, and globalization of business and technical systems are generating new market requirements.
This presentation informs you about our future-oriented PLCs and I/Os of our MODULAR AUTOMATION SYSEM.

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The modular automation system: basic idea

Modular automation system



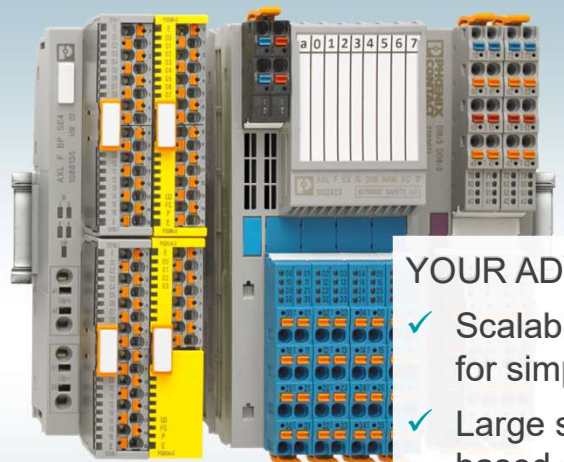
Controllers

PLCs for high-level languages and IEC 61131-3 programming.



Bus couplers

Open to all common bus systems and network protocols.



I/Os

Modules with digital and analog inputs and outputs, functions or for special applications.

YOUR ADVANTAGES

- ✓ Scalable automation system for simple to complex tasks
- ✓ Large selection of modules based on the modular principle
- ✓ Systemic configuration to different networks using various front modules

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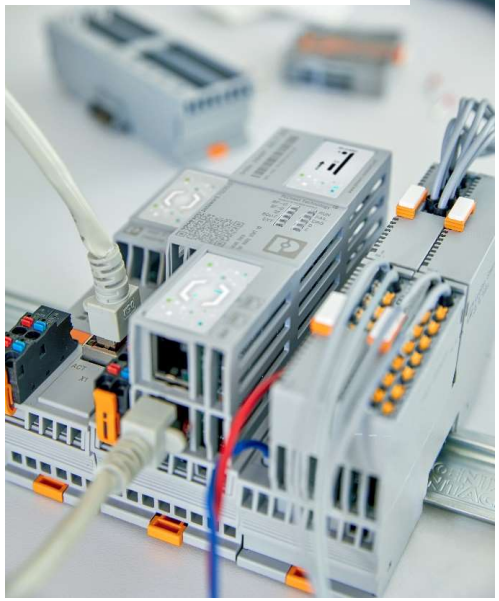
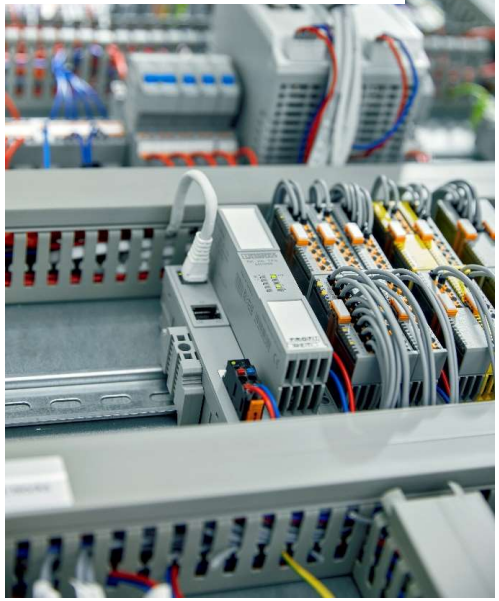
Details of each „discipline“

CONTROLS



BUS COUPLERS



I/Os



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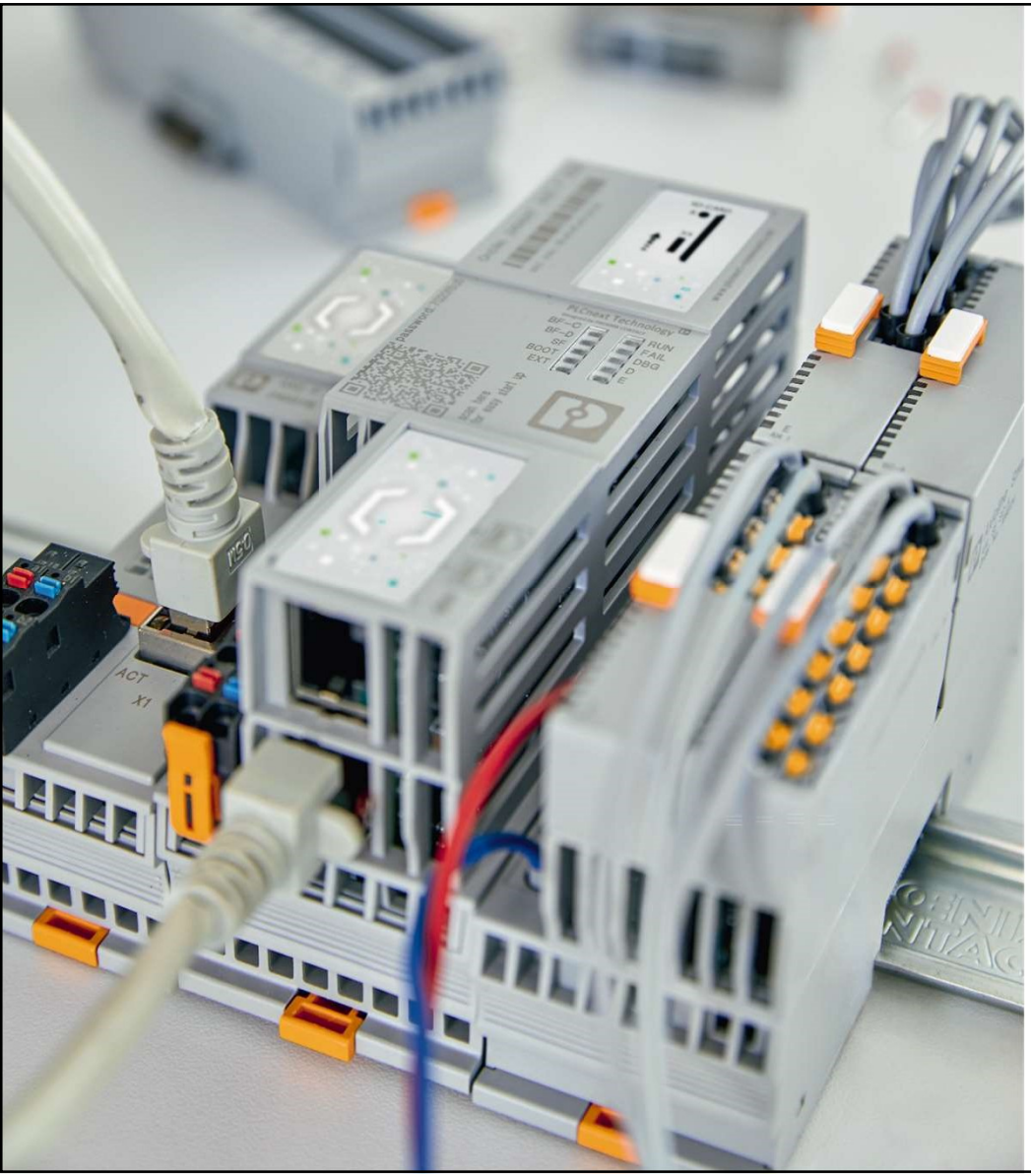
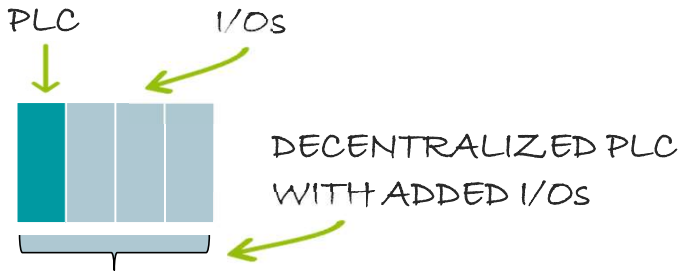


Controllers

PLCs for numerous applications

“PLCs for the open PLCnext Technology ecosystem are available in the form of PLCnext Control devices. They enable the implementation of automation projects without the limitations of proprietary systems.”

PLC in a modular I/O system



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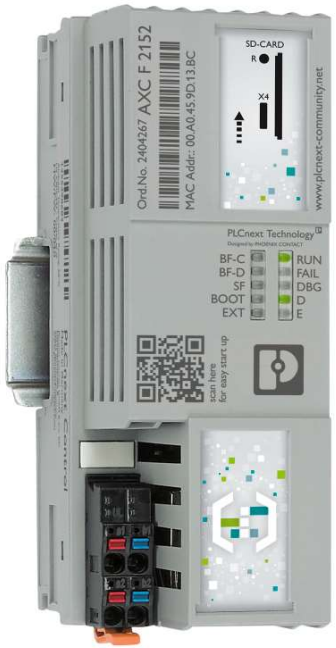
PLCnext Control

Portfolio overview - controllers









FOR BEGINNERS	STANDARD OPTION	HIGHER PERFORMANCE
AXC F 1152	AXC F 2152	AXC F 3152
8 tasks, 16 PN devices	32 tasks, 64 PN devices	32 tasks, 128 PN devices
ALL DETAILS	ALL DETAILS	ALL DETAILS

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PLCnext Control

Portfolio overview - extensions





ETHERNET PORT

AXC F XT ETH 1TX

ALL DETAILS



INTERBUS MASTER

AXC F XT IB

ALL DETAILS



SAFETY CONTROLLER

AXC F XT SPLC 1000

ALL DETAILS

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PLCnext Control

Easy expansion

“Extend the functions of your PLCnext Control device (AXC F 2152 or AXC F 3152) with a safety, Ethernet, or INTERBUS module that can be aligned to the left of the controller. The left-alignable PROFIsafe extension is a fully functional safety-oriented small-scale PLC which extends the functional scope of your PLCnext Control device for safety applications up to SIL 3. Connect up to three modules to your PLC with an additional extension module.”



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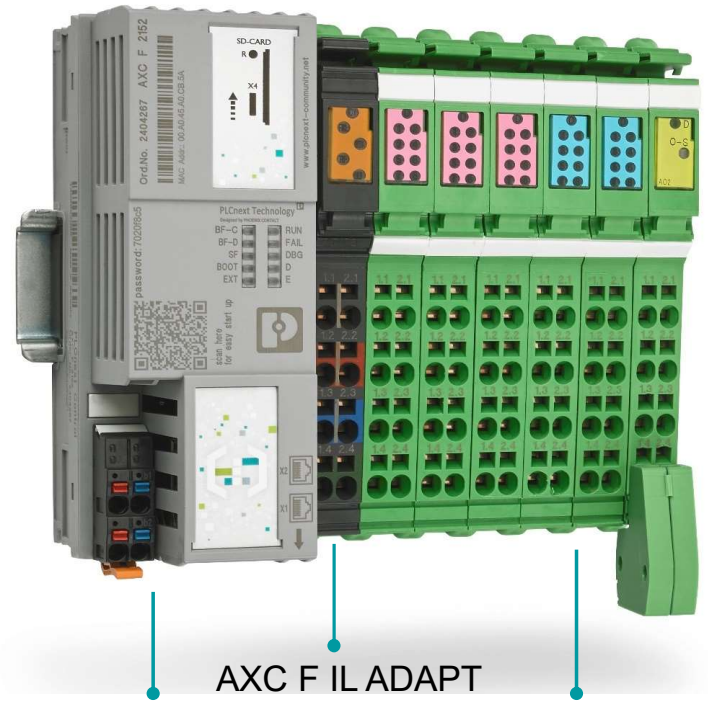
PLCnext Control

(Retro-)fit for the future

“ The Inline I/O system and PLCnext Technology fit together!
The Inline adapter terminal
(AXC F IL ADAPT 1020304) allows you to easily extend an existing I/O station with a PLCnext Control device, thereby enabling the successive modernization of an existing system. ”

AXC F IL ADAPT | ALL DETAILS



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INSPIRING INNOVATIONS

PLCnext Control

Store

“ In the PLCnext Store, you can download ready-to-use solutions to your PLCnext Control device and create your application quickly – without any deep understanding of programming. Phoenix Contact already provides numerous software libraries for PLCnext Engineer which are now available for download. ”

LINK TO THE PLCnext Store



PHOENIX CONTACT
INSPIRING INNOVATIONS

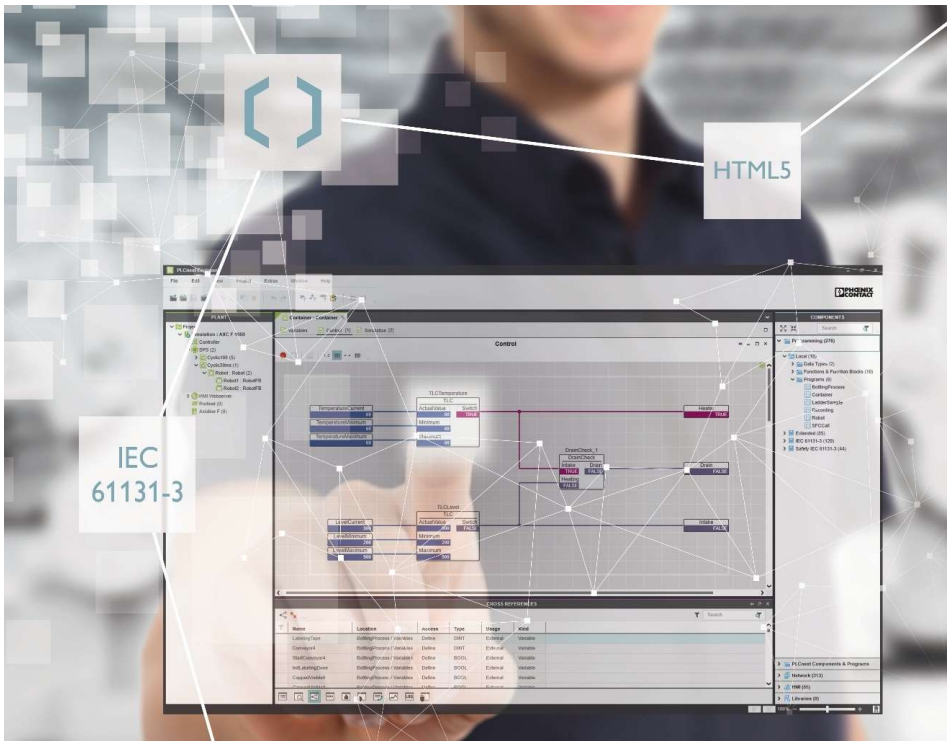
Controls

Function blocks

“You can easily integrate numerous functions into your system without programming effort, like:

- IT functionality
- Remote control functions
- SQL connection
- Control technology
- Industry-specific solutions

All available function blocks can be found by on our website.”



PHOENIX CONTACT
INSPIRING INNOVATIONS

Conventional PLCs

Portfolio overview - controllers

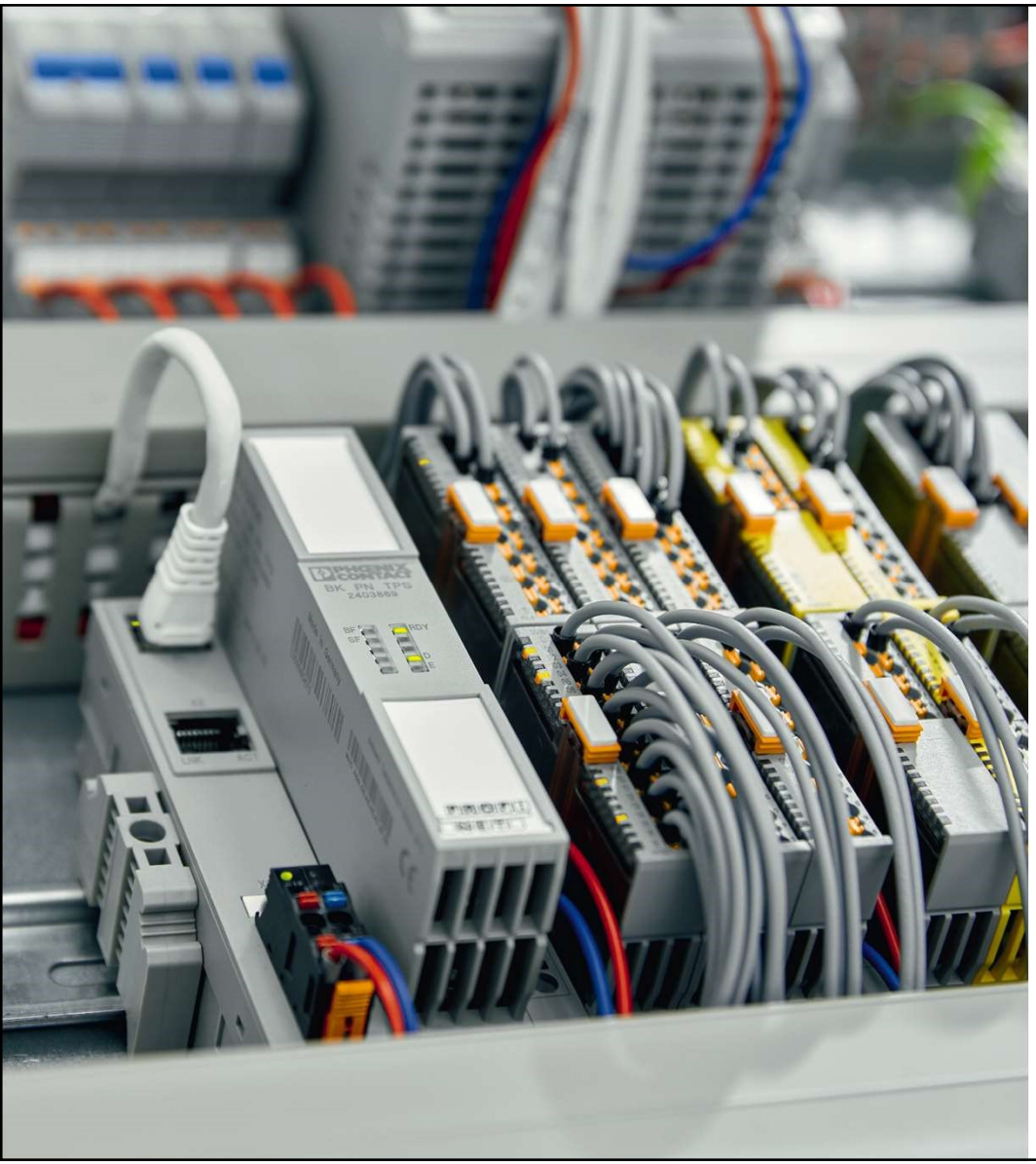






STANDARD PLC	PLC WITH ENHANCED PERFORMANCE
AXC 1050 + XC	AXC 3050
2 Ethernet interfaces	3 Ethernet interfaces
ALL DETAILS	ALL DETAILS

PHOENIX CONTACT
INSPIRING INNOVATIONS

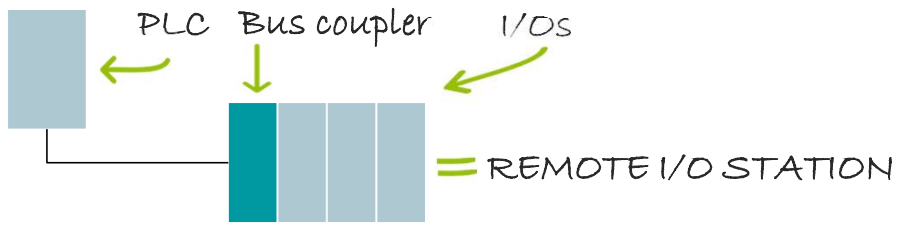


Bus coupler

Connect to various networks

“Use bus couplers to integrate all the I/Os of the modular automation system into your existing Ethernet network or bus system. The bus coupler opens up a local bus for up to 63 further I/Os.”

Bus coupler for a remote I/O soulution



PHOENIX CONTACT
INSPIRING INNOVATIONS

Bus coupler

Portfolio overview



MORE FLEXIBILITY IN YOUR AUTOMATION

- Bus couplers for all relevant communication protocols
- Links the I/O system into your network
- Opens up a local bus for up to 63 further devices

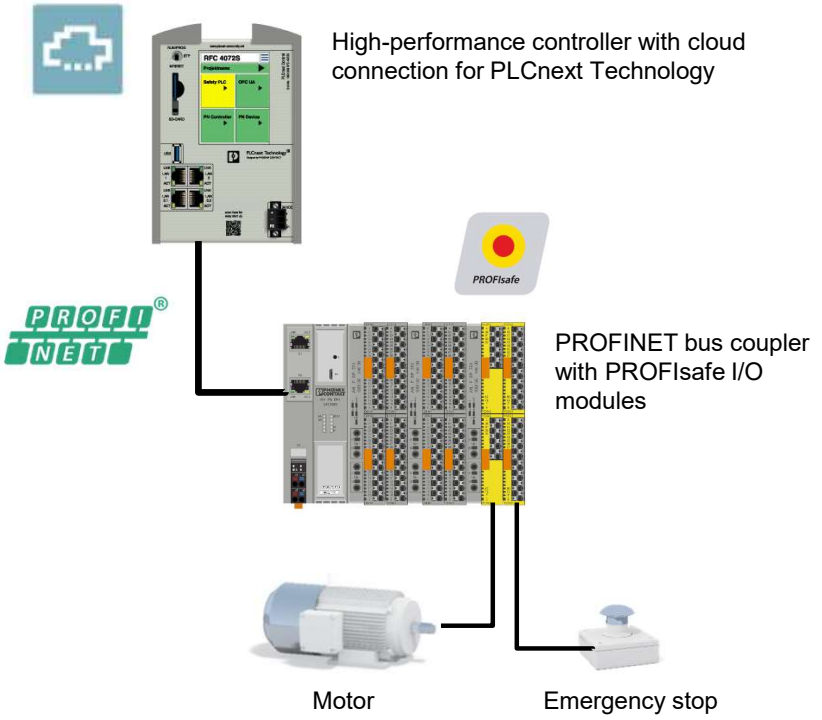
+ XC	+ XC			+ XC		
PROFINET	PROFIBUS	EtherCAT	EtherNet/IP	Modbus	sercos the automation bus	IEC 61850
PN	PB	EC	EIP	ETH	S3	SAS
ALL DETAILS	ALL DETAILS	ALL DETAILS	ALL DETAILS	ALL DETAILS	ALL DETAILS	ALL DETAILS

PHOENIX CONTACT
INSPIRING INNOVATIONS

Bus coupler

Safety in the system

“Implement PROFIsafe solutions systemically in PROFINET networks. This can be easily done through the lower-level connection of PROFINET bus couplers with PROFIsafe I/O modules to a Phoenix Contact PROFIsafe controller.”

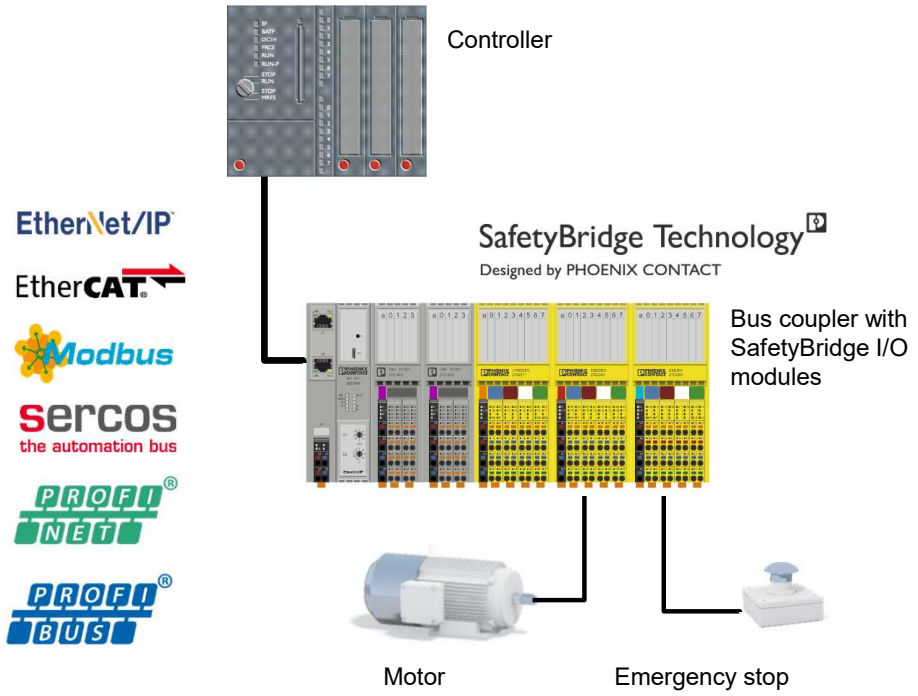


PHOENIX CONTACT
INSPIRING INNOVATIONS

Bus coupler

SafetyBridge Technology

“Use bus couplers to integrate I/Os into all common ethernet networks and bus systems. SafetyBridge Technology enables the network- and controller-independent implementation of safety applications – even without a safety controller.”

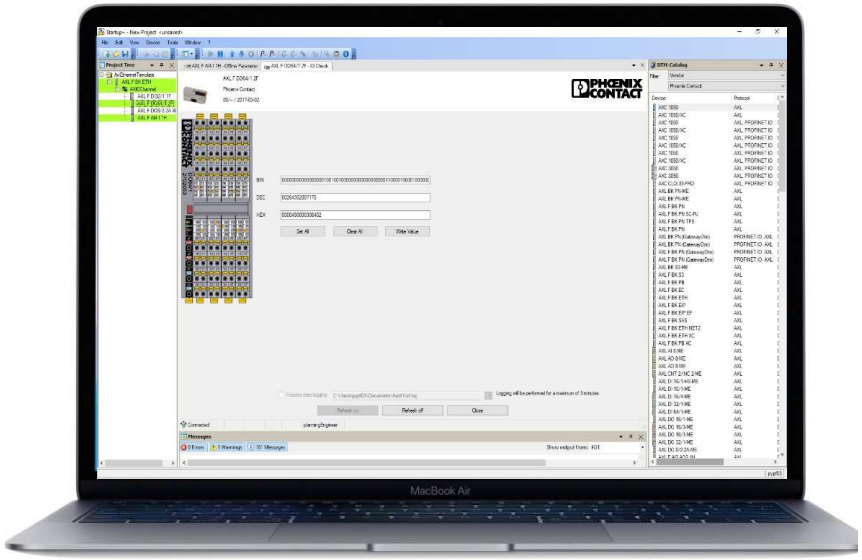


PHOENIX CONTACT
INSPIRING INNOVATIONS

Bus coupler

Easy offline parameterization - Startup+

“The Startup+ software is specifically designed for the Axioline F I/O system. Each bus coupler provides an interface for the data exchange with the software.”



Your benefits

- Easily check the wiring of the Axioline F I/O station
- Parameterization of the I/O modules used
- Comprehensive diagnostics during operation

AVAILABLE AS FREE DOWNLOAD !

PHOENIX CONTACT
INSPIRING INNOVATIONS

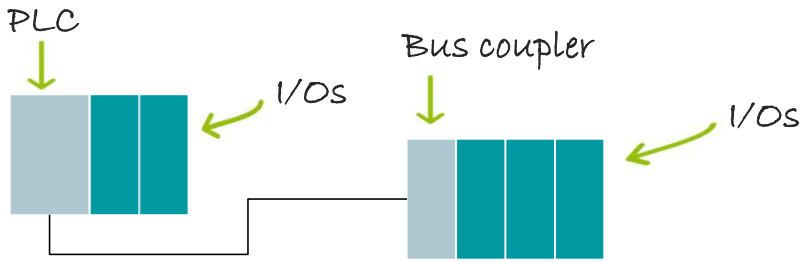


I/Os

Combine I/Os flexibly

“The versatile IP20 range, which can be combined flexibly, provides reliable protection for your data and signal traffic, allowing you to design your systems for every possible area of application.”

I/Os combined with a PLC or a bus coupler



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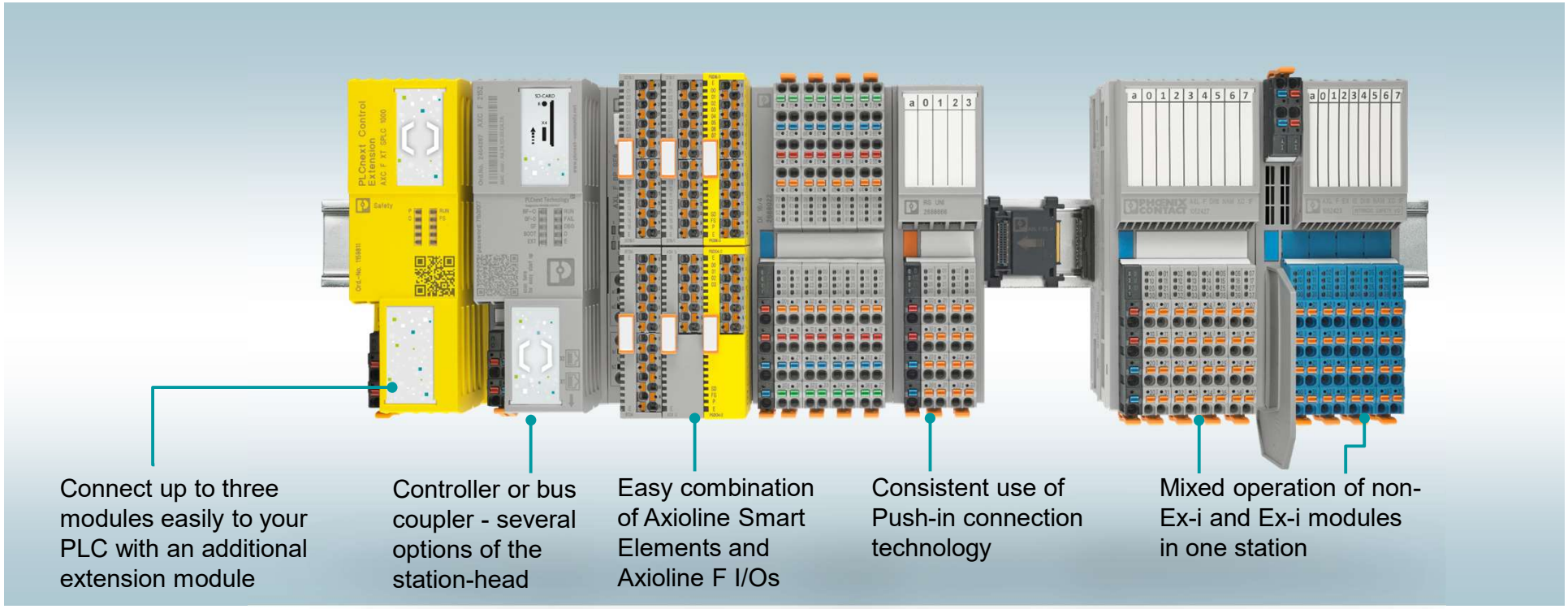
INSPIRING INNOVATIONS

I/Os

Modularity in the system

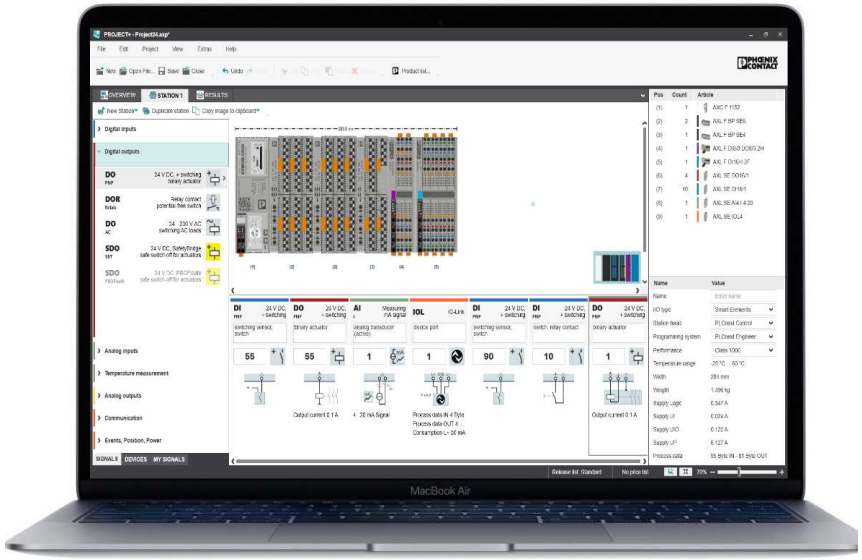


PHOENIX CONTACT
INSPIRING INNOVATIONS

I/Os

Configuration for I/Os - Project+

“With no training required, you can create a functional station in accordance with your specifications very quickly with Project+.”

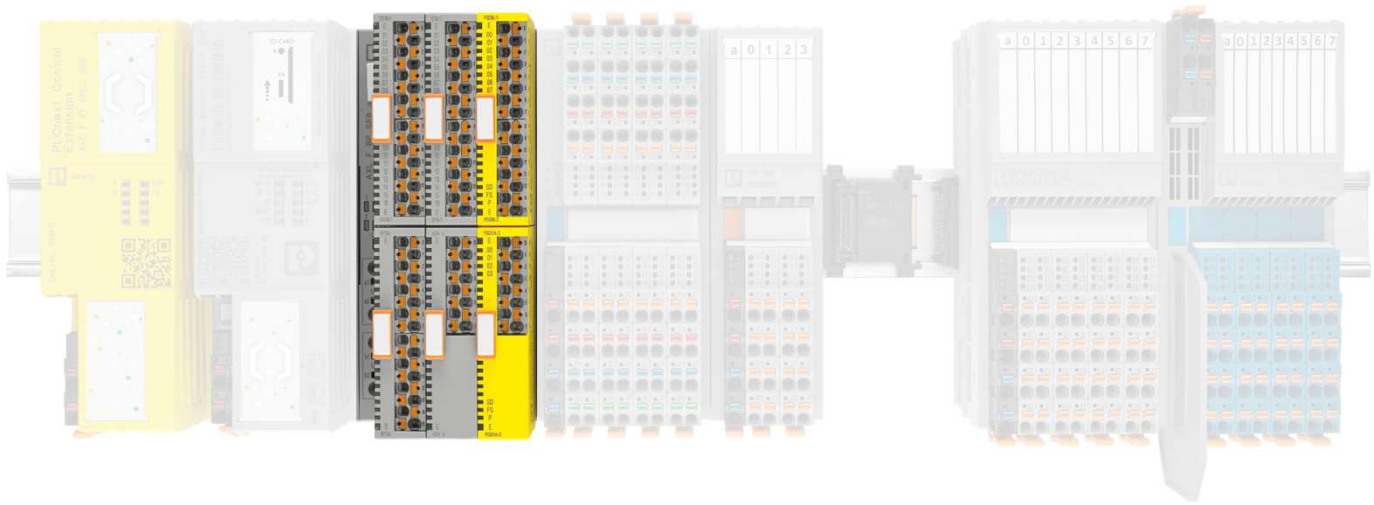


Your benefits

- Configuration software for fast I/O station planning
- Easily create custom I/O stations that are technically correct
- The signal requirements and structure plan at a glance

AVAILABLE AS FREE DOWNLOAD !

PHOENIX CONTACT
INSPIRING INNOVATIONS



AXIOLINE SMART ELEMENTS

PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline Smart Elements

Automate smart and economically



READY FOR AUTOMATION

- Initial portfolio with all major I/Os
- All necessary functionalities incl. Safety and IO-Link

DI	SDI	AI	IO-Link	INC
DO	SDO	AO	RS485	CNT

PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline Smart Elements

Compact and flexible

COMPACT



8 or 16 connection points on a small footprint of 15 mm x 62 mm

SYSTEM-INDEPENDENT



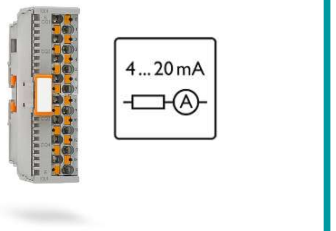
Due to the system-independent interface the elements can be used universally with specific backplanes

EASY HANDLING



Push-in technology and the toolfree unlook-mechanism reduce installation efforts

FAST START-UP



One function per module and few parameters to be set guarantee fast commissioning

PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline Smart Elements

Just like an Axioline F I/O

PLUGGABLE INTO AXIOLINE F BACKPLANES

Without any rules - plug the Axioline Smart Elements into any position in the Axioline F backplane



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Axioline Smart Elements

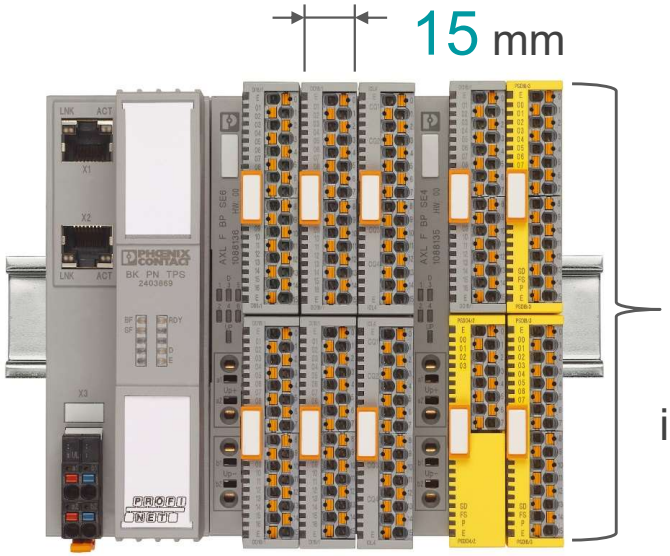
Portfolio

ANALOG INPUT	ANALOG OUTPUT	DIGITAL INPUT	DIGITAL OUTPUT	FUNCTION MODULES	SAFETY MODULES	SYSTEM MODULES
 AI4 I	 AO4 I	 DI16	 DO16	 IOL4	 PSDI	 SC-A
 AI4 U	 AO4 U	 DI16 NPN	 DO16 NPN	 CNT1	 PSDO	 SC
 RTD4 PT100			 DOR2	 RS485	 SSDI	AXL F-BACKPLANE
 RTD4 PT1000				 INC1 SYM	 SSDO	 BP 4
				 INC1 ASYM		 BP 6

PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline Smart Elements

Compact and flexible I/O solution



Up to
32
I/O channels
in ONE column

EXTREMLY COMPACT

Less space required on the DIN rail enables compact control cabinet solutions

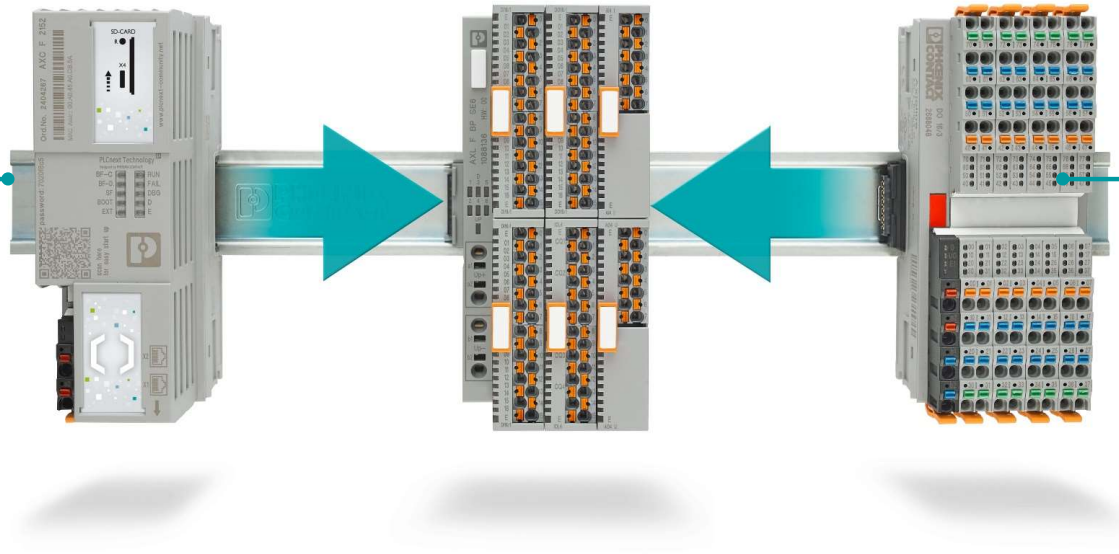
PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline Smart Elements

Full compatibility

All Axiocontrols

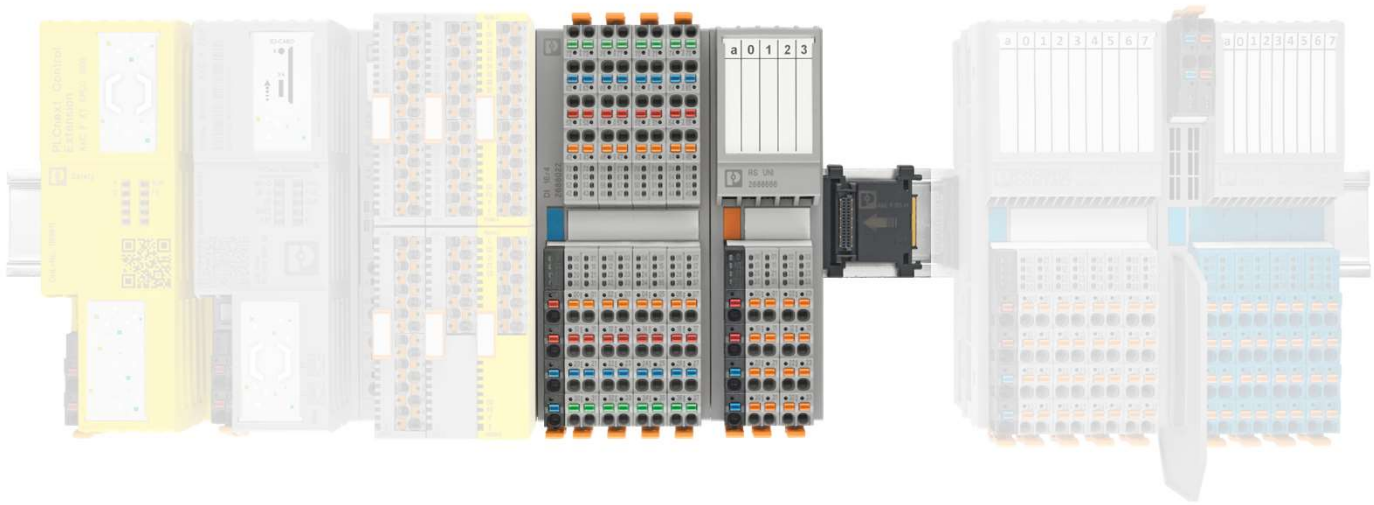
All bus couplers



All Axioline F I/Os

Choose out of a portfolio of more than 80 I/Os, bus couplers and controls

PHOENIX CONTACT
INSPIRING INNOVATIONS



AXIOLINE F: Standard I/O modules

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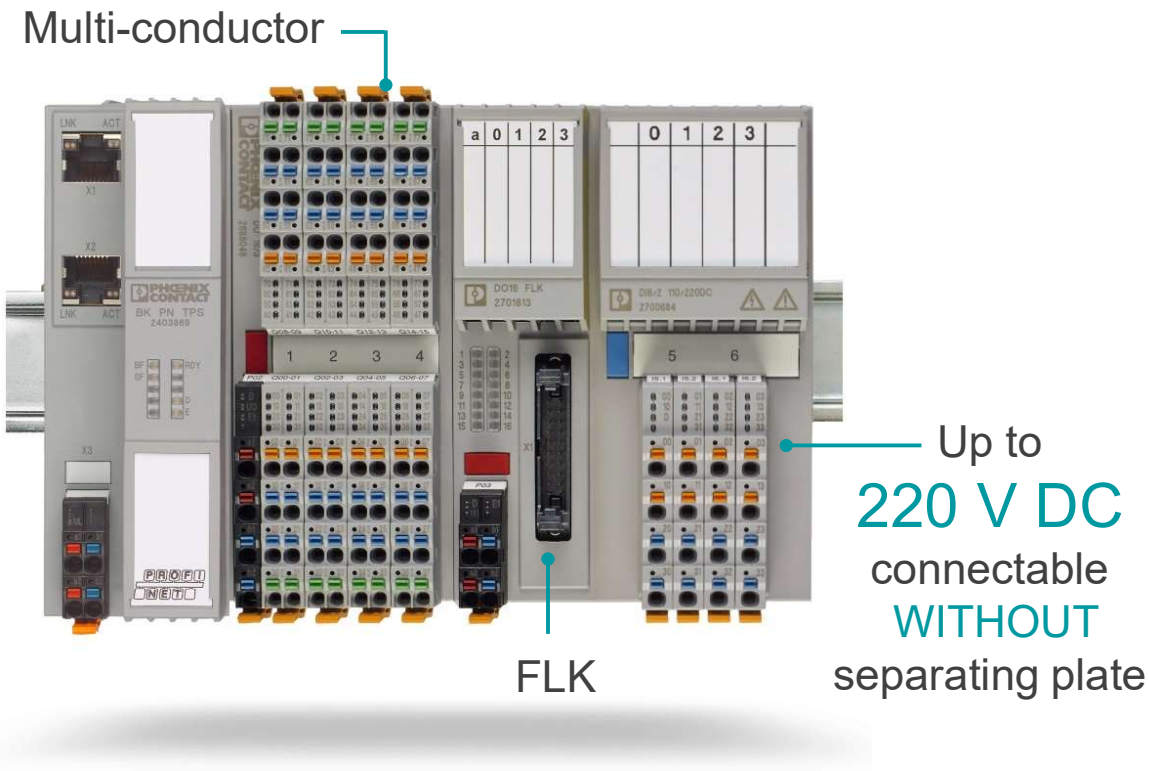
Various connection methods



VERSATILE CONNECTABLE

Axioline F impresses with its versatile connection methods. Just as you need it.

PHOENIX CONTACT
INSPIRING INNOVATIONS

I/Os

Functions for every application



IEC 61850



SafetyBridge Technology
Designed by PHOENIX CONTACT



IO-Link

LAGRE RANGE OF I/Os

“Axioline F is a modular I/O system designed to meet every requirement and it offers a large range of I/O modules with digital and analog inputs and outputs, functions or for special applications. Implement safety applications with PROFIsafe or SafetyBridge Technology.”

DIGITAL | ANALOG | FUNCTION | SAFETY

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Designed to meet every requirement

OPTIMUM PERFORMANCE



Update time of 1 µs per I/O module in the local bus

QUICK INSTALLATION



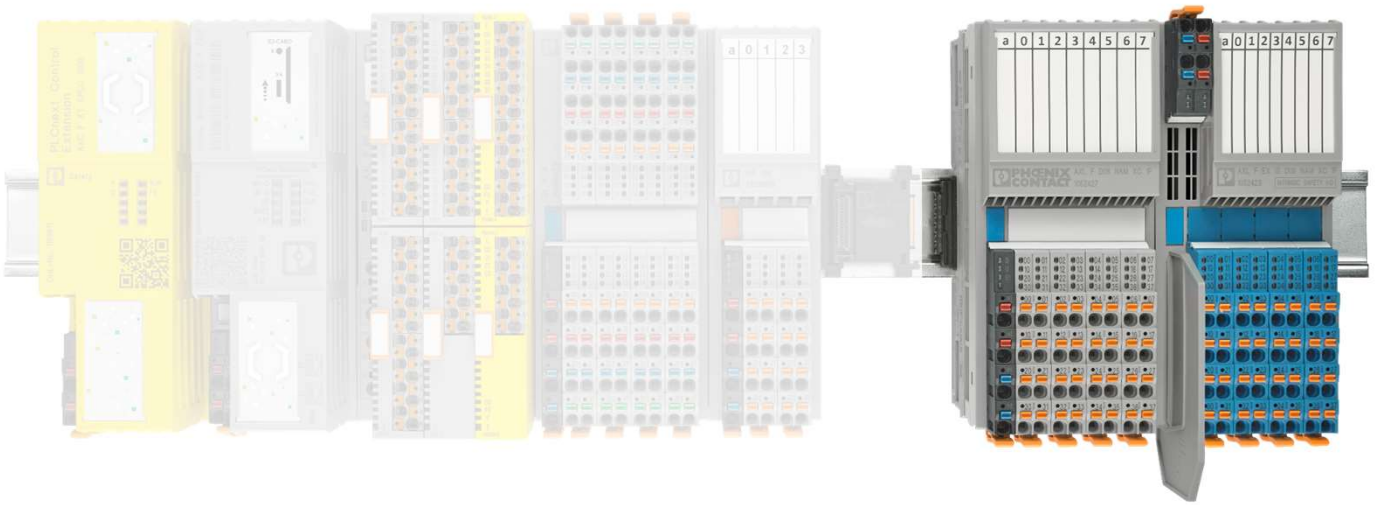
Push-in connection and clear wiring shortens installation times

ROBUST MECHANICAL DESIGN



Axioline F offers high shock and vibration resistance

PHOENIX CONTACT
INSPIRING INNOVATIONS



AXIOLINE F: Modules for special environment

PHOENIX CONTACT
INSPIRING INNOVATIONS

Extended temperature range



RELIABLE AT EXTREME TEMPERATURES

“In harsh environments, reliable communication is essential. Axioline F features a particularly robust mechanical design.

The XC versions with an extended operating temperature range from -40°C to +70°C and coated printed circuit boards are ideal for use under extreme conditions.”

PHOENIX CONTACT
INSPIRING INNOVATIONS

Approvals for marine automation



RELIABLE WITHOUT INTERFERENCE

“Due to their advantageous properties, the I/O modules have been approved by all major marine classification societies. With its low noise emission and robust mechanical design, Axioline F satisfies the stringent requirements for automation in shipbuilding.”

PHOENIX CONTACT
INSPIRING INNOVATIONS

Intrinsically safe I/Os



RELIABLE UP TO ZONE 0

“The intrinsically safe I/O modules can be installed in zone 2 and are suitable for the use of sensors and actuators up to zone 0. They feature HART communication and NAMUR functionality, making them particularly suitable for applications in process automation.”

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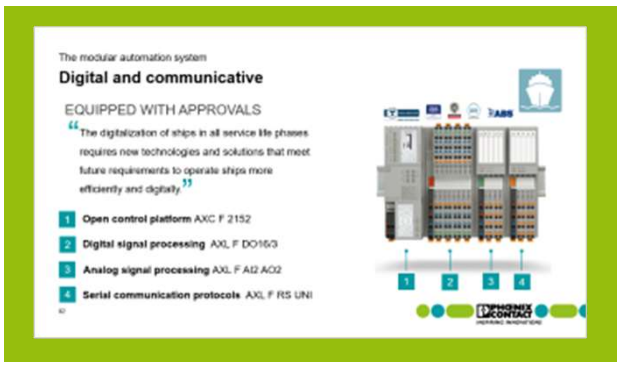
INSPIRING INNOVATIONS

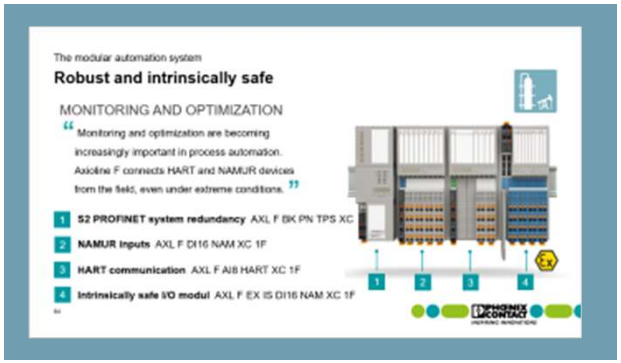
The right automation solution for every requirement







Click on the tiles to see four possible solution for different use cases which can be created using our Modular automation system.



PHOENIX CONTACT
INSPIRING INNOVATIONS

The modular automation system

Some solutions

OPEN AND FUTUREPROOF

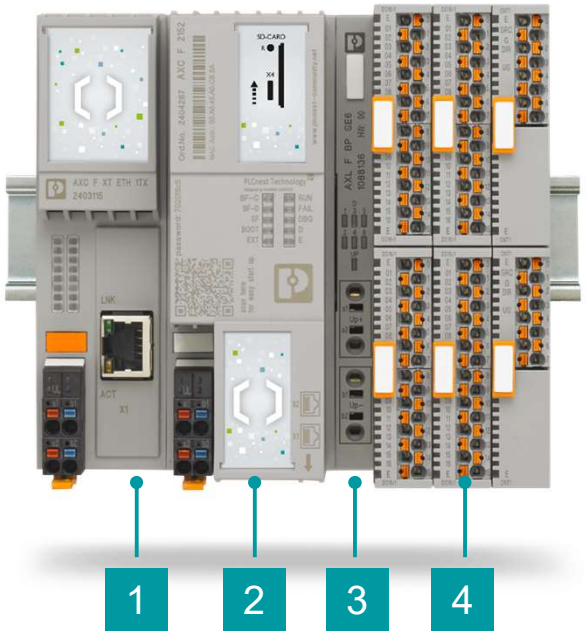
“Create a compact I/O solution with Axioline Smart Elements and a PLCnext Control. Use parallel programming such as IEC 61131-3 or high-level-languages and easy access to cloud services.”

1 **Functional expansion of the PLC** AXC F XT ETH 1TX

2 **Open control platform** AXC F 2152

3 **Backplane for Axioline Smart Elements** AXC F BP SE6

4 **Digital signal processing** AXL SE DI16/1

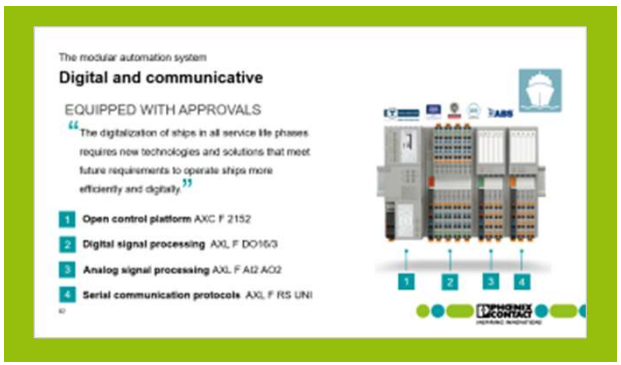


PHOENIX CONTACT
INSPIRING INNOVATIONS

The right automation solution for every requirement







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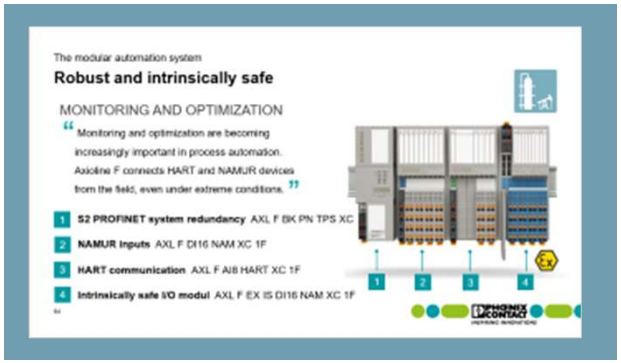


PHOENIX CONTACT
INSPIRING INNOVATIONS

Some solutions

NUMEROUS POSSIBILITIES

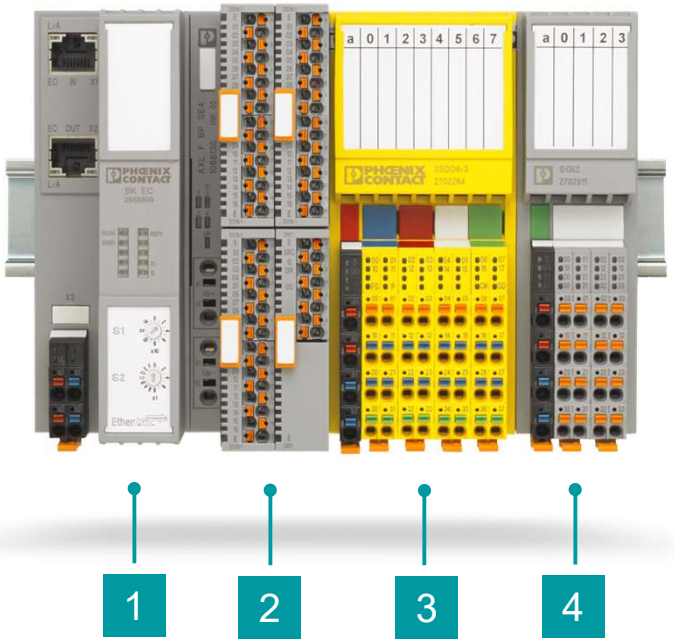
“Many machine variants require a high degree of flexibility with respect to the station structure and a wide range of function modules. Axioline F offers many products to provide an optimal solution for this type of application.”

1 **EtherCAT communication** AXL F BK EC

2 **Digital signal processing** AXL SE DO16

3 **SafetyBridge Technology** AXL F SSDO8/3

4 **Connection of strain gauge** AXL F SGI2

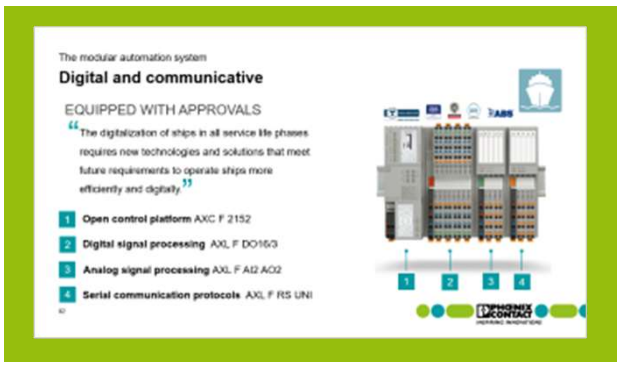


PHOENIX CONTACT
INSPIRING INNOVATIONS

The right automation solution for every requirement







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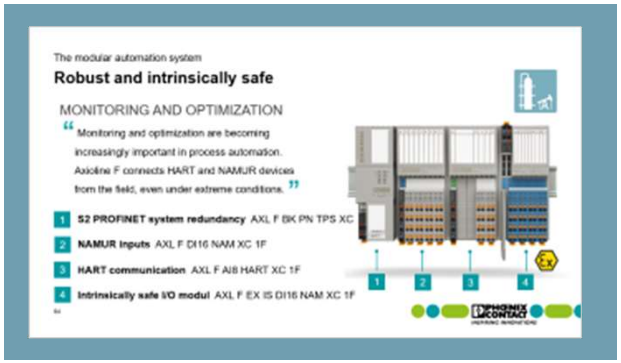


PHOENIX CONTACT
INSPIRING INNOVATIONS

The modular automation system

Digital and communicative

EQUIPPED WITH APPROVALS

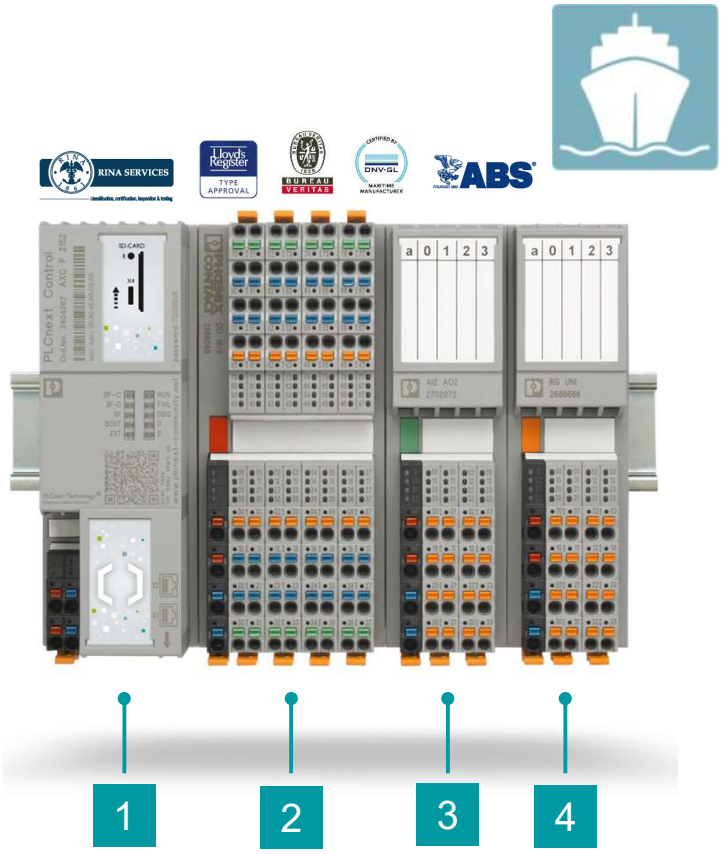
“The digitalization of ships in all service life phases requires new technologies and solutions that meet future requirements to operate ships more efficiently and digitally.”

1 **Open control platform** AXC F 2152

2 **Digital signal processing** AXL F DO16/3

3 **Analog signal processing** AXL F AI2 AO2

4 **Serial communication protocols** AXL F RS UNI

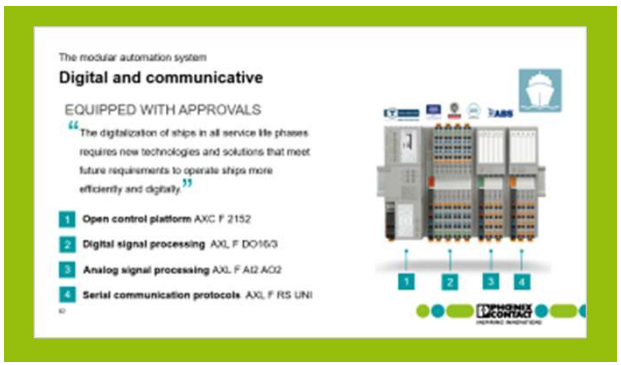


PHOENIX CONTACT
INSPIRING INNOVATIONS

The right automation solution for every requirement







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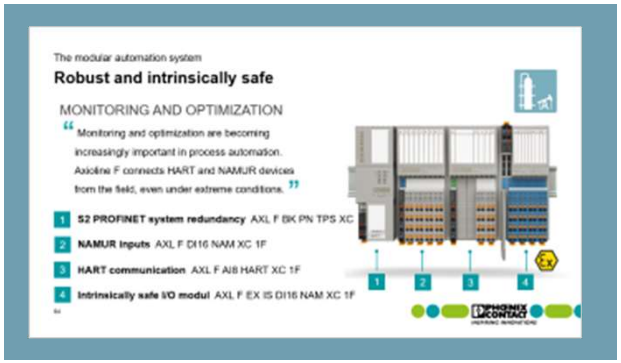


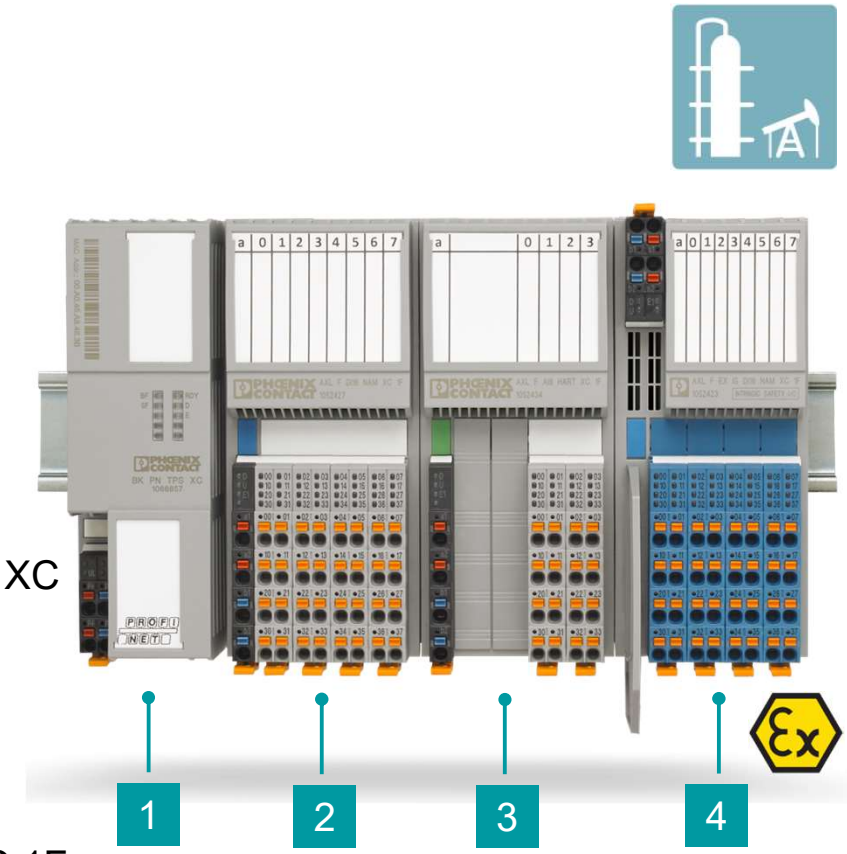
PHOENIX CONTACT
INSPIRING INNOVATIONS

The modular automation system

Robust and intrinsically safe

MONITORING AND OPTIMIZATION

“Monitoring and optimization are becoming increasingly important in process automation. Axioline F connects HART and NAMUR devices from the field, even under extreme conditions.”



1 **S2 PROFINET system redundancy** AXL F BK PN TPS XC

2 **NAMUR inputs** AXL F DI16 NAM XC 1F

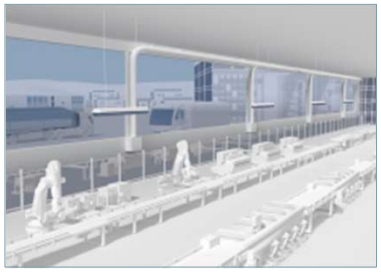
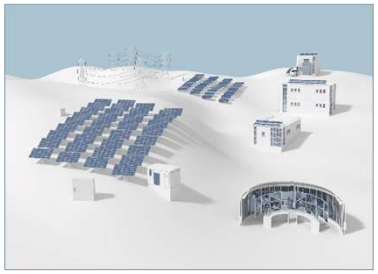
3 **HART communication** AXL F AI8 HART XC 1F

4 **Intrinsically safe I/O modul** AXL F EX IS DI16 NAM XC 1F

PHOENIX CONTACT
INSPIRING INNOVATIONS

Scope of applications

IP20 I/O Systems




SIMPLE APPLICATIONS COMPLEX









IO-Link IO-Link HART COMMUNICATION PROTOCOL HART COMMUNICATION PROTOCOL

MODULAR AUTOMATION SYSTEM

PHOENIX CONTACT INSPIRING INNOVATIONS



Axioline F - Profinet

Set up

Linking a Profinet I/O station into the TIA Portal V13

PHOENIX CONTACT

PHOENIX CONTACT
INSPIRING INNOVATIONS



Thank you

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

AXC F 1152 - 1151412



- ARM Cortex A9 single core, 800 MHz
- Up to 8 tasks
- Up to 16 PROFINET devices
- Up to 63 Axioline I/O modules can be aligned directly
- Trusted Platform Module (TPM) for security
- M2M system networking with OPC UA

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

AXC F 2152 - 2404267



- ARM Cortex A9 dual core, 2x 800 MHz
- Up to 32 tasks
- Up to 64 PROFINET devices
- Up to 63 Axioline I/O modules
- Left-alignable interface extension (INTERBUS, PROFIBUS, Ethernet)
- Trusted Platform Module (TPM) for security
- M2M system networking with OPC UA

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

AXC F 3152 - 1069208



- Intel® Atom™ E3930 dual core, 2x 1.3 GHz
- Integrated UPS
- Up to 128 PROFINET devices
- Ready for time-sensitive networking
- Up to 63 Axioline I/O modules
- Left-alignable interface extension (INTERBUS, PROFIBUS, Ethernet)
- Trusted Platform Module (TPM) for security
- M2M system networking with OPC UA

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

AXC 1050 - 2700988



- Altera NIOS II processor
- 1 MB program memory
- 2 MB mass storage
- 48 kB non-volatile mass storage
- PROFINET controller
- 2 Ethernet interfaces and 1 Axioline F interface
- Extended temperature range with the XC version: -40°C … +70°C
- Programming with PC Worx in accordance with IEC 61131-3

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

AXC 3050 - 2700989



- Intel® Atom™ E660
- 4 MB program memory
- 8 MB mass storage
- 128 kB non-volatile mass storage
- 3 separate Ethernet interfaces and 1 Axioline F interface
- PROFINET controller
- Maritime approvals
- Programming with PC Worx in accordance with IEC 61131-3

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

AXC F XT ETH 1TX- 2403115



- Individual expansion option for PLCnext Controls of the Axiocontrol series
- Left-alignable Gigabit-class Ethernet interface
- Additional independent MAC address
- PROFINET support
- Electrical isolation between Ethernet interface and logic

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

AXC F XT IB - 2403018



- Individual expansion option for PLCnext Controls of the Axiocontrol series
- Up to 512 INTERBUS remote bus devices can be connected
- INTERBUS connection via 9-pos. D-SUB socket
- Automatic detection of the transmission speed in INTERBUS (500 kbps or 2 Mbps)
- Electrical isolation between INTERBUS interface and logic
- Diagnostic and status indicators

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

AXC F XT SPLC 1000- 1159811



- Individual expansion option for PLCnext Controls of the Axiocontrol series
- Safety-relevant high performance small scale SPLC with full functionality for cost-intensive applications
- Rapid implementation of requirements with reloadable C functions
- Can be used in applications with the highest safety requirements in accordance with SIL 3/PL e

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

AXC F IL ADAPT - 1020304



- Inline I/O adapter terminal specifically developed for all PLCnext Control devices of the Axiocontrol series
- A variety of functional I/Os creates options for flexible automation solutions
- Convert existing machines and systems to the new, open PLCnext Technology ecosystem
- Automatic detection of the transmission speed in INTERBUS (500 kbps or 2 Mbps)
- Up to 63 INTERBUS devices can be connected
- Diagnostic and status indicators

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

AXL F BK PN TPS - 2403869



- PROFIsafe support and PROFIenergy support
- Conformance with PROFINET specification V2.3
- 2 RJ45 connections
- BootP and DCP
- Firmware can be updated
- Typical cycle time of the Axioline F local bus is around 10 µs
- Safe analog value processing with SAFE AI and other components

+ XC **AXL F BK PN TPS XC- 1068857**

- Extended temperature range of -40 °C ... +70 °C

BACK TO OVERVIEW

Product details

AXL F BK EC - 2688899



- 2 RJ45 connections
- Automatic addressing
- Station mapped as a modular EtherCAT® device using a modular device profile (MDP)
- Station can be mapped as a block device
- Acyclic data communication (mailbox protocols)
- Cyclic data communication
- Firmware can be updated
- Typical cycle time of the Axioline F local bus is around 10 µs

BACK TO OVERVIEW

Product details

AXL F BK EIP EF - 2702782



- 2 Ethernet ports (with integrated switch)
- Transmission speed of 10 Mbps and 100 Mbps
- Rotary coding switches for setting the IP address assignment and other functions
- Supported protocols: EtherNet/IP□, DLR, SNMP, HTTP, TFTP, FTP, BootP, DHCP, DCP
- Firmware can be updated
- Typical cycle time of the Axioline F local bus is around 10 µs

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

AXL F BK ETH - 2688459



- 2 Ethernet ports (with integrated switch)
- Rotary coding switches for setting the IP address assignment and other functions
- Supported protocols: Modbus/TCP (UDP), SNMP, HTTP, TFTP, FTP, BootP, DHCP, DCP
- Firmware can be updated
- Runtime in the bus coupler is negligible (almost 0 µs) (for Modbus/UDP)

+ XC **AXL F BK ETH XC - 2701949**

- Extended temperature range of -40 °C ... +70 °C

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

AXL F BK S3 - 2701686



- 2 RJ45 connections
- Rotary encoding switch
- Supports Sercos V1.3
- FSP-IO (Function Specific Profile-IO) for modular I/O devices
- 8 connections
- Firmware can be updated
- Typical cycle time of the Axioline F local bus is around 10 µs

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

AXL F BK SAS - 2701457



IEC 61850

- 2 RJ45 connections
- Transmission speed of 100 Mbps
- Rotary encoding switch
- Supports IEC 61850, MMS, and GOOSE
- BootP and DHCP
- Web-based management to set up an I/O station for MMS or GOOSE communication

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

AXL F BK PB - 2688530



- Electrical isolation between PROFIBUS interface and logic
- DP/V1 for class 1 and class 2 masters
- PROFIBUS data transmission speed of 9.6 kbps to 12 Mbps
- Dynamic configuration is supported
- I&M functions
- Firmware can be updated
- Typical cycle time of the Axioline F local bus is around 10 µs

+ XC **AXL F BK PB XC - 2702463**

- Extended temperature range of -40 °C ... +70 °C

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

Digital I/Os



Digital inputs	+ XC
CHANNELS	8 - 64
CONNECTION METHOD	1-, 2, or 4-wire-connection
SPECIAL FEATURES	Input modules for IEC 61850

Digital outputs	+ XC
CHANNELS	4 - 64
CONNECTION METHOD	1-, 2, or 3-wire- or FLK connection
SPECIAL FEATURES	Output modules for IEC 61850, relay outputs

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

Analog I/Os



Analog inputs	+ XC
CHANNELS	2 - 8
A/D CONVERTER RESOLUTION	2-, 3, or 4-wire-connection
TYPES	Current, voltage, RTD, UTH

Analog outputs	+ XC
CHANNELS	2 - 8
A/D CONVERTER RESOLUTION	2-, 3, or 4-wire-connection
TYPES	Current, voltage

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

I/Os for safety applications



Safe digital inputs	
CHANNELS	4 safe digital inputs (two-channel) 8 safe digital inputs (single-channel)
TECHNOLOGY	SafetyBridge Technology PROFIsafe

Safe digital outputs	
CHANNELS	4 safe digital inputs (two-channel) 8 safe digital inputs (single-channel)
TECHNOLOGY	SafetyBridge Technology PROFIsafe

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS

Product details

Function modules



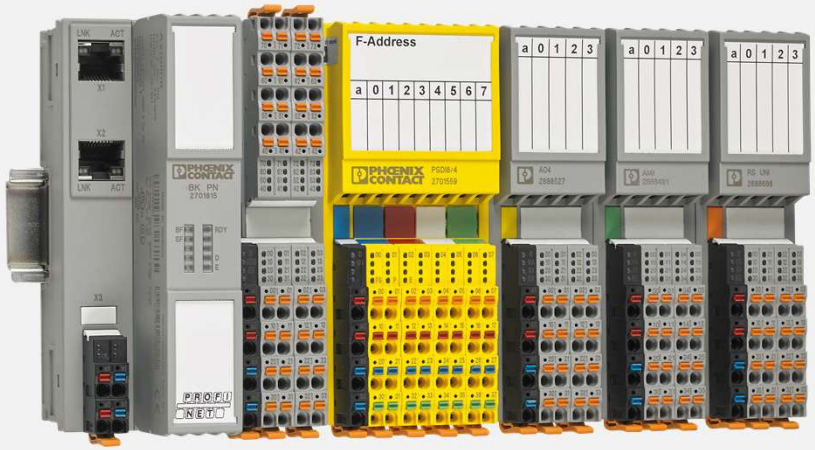
Portfolio overview

TYPES

Counter inputs and Incremental encoder inputs	AXL F CNT2 INC2 1F	+ XC
SSI-interface	AXL F SSI1 AO1 1H	
Digital pulse interface	AXL F IMPULSE2 XC 1H	XC
Pulse width modulation	AXL F PWM2 1H	
Strain gauge capture	AXL F SGI2 1H	
Power measurement	AXL F PM EF 1F	
Serial communication	AXL F RS UNI 1H	+ XC
IO-Link master	AXL F IOL8 2H	
M-Bus master	AXL F MA MBUS 1H	
DALI master	AXL F MA DALI2 1H	

BACK TO OVERVIEW

PHOENIX CONTACT
INSPIRING INNOVATIONS



Axioline F
the block-based modular I/O system

TECHNICS

PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Agenda

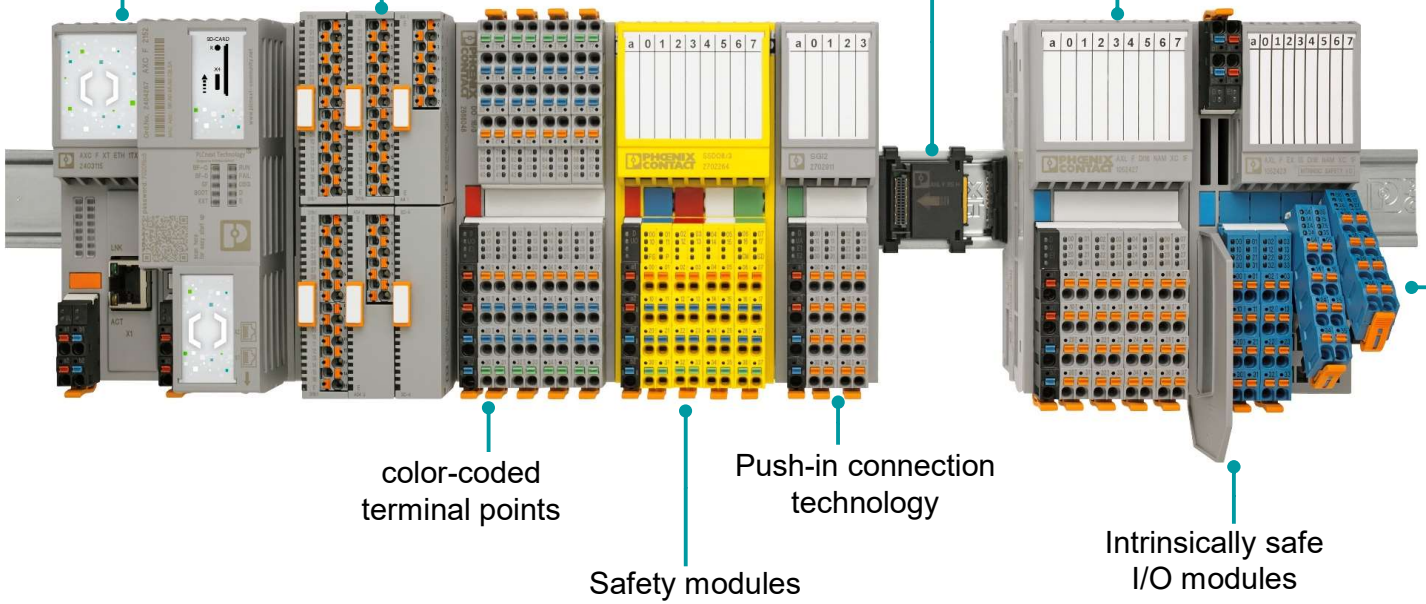
- Overview / Basics Axioline F
- Look, colors, LEDs, mechanical specifications
- Power supply, wiring, labelling, shielding
- STARTUP+ - Wiring Check for Axioline F
- Technical data / Approvals
- Axioline F XC (eXtreme Conditions)
- Process data, PDI channel, Response times
- SafetyBridge Technology
- Product Portfolio



PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

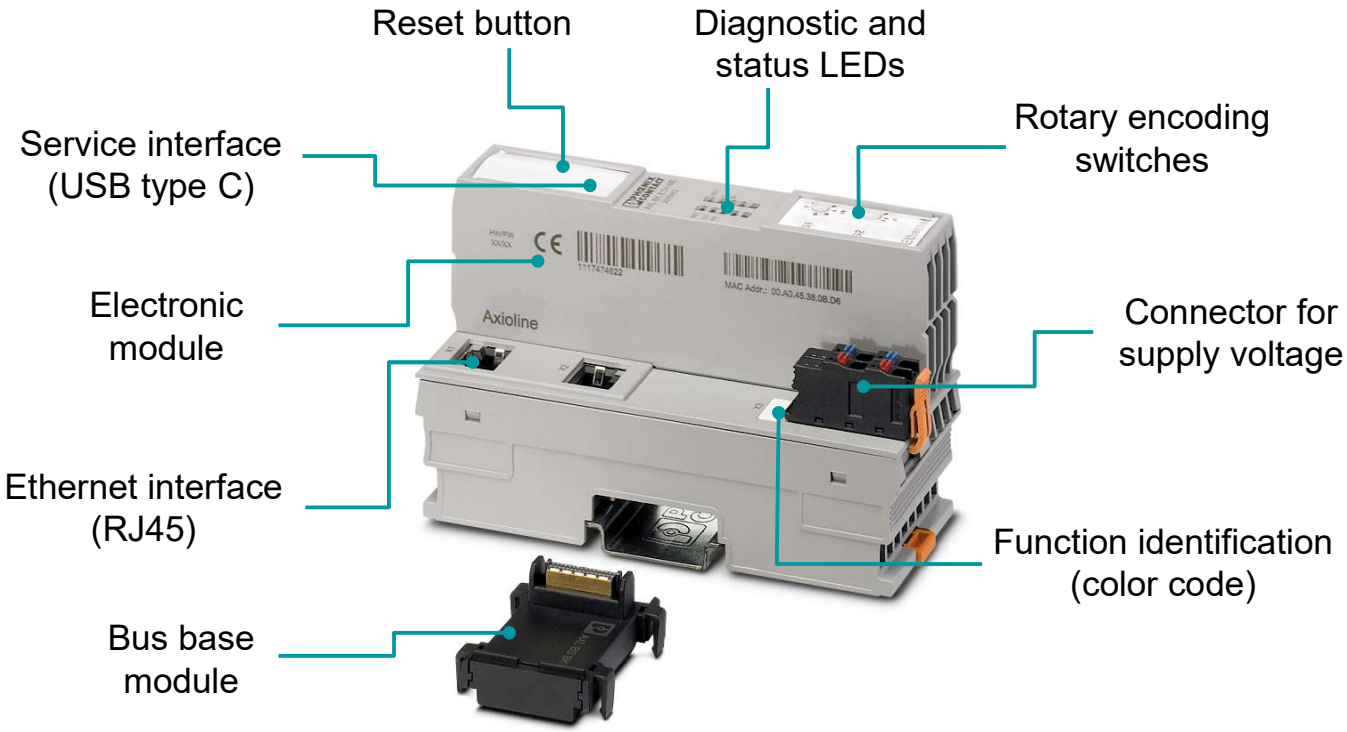
Axioline F – the specialist in the control cabinet



PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

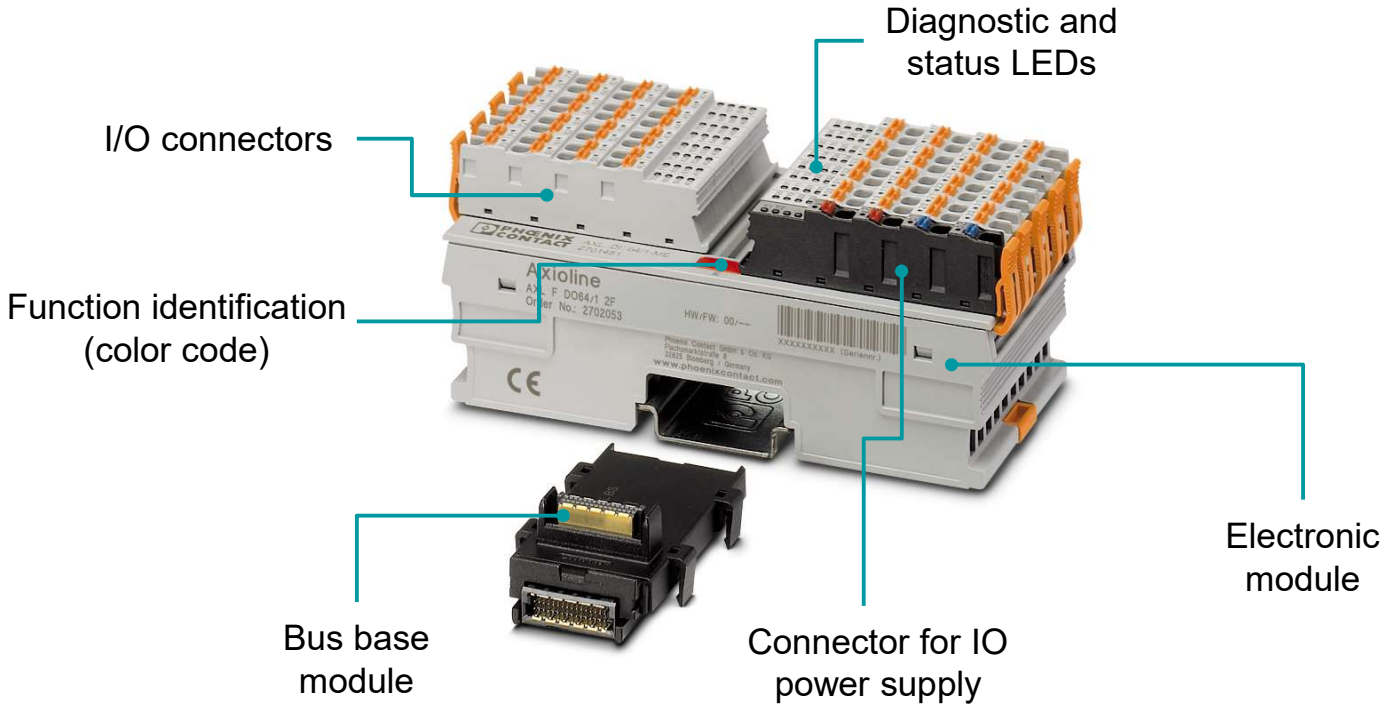
Components of an Axioline F bus coupler



PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Components of an Axioline F I/O module

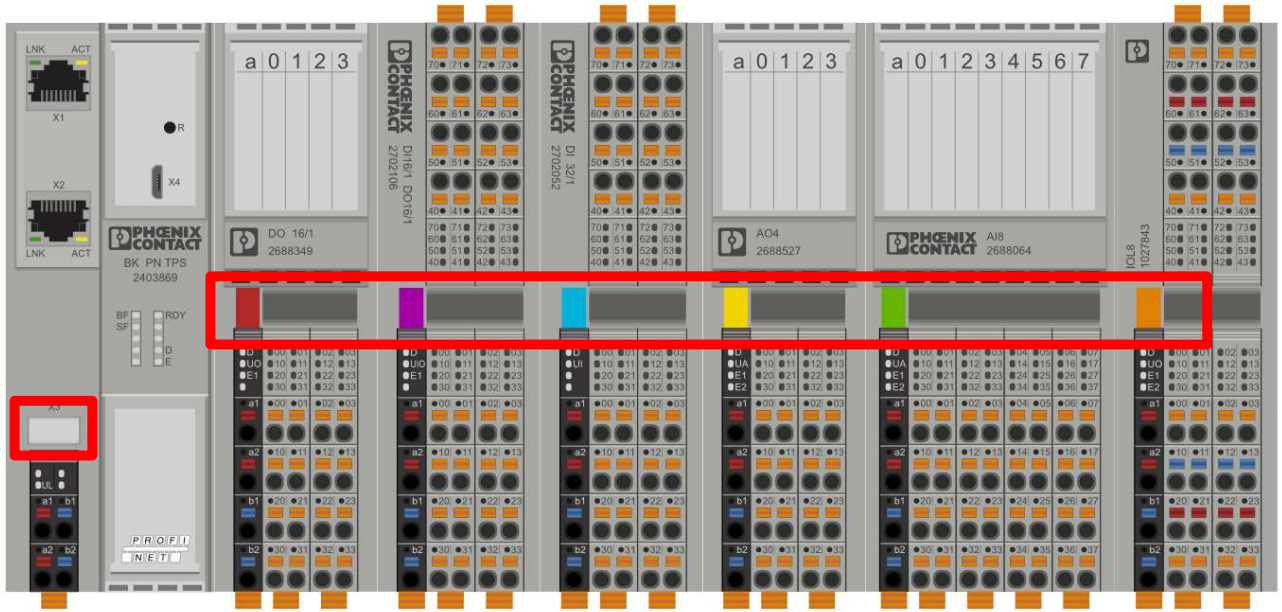


PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Function identification via color code

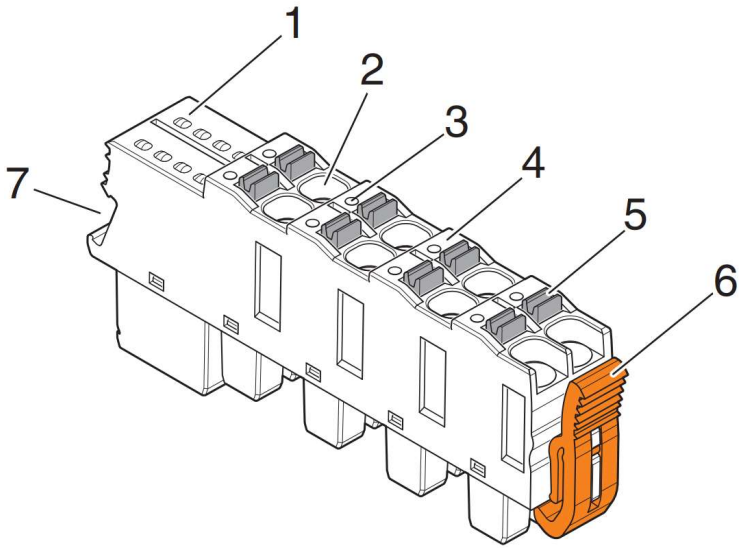
- Bus coupler / PWR
- Digital input
- Digital output
- Digital input / output
- Analog input
- Temperature measurement
- Analog output
- Function / communication

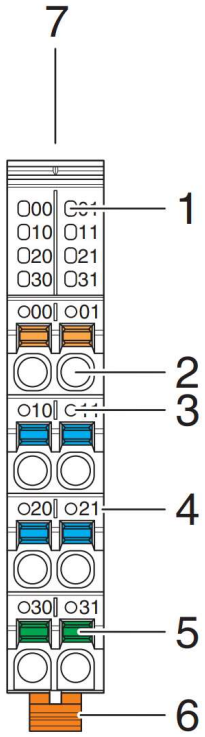


INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Basic design of an Axioline F connector





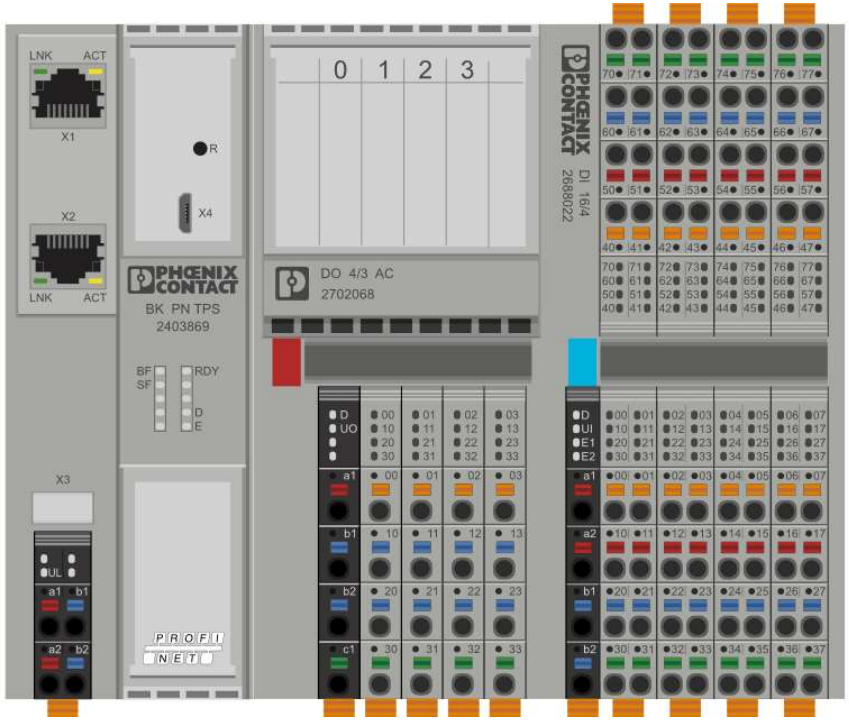
1. Local diagnostic and status LEDs
2. Terminal point
3. Touch connection (Measuring point)
4. Terminal point marking
5. Colored spring lever
6. Locking latch
7. Space for connector marking (“ZBF 10/5,8 AXL” or “ZBF 5”)

PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Color coded terminal points (spring lever)

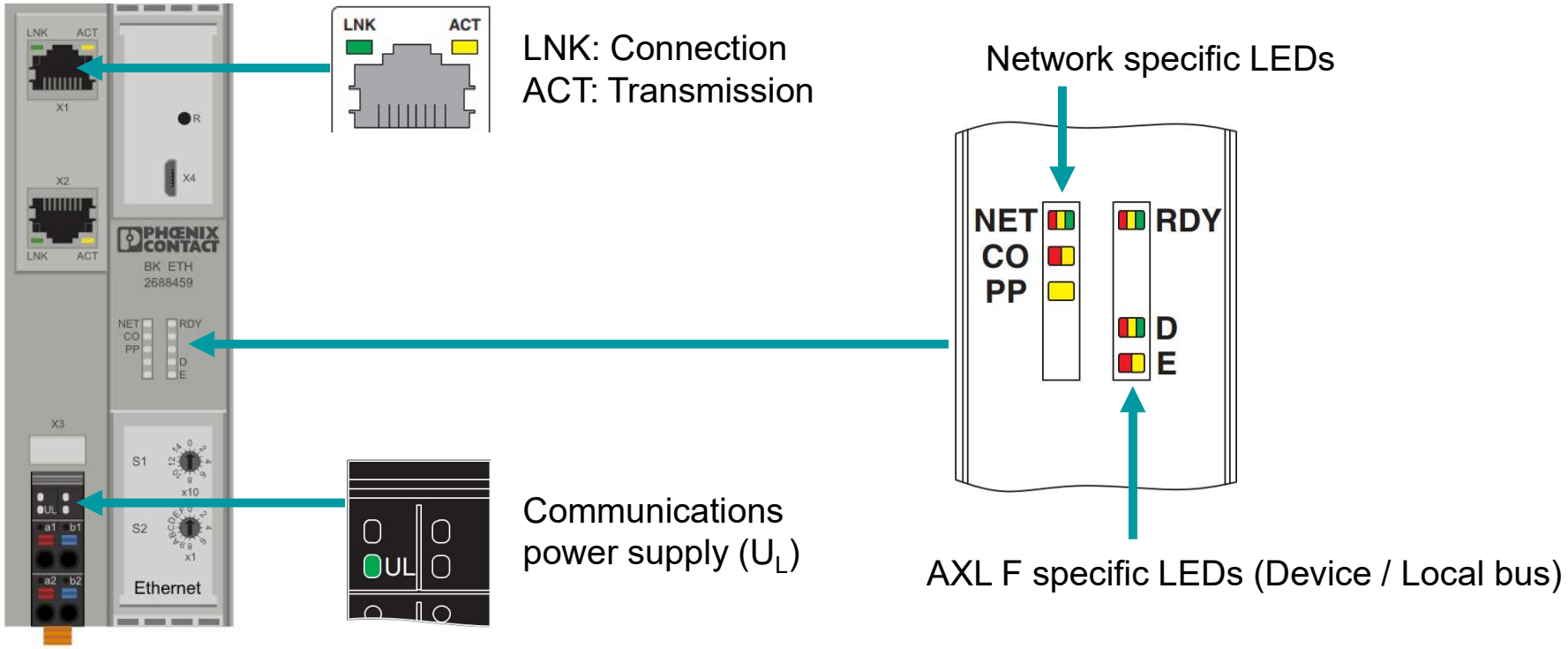
Color	Function of the terminal points	
	Low-level signal	Low voltage
	Signal	Signal
	24 V DC	230 V AC, 220 V DC, relay main contact
	GND	N (neutral conductor)
	FE (functional ground)	PE (protective conductor)



INSPIRING INNOVATIONS

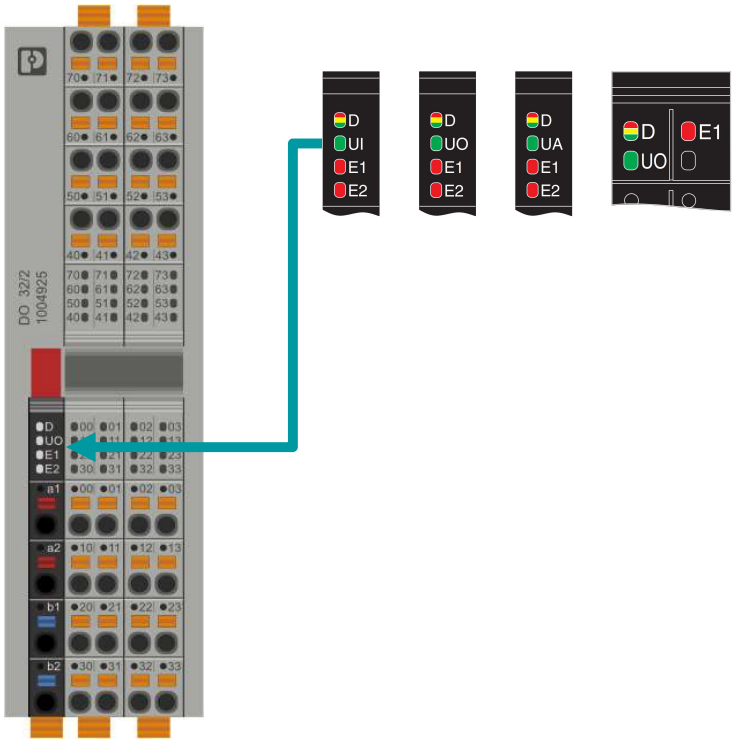
Axioline F - the block-based modular I/O system

Diagnostic LEDs of bus couplers



PHOENIX CONTACT
INSPIRING INNOVATIONS

Diagnostic LEDs of I/O modules | PWR connectors





Diagnostics of local bus communication

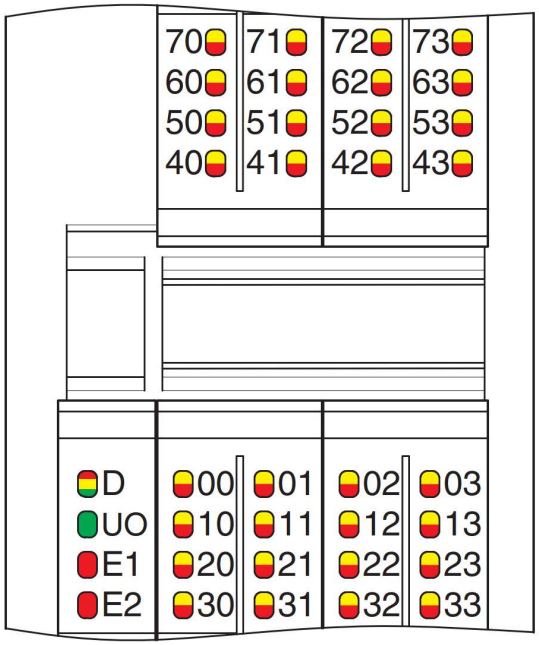
I/O supply (U_I, U_O, U_{IO}, U_A)

I/O error (entire device)

Channel error

PHOENIX CONTACT
INSPIRING INNOVATIONS

Diagnostic LEDs of I/O modules | I/O connectors

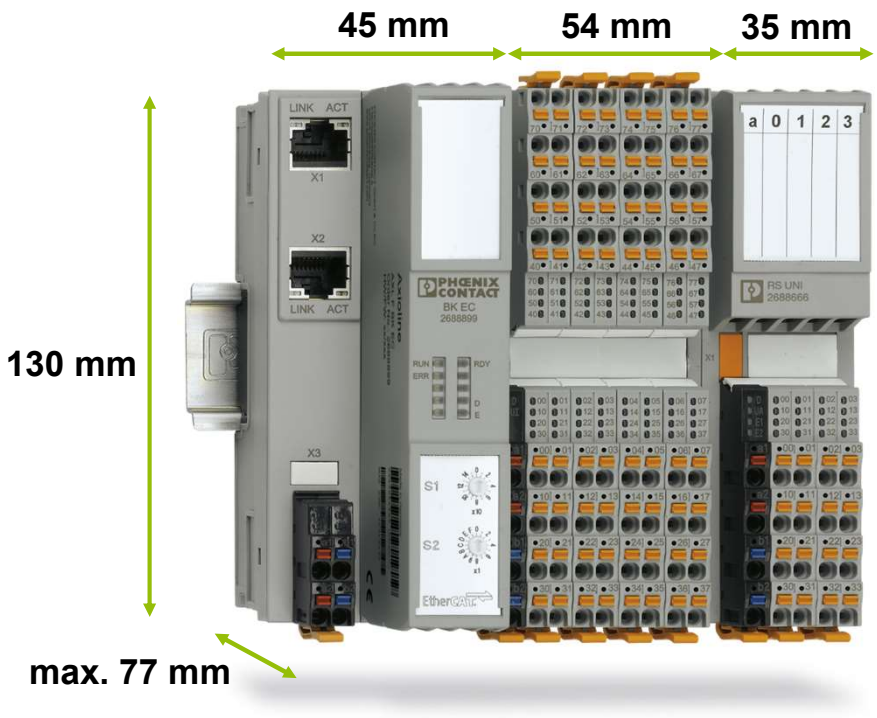


- LEDs are numbered according to terminal points
- Yellow → Status of the input or output
- Red → Diagnostics of the output

PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

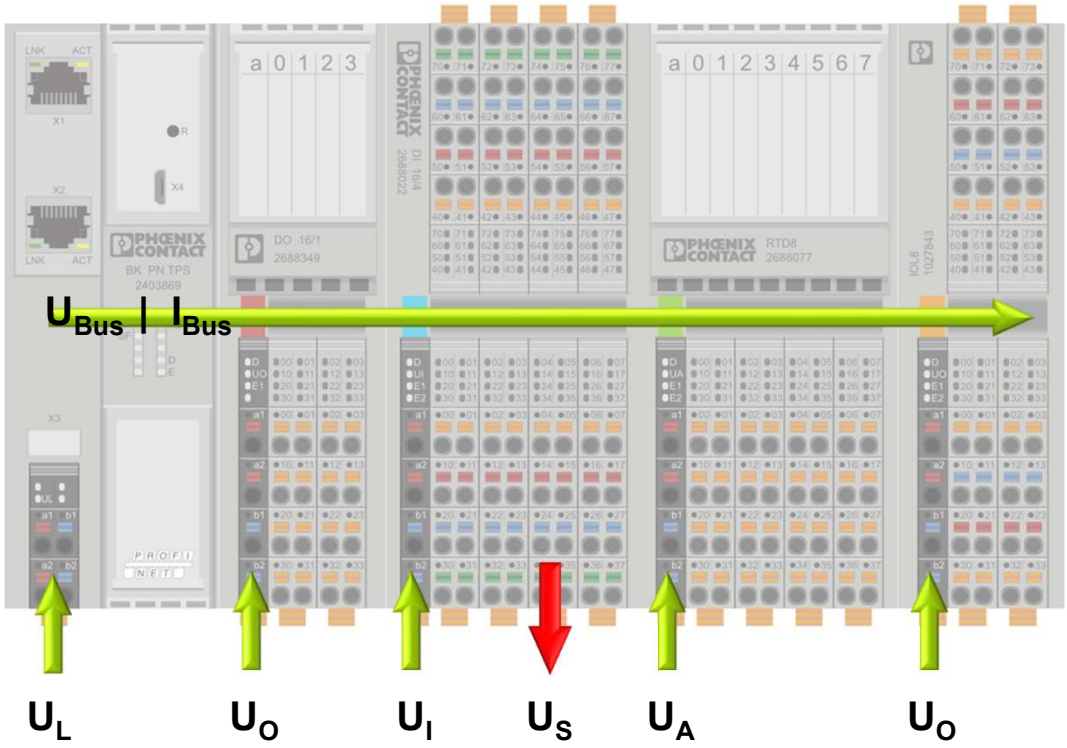
Module dimensions





PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F system supply

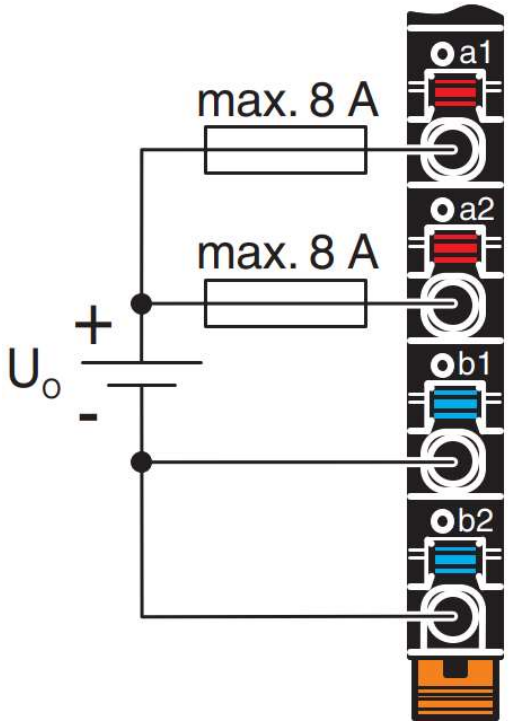


- U_L (U_{Logic}) Communications power supply
- I_{Bus} (I_{Bus}) Local bus
- U_{Bus} (U_{Bus}) Local bus (gen. from U_L)
- U_I (U_{Input}) Digital input modules
- U_S (U_{Sensor}) Sensor supply (gen. from U_I)
- U_O (U_{Output}) Digital output modules
- U_{IO} ($U_{Input/Output}$) Digital input/output modules
- U_A (U_{Analog}) Analog modules

PHOENIX CONTACT
INSPIRING INNOVATIONS

Parallel power supply for more than 8 A

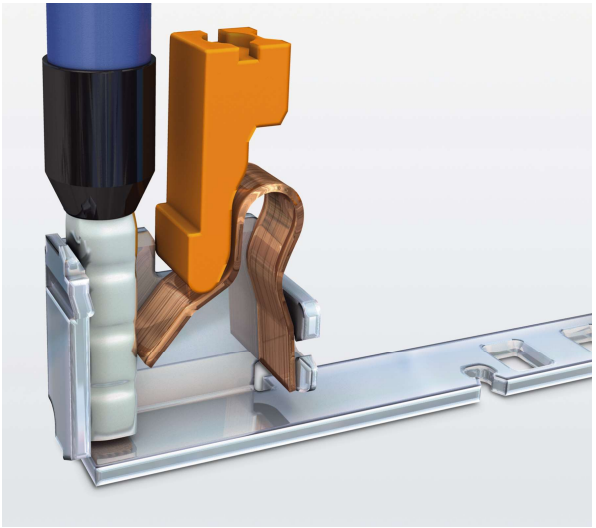
- Maximum current consumption of a terminal point → 8 A
- Example:
  - AXL F DO32/1 2H → 32 channels * 0,5 A = 16 A
  - Power supply (U_O) via one single terminal point limited up to 8 A
  - → Parallel power supply for U_O up to 16 A



Axioline F - the block-based modular I/O system

Conductor cross sections | Push-in Technology

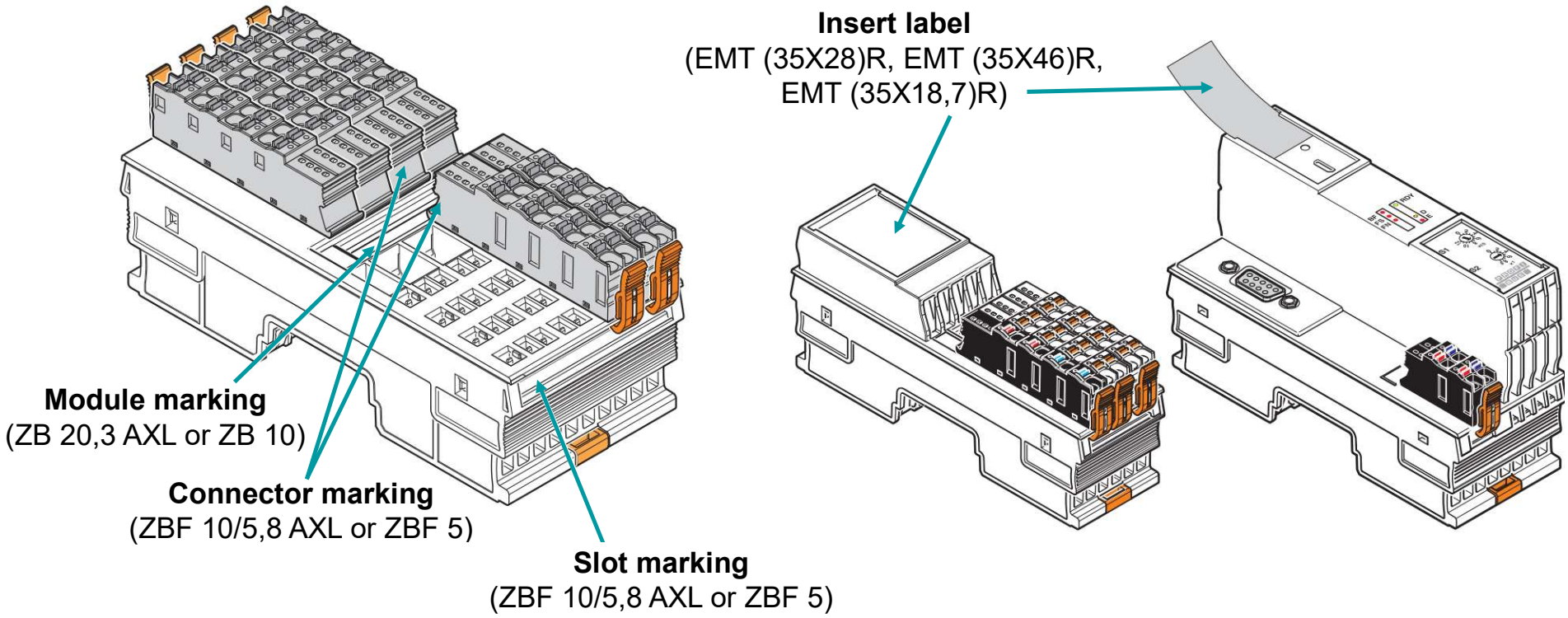
Conductor	Push-in technology	using the spring lever
solid 	min. 0,50 mm² max. 1,50 mm²	min. 0,20 mm² max. 1,50 mm²
stranded 	-	min. 0,20 mm² max. 1,50 mm²
ferrule without collar 	min. 0,25 mm² max. 1,50 mm²	min. 0,25 mm² max. 1,50 mm²
ferrule with collar 	min. 0,25 mm² max. 1,50 mm²	min. 0,25 mm² max. 1,50 mm²



PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Individual marking with zack marker strips and labels

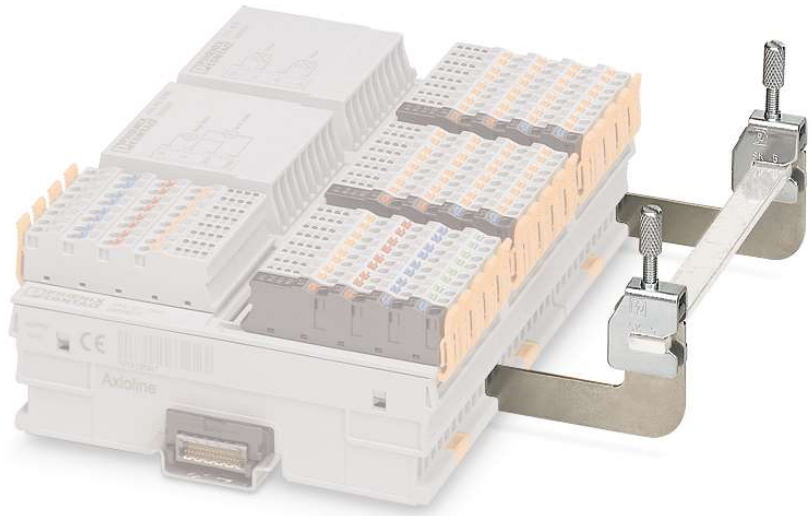


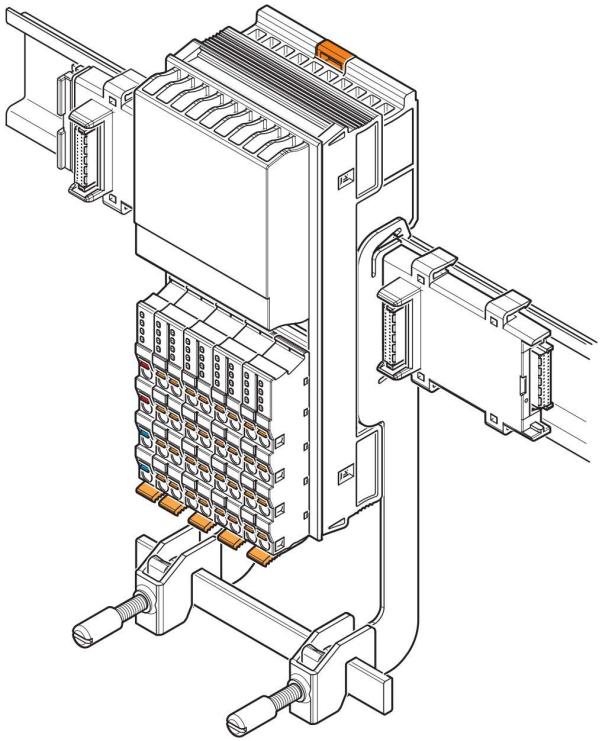
PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Shielding of signal cables

- System integrated shielding set
  - AXL SHIELD SET - 2700518





PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

STARTUP+ – Wiring Check for Axioline F

- Connection to the bus coupler via RJ45 or USB interface
- Reading the connected bus; all modules will be displayed
- Reading and writing module process data (IO-Check)
- Parameterization of the modules
- I/O module and the bus coupler diagnostics
- Free to download



AVAILABLE AS FREE DOWNLOAD !

PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Technical Data – Environment & mechanical tests

Ambient temperature (operation)	-25°C ... +60°C
Ambient temperature (storage/transport)	-40°C ... +85°C
Permissible humidity	5% ... 95% (non-condensing)
Permissible air pressure	70 kPa ... 106 kPa (up to 3000 m above sea level) (> 3000 m with restraints, see user manual)
Degree of protection	IP20
Vibration resistance (IEC 60068-2-6)	5g
Shock testing (IEC 60068-2-27)	30g
Bump endurance test (IEC 60068-2-27)	10g
Noise emission test (EN 61000-6-3)	Class B (residential area)

PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Approvals

Local approvals

CE

c UL US LISTED

EAC

Marine approvals

RINA SERVICES

classification, certification, inspection & testing

BUREAU VERITAS

Lloyd's Register TYPE APPROVAL

CERTIFIED BY DNV·GL MARITIME MANUFACTURER

ABS

Ex approvals*

Ex

IECEx

c UL US LISTED

Class 1 Div. 2

* XC modules only

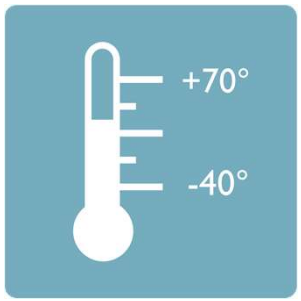
PHOENIX CONTACT

INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Axioline F XC (eXtreme Conditions)

- Axioline F XC modules for rough environment
  - Can be used under extreme ambient conditions
  - Extended temperature range of -40°C ... +70°C (see “Tested successfully: use under extreme ambient conditions” in the data sheet)
  - Partially coated PCBs
  - Ex approvals for many XC modules (July 2020)
    - ATEX (Zone 2)
    - IEC Ex (Zone 2)
    - UL haz. loc. Class 1 Div 2

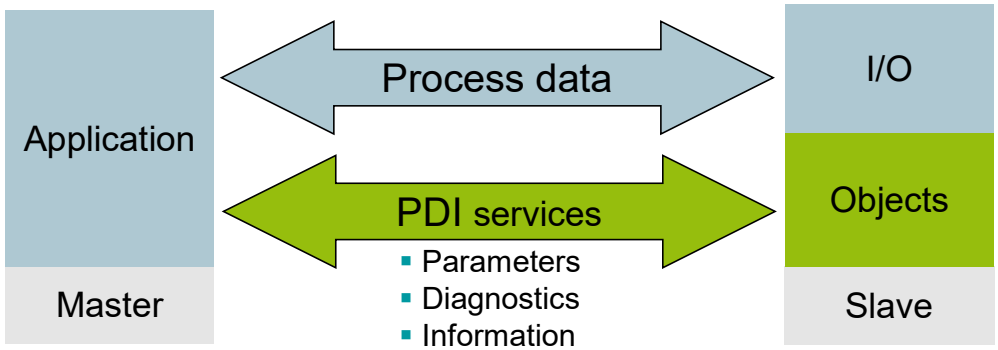


Class 1 Div. 2

PHOENIX CONTACT
INSPIRING INNOVATIONS

Process data and PDI channel

- Process data
  - Every AXL F device has at least one byte process data
  - Motorola format (Big Endian)
- PDI = **P**arameters, **D**iagnostics, and **I**nformation
  - Demand-oriented, acyclic transmission of parameter and diagnostic data

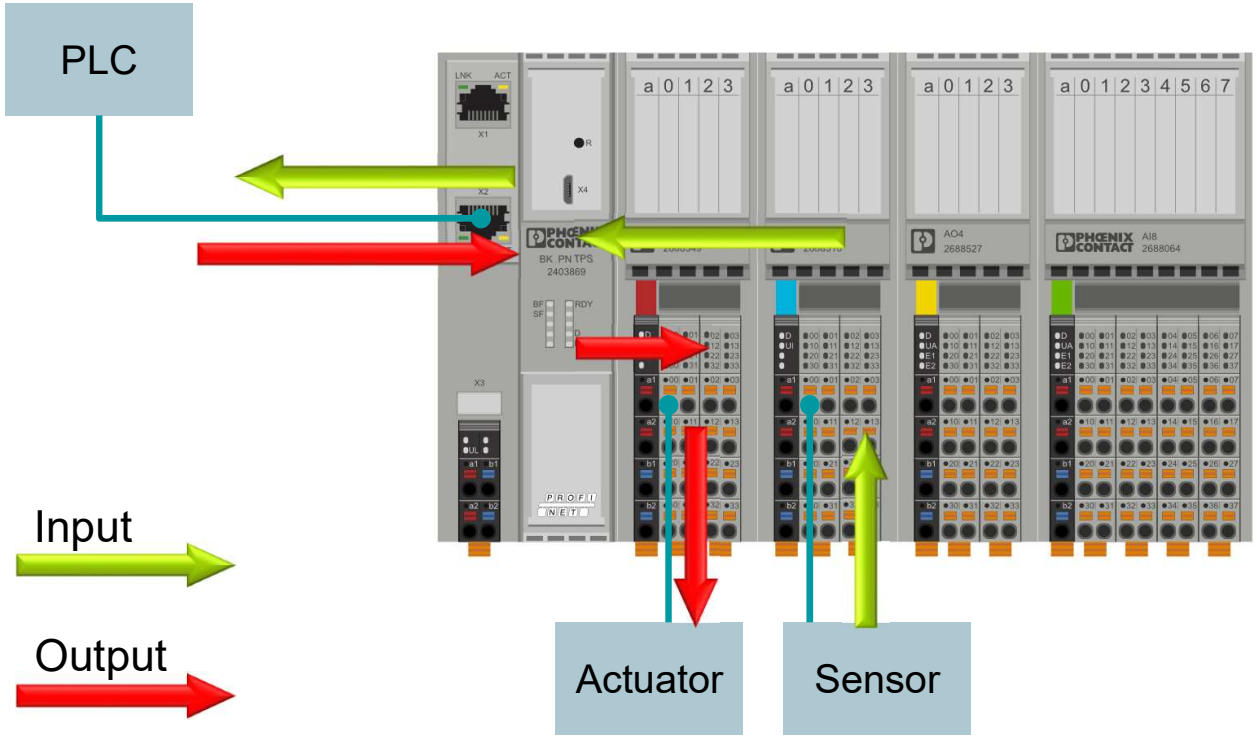


Diagnostic state (0018_{hex}: DiagState)

Index [hex]	Object name	Meaning
0018	DiagState	Diagnostic state
.01	Consec. no.	Consecutive error number since the last power up or error memory reset
.02	Priority	Priority of the message. 1: highest priority
.03	Channel	Channel on which the error occurred (FF_{hex}: entire device)
.04	Code	Error code
….	…	…
.0B	Text	Device-specific explanation of the malfunction that occurred; Default: “Status OK”



Response times for an Axioline F system



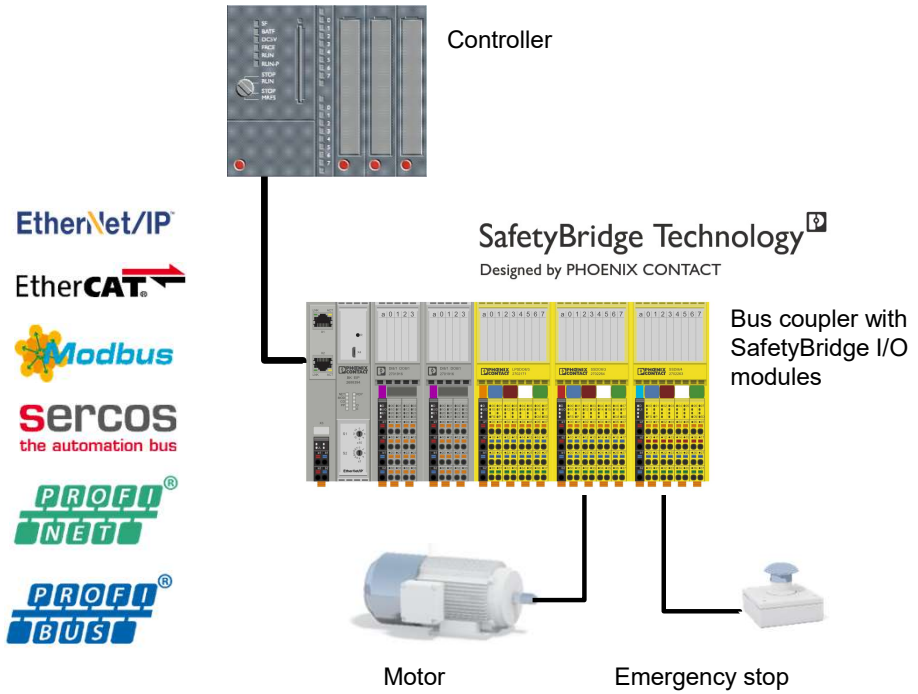
- Response time =
  time from reading in the input,
  processing in the controller
  to setting the output
- When determining the response time of the overall system, Axioline F represents the smallest proportion by far and therefore can normally be ignored.

PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

SafetyBridge Technology

- Safety I/O modules exchange safety-related signals with each other
- The standard controller and network is only used for transport purposes
- Safety I/O modules process the safety functions themselves
- All safety requirements up to SIL 3 or PL e
  - ➢ Cost-effective solution for functional safety in standard applications



PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Axiocontrol

PLCnext Control	Extensions (for AXC F 2152 / 3152)	Conventional PLCs
 **AXC F 1152** 1151412 8 tasks, 16 PN devices, ARM® Cortex® A9 single core, 800 MHz	 **AXC F XT ETH 1TX** 2403115 Left-alignable Ethernet interface, Independent MAC-Address, PROFINET support	 **AXC 1050** 2700988 8 tasks, 16 PN devices, Altera® NIOS® II processor, 100 MHz
 **AXC F 2152** 2404267 32 tasks, 64 PN devices, ARM® Cortex® A9 dual core, 2x 800 MHz	 **AXC F XT IB** 2403018 Left-alignable INTERBUS-master, up to 512 INTERBUS devices, 500K / 2MBD (automatic detection)	 UPS **AXC 3050** 2700989 16 tasks, 256 PN devices, Intel® Atom™ E660, 1.3 GHz
 **AXC F 3152** TSN UPS 1234567 32 tasks, 128 PN devices, Intel® Atom™ E3930 dual core, 2x 1.3 GHz	 **AXC F IL ADAPT** 1020304 Right-alignable Inline adapter terminal (INTERBUS master), 500K / 2MBD (automatic detection)	

PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Bus coupler

PROFINET PROFIBUS	EtherCAT® Sercos	Modbus/TCP (UDP) EtherNet/IP™	Ethernet (IEC 61850)
 **AXL F BK PN TPS** 2403869	 **AXL F BK EC** 2688899	 **AXL F BK ETH** 2688459	**IEC 61850**  **AXL F BK SAS** 2701457
 **AXL F BK PB** 2688530	 **AXL F BK S3** 2701686	 **AXL F BK EIP** 2688394	

INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Digital Input

16 Channels	32 channels	64 channels	8 channels (IEC 61850)
 **AXL F DI16/4 2F** 2688022 24 V DC, 4-wire	 **AXL F DI32/1 2H** 2702052 24 V DC, 1-wire	 **AXL F DI64/1 2F** 2701450 24 V DC, 1-wire	 **AXL F DI8/2 24DC 1F** 2702783 24 V DC, IEC 61850-3
 **AXL F DI16/1 1H** 2688310 24 V DC, 1-wire	 **AXL F DI32/1 1F** 2688035 24 V DC, 1-wire		 **AXL F DI8/2 48/60DC 1F** 2702654 48 / 60 V DC, IEC 61850-3
 **AXL F DI16/1 HS 1H** 2701722 24 V DC, 1-wire, high speed			 **AXL F DI8/2 110/220DC 1F** 2700684 110 / 220 V DC, IEC 61850-3

PHOENIX CONTACT
INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Digital Output

4 / 8 Channels	16 channels	16 / 32 channels	64 channels
 **AXL F DO8/2 2A 1H** 2688381 24 V DC, 2 A, 2-wire	 **AXL F DO16/3 2F** 2688048 24 V DC, 500 mA, 3-wire, safety circuit	 **AXL F DO16 FLK 1H** 2701813 24 V DC, 500 mA, FLK connection	 **AXL F DO64/1 2F** 2702053 24 V DC, 500 mA, 1-wire
 **AXL F DO4/3 AC 1F** 2702068 Triac, 230 V AC, 2 A, 3-wire	 **AXL F DO16/1 1H** 2688349 24 V DC, 500 mA, 1-wire	 **AXL F DO32/1 2H** 1004925 24 V DC, 500 mA, 1-wire	
 **AXL F DOR4/2 AC/220DC 1F** 2700608 Relay, 8A, 220 V DC / 230 V AC	 **AXL F DO16/2 2H** 1027904 24 V DC, 500 mA, 2-wire, safety circuit	 **AXL F DO32/1 1F** 2688051 24 V DC, 500 mA, 1-wire	

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Axioline F - the block-based modular I/O system

Digital Input / Output

16 Channels	24 channels	32 channels
 **AXL F DI8/1 DO8/1 1H** 2701916 8 DI, 24 V DC, 1-wire 8 DO, 24 V DC, 500 mA, 1-wire	 **AXL F DI16/1 DO8/2-2A 2H** 2702291 16 DI, 24 V DC, 1-wire 8 DO, 24 V DC, 2 A, 2-wire	 **AXL F DI16/1 DO16/1 2H** 2702106 16 DI, 24 V DC, 1-wire 16 DO, 24 V DC, 500 mA, 1-wire
 **AXL F DI8/3 DO8/3 2H** 2702071 8 DI, 24 V DC, 3-wire 8 DO, 24 V DC, 500 mA, 3-wire		

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Axioline F - the block-based modular I/O system

Analog Input / Analog Output

Analog Input 4 Channels	Analog Input 8 Channels	Analog Output 4 / 8 Channels	Analog Input / Output 4 Channels
 **AXL F AI4 I 1H** 2688491 0 … 20 mA, 4 … 20 mA, -20 … +20 mA, 2-, 3-, 4-wire	 **AXL F AI8 1F** 2688064 0 ... 5 V, -5 ... +5 V, 0 ... 10 V, -10 ... +10 V, 0 ... 20 mA, 4 ... 20 mA, -20 ... +20 mA, 2-wire	 **AXL F AO4 1H** 2688527 0 ... 5 V, -5 ... +5 V, 0 ... 10 V, -10 ... +10 V, 0 ... 20 mA, 4 ... 20 mA, 2-wire	 **AXL F AI2 AO2 1H** 2702072 0 ... 5 V, -5 ... +5 V, 0 ... 10 V, -10 ... +10 V, 0 ... 20 mA, 4 ... 20 mA, -20 ... +20 mA, 2-wire
 **AXL F AI4 U 1H** 2688501 0 ... 5 V, -5 ... 5 V, 0 ... 10 V, -10 ... 10 V, 2-, 3-, 4-wire	 **AXL F AI8 W 1F** 2702525 0 V ... 5 V, -5 ... +5 V, 0 V ... 10 V, -10 ... +10 V, 0 ... 20 mA, 4 ... 20 mA, -20 ... +20 mA, 2-wire, high long-term stability	 **AXL F AO8 1F** 2688080 0 ... 5 V, -5 ... +5 V, 0 ... 10 V, -10 ... +10 V, 0 ... 20 mA, 4 ... 20 mA, -20 ... +20 mA, 2-wire	

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Axioline F - the block-based modular I/O system

Temperature measurement / Strain Gauge Input

RTD (Resistive Temperature Sensors)	UTH (Thermocouple Sensors)	SGI (Strain Gauge Input)
 **AXL F RTD4 1H** 2688556 4 channels; Pt, Ni, KTY, Cu sensors; linear resistance measuring; 2, 3, 4-wire (shielded)	 **AXL F UTH4 1H** 2688598 4 channels; Sensor types: U, T, L, J, E, K, N, S, R, B, C, W, HK; linear voltage measuring; 2-wire (shielded, twisted pair)	 **AXL F SGI2 1H** 2702911 2 channels; high-precision, 4-, 6-wire connection; 2-point adjustment, path-adjustment, PD update time 0,2 … 100 ms
 **AXL F RTD8 1F** 2688077 8 channels, Pt, Ni, KTY, Cu sensors; linear resistance measuring; 2, 3, 4-wire (shielded)	 **AXL F UTH8 1F** 2688417 8 channels; Sensor types: U, T, L, J, E, K, N, S, R, B, C, W, HK; linear voltage measuring; 2-wire (shielded, twisted pair)	

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Axioline F - the block-based modular I/O system

Communication / Master

IO-Link Master, Serial (RS-232, RS-422/485)	Conventional Subbus Masters / Interfaces	Building Automation Subbus Master
 **AXL F IOL8 2H** 1027843 8 IO-Link class A ports, 3-wire, IO-Link-Spec V1.1.2, Parameter data storage	 **AXL F IF CAN 1H** 2702668 1 CAN interface; transparent protocol, max. speed of 1 Mbps **Restricted distribution**	 **AXL F MA DALI2 1H** 2702864 DALI master, two channels, integrated DALI power supply, single master operation, protected up to 250 V AC **only for AXC / RFC**
 **AXL F RS UNI 1H** 2688666 1 interface, RS-485/422 or RS-232; Speed: 110 bps ... 250 kbps; Protocols: Transparent, end-to-end, XON/XOFF, Modbus/RTU	 **AXL F MA IB 1H** 2702148 1 INTERBUS-Master, 9-pos. D-SUB socket, max. 64 byte process data width, 500K / 2MBD (automatic detect.), Automatic startup of INTERBUS **Restricted distribution**	 **AXL F MA MBUS 1H** 1104545 M-Bus master, 2-wire connection, up to 80 devices, transmission speed up to 38.4 kbps, Integrated isolated M-Bus power supply **only for AXC / RFC**

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INSPIRING INNOVATIONS

Axioline F - the block-based modular I/O system

Function / Power Measurement / Power feed

SSI, PWM	Power Measurement, Counter, Incremental Encoder	Logic power supply
 **AXL F SSI1 AO1 1H** 2688433 1 SSI interface for absolute encoder, 62.5 kHz to 2 MHz; 1 analog output	 **AXL F PM EF 1F** 2702671 Power measurement, 4 inputs, 0 … 400 V AC (phase/neutral), 0 … 690 V AC (phase/phase), 0 … 5 A AC	 **AXL F PWR 1H** 2688297 Logic supply U_{Bus}, max. 4 A
 **AXL F PWM2 1H** 1007352 pulse width modulation, 2 independent channels, 24 V DC, 500 mA, 5 V DC, 10 mA, Frequency output (0 ... 65535 Hz)	 **AXL F CNT2 INC2 1F** 2688093 2 Counter inputs, 32 Bit, 2 Incremental encoder inputs, Input frequency up to 300 kHz	

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Axioline F - the block-based modular I/O system

SafetyBridge / PROFIsafe

SafetyBridge logical module	SafetyBridge I/O	PROFIsafe I/O
 **AXL F LPSDO8/3 1F** 2702171 integrated safety logic; 4 safe DOs (two-channel occupancy) or 8 safe DOs (single-channel occupancy)	 **AXL F SSDI8/4 1F** 2702263 4 safe DIs (two-channel occupancy) or 8 safe DIs (single-channel occupancy)	 **AXL F PSDI8/4 1F** 2701559 4 safe DIs (two-channel occupancy) or 8 safe DIs (single-channel occupancy)
	 **AXL F SSDO8/3 1F** 2702264 4 safe DOs (two-channel occupancy) or 8 safe DOs (single-channel occupancy)	 **AXL F PSDO8/3 1F** 2701560 4 safe DOs (two-channel occupancy) or 8 safe DOs (single-channel occupancy)

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Axioline F - the block-based modular I/O system

XC - Axiocontrol and bus coupler

Conventional PLCs	PROFINET PROFIBUS	Modbus/TCP (UDP) EtherNet/IP™
 **AXC 1050 XC** 1089334 8 tasks, 16 PN devices, Altera® NIOS® II processor, 100 MHz	 **AXL F BK PN TPS XC** 1068857	 **AXL F BK ETH XC** 2701949
	 **AXL F BK PB XC** 2702463	 **AXL F BK EIP XC** 1167192

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Axioline F - the block-based modular I/O system

XC - Digital Input / Output

Digital Input	Digital Output	Digital Output Digital Input/Output
 **AXL F DI16/4 XC 2F** 2701224 24 V DC, 4-wire	 **AXL F DO16/3 XC 2F** 2701228 24 V DC, 500 mA, 3-wire, safety circuit	 **AXL F DO8/2 2A XC 1H** 1035427 24 V DC, 2 A, 2-wire
 **AXL F DI32/1 XC 1F** 2701226 24 V DC, 1-wire	 **AXL F DO32/1 XC 1F** 2701230 24 V DC, 500 mA, 1-wire	 **AXL F DI8/1 DO8/1 XC 1H** 2702017 8 DI, 24 V DC, 1-wire 8 DO, 24 V DC, 500 mA, 1-wire

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Axioline F - the block-based modular I/O system

XC Process I/Os - Digital Input / Output

Digital Input	Digital Output
 **AXL F DI16 NAM XC 1F** 1052427 16 digital inputs for NAMUR proximity sensors (IEC/EN 60947-5-6), 2-wire	 **AXL F EX IS DO4 SD 24-48 XC 1F** 1086901 Intrinsically safe, 4 digital outputs, 24 V DC, 48 mA, 3-wire
 **AXL F EX IS DI16 NAM XC 1F** 1052423 Intrinsically safe, 16 digital inputs for NAMUR proximity sensors (IEC/EN 60947-5-6), 2-wire	 **AXL F EX IS DO4 SD 21-60 XC 1F** 1086902 Intrinsically safe, 4 digital outputs, 21 V DC, 60 mA, 3-wire

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Axioline F - the block-based modular I/O system

XC - Analog Input / Output

Analog Input	Analog Input Analog Input/Output	Analog Output
 **AXL F AI4 I XC 1H** 2702007 0 … 20 mA, 4 … 20 mA, -20 … +20 mA, 2-, 3-, 4-wire	 **AXL F AI8 XC 1F** 2701232 0 ... 5 V, -5 ... +5 V, 0 ... 10 V, -10 ... +10 V, 0 ... 20 mA, 4 ... 20 mA, -20 ... +20 mA, 2-wire	 **AXL F AO4 XC 1H** 2702153 0 ... 5 V, -5 ... +5 V, 0 ... 10 V, -10 ... +10 V, 0 ... 20 mA, 4 ... 20 mA, 2-wire
 **AXL F AI4 U XC 1H** 2702008 0 ... 5 V, -5 ... 5 V, 0 ... 10 V, -10 ... 10 V, 2-, 3-, 4-wire	 **AXL F AI2 AO2 XC 1H** 1035429 0 ... 5 V, -5 ... +5 V, 0 ... 10 V, -10 ... +10 V, 0 ... 20 mA, 4 ... 20 mA, -20 ... +20 mA, 2-wire	 **AXL F AO8 XC 1F** 2701237 0 ... 5 V, -5 ... +5 V, 0 ... 10 V, -10 ... +10 V, 0 ... 20 mA, 4 ... 20 mA, -20 ... +20 mA, 2-wire

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Axioline F - the block-based modular I/O system

XC Process I/Os - Analog Input / Output (HART)

Analog Input	Analog Output
 **AXL F AI8 HART XC 1F** 1052434 8 analog inputs, HART enabled, 4 … 20 mA, 2-wire	 **AXL F AO4 HART XC 1F** 1087080 4 analog outputs, HART enabled, 4 … 20 mA, 2-wire
 **AXL F EX IS AI8 HART XC 1F** 1052432 Intrinsically safe, 8 analog inputs, HART enabled, 4 … 20 mA, 2-wire	 **AXL F EX IS AO4 HART XC 1F** 1087081 Intrinsically safe, 4 analog outputs, HART enabled, 4 … 20 mA, 2-wire

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Axioline F - the block-based modular I/O system

XC - Temperature measurement / Communication / Function

RTD (Resistive Temperature Sensors)	UTH (Thermocouple Sensors) Serial (RS-232, RS-422/485)	Counter, Incremental Encoder Impulse-Input
 **AXL F RTD4 XC 1H** 1035430 4 channels; Pt, Ni, KTY, Cu sensors; linear resistance measuring; 2, 3, 4-wire (shielded)	 **AXL F UTH8 XC 1F** 2702464 8 channels; Sensor types: U, T, L, J, E, K, N, S, R, B, C, W, HK; linear voltage measuring; 2-wire (shielded, twisted pair)	 **AXL F CNT2 INC2 XC 1F** 2701239 2 Counter inputs, 32 Bit, 2 Incremental encoder inputs, Input frequency up to 300 kHz
 **AXL F RTD8 XC 1F** 2701235 8 channels, Pt, Ni, KTY, Cu sensors; linear resistance measuring; 2, 3, 4-wire (shielded)	 **AXL F RS UNI XC 1H** 2702006 1 interface, RS-485/422 or RS-232; Speed: 110 bps ... 250 kbps; Protocols: Transparent, end-to-end, XON/XOFF, Modbus/RTU	 **AXL F IMPULSE2 XC 1H** 2702655 2 channels for magnetostrictive position sensors with start/stop interface, 5 stop events per channel, 4 digital inputs

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Axioline F - Profibus

Set up

Linking a Profibus I/O station into the TIA Portal V13

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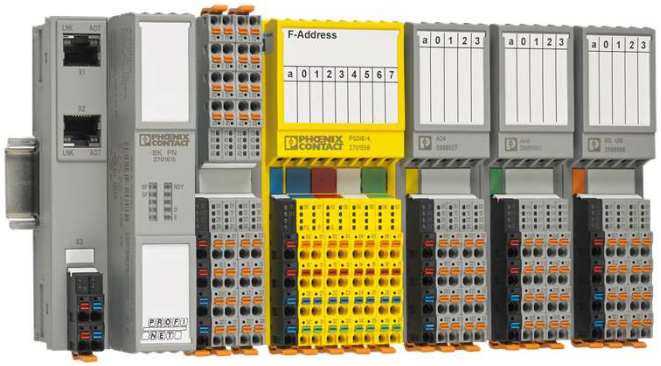
Axioline F - the block-based modular I/O system | Technic



Thank you

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I/O solutions for Process Industry



Welcome

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I/O solutions for Process Industry

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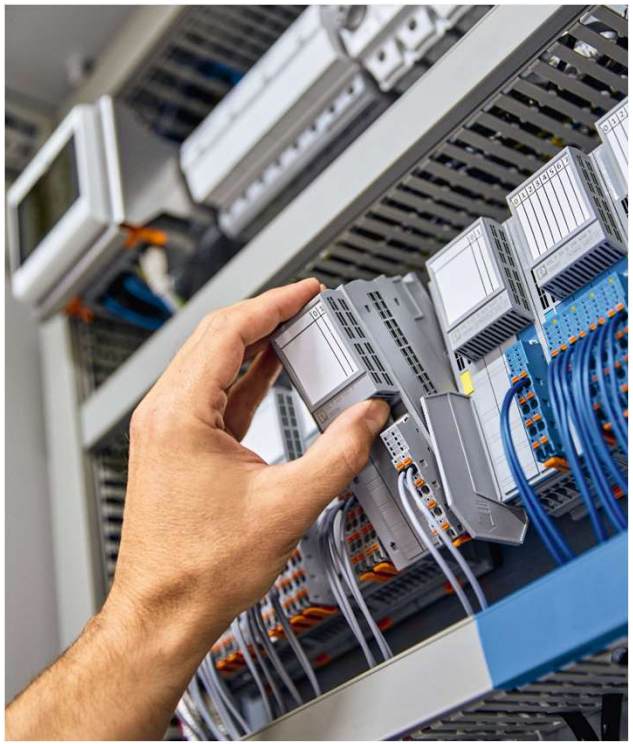
I/O solutions for Process Industry

Agenda

- Customer Requirements
- Market Launch
- AXL P and F process IOs
  - Positioning
  - Features
  - Portfolio



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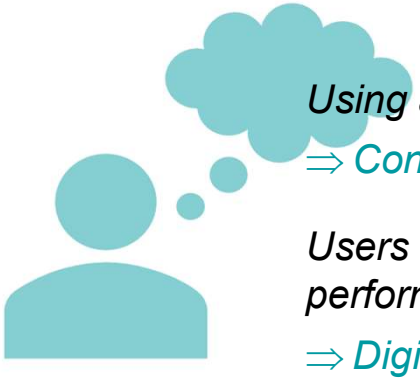
Reasons for development

Customer requirements



Using a future-proof ethernet based network is a major trend in many industries.

⇒ *Connectivity*

Users are demanding more information with the goal of optimizing assets and operating performance.

⇒ *Digitalization*

PROFINET Organization continues to upgrade the standard and opens new possibilities to the user like high availability of the devices.

⇒ *Redundancy*

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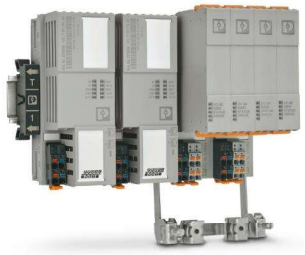
I/O solutions for Process Industry

Market Launch – Time schedule

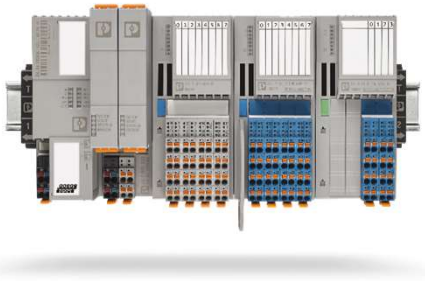
AXL F I/O

AXL P I/O



Phase I – **HM 2019**
(PN-PB PA Proxy)





Phase II – **HM 2020**

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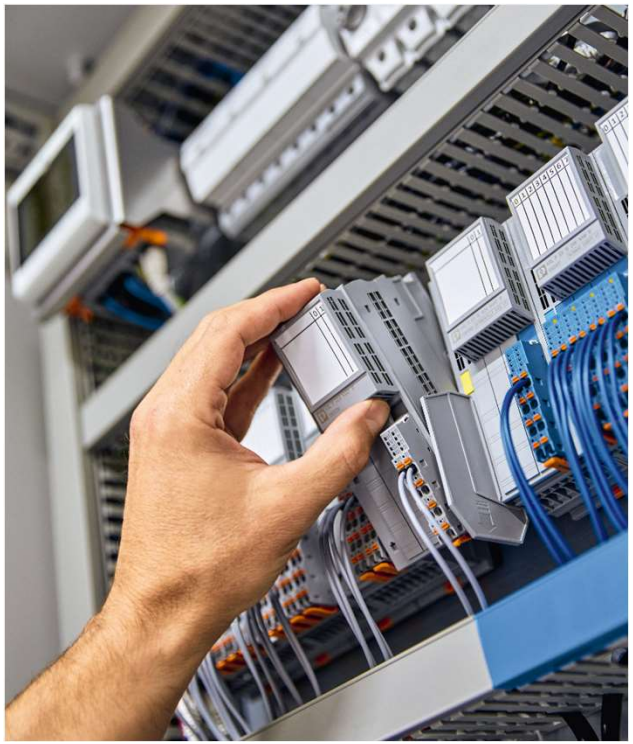
I/O solutions for Process Industry

Agenda

- Customer Requirements
- Market Launch
- AXL P and F process IOs
  - Positioning
  - Features
  - Portfolio



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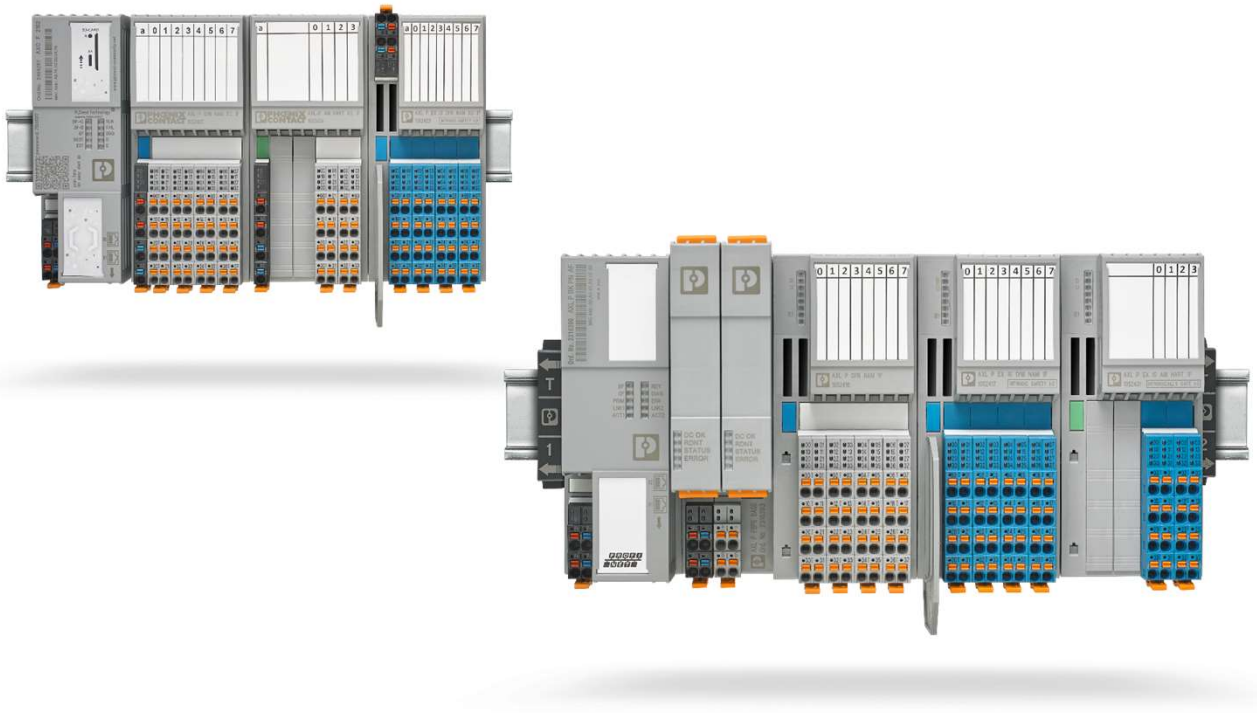
Phase II – AXL P and F Hardened IOs



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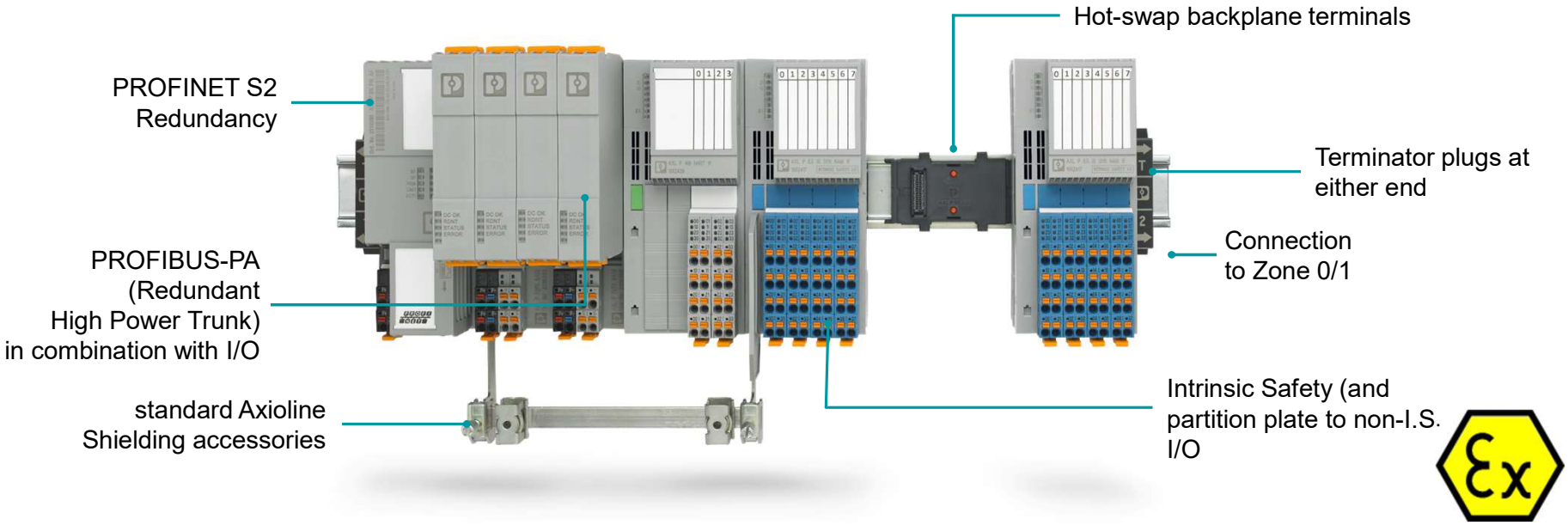
I/O solutions for Process Industry

Axioline P – High Availability



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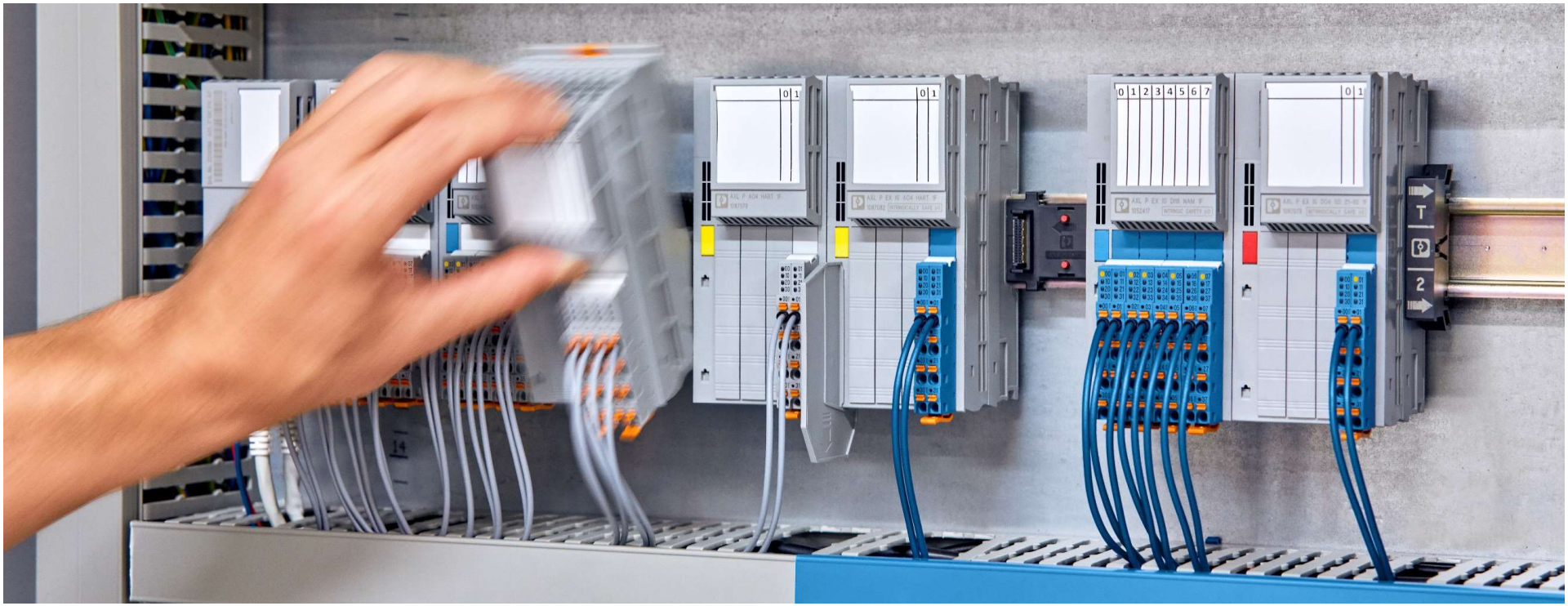
Axioline P – High Availability due to easy hot-swap



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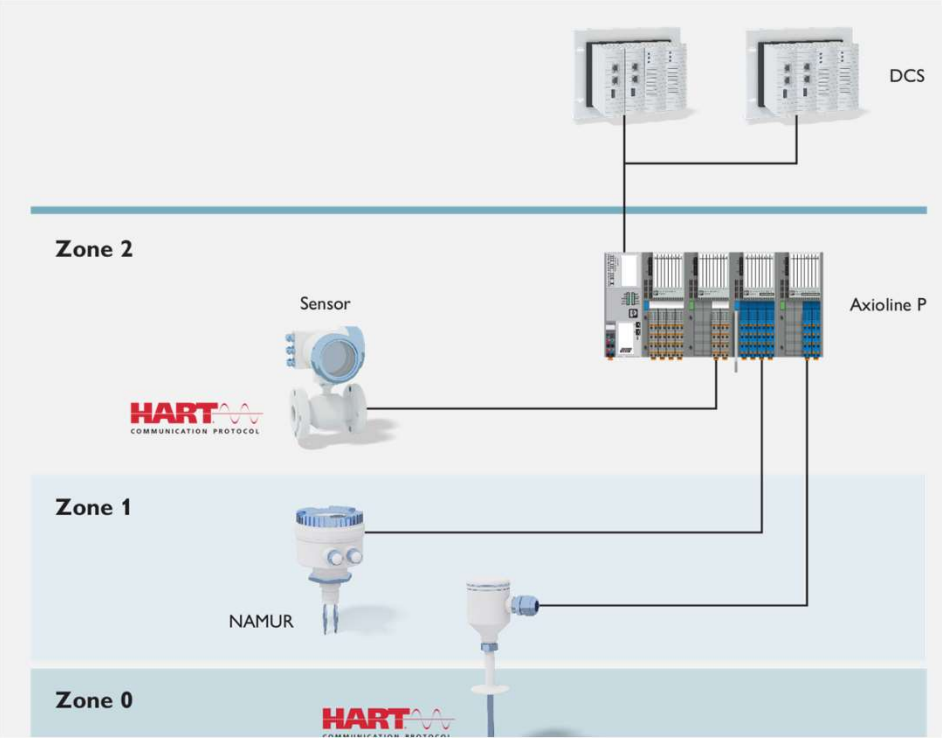
I/O solutions for Process Industry

Reliable communication up to zone 0

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

- Installation of the I/O station in zone 2
- Ability to connect sensor and actuator signals out zones 1 and 0



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Axioline P – High Availability



Power supply and I/O are combined in the module – no separate I.S. power supply is needed

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

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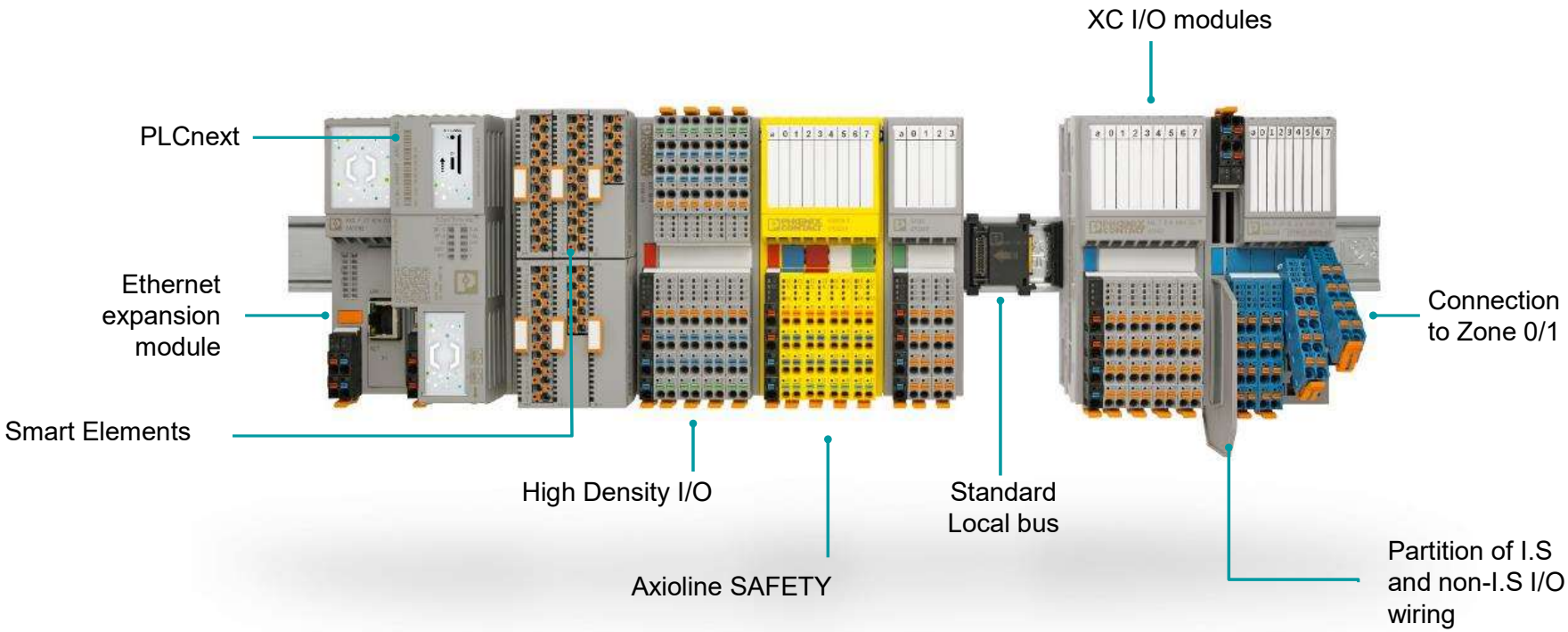
I/O solutions for Process Industry

Axioline F – Monitoring and Optimization



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I/O solutions for Process Industry

Axioline F XC I/O modules

All the Axioline F I/O attributes **plus** extreme condition temperature ratings, and IECEX / ATEX Zone 2 Certification



Channel I/O marker card

Power Supply Connector and I/O connector with status LEDs

Power supply and Intrinsically Safe I/O connectors are visibly separated from each other

Connection to Zone 0/1

Degree of protection IP20

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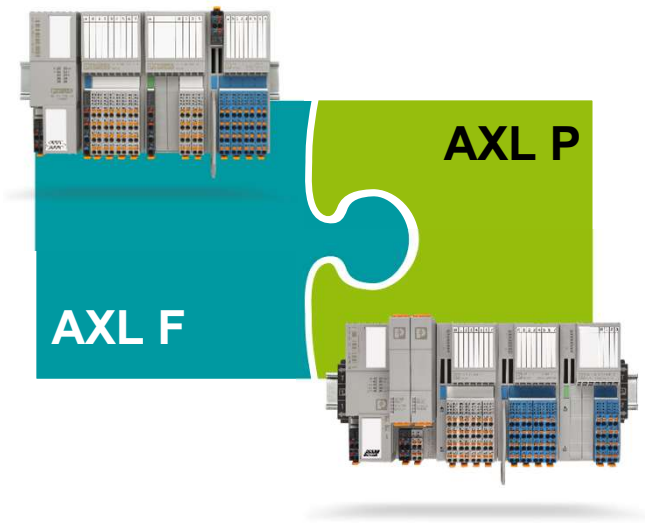
I/O solutions for Process Industry

Market positioning

Axioline F

- **Ship building**
- **Batch process**
- **Monitoring**
- **Hybrid applications**

- Extends the existing portfolio with intrinsic safe I/O
- Addition of HART and NAMUR functionality for new applications
- Ideal together with PLCnext Control in monitoring applications (data diode)



Axioline P

- **Heavy process (Continuous and Batch)**
- **Skid Building**

- Redundant bus coupling for critical applications
- Hot swappable I/O modules guarantee high system availability

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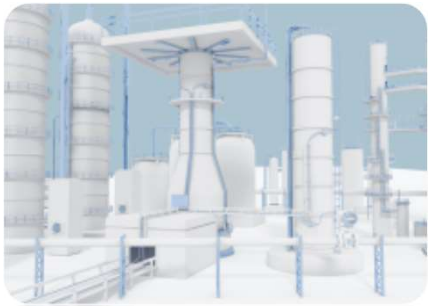
I/O solutions for Process Industry

Target Markets

- Oil & Gas
- Marine & Offshore
- Chemical & Pharma
- Hybrid Applications of PA and FA, e.g.
  - Power Plants
  - Paint Booths
  - Semiconductor Production
  - Water/ Wastewater Plants





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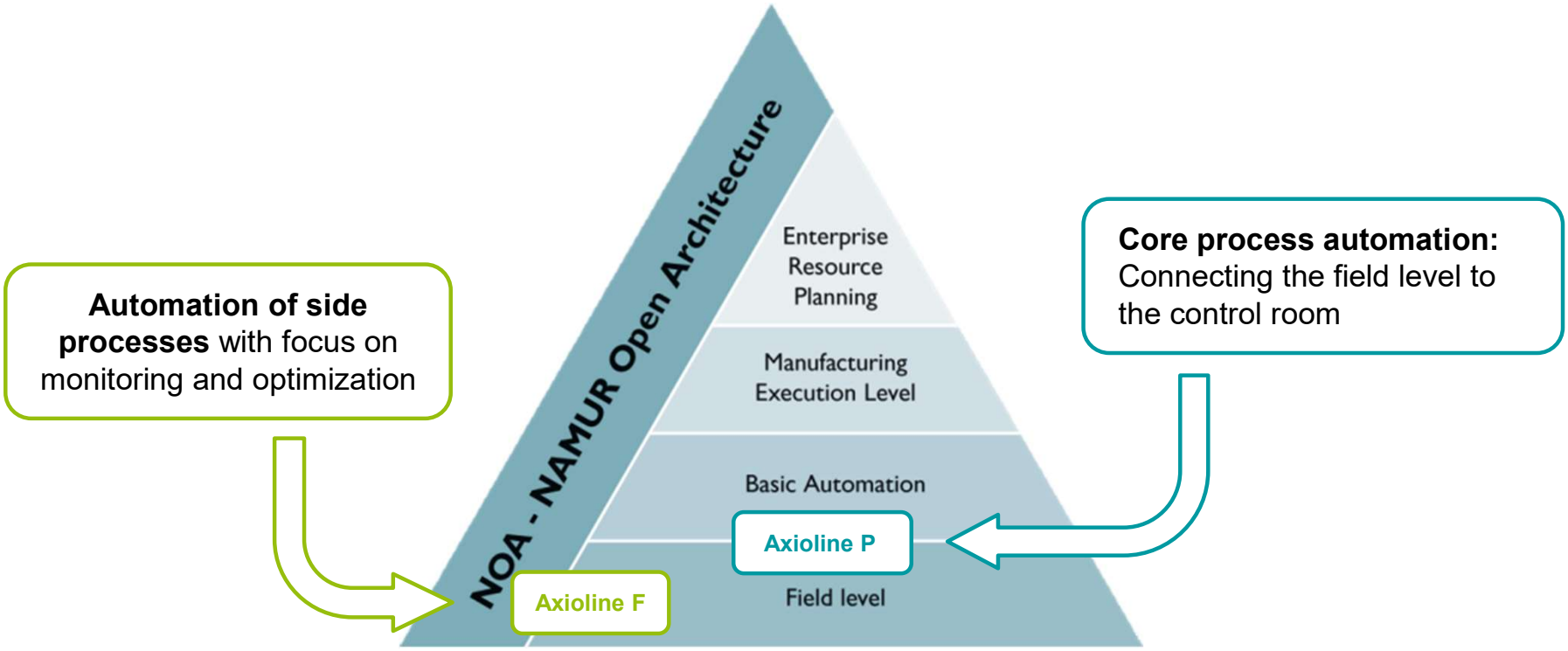
Use Cases for AXL F and P
NAMUR Open Architecture (NOA)



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Use Cases for AXL F and P

AXL P – Connecting the field level

Applications in the core processes – AXL P connects the field level with the control system

- The Hot-Swap-Functionality of Axioline P protects the plant from unplanned and unexpected downtimes during the continuous processes.



✓ High Availability
✓ Redundancy
✓ Hot-Swapability



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Use Cases for AXL F and P

AXL F – Maintenance & Optimization

Applications in the secondary processes

- Hot-swap capability not required
- Redundancy optional

Use Case: Maintenance & Optimization

- In NOA (NAMUR Open Architecture) solutions with Proficloud
- In MTP (Modular Type Packaging) applications

⇒ Interesting for Skid Builders where pricing is a decision criterion

Maintenance



Optimization

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Differences between AXL F and P



AXL F Hardened IO	AXL P

• AXL F local bus
• XC-Variants
 	
• PN Redundancy (S2)
• HART analogue modules
• NAMUR digital inputs
• Intrinsic safe and non safe
• Zone 2 (acc. ATEX, IECex and UL)
• Ship Approvals (planned)
	• New local bus
	  • Hot Swappable
	  • Ethernet ring
	• PN Redundancy (S2, R1 & R2)
	• HART analogue modules
	• NAMUR digital inputs
	• Intrinsic safe and non safe
	• Zone 2 (acc. ATEX, IECex and UL)
	• Ship Approvals
	⇒ Highly available



Not mixable inside an I/O station!

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I/O solutions for Process Industry

Planned Start Portfolio

	Axioline F		Function	Axioline P	
Non EXi	-	-	PN bus coupler	AXL P BK PN	1132800
	AXL F DI16 NAM XC 1F	1052427	NAMUR DI NonEX	AXL P DI16 NAM 1F	1052416
	AXL F AI8 HART XC 1F	1052434	HART AI NonEX	AXL P AI8 HART 1F	1052429
	AXL F AO4 HART XC 1F	1087080	HART AO NonEX	AXL P AO4 HART 1F	1087079
EXi	AXL F EX IS DI16 NAM XC 1F	1052423	NAMUR DI EXi	AXL P EX IS DI16 NAM 1F	1052417
	AXL F EX IS AI8 HART XC 1F	1052432	HART AI EXi	AXL P EX IS AI8 HART 1F	1052431
	AXL F EX IS DO4 SD 21-60 XC 1F	1086902	DO EXi	AXL P EX IS DO4 SD 21-60 1F	1087078
	AXL F EX IS DO4 SD 24-48 XC 1F	1086901	DO EXi	AXL P EX IS DO4 SD 24-48 1F	1087077
	AXL F EX IS AO4 HART XC 1F	1087081	HART AO EXi	AXL P EX IS AO4 HART 1F	1087082

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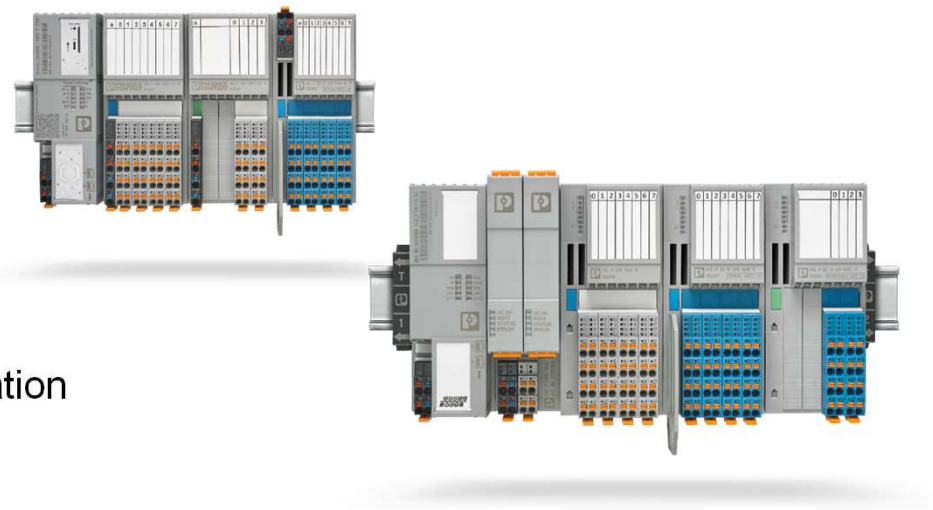
I/O solutions for Process Industry

AXL F (EX IS) DI16 NAM XC 1F
AXL P (EX IS) DI16 NAM 1F

Digital Input for NAMUR Sensors

- 16 channels
- For 2-wire NAMUR sensors acc. to EN 60947-5-6
- Intrinsic safe and non-safe
- Conformal coated (AXL F XC)
- ATEX, IECEX and UL EX approvals for Zone 2 installation
- Operation temperature -40°C up to +70°C



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I/O solutions for Process Industry

AXL F (EX IS) AI8 HART XC 1F
AXL P (EX IS) AI8 HART 1F

Analogue Input for HART Sensors

- 8 channels
- 4…20 mA
- For 2-wire loop powered passive transmitters
- Compliant to HART Standard Versions 5, 6, or 7
- Intrinsic safe and non-safe
- Conformal coated (AXL F XC)
- ATEX, IECEX and UL EX approvals for Zone 2 installation
- Operation temperature -40°C up to +70°C



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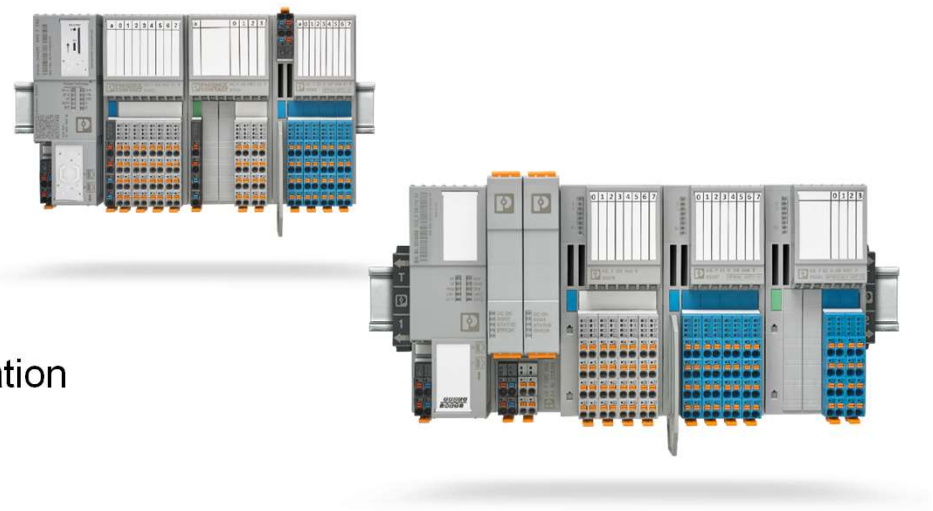
AXL F/P EX IS DO4 SD 21-60 (XC) 1F
AXL F/P EX IS DO4 SD 24-48 (XC) 1F

Digital Output for e.g. Solenoid Valves

- 4 channels
- 21V/60 mA or 24V/48 mA
- Intrinsic safe
- Conformal coated (AXL F XC)
- ATEX, IECEX and UL EX approvals for Zone 2 installation
- Operation temperature -40°C up to +70°C



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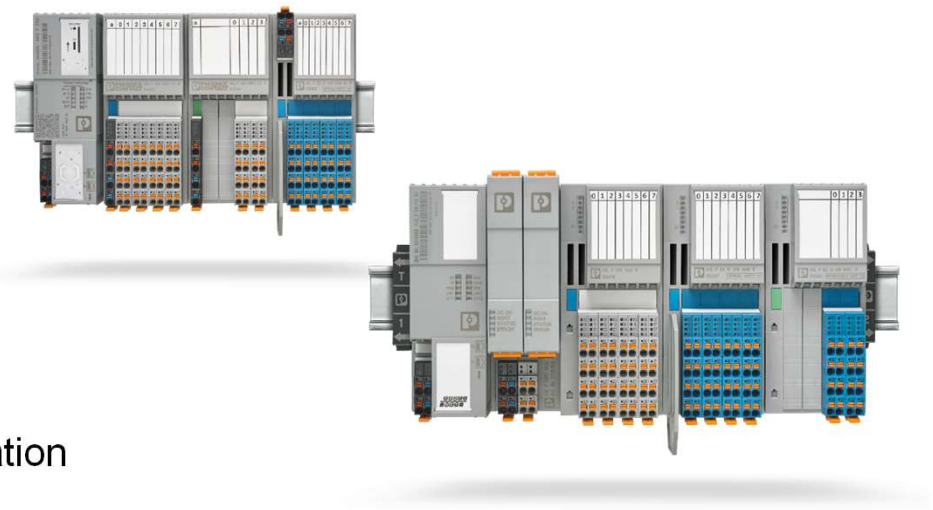
AXL F (EX IS) AO4 HART XC 1F
AXL P (EX IS) AO4 HART 1F

Analogue Output for HART Actuators

- 4 channels
- 0/4…20 mA
- Compliant to HART Standard Versions 5, 6, or 7
- Intrinsic safe and non-safe
- Conformal coated (AXL F XC)
- ATEX, IECEX and UL EX approvals for Zone 2 installation
- Operation temperature -40°C up to +70°C



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Approvals

- **IECEx:** EX ec IIC T4 Gc
- **(C)UL-EX LIS:** Class I, Div. 2, Groups A, B, C, D T4
- **ATEX:** Ex II 3G; Ex nA IIC T4 Gc



EU-Konformitätserklärung Nr. 2316390.CE.01
EU-Declaration of Conformity No.

PHOENIX CONTACT Development and Manufacturing Inc.
586 Fulling Mill Road, Middletown, PA 17057-2968, USA

NRAG.E196811 - Programmable Controllers for Use in Hazardous Locations

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PHOENIX CONTACT GMBH & CO. KG
FLACHSMARKTSTRASSE 8
32825 BLOMBERG, GERMANY

IECEx Certificate of Conformity

INTERNATIONAL ELECTROTECHNICAL COMMISSION
IEC Certification Scheme for Explosive Atmospheres

Certificate No.: IECEx IBE 18.0023X
Status: Current
Date of Issue: 2018-12-14
Applicant: PHOENIX CONTACT GmbH & Co. KG
Flachsmarktstraße 8
32825 Blomberg
Germany
Equipment: Axiocline P Modules - AXL P BK... and AXL P PBPS...
Type of Protection: Increased safety "e"
Marking: Ex ec IIC T4 Gc
-40 °C ≤ T_{amb} ≤ +65 °C

Approved for issue on behalf of the IECEx Certification Body:
Dipl.-Ing. Alexander Henker
Position: Deputy Head of Certification Body
Date: 2018-12-14

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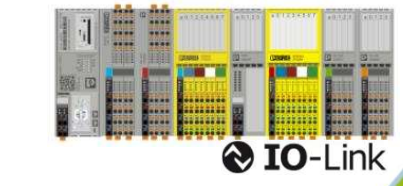
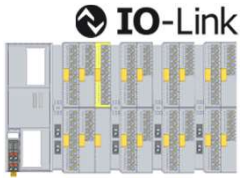
I/O solutions for Process Industry

Gapless I/O solutions for our Vertical Markets







- Overall width
- Speed
- Wide range of I/Os
- Price



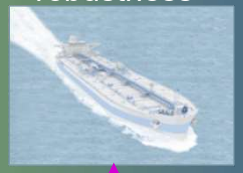
- Mechanical robustness
- Wide range of I/Os



HYBRID

Mixed requirements

- Wide Temp
- Haz Loc Areas
- Mechanical robustness



- Redundancy
- Hot Swap
- Wide Temp
- Haz Loc Areas

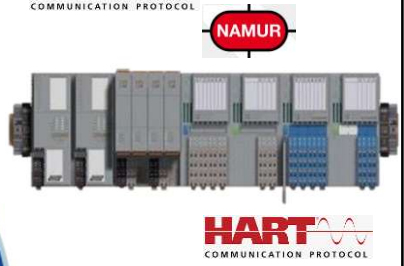


FACTORY

PROCESS

Axioline SE | Axioline F | AXL F XC + IS | Axioline P





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Axioline P and F

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Axioline P

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