Axioline F: system and installation

User manual

PHOENIX CONTACT
INSPIRING INNOVATIONS

User manual

Axioline F: system and installation

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Artikel-Nr.: —

This user manual is valid for:

All modules of the Axioline F product group without bus-specific special features.

Please observe the following notes

User group of this manual

The use of products described in this manual is oriented exclusively to qualified electricians or persons instructed by them, who are familiar with applicable standards and other regulations regarding electrical engineering and, in particular, the relevant safety concepts.

Explanation of symbols used and signal words

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety measures that follow this symbol to avoid possible injury or death.

There are three different categories of personal injury that are indicated with a signal word.

DANGER This indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING This indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION This indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

This symbol together with the signal word **NOTE** and the accompanying text alert the reader to a situation which may cause damage or malfunction to the device, hardware/software, or surrounding property.

This symbol and the accompanying text provide the reader with additional information or refer to detailed sources of information.

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1 Documentation landscape of Axioline F

1.1 Available documents

The documentation for the Axioline F product group is modular, providing you with the optimum information to meet your requirements, for example, for installation or startup with software.

In the following table, the term module describes the controller, bus coupler, and I/O module.

Table 1-1 Axioline F documentation

Document	Contents
System: Information on the Axioline F system	
User manual “Axioline F: System and installation” UM EN AXL F SYS INST (this manual)	This manual is the generic system manual for Axioline F. It describes the system and everything about Axioline F module mounting and wiring regardless of a higher-level network.
User manual “Axioline F: Diagnostic registers, and error messages” UM EN AXL F SYS DIAG	The user manual lists all error message for the system and provides remedial measures.
Module: Basic information on a specific module	
Package slips	A package slip is provided with the module upon delivery. It contains key information for the electrical installation of a module or group of modules. These include, for example: – Short description – Safety notes – Mounting/removal – Terminal point assignment
User manuals for the safety modules and controller	The user manual for each safety module or controller contains the complete information needed for use. These include at the very least: – Description – Mounting/removal and power supply – Startup under PC Worx and – Technical data and ordering data

Table 1-1 Axioline F documentation [...]

Document	Contents
Module-specific data sheets	The data sheet for each module contains the complete information needed for use. These include at the very least: – Function description – Accessories – Technical data – Pin assignment/terminal point assignment – Local diagnostics and status indicators and – Connection examples
Additional: Information on a specific module	
Additional user manuals	The additional user manuals either describe: – A bus coupler connected to a network or – A specific module Each manual only describes the relevant module and/or bus-specific special features. Being a generic manual, the “UM EN AXL F SYS INST” user manual also applies.
Quick start guides	Quick start guides are available for various topics. A quick start guide describes the startup of a system or a module step by step using an example.
Application notes	Application notes provide additional information about special topics.
Up-to-date pdf	
Generate PDF	By clicking the “Generate product PDF” button on the Internet, you can call up up-to-date information on the product (see Section “Documentation on the Internet” on page 11). These include at the very least: – Short description – Technical data – Drawings – Approvals

1.2 Documentation on the Internet

This documentation can be downloaded at phoenixcontact.net/products. Here you will find information on each product. During your search, take into account the difference between “Generate product PDF” and “Download”.

Generate product PDF

Click the “Generate product PDF” button to receive up-to-date selected information. It provides a **short overview** of the module.
The generated PDF file contains the essential product information. If you require further information, you can use the “Downloads” tab.

Downloads

Under the “Downloads” tab, you can access the **complete** documentation and all other downloads related to a module.
Module-specific documentation can be found in the download area for the corresponding module.
Comprehensive documentation can be found in the download area for the corresponding bus coupler.

1.3 Purpose of this user manual

This user manual informs you about the Axioline F system. It describes the system and everything about Axioline F module mounting and wiring regardless of a higher-level network.

2 The Axioline F product group

2.1 What is Axioline F?

Axioline F is a modular I/O system for the control cabinet. Open to all Ethernet-based communication protocols, Axioline F offers maximum flexibility. In addition, Axioline F is fast as regards response times and installation, robust in terms of its design and mechanics, and at the same time very easy to operate.

It is used for the transmission of process signals to a higher-level controller. Various networks are supported.

2.2 Features

Axioline F is fast

Axioline F features shortest response times and fast synchronous signal processing. This reduces cycle times and helps to increase the machine output and productivity. In addition, the control quality and as a result the product quality increases thanks to the fast signal processing feature.

Axioline F is as fast as parallel cabling, so the speed for data transmission is determined by the higher-level network.

– Synchronous to the higher-level network (depends on the bus coupler)
– Local bus cycle time in the µs range
– Fast I/O update times
– Fast and efficient station set-up

Axioline F is robust

Axioline F features a particularly robust mechanical design. The high electromagnetic compatibility, noise immunity, and low emissions ensure problem-free use in the industrial environment and beyond.

The XC modules, including controllers, bus couplers, and I/O modules, give you an extended temperature range. The coated modules open up even more applications.

– Vibration and shock resistant
– High noise immunity even in electromagnetically strongly contaminated environments
– Future-proof – thanks to reduced radiation it can even be used after reducing limit values
– Wide temperature range
– Coated modules withstand even the harshest environments
– All important approvals for marine automation

Axioline F is easy

Extremely user friendly. Thanks to the push-in connection technology, you can wire efficiently without tools – solid conductors or conductors with ferrules can be inserted directly into the terminal. The color coding of the contact points enables fast and intuitive wiring – this saves installation time and therefore also costs.

In addition, intelligent marking systems from Phoenix Contact simplify the individual I/O system marking.

Clear wiring: the design supports cabling from above and below. Module replacement is particularly fast with existing wiring.

Other properties

- High channel density
- Voltage ranges: 24 V DC (protective extra low voltage) and up to 220 V DC/230 V AC (low voltage)
- Transmission speed in the local bus: 100 Mbps
- Communication to the higher-level system via an Ethernet-based protocol (e.g., PROFINET, Sercos, EtherCAT®, Modbus/TCP)
- Very good diagnostic properties for the Axioline F system and application

2.3 Structure of an Axioline F station

An Axioline F station consists of individual modules that are snapped onto a DIN rail.
A controller or a bus coupler forms the head of the station. I/O modules are mounted next to it.
Bus base modules are used for the connection of the individual modules to one another and to the station head. The bus base modules are snapped onto the DIN rail side by side and thus form the Axioline F local bus.

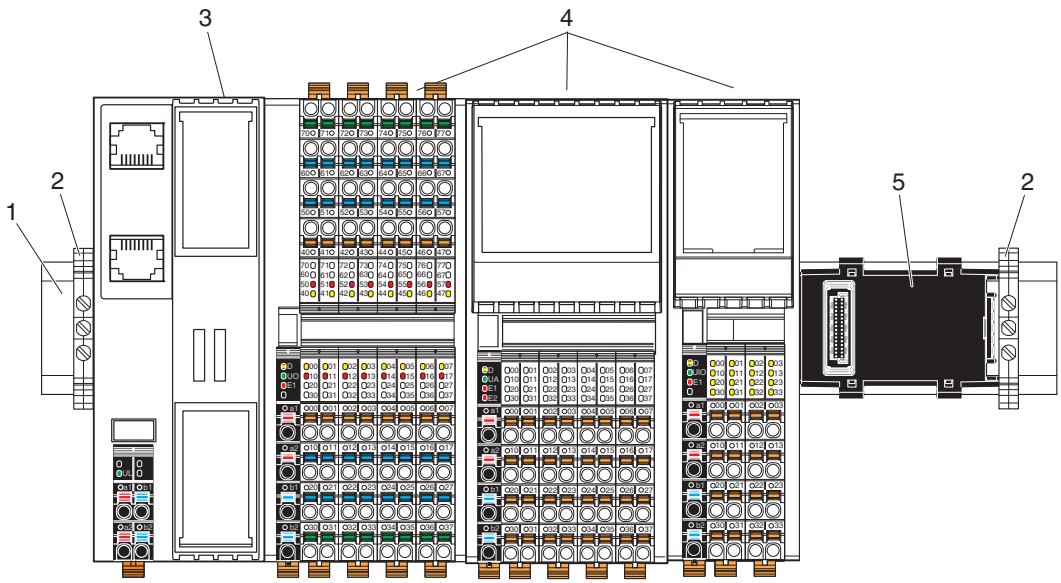


Figure 2-1 Example of an Axioline F station

1 DIN rail
2 End bracket (for securing the station; see “End brackets” on page 51)
3 Bus head (bus coupler or controller)
4 I/O modules
5 Bus base module

For detailed information about the function, properties, wiring, and parameterization, please refer to the module-specific documentation.

2.4 Product description

Modules with various functions are available within the Axioline F product group.

The Axioline F modules consist of an electronic module, one or several connectors, and a bus base module.

The electronics module can be changed without having to remove a wire from the connector.

The bus base modules are snapped onto the DIN rail side by side and thus form the Axioline F local bus that connects the modules to one another.

The Axioline F local bus is subsequently referred to as the local bus.

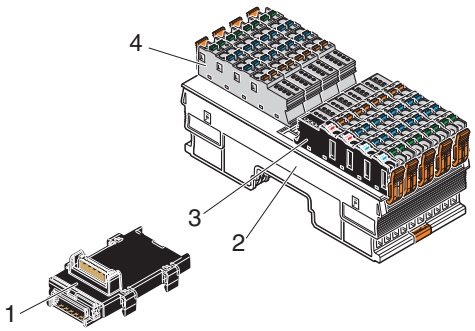


Figure 2-2 Components of an Axioline F I/O module

Key:

1 Bus base module
2 Electronics module
3 Connector for connecting the supply voltage
4 I/O connector

Versions

Modules are available for the following automation tasks:

– Controller
– Bus couplers to integrate the Axioline F station into various networks (PROFINET, Sercos, PROFIBUS, etc.).
– Input and output modules for digital and analog signals
– Modules for temperature recording
– Module for open and closed-loop control, and position detection
– Modules for communication
– ...

This product range is growing continuously.

Voltage ranges

Axioline F modules are available for the protective extra low voltage (PELV) range and the low voltage range. You can use low voltage and extra low voltage modules directly next to each other within an Axioline F station.

Table 2-1 Voltage ranges for Axioline F

Voltage range	Product groups	Nominal voltage used	Permissible voltage range	Examples
PELV	Low-level signal modules	24 V DC	19.2 V DC ... 30 V DC	AXL F DI16/4 2F
Low voltage	Low voltage modules	110 V DC/ 220 V DC	-300 V DC ... +300 V DC	AXL F DI8/2 110/220DC 2F
		220 V DC 230 V AC	-300 V DC ... 300 V DC 24 V AC ... 230 V AC (50 Hz ... 60 Hz)	AXL F DOR4/2 AC/220DC 1F
		230 V AC	12 V AC ... 253 V AC (50 Hz ... 60 Hz)	AXL F DO4/3 AC 1F

The instructions given in this user manual and in the module-specific documentation must be followed during installation and startup.

Particularly observe:

Section “Safety notes for mounting/removal” on page 47.

Mounting location

The Axioline F modules meet IP20 protection and can be used in closed control cabinets or in control boxes (terminal boxes) with IP54 protection according to EN 60529 or higher.

The compact structure means that the Axioline F modules can be installed in standard terminal boxes. Please observe the mounting distances when selecting the housing (see Section “Mounting distances” on page 62).

Mounting

Each Axioline F module consists of a bus base module and an electronics module. Snap the bus base modules onto the DIN rail without the need for tools and arrange the modules side by side. The local bus is created automatically when the bus base modules are installed next to one another.

Then, snap the electronics modules onto the DIN rail over the bus base modules.

See Section “Mounting and removing modules” on page 47.

Removal

Only a standard tool is necessary for removing the electronics module (e.g., a bladed screwdriver with a blade width of 2.5 mm).

See Section “Mounting and removing modules” on page 47.

Bus connection (network)

The Axioline F station is integrated in the network using a controller or a bus coupler.

Axioline F local bus

There is an interface to the Axioline F local bus on the bottom of the modules. Bus base modules are used to carry the communications power and the bus signals from the controller or bus coupler through the Axioline F station. The bus base module is supplied as standard with each module.

Please note the special feature of the bus couplers:
For bus couplers with the designation AXL BK ...., the bus coupler is integrated.
For bus couplers with the designation AXL F BK..., a separate bus base module is supplied in the scope of delivery.

The maximum number of Axioline F modules within a station is 63. The actual number of modules within an Axioline F station may be limited by the supplied logic current, the current consumption of the connected modules, and the system limits of the controller or bus coupler. See Section “Maximum number of modules” on page 52.

Connector

The Axioline F modules have connectors for connecting to the power supply and the I/O. The connectors have spring-cage terminal blocks. Suitable wires can be connected with push-in technology (see Section “Conductor cross sections and stripping/insertion lengths” on page 66).

Connecting the supply voltage

The communications power for the Axioline F station is supplied at the controller or bus coupler. The I/O voltage for the module is supplied separately to each I/O module (see Section “Connecting the power supplies” on page 72).

I/O connection

Sensors or actuators are connected with connectors using 1, 2, 3 or 4-wire technology (see Section “Connecting sensors and actuators” on page 77).

Depending on the module, the sensor/actuator cables are connected in one direction (at the bottom) or in two directions (at the top and at the bottom).

FE connection

At the bottom of each module there is at least one FE spring (metal contact) creating a functional earth ground connection when the module is snapped onto a grounded DIN rail.

Programming interface, service interface

The AXC 305x controllers are provided with a programming interface, and the AXC 105x controllers and the bus couplers are provided with a service interface. This interface is a type B micro USB socket. In addition to providing the network interface, it enables communication with the controller or bus coupler from a PC.

AXL BK ... bus couplers (not AXL F BK ...) do not have a micro USB socket but an IFS adapter interface. Please observe the information in the corresponding data sheet in this case.

Startup+

For information on Startup+, please refer to Section 10, “Software support” and the corresponding documentation.

Web-based management

By means of the web-based management integrated into the controllers and some bus couplers, you have the option to display static and dynamic information of the controller using a standard browser. The status and diagnostic functions can be clearly displayed on a graphical user interface by means of read access via a device network connection.
In addition, specific controller/bus coupler properties can be configured via web-based management.

Diagnostics

The Axioline F system provides comprehensive diagnostics:

- Remote diagnostics
- Process diagnostics (e.g., cycle time monitoring)
- Communication diagnostics
- Module diagnostics (status of the Axioline F module)
- I/O diagnostics (status of sensors/actuators)

For the diagnostic options of a specific module, please refer to the module-specific data sheets.

Reset button

The reset button provided on the controllers and bus couplers can only be operated with a pointed object (e.g., a pen) and is therefore protected against accidental activation.

If the reset button is actuated during operation, the controller or bus coupler is restarted.

Using the reset button, the controller or bus coupler can also be reset to the default settings.

For more detailed information on the reset button, please refer to the module-specific documentation.

Parameterization memory (controller)

The controllers have an integrated parameterization memory. Alternatively, it is possible to use a plug-in parameterization memory in the form of an SD card or USB stick.

For more detailed information on the parameterization memory, please refer to the user manual for the controller used.

2.5 Intended use

Axioline F controllers, Axioline F bus couplers, and Axioline F I/O modules should only be used according to the instructions in the module-specific documentation and this user manual (see Section “Technical data” on page 107). Phoenix Contact accepts no liability if the modules are used for anything other than their designated use.

2.6 Approvals

For the latest approvals for a module, please visit phoenixcontact.net/products.

Observe any notes and restrictions for the approvals in the module-specific package slip or in the module-specific documentation.

Search for approvals of a product

When searching for the approvals of a specific product, please proceed as follows:

- Enter the order designation, a part of it, or the order number in the search window.

Figure 2-3 Searching for order number 2688310

- Select the product.
- Switch to the “Approvals” tab.

The current approvals of the product are listed.

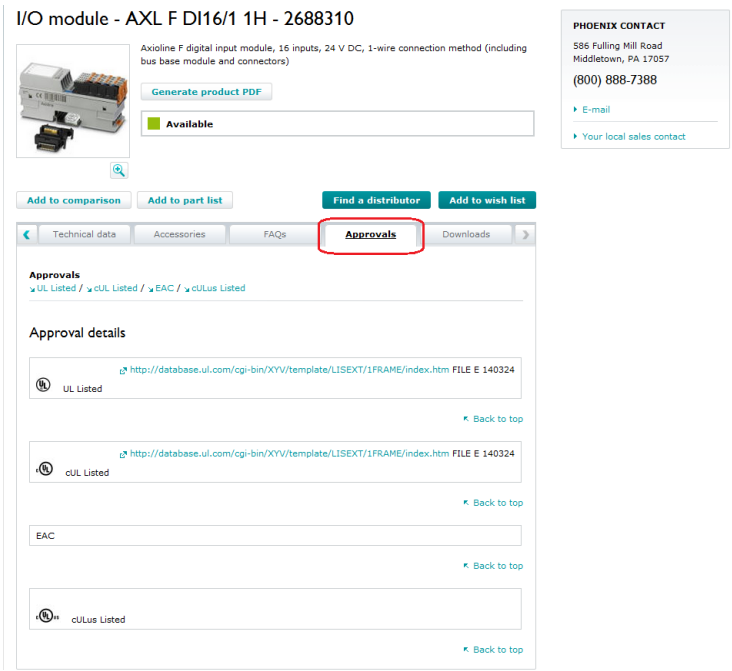


Figure 2-4 Current approvals of product 2688310

Search for all products that have a specific approval

When searching for products that have a specific approval, e.g., GL or ATEX-approved products, please proceed as follows:

- Enter AXL F, for example, in the search window.

Figure 2-5 Searching for AXL F

- UL approvals are listed directly; for other approvals, open “Approvals, More Options”.
- Activate the checkbox of the required approval and confirm the selection with “Submit”.

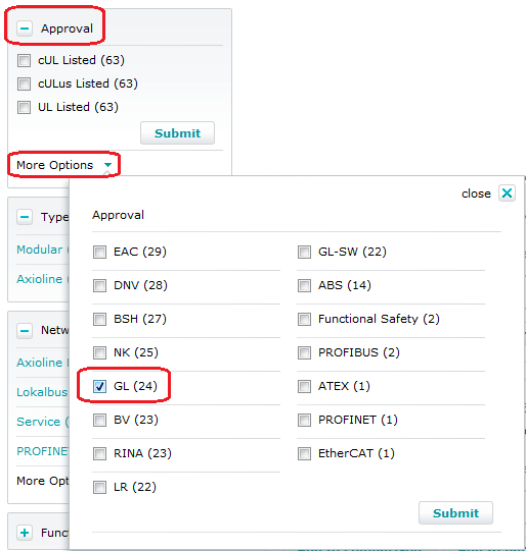


Figure 2-6 Selecting GL approval

This results in a list of all modules that have the selected approval.

3 Axioline F modules at a glance

3.1 Axioline F order designation

The order designation helps you to identify the function of a module.

Previous designation:

	Product group	Function	System	Number of inputs or outputs	Conductor connection	Extension
Examples:	AXL	BK	PN			
	AXL	DI		16	/4	-ME
	AXL	RTD		8		

New designation:

	Product group	Function and number of inputs of outputs	Conductor connection	Function extension	Housing
Examples:	AXL F	BK		PB	
	AXL F	DI16	/1	HS	1H
	AXL F	DI16	/4		2F
	AXL F	AI4		I	1H
	AXL F	DO8	/2	2A	1H
	AXL F	PSDO8	/3		1F
	AXL F	DO4	/3	AC	1F
	AXL F	DOR4	/2	AC/220DC	1F
	AXL F	DI8	/2	110/220DC	1F

Table 3-1 Structure of the order designations

Product group	AXL	Axioline F (previous designation)
	AXL F	Axioline F (new designation)
Function	BK	Bus coupler AXL BK ... : BK housing AXL F BK ... : F-BK housing
	DI	Digital input
	DO	Digital output
	DOR	Relay output
	SDI	Safe digital input
	SDO	Safe digital output
	P(SDI, SDO)	PROFIsafe
	AI	Analog Input
	AO	Analog output
	RTD	Analog input for the connection of resistance temperature detectors
	UTH	Analog input for the connection of thermocouple sensors
	CNT	Counter
	INC	Incremental encoder input
	SSI	SSI interface for absolute encoders
	RS UNI	Communication module for serial data transmission via RS-232 or via RS-485/422
	PWR	Supply
Number of inputs or outputs	1 ... 64	1 channel ... 64 channels
Function extension **(for bus couplers (BK): bus system/network)**	PN	PROFINET
	S3	Sercos
	PB	PROFIBUS DP
	EC	EtherCAT®
	ETH	Ethernet (Modbus/TCP)
	EIP	EtherNet/IP™

Table 3-1 Structure of the order designations [...]

Function extension (for other modules)	HS	High speed
	XC	Extreme ambient conditions
	S	Speed
	I	Current
	U	Voltage
	2A	2 A outputs
	FLK	FLK connection
	AC	Low voltage range AC (nominal output voltage 230 V AC)
	AC/220DC	Low voltage range AC and DC (nominal output voltage 230 V AC, 220 V DC)
	110/220DC	Low voltage range DC (Nominal voltage 110 V DC, 220 V DC)
Connection technology (for digital modules only)	/4	4-wire technology
	/3	3-wire technology
	/2	2-wire technology
	/1	1-wire technology
Housing	1F	1 terminal field, F housing (wide housing), cable outlet at the bottom
	2F	2 terminal fields, F housing (wide housing), cable outlets at the bottom and top
	1H	1 terminal field, H housing (narrow housing), cable outlet at the bottom
	2H	2 terminal fields, H housing (narrow housing), cable outlets at the bottom and top
Extension (only for previous designation)	ME	Module electronics (without bus base module and without connector) - as a replacement item

The standard modules are supplied with bus base module and Axioline F connectors. The connectors are mounted to the electronics module, and the bus base module is supplied as a separate part.

Bus base modules are also available as replacement items.
Please refer to the download area for the module at phoenixcontact.net/products to see whether a module-specific connector set is available as a replacement item.

3.2 Controller

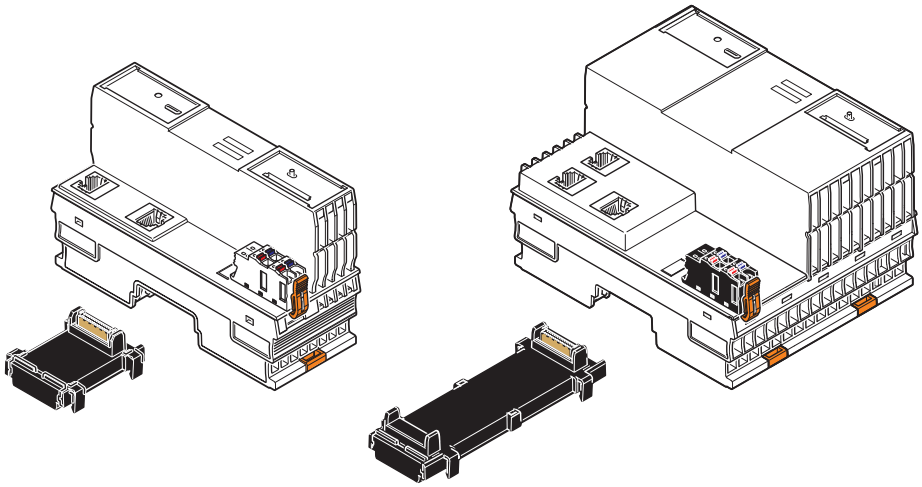


Figure 3-1 Example: AXC 1050 (F-BK housing) and AXC 3050 (AXC 3 housing)

A controller is a modular control system with integrated Ethernet and Axioline F local bus connection. As the head of an Axioline F station, it provides the function of a control system.

Choose a class 1000 controller for small to medium-sized automation tasks and benefit from the Axioline F local bus, PROFINET, Modbus/TCP, and an integrated UPS, for example.

A class 3000 controller is the ideal controller for medium-sized to complex applications in which networking options as well as a particularly short processing and response speed are required.

3.3 Bus coupler

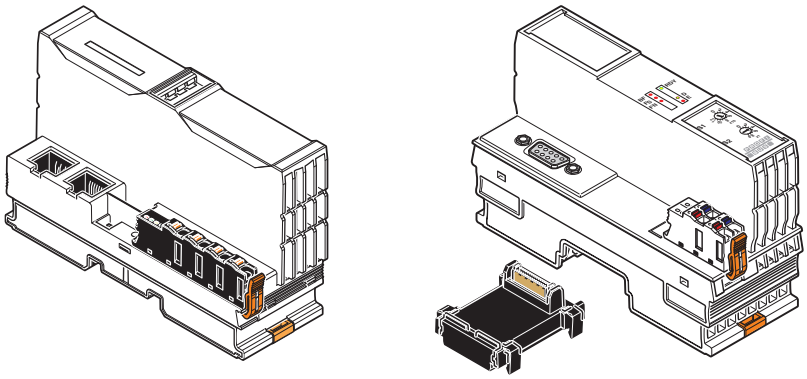


Figure 3-2 Example: AXL BK PN (BK housing) and AXL F BK PB (F-BK housing)

As the head of an Axioline F station, the bus coupler with a network and an Axioline F local bus connection represents the link between your network and the Axioline F station.

Table 3-2 Supported bus systems/networks

Bus system/network	Bus coupler (examples)
PROFINET	AXL BK PN, AXL F BK PN
PROFIBUS DP	AXL F BK PB
EtherNet/IP™	AXL F BK EIP
Ethernet (Modbus/TCP)	AXL F BK ETH
Ethernet IEC 61850	AXL F BK SAS
Sercos	AXL F BK S3
EtherCAT®	AXL F BK EC

3.4 Input/output modules

3.4.1 Overview

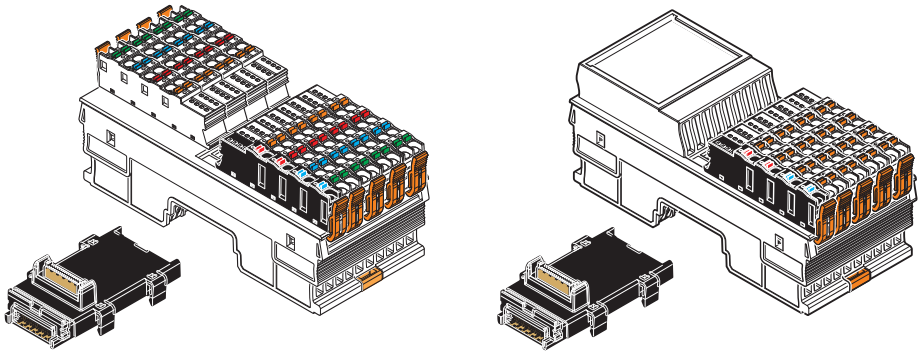


Figure 3-3 Example: AXL F DI16/4 2F and AXL F AO8 XC 1F

Modules are available with various functions. These include, for example, the modules listed below. The text in brackets indicates the function according to the order designation.

- Digital input and output modules (DI, DO, DOR)
- Analog input and output modules (AI, AO)
- Digital input and output modules for the low voltage range (220DC, AC)
- Temperature recording modules (RTD, UTH)
- Module for open and closed-loop control, and position detection (CNT/INC)
- Module for communication (RS, UNI)
- Function module (SSI1 AO1)
- Modules for use under extreme ambient conditions (XC versions, see Section “Extreme conditions version (XC)” on page 29)
- Safety module with safe digital inputs or outputs (PSDI, PSDO, see Section “Safety modules with safe digital inputs or outputs” on page 30)
- Power module for the communications power U_{Bus} (see Section “Power module for the communications power U_{Bus}” on page 30)
- ...

3.4.2 Extreme conditions version (XC)

Thanks to special engineering measures and tests as well as partially coated PCBs, the XC modules can be used under extreme ambient conditions.

For use in the extended temperature range from -40°C to +70°C, please observer Section "Tested successfully: Use under extreme ambient conditions" and the notes in the module-specific data sheet.

The function of an XC version is the same as the function of the corresponding standard version.
On the device rating plate for the XC version, the AXL F XC product range is stored in object 0006_{hex}.

Tested successfully: Use under extreme ambient conditions

XC modules have been tested successfully over 250 temperature change cycles according to IEC 61131-2 in the range from -40°C to +70°C.

The following conditions were observed:

– The Axioline F devices for all connecting cables were connected with a minimum conductor cross section of 0.5 mm^2
– The Axioline F station was installed on a wall-mounted horizontal DIN rail
– Fans were used to ensure continuous movement of air in the control cabinet
– The Axioline F station was not exposed to vibration or shock
– The Axioline F station was operated with a maximum of 24.5 V (ensured by using electronically regulated power supply units)

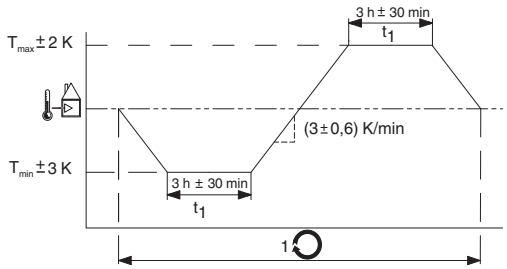


Figure 3-4 Temperature change cycle

Temperature in the control cabinet/ambient temperature

Cycle

Observe the information in the module-specific documentation.

3.4.3 Safety modules with safe digital inputs or outputs

The safety modules are to be used in an Axioline F station at any point in a safe system (e.g., PROFIsafe).

Depending on the version, the modules either have safe digital inputs or outputs. They can be parameterized according to the specific application and enable the integration of sensors and actuators in the safe system.

For more detailed information on these modules, please refer to the module-specific user documentation.

3.4.4 Power module for the communications power U_{Bus}

If the maximum load of the controller or bus coupler for the Axioline F local bus supply (communications power U_{Bus}) is reached, you can use this power module to provide this voltage again.

4 Housing versions, design, and dimensions

4.1 Housing versions

Various housing versions are available in the Axioline F portfolio; they are shown in Figure 4-1.

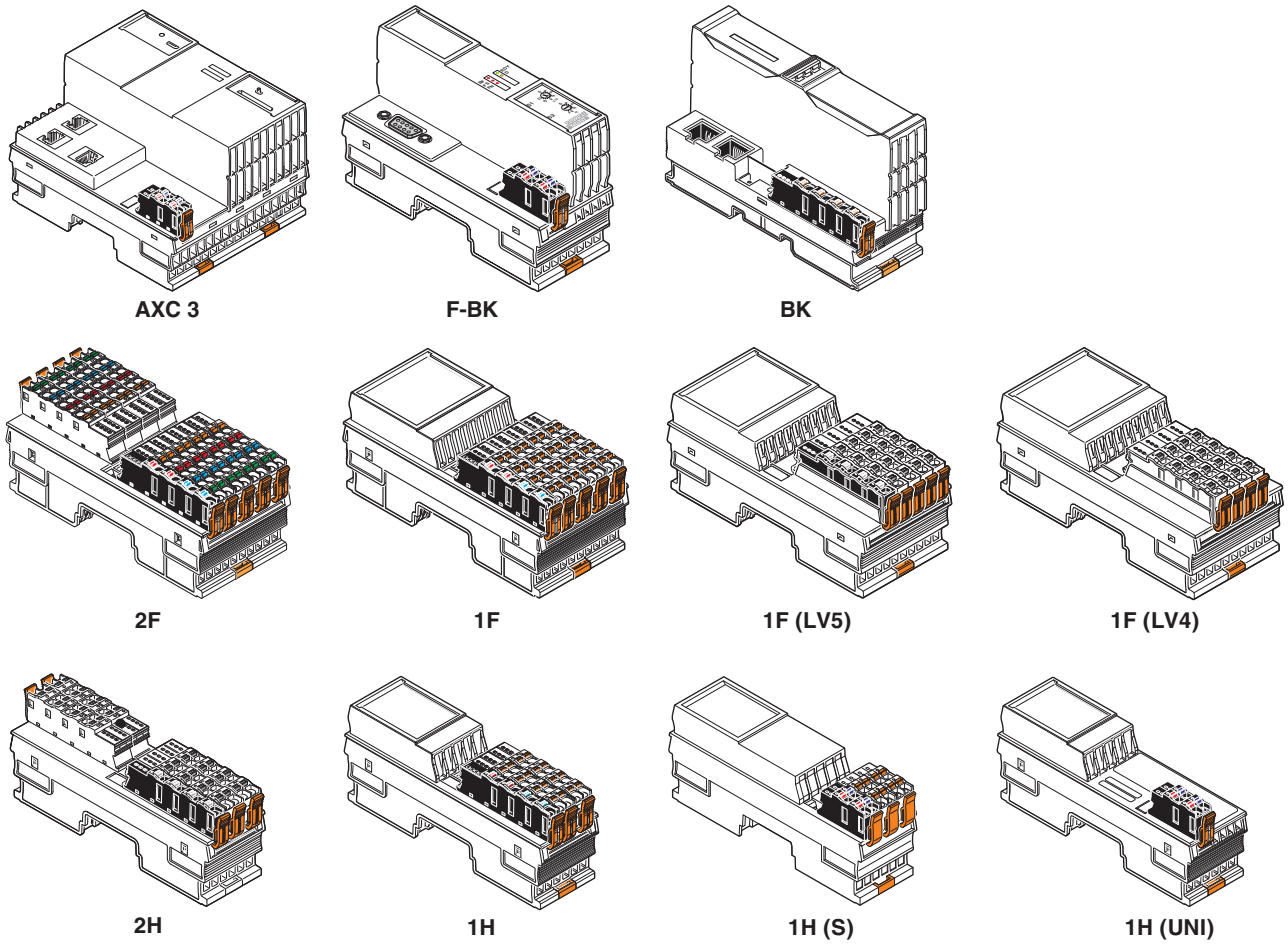


Figure 4-1 Housing versions

Table 4-1 Housing versions

Housing type	Special feature	Example	Design	Dimensions
AXC 3	Class 3000 AXC controller, separate bus base module	AXC 3050, AXC 3051	See user manual for the controller	Figure 4-5 on page 36
F-BK	AXL F BK ... bus couplers Class 1000 AXC controller, separate bus base module	AXL F BK PB, AXC 1050	Figure 4-3 on page 34	Figure 4-6 on page 36
BK	AXL BK ... bus couplers, integrated bus base	AXL BK PN		Figure 4-7 on page 36
2F	Wide housing, 2 terminal fields	AXL F DI16/4 2F AXL F DO16/3 2F	Figure 4-4 on page 35	Figure 4-8 on page 37
1F	Wide housing, 1 terminal field	AXL F AI8 XC 1F AXL F DI32/1 1F		Figure 4-9 on page 37
1F (LVx)	Wide housing, 1 terminal field, **l**ow **v**oltage			
1F (LV5)	5 connectors	AXL F DO4/3 AC 1F		Figure 4-15 on page 39
1F (LV4)	4 connectors	AXL F DI8/2 110/220DC 1F AXL F DOR4/2 AC/220DC 1F		Figure 4-16 on page 39
2H	Narrow housing, 2 terminal fields	AXL F DI16/1 DO16/1 2H AXL F DI32/1 2H		Figure 4-10 on page 37
1H	Narrow housing, 1 terminal field			
1H	Long connectors	AXL F DI16/1 HS 1H AXL F UTH4 1H AXL F RS UNI 1H		Figure 4-11 on page 38
1H (S)	Short connectors	AXL SSI 1/AO 1		Figure 4-12 on page 38
1H (UNI)	Universal	AXL F PWR 1H		Figure 4-13 on page 38
		AXL F DO16 FLK 1H		Figure 4-14 on page 39

4.2 Basic design of Axioline F modules

4.2.1 Class 3000 AXC controllers

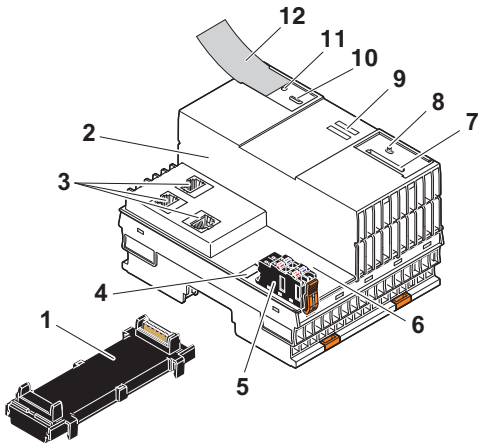


Figure 4-2 Design of an AXC 3050 controller

1 Bus base module
2 Electronics module
3 Ethernet interfaces
4 Function identification and FE tab:
A 2.8 mm FE tab for optional functional earth ground connection is located under the function identification (see user manual for the controller)
5 Connector for connecting the communications power U_L
6 USB interface
7 Slot for the parameterization memory
8 Mode selector switch
9 Diagnostics and status indicators (here: LEDs)
10 Programming interface
11 Reset button
12 Insert label

4.2.2 Class 1000 AXC bus couplers and controllers

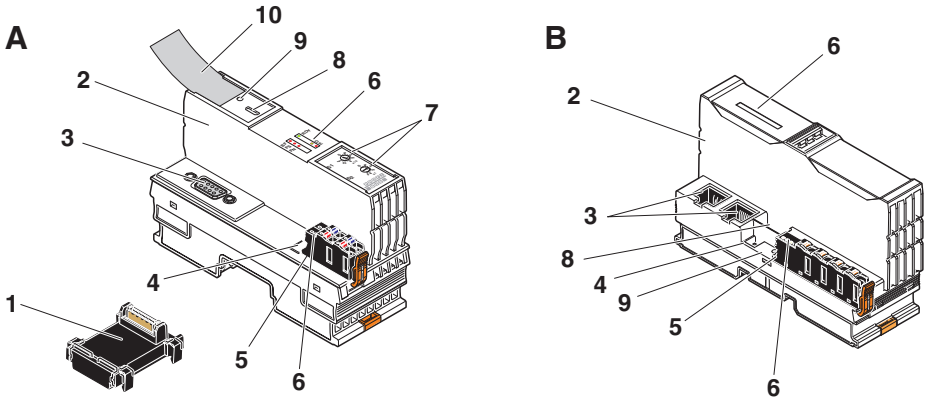


Figure 4-3 Design of a bus coupler

A	F-BK housing	e.g., AXL F BK PB, AXC 1050
B	BK housing	e.g., AXL BK PN

1 Bus base module
On the bus couplers in the BK housing, the bus base is integrated in the module.
The bus couplers in the F-BK housing have a separate bus base module is supplied in the scope of delivery.

2 Electronics module

3 Bus connection (here: Ethernet connections, PROFIBUS connection)

4 Function identification

5 Connector for connecting the communications power U_L

6 Diagnostics and status indicators (here: LEDs)

7 Rotary coding switch

8 Service interface

9 Reset button

10 Insert label

On the underside of the module, there are two FE springs for connecting the functional earth ground via the DIN rail. These are not shown on Figure 4-3. They can be seen on Figure 7-1 on page 86.

4.2.3 Input/output module (electronics module)

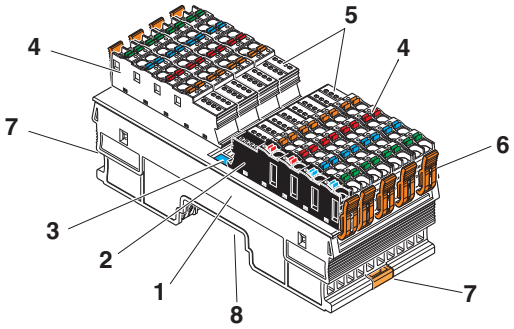


Figure 4-4 Design of an input/output module (example: AXL F DI16/4 2F)

1 Electronics module
2 Connector for connecting the I/O supply voltage (U_I, U_O, U_{IO} or U_A)
3 Function identification
4 Connectors for connecting the I/O
5 Diagnostics and status indicators
6 Locking latches of the I/O connectors
7 Base latch for latching to the DIN rail (2 x)
8 Device connector for connecting to the local bus via the bus base module (at the bottom, not illustrated)

On the underside of the module, there is at least one FE spring for connecting the functional earth ground via the DIN rail. This is not shown on Figure 4-4. It can be seen on Figure 7-1 on page 86.

4.3 Axioline F module dimensions

4.3.1 AXC controllers and bus couplers

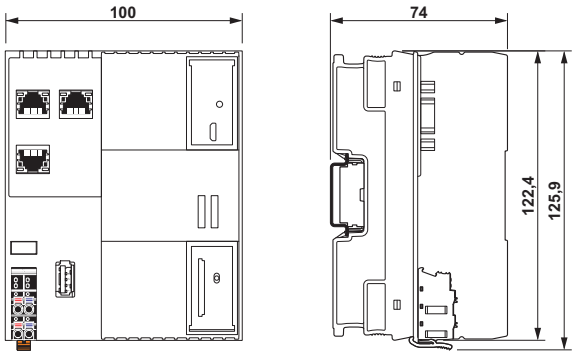


Figure 4-5 Nominal dimensions of class 3000 AXC controller housings (type AXC 3, e.g., AXC 3050, AXC 3051)

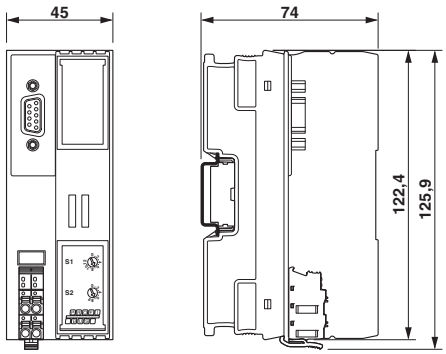


Figure 4-6 Nominal dimensions of the controller/bus coupler housing with separate bus base (type F-BK, e.g., AXL F BK PB, AXC 1050)

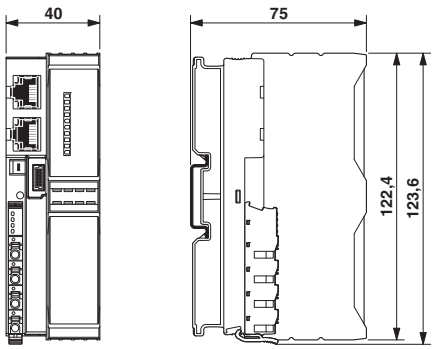


Figure 4-7 Nominal dimensions of the bus coupler housing with integrated bus base (type BK, e.g., AXL BK PN)

4.3.2 I/O modules for the 24 V range

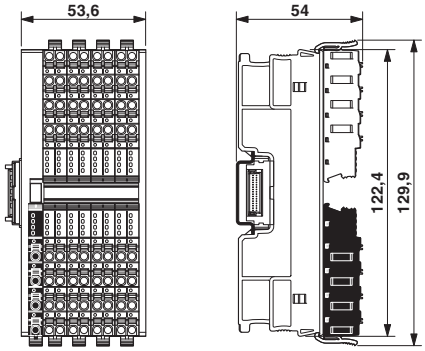


Figure 4-8 Nominal dimensions of the F housing with two terminal fields (type 2F; e.g., AXL F DI16/4 2F, AXL F DO16/3 2F)

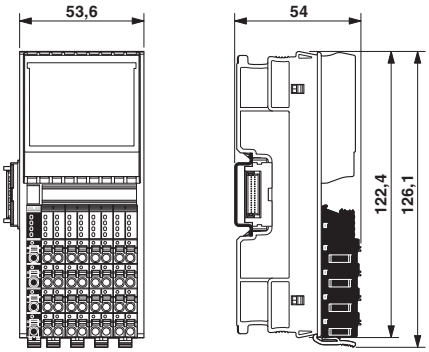


Figure 4-9 Nominal dimensions of the F housing with one terminal field (type 1F; e.g., AXL F AI8 XC 2H, AXL F DI32/1 2H)

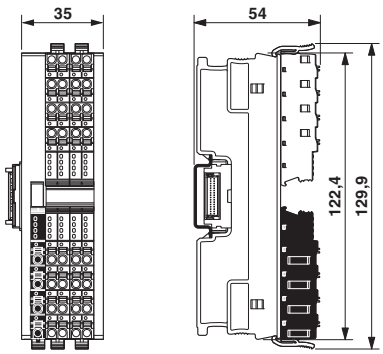


Figure 4-10 Nominal dimensions of the H housing with two terminal fields (type 2H; e.g., AXL F DI16/1 DO16/1 2H)

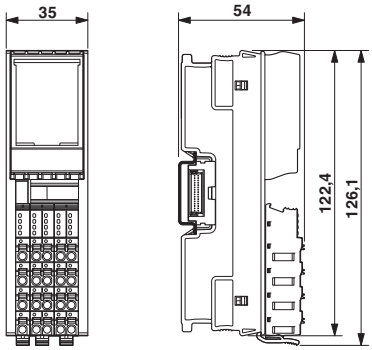


Figure 4-11 Nominal dimensions of the H housing with one terminal field (type 1H; e.g., AXL F DI16/1 HS 1H, AXL F UTH4 1H, AXL F RS UNI 1H)

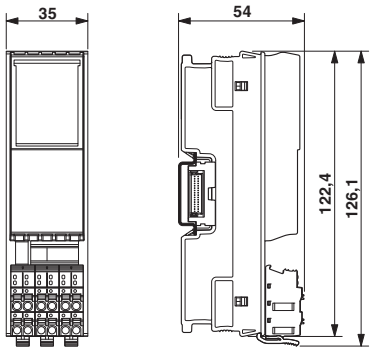


Figure 4-12 Nominal dimensions of the H housing with one terminal field and short connectors (type 1H (S); e.g., AXL F SSI1 AO1 1H)

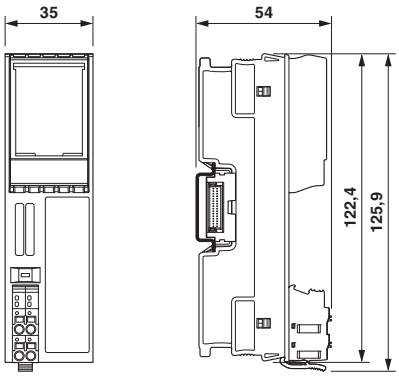


Figure 4-13 Nominal dimensions of the H housing with one terminal field and short connectors (type 1H (UNI); e.g., AXL F PWR 1H)

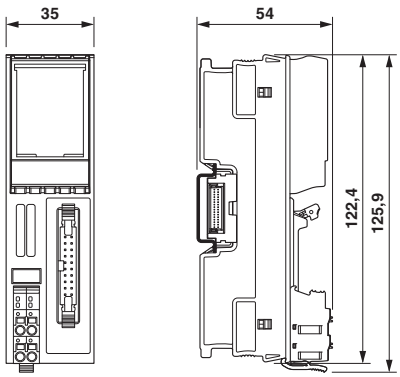


Figure 4-14 Nominal dimensions of the H housing with one terminal field and short connectors
(type 1H (UNI); AXL F DO16 FLK 1H)

4.3.3 I/O modules for the low voltage range

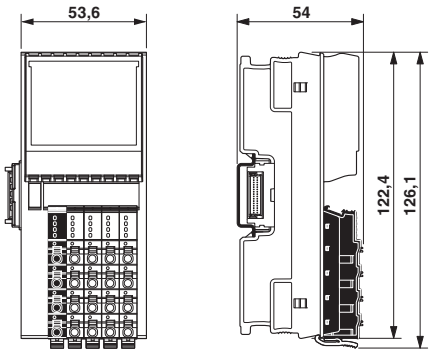


Figure 4-15 Nominal dimensions of the F housing for the low voltage area with one terminal field and five connectors (type 1F-LV5; e.g., AXL F DO4/3 AC 1F)

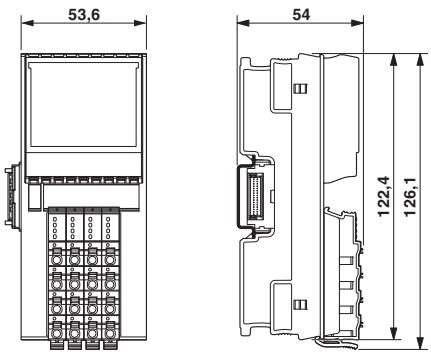


Figure 4-16 Nominal dimensions of the F housing for the low voltage area with one terminal field and four connectors (type 1F-LV4; e.g., AXL F DI8/2 110/220DC 1F, AXL F DOR4/2 AC/220DC 1F)

4.4 Bus base modules

Bus base modules connect the modules to each other.

Bus base modules carry the communications power and the bus signals from the bus coupler or the controller through the Axioline F station (local bus).

A bus base module is supplied as standard with each Axioline F module. Excluded from this are bus couplers in the BK housing into which the bus base is integrated.

NOTE: Malfunction

Ensure you insert the bus base module belonging to the relevant module.
Bus base modules with different design widths and functions are available (e.g., red bus base module for the power module).

Versions

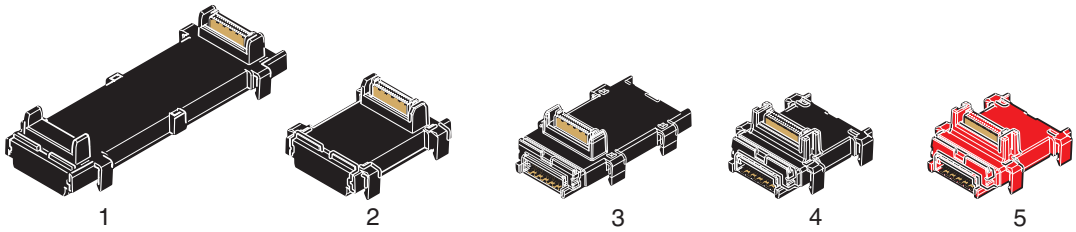


Figure 4-17 Bus base modules

Table 4-2 Bus base modules

No.	Type	Order No.	For use with
1	AXC BS	2701582	AXC 3xxx controller
2	AXL BS BK	2701422	Bus coupler in F-BK housing, AXC 1050 controller
3	AXL F BS F	2688129	F housing
4	AXL F BS H	2700992	H housing
5	AXL F BS H PWR	2702051	H housing, power module

Basic design

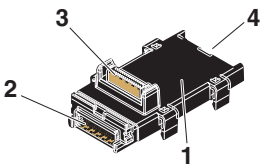


Figure 4-18 Bus base module design

1 Bus base module
2 Connection to the bus coupler or the previous bus base module (connector)
3 Connection of the local bus to an I/O electronics module (socket)
4 Connection for the following bus base module (socket)

4.5 Axioline F connector

The Axioline F connectors accept cables up to 1.5 mm^2 and a stripping length of 8 mm. Detailed information on the conductor cross sections and stripping lengths can be found in Section “Conductor cross sections and stripping/insertion lengths” on page 66.

4.5.1 Versions and dimensions

Various Axioline F connector versions are available.

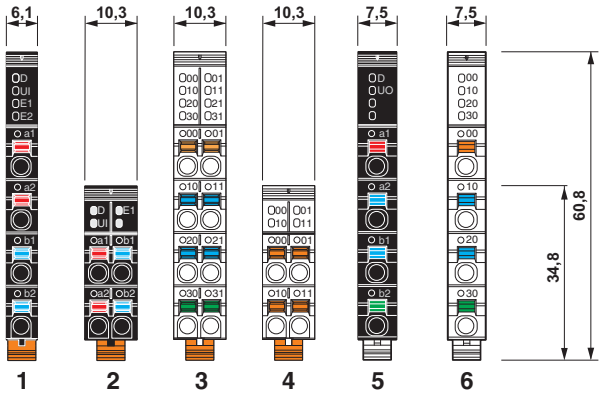


Figure 4-19 Connectors: versions and dimensions

Table 4-3 Connectors: versions and dimensions

No.	Color	Use	Examples of use
24 V range			
1	Black RAL 9005	Feeding the supply voltage	AXL BK ... AXL F DI..., AXL F DO... AXL F AI..., AXL F AO... AXL F CNT2 INC2 1F
2			AXC 1xxx, AXC 3xxx AXL F BK ... AXL SSI1 AO1
3	Traffic gray A RAL 7042	I/O connection (protective extra low voltage)	AXL F DI..., AXL F DO... AXL F AI..., AXL F AO... AXL F CNT2 INC2 1F
	Zinc yellow RAL 1018	I/O connection (safety modules, protective extra low voltage)	AXL F PSDI8/4 1F AXL F PSDO8/3 1F
4	Traffic gray A RAL 7042	I/O connection (protective extra low voltage)	AXL SSI1 AO1
230 V range			
5	Black RAL 9005	Feeding the supply voltage	AXL F DO4/3 AC 1F
6	Traffic gray A RAL 7042	I/O connection (low voltage)	AXL F DO4/3 AC AXL F DOR4/2 AC/220 DC 1F

4.5.2 Basic design

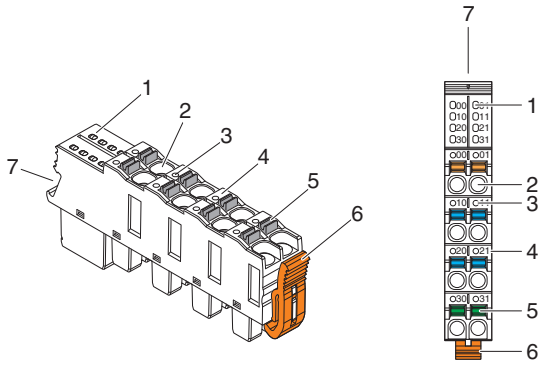


Figure 4-20 Basic design of an Axioline F connector

1 Local diagnostics and status indicators
2 Terminal point
3 Touch connection
4 Terminal point marking
5 Spring lever; color of the spring lever corresponds to the function (see Section “Color and marking” on page 43)
6 Locking latch
7 Space for connector marking (zack marker strip ZBF 10/5,8 AXL or ZBF 5)

4.6 Color and marking

Housing

The following housing colors are currently used for the electronics module:

Table 4-4 Electronics module housing colors

Color	Similar RAL color	Use
Traffic gray A	RAL 7042	Standard modules
Zinc yellow	RAL 1018	Safety modules

Connector

All connectors for the voltage supply are completely black (RAL 9005).

The bottom parts of the connectors for the I/O connection are black (RAL 9005).
The upper parts match the color of the housing, i.e., traffic gray A or zinc yellow.

Function identification

The module functions are color coded (1 in Figure 4-21).

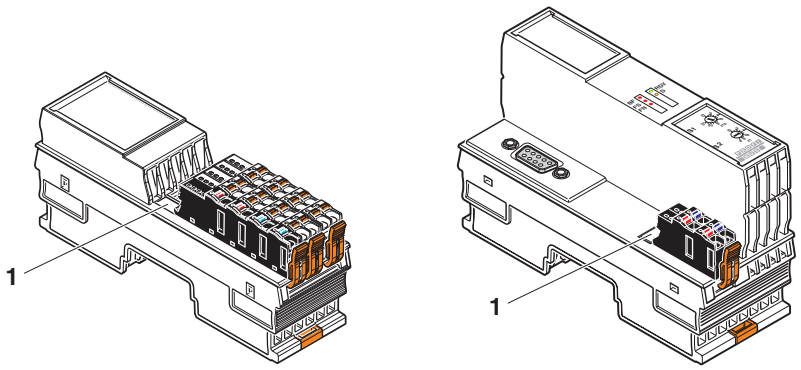


Figure 4-21 Color coding of the module function

The following colors indicate the function:

Table 4-5 Color coding of the module function

Color	Similar RAL color	Function of the module
Light blue	RAL 5012	Digital input
Flame red	RAL 3000	Digital output
Signal violet	RAL 4008	Digital input and output
Pale green	RAL 6021	Analog input, temperature recording
Zinc yellow	RAL 1018	Analog output
Pastel orange	RAL 2003	Function: open and closed-loop control, communication, position detection
Pure white	RAL 9010	Bus coupler, controller, boost

Connections

Apart from the Axioline F connectors, all connections are consecutively numbered, e.g., X1, X2 for Ethernet connections.

Operating elements

Operating elements are marked according to their function, e.g., rotary coding switches with S1 and S2 including the switch positions.

Indication elements

Diagnostics and status indicators are marked with the function, e.g., D, E, UI, 00, 01, ... (1 in Figure 4-22).

Terminal points

The terminal points are consecutively numbered, e.g., a1, b1, 00, 01, ... (2 in Figure 4-22).

The associated colored spring lever indicates the function (signal, potential) (3 in Figure 4-22).

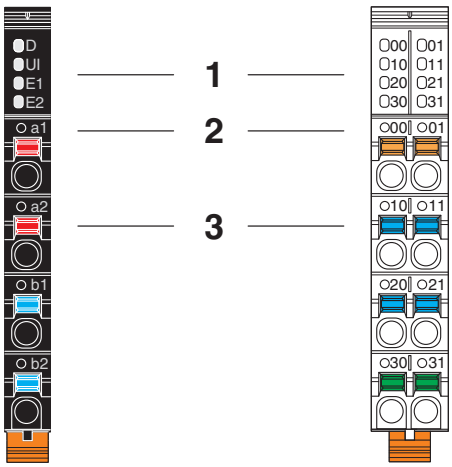


Figure 4-22 Marking of the terminal points and the LEDs on the connectors

Table 4-6 Color coding of terminal point function

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

For the marking and function identification of a module, please refer to the module-specific data sheet.

Additional marking options

In addition to the standard markings detailed above, you can also custom-mark the module using a zack marker strip or an insert label.

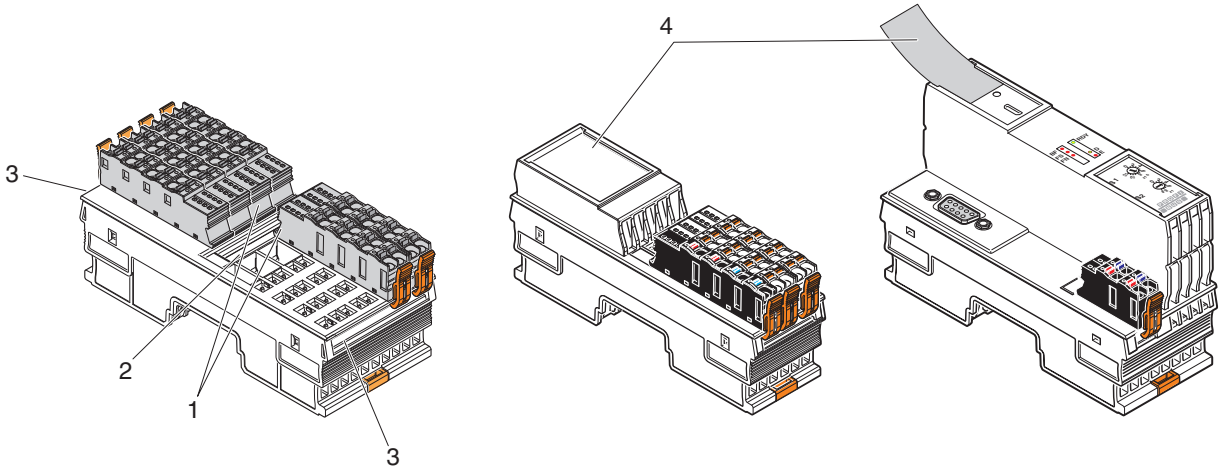


Figure 4-23 Individual marking options

1 Space for connector marking (zack marker strip ZBF 10/5,8 AXL or ZBF 5)
2 Space for module marking (zack marker strip ZB 20,3 AXL or ZB 10)
3 Space for slot marking (zack marker strip ZBF 10/5,8 AXL or ZBF 5)
4 Insert label (EMT (35X28)R, EMT (35X46)R, EMT (35X18,7)R)

Ordering data can be found in Section “Ordering data” on page 111.

Slot and connector marking

Each slot on the module and the associated connector can be marked individually to ensure clear assignment between the slot and connector (1 and 3 in Figure 4-23).

5 Mounting and removing modules

5.1 Unpacking the modules

The modules are supplied in a packaging together with a package slip with installation instructions. Please read the complete package slip carefully before unpacking the module.

5.2 Safety notes for mounting/removal

5.2.1 General safety notes

NOTE: Electrostatic discharge

The modules contain components that can be damaged or destroyed by electrostatic discharge. When handling the modules, observe the necessary safety precautions against electrostatic discharge (ESD) according to EN 61340-5-1 and IEC 61340-5-1.

NOTE: Electrical damage due to inadequate external protection

Fuse does not trip in the event of an error

Provide external fuses for the 24 V area of each module. The power supply unit must be able to supply 4 times the nominal current of the external fuse, to ensure that it trips in the event of an error.

NOTE: Disregarding this warning may result in damage of the contacts or malfunction

Before working on the a module, disconnect the module from the I/O devices and power.

For an I/O module, this means:
Disconnect the connected I/O devices from the power.
Switch off the I/O supply voltage at the relevant module. The communications power that is supplied at the bus coupler/controller is still available.

For a bus coupler/controller, this means:
Disconnect the communications power supply at the bus coupler/controller.

NOTE: Damage to the contacts when tilting

If the modules tilt, you can damage the contacts.

Place and also remove the modules onto/from the DIN rail vertically.

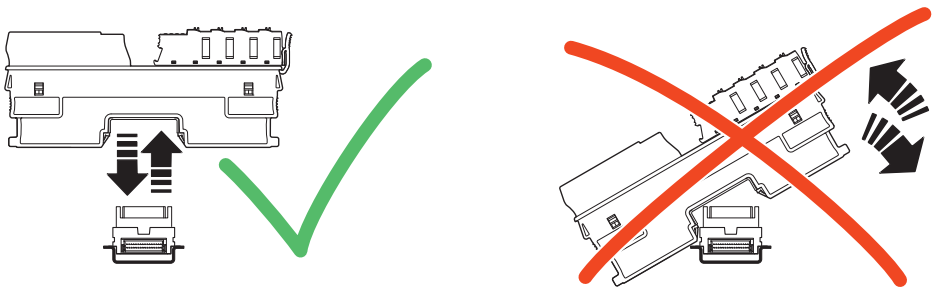


Figure 5-1 Placing/removing the module **vertically**

When using modules in the low voltage area, please also observe Section “Additional safety notes for the low voltage area” on page 49.

Additionally observe the information in the module-specific data sheets.

5.2.2 Additional safety notes for the low voltage area

Installing the system

Install the system according to the requirements of EN 50178.

Only qualified personnel may work on Axioline F modules in the low voltage area.

Qualified personnel are people who, because of their education, experience, and instruction and their knowledge of relevant standards, regulations, accident prevention, and service conditions, have been authorized by those responsible for the safety of the plant to carry out any required operations and who are able to recognize and avoid any possible dangers.
(Definitions for skilled workers according to EN 50110-1:1996).

WARNING: Dangerous contact voltage

Please be aware of dangerous voltages when working on circuits that do not meet protective extra low voltage requirements.

The Axioline F modules for the low voltage area may only be mounted and removed when the power supply is disconnected.

When working on the modules and wiring, always switch off the supply voltage and ensure it cannot be switched on again.

The Axioline F modules for the low voltage area must only be operated in a closed control cabinet.

Failure to observe these instructions can lead to damage to health or even life-threatening injury.

WARNING: Dangerous contact voltage in the event of ground faults

The Axioline F modules for the low voltage area must only be operated in grounded networks.

Additionally observe the information in the module-specific data sheets.

5.3 Basic information about mounting

Mounting location

The Axioline F modules meet IP20 protection and can be used in closed control cabinets or in control boxes (terminal boxes) with IP54 protection according to EN 60529 or higher.

The compact design means that most of the Axioline F modules can be installed in standard terminal boxes. Please observe the mounting distances when selecting the housing (see Section “Mounting distances” on page 62).

IP20 protection

Insert the connectors onto the electronics modules in order to achieve IP20 protection.

DIN rail

All Axioline F modules are mounted on 35 mm standard DIN rails. The preferred height of the DIN rail is 7.5 mm (corresponds to TH 35-7.5 according to EN 60715).

The recommended DIN rails from Phoenix Contact or recommended mounting straps from Lütze can be found in Section “Ordering data” on page 111.

Mount the modules **vertically** on the DIN rail. This way, the module does not need to be tilted and it provides easy installation and removal, even in confined spaces.

The distance between the DIN rail fasteners must not exceed 200 mm. This distance is necessary for the stability of the rail when mounting and removing modules.

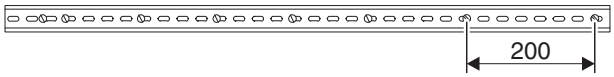


Figure 5-2 Fixing the DIN rail (in mm)

NOTE: Electrical damage from the fixing elements

Danger of malfunction

If the fixing elements (screw, rivet, etc.) are too high, the bus base modules are not correctly snapped onto the DIN rail.

For fixing the DIN rail, only use elements with a maximum installation height of 3 mm.

Mounting position

Wall mounting on a horizontal DIN rail on the wall is the preferred mounting position (Figure 5-3, A). This mounting position provides optimum air flow for the modules.

Other mounting positions are possible, however, temperature derating may be required. Observe the ambient temperatures provided in the module-specific documentation.

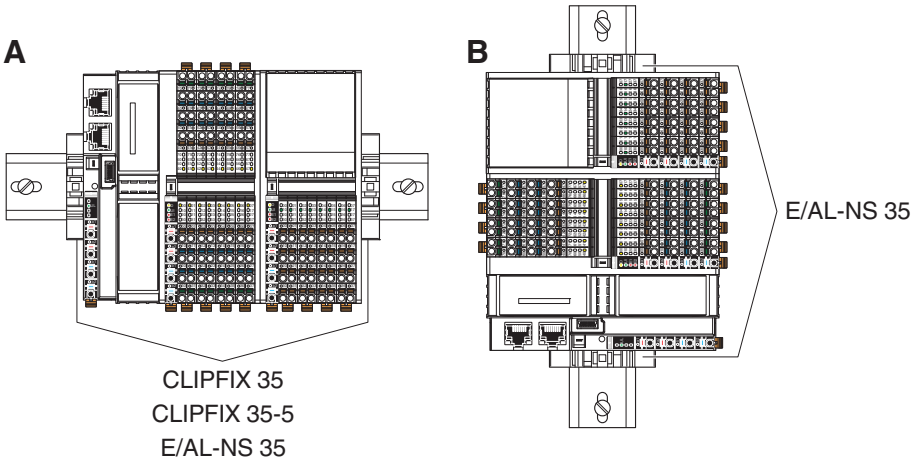


Figure 5-3 Mounting positions for an Axioline F station

The module-specific documentation specifies whether any other mounting position than the preferred mounting position is not permitted.

End brackets

Mount end brackets on both sides of the Axioline F station (see also Figure 5-3). The end brackets ensure that the Axioline F station is correctly mounted. End brackets secure the station on both sides and keep it from moving from side to side on the DIN rail.

Always attach the left end bracket of the station when beginning to mount the station. This ensures the following:

– It prevents the station from slipping on the DIN rail.
– The space for the end bracket is secured.
– There is a counter pressure for the insertion force that occurs when the bus base modules are installed next to the bus coupler.
– For bus couplers in the BK housing: if the bus coupler needs to be replaced you have enough space to separate the bus coupler from the bus base modules.

Table 5-1 Recommended end brackets

Mounting position	Ambient conditions	End bracket
Horizontal; Figure 5-3, A	Normal	CLIPFIX 35, CLIPFIX 35-5
	High shock and vibration load	E/AL-NS 35
Other; Figure 5-3, B	Normal	E/AL-NS 35
	High shock and vibration load	

Tools

No tools are required for mounting the modules.

A standard tool, e.g., a bladed screwdriver with a blade width of 2.5 mm, is necessary for removing the electronics modules and using the spring levers.

Order of the modules

The modules on the DIN rail can be put in any order behind the bus coupler. To ensure functionality, mount the modules side by side, without a gap.

If you are using modules with shield connection, installing them next to each other is recommended in order to make optimum use of the busbar for shield connection.

Maximum number of modules

The maximum number of Axioline F modules within a station is 63.

The actual number of modules within an Axioline F station may be limited by the supplied logic current, the current consumption of the connected modules, and the system limits of the bus coupler.

Power supply/ current consumption

The bus coupler, controller or the power module for the communications power provide the power supply for the local bus. In the module-specific documentation, this current value is specified as “Power supply at U_{Bus}”.

The total current consumption of all Axioline F modules arranged in the station must not exceed this maximum current. The logic current consumption values are specified for each module in the module-specific data sheet as “Current consumption from U_{BUS}”.

The current supplied by the bus coupler, controller or the power module and the maximum current that can be taken up by the connected modules, are noted in the device description files (e.g., gsdml file). You can use these maximum currents in the engineering tool for configuration in order to prevent an overload of the communications power.

NOTE: Electronics may be damaged when overloaded

Observe the current consumption of each device when configuring an Axioline F station. It is specified in every module-specific data sheet and may vary. As such, the permissible number of devices that can be connected therefore depends on the station structure.

Install a power module for the communications power or create an additional station if the maximum current consumption at U_{Bus} is reached.

System limits of the bus coupler

For information regarding the system limits of the bus coupler or controller used, please refer to the module-specific documentation. The system limits include:

Table 5-2 System limit examples

Network	Bus coupler	System limits
Sercos	AXL BK S3	Amount of process data
PROFINET	AXL BK PN	Amount of process data
PROFIBUS	AXL F BK PB	Amount of process data
		Amount of parameter data
		Amount of configuration data

The amount of process data and the amount of parameter and configuration data for PROFIBUS are documented in the module-specific data sheet for each I/O module.

If the system limits of the bus coupler or controller are reached, create a new station.

Example structure of an Axioline F station

See Section “Example of an Axioline F station” on page 15.

5.4 Mounting the modules

Please refer to Section “Safety notes for mounting/removal” on page 47.

Note that bus couplers in the BK housing with the integrated bus base are mounted differently than in the F-BK housing with a separate bus base module.

No tools are required for mounting the Axioline F modules.

- First mount the end bracket on the DIN rail.

5.4.1 Controller and bus coupler in the F-BK housing

Mounting bus base modules

- First install the bus base module for the controller/bus coupler and all bus base modules necessary for the station onto the DIN rail (Figure 5-4, A).

NOTE: Malfunction

Ensure you insert the bus base module belonging to the relevant module.
Bus base modules with different design widths and functions are available.

- Push each subsequent bus base module into the connection of the previous bus base module (Figure 5-4, B).

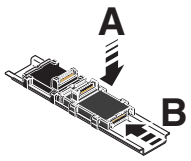


Figure 5-4 Connecting bus base modules to each other

It is not possible to snap a bus base module onto the previous bus base module if there is already an electronics module on it. In this case, first remove the last electronics module before snapping on more bus base modules.

Snapping on the controller/bus coupler

- Place the controller/bus coupler **vertically** on the first bus base module and the DIN rail until it snaps into place with a click.
  Make sure that the device connector for the bus base connection is situated above the corresponding socket on the bus base module.

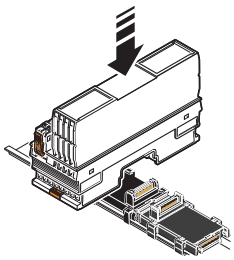


Figure 5-5 Snapping the bus coupler on

Connecting the network

Connect the network according to the specifications in the module-specific documentation.

5.4.2 Bus coupler in the BK housing

Snapping the bus coupler on

Note that you need at least 5 mm of space to slide the bus coupler to the left if you want to remove it in the BK housing (e.g., for a replacement).

- Place the bus coupler **vertically** on the DIN rail until it snaps into place with a click (Figure 5-6).

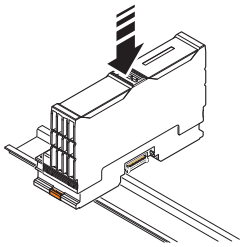


Figure 5-6 Snapping the bus coupler on

Mounting bus base modules

- Place all bus base modules necessary for the station on the DIN rail (Figure 5-7, A). Observe the proper orientation of the bus base modules. When mounting on horizontal DIN rails on the wall, the logo must be readable and the laser-engraved arrow should point towards the bus coupler.
- Push the bus base module into the connection of the bus coupler or the previous bus base module (Figure 5-7, B).

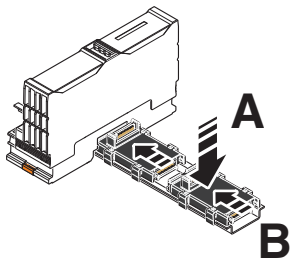


Figure 5-7 Connecting bus base modules with each other and with the bus coupler

It is not possible to snap a bus base module onto the previous bus base module if there is already an electronics module on it. In this case, first remove the last electronics module before snapping on more bus base modules.

Connecting the network

Connect the network according to the specifications in the module-specific documentation.

5.4.3 Input/output modules

- Place the necessary input/output modules **vertically** on the corresponding bus base module and DIN rail until they audibly click into place.
  Pay attention to the correct position.
  Make sure that the device connectors for the bus base connection are situated above the corresponding sockets on the bus base module.

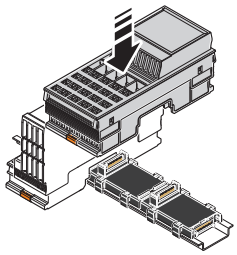


Figure 5-8 Mounting input/output modules

If you are using analog modules, mount the necessary shield connection elements.

For connecting the shield, Phoenix Contact recommends the AXL SHIELD SET Axioline F shield connection set or the shield connection clamp products from the “Marking systems, tools, and mounting material” catalog.

When using the AXL SHIELD SET, mount the elements in the following order:

1. Bus base module
2. Shield bus holder
3. Electronics module

See also Section “Connecting the shield using the Axioline F shield connection set” on page 88.

5.5 Removing modules

Please refer to Section “Safety notes for mounting/removal” on page 47.

A standard tool, e.g., a bladed screwdriver with a blade width of 2.5 mm is necessary for removing modules.

5.5.1 Removing connectors or cables

Removing the network connector

- Remove the network connector, if present, according to the specifications in the module-specific documentation.

Supply connector, I/O connector

- Prior to module removal, also remove the connectors or cables, if present, from the module.
  - If no cables are inserted, the connectors do not need to be removed.
  - If cables are inserted, either remove the connectors from the module or the cables from the connectors.
    The cables should only be removed from the supply connector if you wish to change the wiring or no longer wish to use the connector.

Removing cables

See Section “Removing cables from the terminal point” on page 71.

Removing the Axioline F connectors

See Section “Inserting/removing a connector” on page 61.

5.5.2 Controller, bus coupler in the F-BK housing, and input/output modules

The controller, bus coupler and each I/O module can be removed individually from the station.

- Insert a suitable tool (e.g., bladed screwdriver) first in the upper **and** then in the lower snap-on mechanism (base latches) of the module release it (Figure 5-9, Figure 5-10, A). The base latches are locked in place in the open position.
- Remove the electronics module **perpendicular** to the DIN rail (Figure 5-9, Figure 5-10, B). The base latches return to the idle position again.

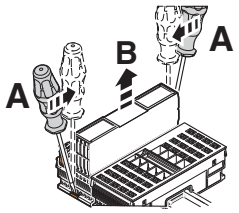


Figure 5-9 Removing the bus coupler

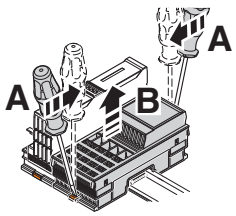


Figure 5-10 Removing an input/output module

The bus base module remains on the DIN rail.

Bus base module

Please proceed as follows if, after having removed modules, you want to remove bus base modules as well:

- If a module is located on the neighboring bus base module to the left, remove it.

If the bus base module is in the end position:

- Remove the bus base module from the connection of the previous bus base module by sliding it approximately 5 mm to the right (A).
- Insert a suitable tool (e.g., bladed screwdriver) into the latches on one side one after the other (B, B1, B2).
- Swivel the bus base module upwards and remove it (C).

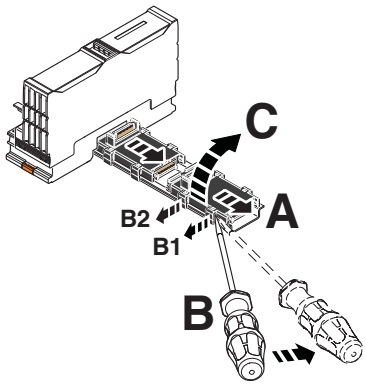


Figure 5-11 Removing the bus base module

If the bus base module to be removed is inside the station:

- If possible, push the following bus base modules and any fitted modules approximately 15 mm to the right.
  In doing so, disconnect the bus base module you want to remove from the connection of the following bus base module.
- If it is not possible to slide the following bus base modules and modules, detach the modules, and, starting at the end of the station, remove the bus base modules.
- Remove the bus base module to be removed from the connection of the previous bus base module by sliding it approximately 5 mm to the right (A).
- Insert a suitable tool (e.g., bladed screwdriver) into the latches on one side one after the other (B, B1, B2).
- Swivel the bus base module upwards and remove it (C).
- Push the rest of the station back to the left until the bus base modules touch each other again.

5.5.3 Bus coupler in the BK housing

NOTE: Module can be damaged when removed forcibly

Risk of damage to components

The bus coupler can only be removed from the station after the bus coupler has been slid to the left and thereby disconnected from the subsequent module.

NOTE: Damage to the FE contacts

Pushing the bus coupler on the DIN rail can result in damage to the FE contacts. Check the contacts following removal of the bus coupler.

- Remove the left end bracket.
- Disconnect the bus coupler from the subsequent bus base module by sliding it approximately 5 mm to the left (A). It must be completely removed from the neighboring bus base module.
- Insert a suitable tool (e.g., bladed screwdriver) first in the upper **and** then in the lower snap-on mechanism (base latches) of the bus coupler and release it (B). The base latches are locked in place in the open position.

You can swap steps A and B. In this case, make sure to align the bus coupler properly to avoid damage of the bus contacts.

- Remove the bus coupler **perpendicular** to the DIN rail (C). The base latches return to the idle position again.

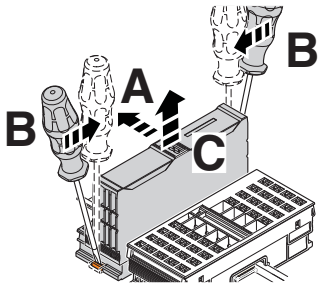


Figure 5-12 Removing the bus coupler

5.6 Inserting/removing a connector

5.6.1 Removing a connector

- Release the locking latch (A), tilt the connector slightly upwards (B) and remove it from the module (C).

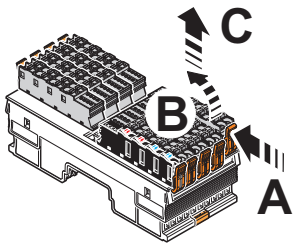


Figure 5-13 Removing a connector

5.6.2 Inserting a connector

- Place the connector vertically into its position and press firmly. Ensure that it engages with a click.

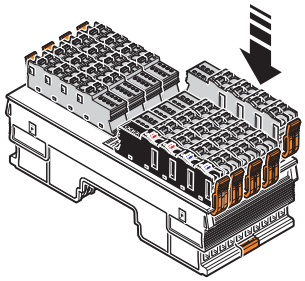


Figure 5-14 Snapping a connector on

5.7 Replacing a module

- To replace a module, proceed as described in Sections “Removing modules” on page 57 and “Mounting the modules” on page 53.
- Once replaced, restore all the necessary connections.

When replacing a controller:
Observe any notes for replacement in the module-specific documentation.

5.8 Mounting distances

The space required for cable routing depends on the number of cables to be installed and must be left free at the top and/or at the bottom.

For the distances of the upper and lower cable ducts or the cable routing to the modules, please refer to Figure 5-16 to Figure 5-17.

In addition the specified dimensions, provide adequate space for mounting and removal of the connectors and cables.

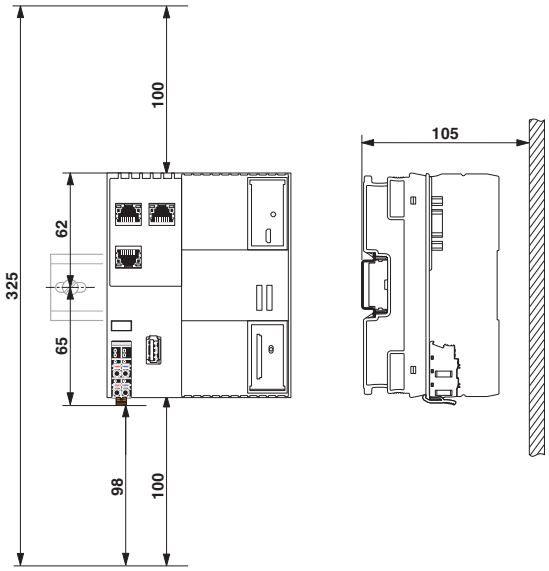


Figure 5-15 Mounting distances: AXC 305x controller (dimensions rounded)

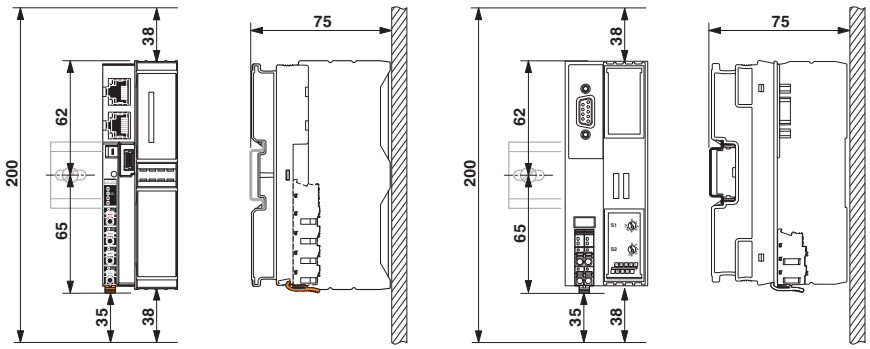


Figure 5-16 Mounting distances: bus coupler and AXC 105x controller (dimensions rounded)

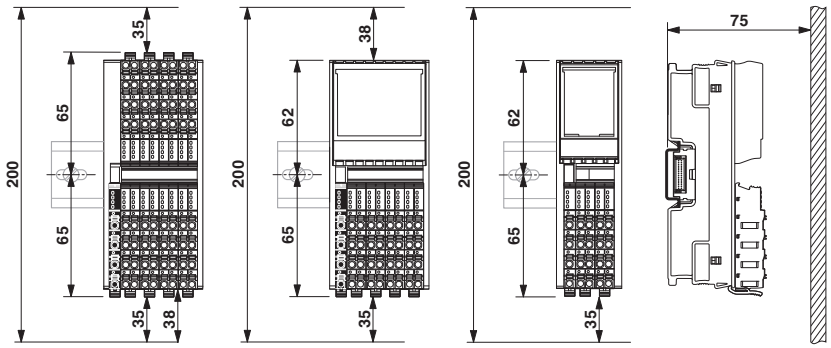


Figure 5-17 Mounting distances: I/O modules (dimensions rounded)

If the distances are smaller, the minimum bending radius of the cables, easy handling during installation, and a clear structure cannot be guaranteed.

6 Connecting and removing cables

6.1 Connections and cables in the Axioline F system

All electrical connections are plug-in.

The network cables on the controller/bus coupler are connected via the D-SUB or RJ45 connectors depending on the network.

The cables for the I/O devices and supply voltages are connected via Axioline F connectors.

Each terminal point, both for the periphery of the I/O modules (I/O connectors) as well as for the communications power, sensor, and actuator supply (power connectors), is designed for a maximum current of 8 A.

The current can be reduced when used in applications in which an UL approval is required. Observe any specifications in the module-specific package slip and the rating on the modules.

When using Axioline F modules you can use shielded and unshielded, solid and stranded cables, with or without ferrules.

Please observe the following when wiring:

– Twist stranded cable ends.
– Make sure to install the conductor in the middle of the wiring space, especially with small cross sections.

If using ferrules, use those which correspond to the specifications in Section “Conductor cross sections and stripping/insertion lengths” on page 66.

Make sure the ferrules are properly crimped.

6.2 Conductor cross sections and stripping/insertion lengths

For electrical and/or thermal reasons, it may not be possible to use the minimum conductor cross sections specified here for certain modules.

Therefore, always observe the information in the module-specific documentation.

Conductor cross sections

Table 6-1 Permissible conductor cross sections for push-in connection technology (**without using the spring lever** for inserting the conductor)

Conductor	Cross section
Solid	0.5 mm^2 ... 1.5 mm^2
Stranded with ferrule without insulating collar (A ...)	
– According to DIN 46228-1 sleeve length = 10 mm	0.25 mm^2 ... 1.5 mm^2
Stranded with ferrule with insulating collar (AI ...)	
– According to DIN 46228-4 sleeve length = 8 mm	0.25 mm^2 ... 1.0 mm^2
– According to DIN 46228-1 sleeve length = 10 mm	0.25 mm^2 ... 1.5 mm^2

Stranded cables without ferrules are not suitable for push-in connection technology without simultaneous actuation of the spring lever.

Table 6-2 Permissible conductor cross sections **when using the spring lever** for inserting the conductor

Conductor	Cross section
Solid	0.2 mm^2 ... 1.5 mm^2
Stranded without ferrule	0.2 mm^2 ... 1.5 mm^2
Stranded with ferrule without insulating collar (A ...)	0.25 mm^2 ... 1.5 mm^2
Stranded with ferrule with insulating collar (AI ...)	0.25 mm^2 ... 1.5 mm^2

Table 6-3 Permitted AWG conductor cross sections

Conductor	Cross section
AWG	24 ... 16

Stripping/ insertion lengths

NOTE: Malfunction when the conductor is not securely fixed

Make sure that the stripping length of a conductor without ferrule or the insertion length of a conductor with ferrule corresponds to the specifications in order to ensure secure hold and correct function.

The crimping form must be trapezoidal. The relevant tools can be found in the Phoenix Contact product range.

For crimping, we recommend pliers for trapezoidal crimp CRIMPFOX 6 or CRIMPFOX 6T (see Section “Ordering data for accessories” on page 111).

Conductor without ferrule: stripping length 8 mm

Conductor with ferrule: insertion length 8 mm or 10 mm

Ferrules: see Section “Ordering data for accessories” on page 111.

TWIN ferrules

NOTE: Malfunction when using wrong ferrule

TWIN ferrules are not permitted in the Axioline F system.

6.3 Terminal point, associated spring lever, and associated touch connection

When using the screwdriver, pay attention to the position of the spring lever to the assigned terminal point.

When testing the signals with a measuring probe, pay attention to the position of the touch connection to the assigned terminal point.

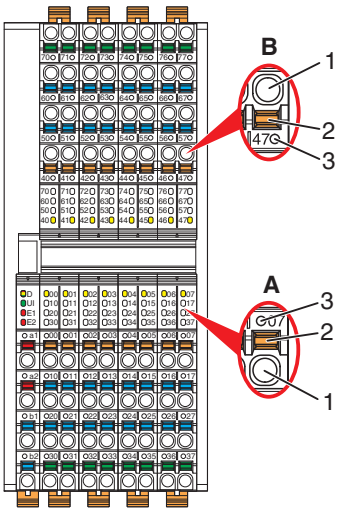


Figure 6-1 Terminal point with associated spring lever, and associated touch connection

A	Cable outlet at the bottom:	Spring lever and touch connection **above** the terminal point
B	Cable outlet at the top:	Spring lever and touch connection **below** the terminal point (B)
1	Terminal point	
2	Spring lever	
3	Touch connection	

6.4 Connecting unshielded cables

Wire the connectors according to your application.

For the terminal point assignment, please refer to the corresponding module-specific documentation.

When wiring, proceed as follows:

- Strip 8 mm off the cable.

Solid cable / ferrules with direct plug-in technology (push-in)

- When using solid cables from 0.5 mm^2 onwards or cables with ferrules:
  Insert the cable into the terminal point. It is clamped automatically.

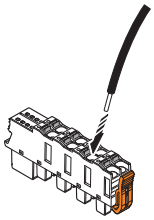


Figure 6-2 Connecting a solid unshielded cable

Stranded cable without ferrules

- When using stranded cables:
  Open the spring by pressing the screwdriver onto the spring lever (Figure 6-3, A).
  Use, for example, a bladed screwdriver with a blade width of 2.5 mm.
  Phoenix Contact recommends the SZS 0,4x2,5 screwdriver (see Section “Ordering data” on page 111).
- Insert the cable in the terminal point (B).
- Remove the screwdriver to secure the cable.

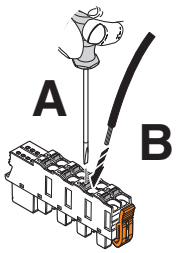


Figure 6-3 Connecting a stranded cable

After installation, it is advisable to mark the cables in addition to the module and connectors. Marking the module: see Section “Color and marking” on page 43.

Inserting the connector

- Place the connector vertically into its position and press firmly. Make sure that the locking latch snaps in.

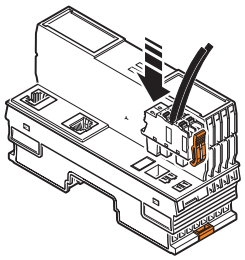


Figure 6-4 Inserting the connector

6.5 Connecting shielded cables

Please also observe the information in Section “Shielding concept” on page 87 for shielding.

Connect the shield before the module.

When connecting the cables proceed as follows:

Stripping the cables and connecting the shield

- Strip approximately 20 mm off the outer sheath of the cable at the required distance from the end of the cable (a in Figure 6-5).
  The necessary distance a depends on the distance to the busbar.
- Strip 8 mm off the wires.

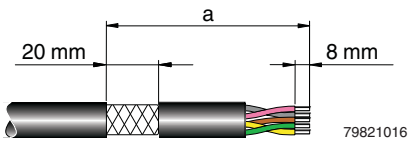


Figure 6-5 Connecting the shielded cable

- If present, remove the protective foil.
- Lay the cable with the braided shield under a shield terminal and tighten it with a screw. Malfunctions will then be lead via a busbar to the support brackets, which are connected to the grounded DIN rail.
  Ordering data can be found in Section “Ordering data” on page 111.

Make sure the shield is as close as possible to the signal terminal points.

When using twisted pair cables, keep the cable twisted until just before the terminal point.

NOTE:

The busbar is only for shielding the modules, not for the strain relief of the connected cables.

Wiring connectors

- Connect the cables to the connector. To do this, proceed as described in Section “Connecting unshielded cables” on page 69.

6.6 Removing cables from the terminal point

- To remove a cable from the terminal point, press on the spring lever with a suitable tool (e.g., bladed screwdriver with a blade width of 2.5 mm). This opens the push-in connection of the relevant terminal point (Figure 6-6, A).
- Remove the conductor (Figure 6-6, B).

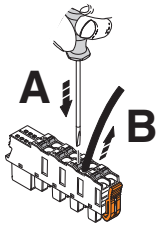


Figure 6-6 Removing the cable

6.7 Connecting the power supplies

6.7.1 Axioline F system supply

To operate an Axioline F station you must provide the supply voltage for the bus coupler, for the local bus (communications power of the connected modules) and for the sensors and actuators.

Unshielded cables are usually sufficient for connecting the power supplies. Connect them as shown in Section “Connecting unshielded cables” on page 69.

For the connector pin assignment of the supply voltage connections, please refer to the module-specific documentation.

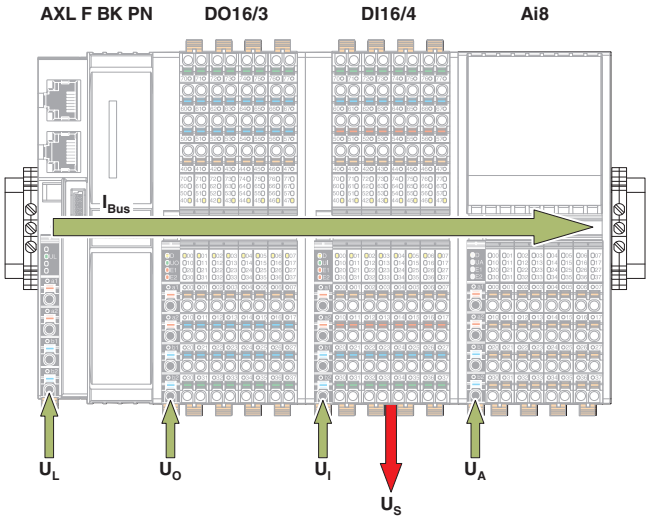


Figure 6-7 Supply voltages in the Axioline F system

Key:

U_L	(U_{Logic})	Communications power supply
U_{Bus}	(U_{Bus})	Power supply of the Axioline F local bus (generated from U_L)
U_I	(U_{Input})	Supply for digital input modules Sensor/encoder supply (AXL CNT 2/INC 2) Sensor/analog supply (AXL SSI 1/AO 1)
U_S	(U_{Sensor})	Sensor supply (generated from U_I)
U_O	(U_{Output})	Supply for digital output modules
U_{IO}	($U_{Input/Output}$)	Supply for digital input and output modules
U_A	(U_{Analog})	Supply for analog modules
I_{Bus}	(I_{Bus})	Power supply for the local bus

For information regarding which supply voltage is used with a module, please refer to the module-specific documentation.

6.7.2 Power supply requirements

Choose a power supply unit that is suitable for the currents in your application. The selection depends on the bus configuration and the resulting maximum currents.

WARNING: Loss of electrical safety when using unsuitable power supplies / hazardous shock currents

The Axioline F low-level signal controllers, bus couplers, and modules are designed exclusively for protective extra low voltage (PELV) operation according to EN 60204-1. Only PELV according to the defined standard may be used for supply purposes.

Only use power supply units that ensure safe isolation according to EN 50178 and EN 61010-2-201. They prevent short circuits between the primary and secondary circuit.

WARNING: Dangerous contact voltage in the event of ground faults

The Axioline F modules for the low voltage area must only be operated in grounded networks.

Observe the information in the module-specific documentation.

6.7.3 Supply at the controller or bus coupler

Communications power (U_L) is supplied at the controller or bus coupler. It supplies the module electronics (logic) of the controller or bus coupler. Additionally, it generates the communications power for the local bus (U_{Bus}), which supplies the connected modules with logic current.

If the communications power U_L is switched off, the local bus will shut down.

6.7.4 Supply at the power module

If the maximum load of the bus coupler for the Axioline F local bus supply (communications power (U_{Bus}) is reached, you can use a power module to provide this voltage again.

To this end, apply a 24 V DC voltage (U_L) to the module from which U_{Bus} is generated.

NOTE: Malfunction

The power module only boosts the U_{Bus} voltage when it is snapped onto the associated red bus base module and when the U_{Bus} voltage is available in the bus segment before the power module.

6.7.5 Supply at the input/output modules

The inputs and outputs, as well as the sensors, are supplied directly at each module.

The input and output power supply ($U_I/U_O/U_{IO}/U_A$) should be installed and fused independent of the communications power (U_L). In this way, the local bus can continue to run, even if some components of the I/O devices are switched off. This also prevents unnecessary interference couplings between I/O and logic.

The use of separate power supply units for U_L and $U_I/U_O/U_{IO}/U_A$ may be necessary in environments with a lot of interference.

6.7.6 Jumpers in the power connectors, potential forwarding, and fusing

Terminal points a1 and a2, as well as b1 and b2 are jumpered in the power connector. You can therefore use one of the terminal points for supply and the second terminal point for forwarding a potential respectively.

NOTE: Module damage when overloaded

Please note that the maximum current carrying capacity of a terminal point of 8 A must not be exceeded.

Protect the supply accordingly.

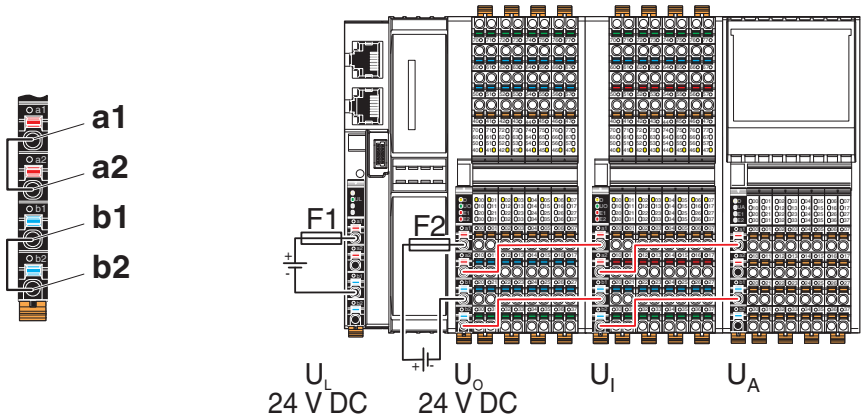


Figure 6-8 Jumpering in the power connector and example of potential forwarding

F1, F2 Protecting the supply voltage using suitable fuses (see module-specific documentation)

Considering the current carrying capacity of the terminal points, the potential forwarding shown in Figure 6-8 must not be used when the digital output module is fully loaded (e.g., AXL F DO16/3 2F current consumption at U_O is 8 A, maximum).

6.7.7 Parallel supply

If the maximum current consumption is greater than 8 A for a module, however, you wish to fully load the module, the supply voltage can be supplied in parallel. The module can now be loaded with 16 A, maximum.

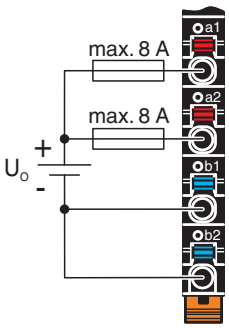


Figure 6-9 Parallel supply of the supply voltage

6.8 Connecting the network

Your network cable is connected to a controller or bus coupler.

Connect the network according to the module-specific documentation.

6.9 Connecting the USB cable to the micro USB interface

The AXC 305x controllers are provided with a programming interface, and the AXC 105x controllers and the bus couplers are provided with a service interface. This interface is a type B micro USB socket. In addition to providing the network interface, it enables communication with the controller or bus coupler from a PC.

This interface can be used, e.g., to assign the IP address of the controller or bus coupler. In addition, the Diag+ diagnostic tool can be used to access the controllers, and Startup+ can be used to access the bus couplers and the class 1000 controllers.

To use the programming interface, a corresponding driver must be installed. It is provided with the software tools from Phoenix Contact.

A connecting cable (CAB-USB A/MICRO USB B/2,0M Order No. 2701626) is required for direct connection of the controller/bus coupler to a PC via the programming/service interface.

Do not connect the USB connecting cable until you have supplied the controller/bus coupler with voltage and the controller/bus coupler has successfully entered the operating state following startup.

- Connect the connecting cable to the programming/service interface of the controller or bus coupler and to a free USB interface of the PC.

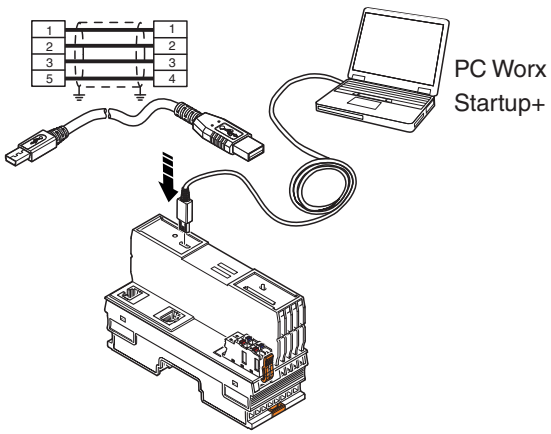


Figure 6-10 Connecting cable between PC and controller or bus coupler

6.10 Connecting sensors and actuators

Sensors and actuators are connected using the I/O module connectors.

Connect the unshielded cables as described in Section “Connecting unshielded cables” on page 69.

Connect the shielded cables as described in Section “Connecting shielded cables” on page 70.

6.10.1 Connection technology for sensors and actuators

The input/output modules of the Axioline F product group normally permit the connection of sensors and actuators in 1, 2, 3 or 4-wire technology.

The relevant module-specific data sheets indicate which connection technology is possible for the individual modules.

6.10.2 Connections used for low-level signal digital input and output modules

For the actual terminal point assignment, please refer to the corresponding module-specific data sheet. It also provides a connection example.

Table 6-4 Overview of the connections used for low-level signal digital input modules

Connection	Representation in the figure	1-wire	2-wire	3-wire	4-wire
Sensor signal IN	IN	X	X	X	X
Sensor supply U_S	U_S (+24 V)	–	X	X	X
Ground GND	GND	–	–	X	X
Grounding/FE shielding	FE (⏚)	–	–	–	X

X Used

– Not used

Table 6-5 Overview of the connections used for low-level signal digital output modules

Connection	Representation in the figure	1-wire	2-wire	3-wire
Actuator signal OUT	OUT	X	X	X
Actuator supply U_O	U_O (+24 V)	–	–	–
Ground GND	GND	–	X	X
Grounding/FE shielding	FE (⏚)	–	–	X

X Used

– Not used

6.10.3 Connecting digital sensors and actuators using the different connection technologies

1-wire technology

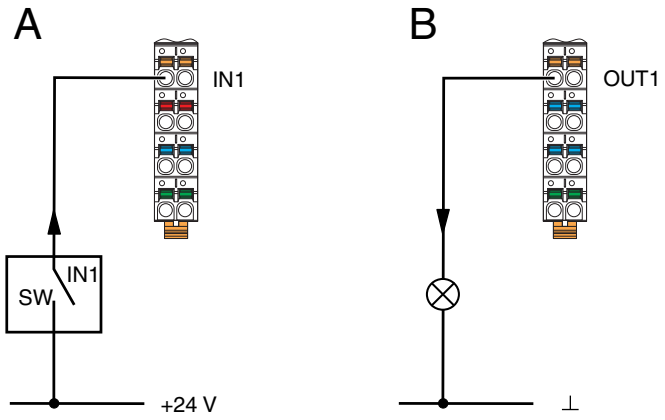


Figure 6-11 1-wire connection for digital modules

Sensor

Figure 6-11, A, shows the connection of a 1-wire sensor.

– The SW switch provides the input signal.
– The sensor signal is routed to the IN1 terminal point.
– The sensor is supplied with a 24 V voltage.

NOTE: Malfunction

To ensure the correct function, supply the sensors and U_I from a power supply with a common GND as the reference potential.

Actuator

Figure 6-11, B, shows the connection of a 1-wire actuator.

– The actuator is supplied with voltage by output OUT1.
– The load is switched directly via the output.

NOTE: Malfunction

To ensure the correct function, make sure that GND of the actuators and GND of supply voltage U_O, which supplies the actuators, have the same potential.

2-wire technology

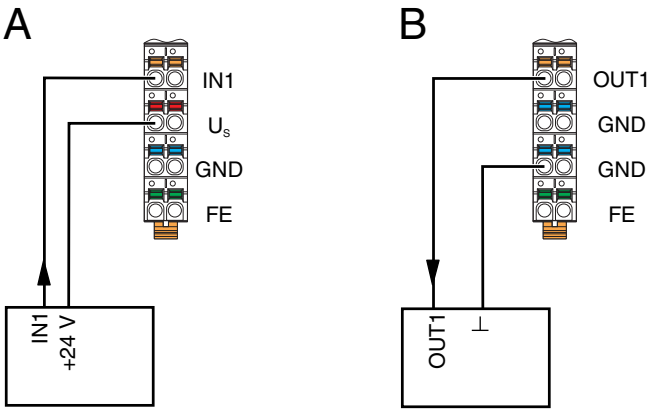


Figure 6-12 2-wire connection for digital modules

Sensor

Figure 6-12, A, shows the connection of a 2-wire sensor.

– The sensor signal is routed to the IN1 terminal point.
– The sensor is supplied by voltage U_S.

Actuator

Figure 6-12, B, shows the connection of an actuator.

– The actuator is supplied with voltage by output OUT1.
– The load is switched directly via the output.

3-wire technology

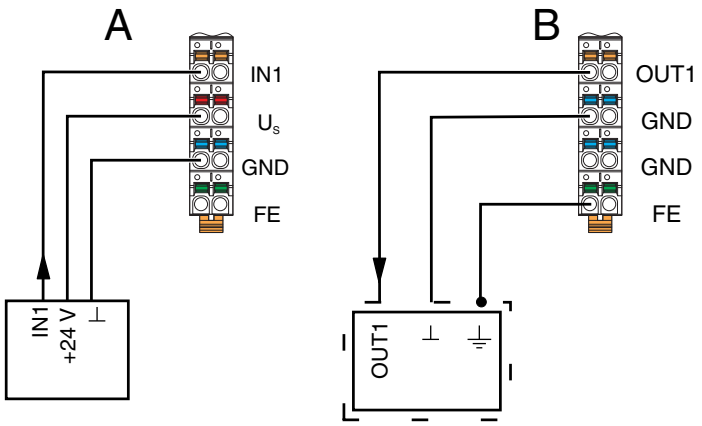


Figure 6-13 3-wire connection for digital modules

Sensor

Figure 6-13, A, shows the connection of a 3-wire sensor.

– The sensor signal is routed to the IN1 terminal point.
– The sensor is supplied with power via terminal points U_S and GND.

Actuator

Figure 6-13, B, shows the connection of a shielded actuator.

– The actuator is supplied by output OUT1.
– The load is switched directly via the output.
– The actuator is grounded via the FE terminal point.

4-wire technology

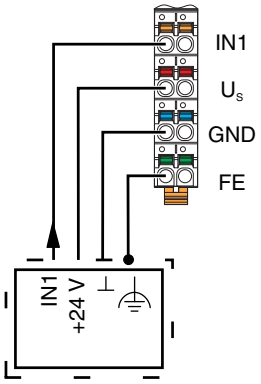


Figure 6-14 4-wire connection for digital modules

Sensor

Figure 6-14 shows the connection of a shielded 3-wire sensor.

– The sensor signal is routed to the IN1 terminal point.
– The sensor is supplied with power via terminal points U_S and GND.
– The sensor is grounded via the FE terminal point.

6.10.4 FLK

You can connect PLC relays from the INTERFACE product range quickly and conveniently using the AXL F DO16 FLK 1H digital output module with 20-pos. FLK connection. This means that you can also use this output module in applications which require relays, e.g., to switch high voltages or currents.

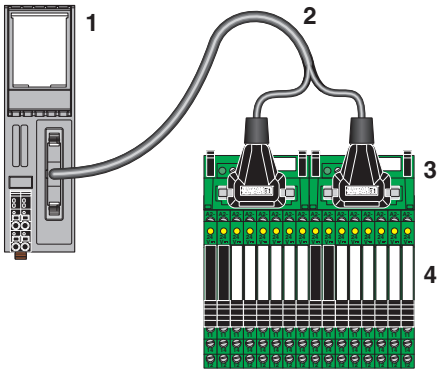


Figure 6-15 Connection of relay modules

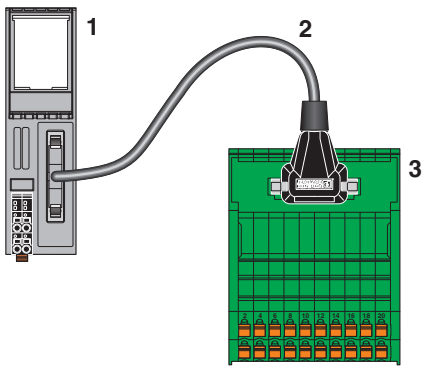


Figure 6-16 Connection of a termination board

For accessories, please refer to the module-specific data sheet.

6.10.5 Redundant signals

If you are using I/O modules redundantly, connect the modules as shown in Figure 6-17.

In the example, the two modules are located in two Axioline F stations.

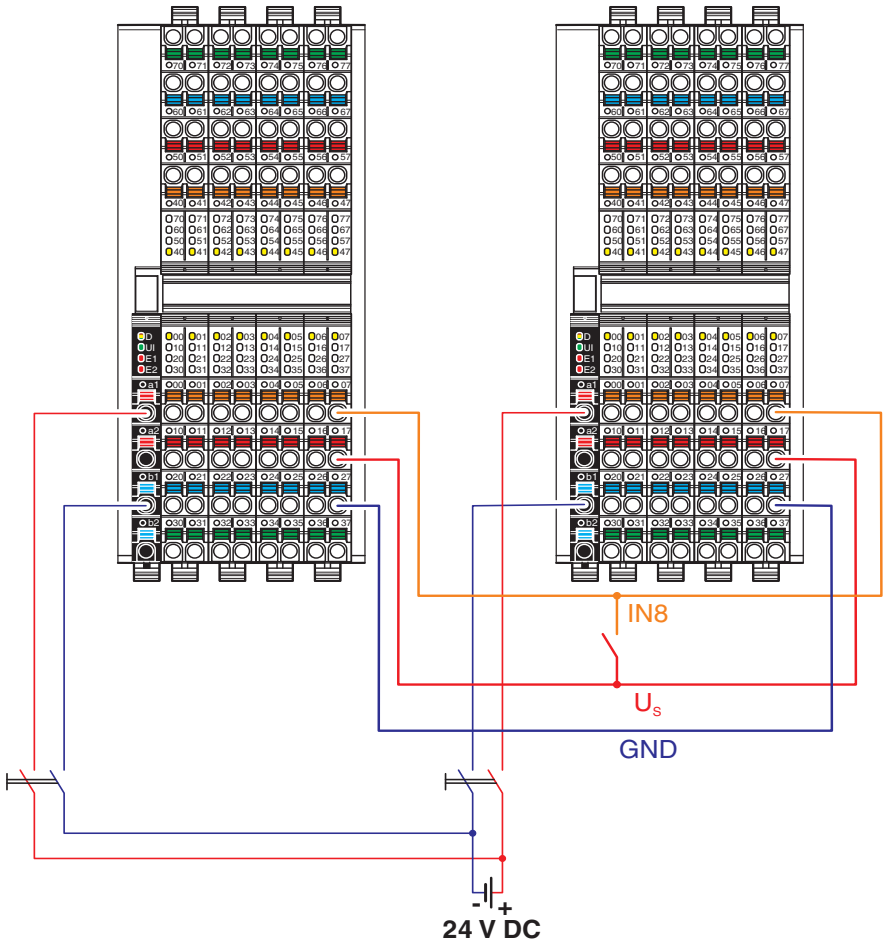


Figure 6-17 Example: connection for redundant use

IN8	Digital input 8
U_S	Sensor supply
GND	Reference potential

CAUTION: Malfunction

To avoid malfunction, make sure that the GND connection shown in Figure 6-17 is established as the reference potential to the redundant signal inputs.

Make sure that, in the event of a short circuit of the sensor supply, the effects are limited by providing decoupling (longitudinal diode).

7 Grounding and shielding

7.1 Grounding concept

Within an Axioline F station, a distinction is made between functional earth ground (FE) and protective earth ground (PE).

Protective earth grounding (PE)

Protective earth grounding protects people and machines against hazardous voltages. To avoid these dangers, as far as possible, correct grounding, taking the local conditions into account, is vital.

Functional earth grounding (FE)

Functional earth ground is only used to discharge interference. It does not provide shock protection for people.

Functional earth grounding is used to improve immunity to interference. All devices must be grounded so that any possible interference from connectors for data transmission is shielded and discharged to ground.

7.1.1 Protective earth ground (PE)

Protective earth ground is a low-impedance current path that minimizes the risk to a user in the event of an error (including a high voltage and/or current error between an electrical circuit and ground).

According to the electrical design, the Axioline F low-voltage modules correspond to protection class 2 devices and therefore do not require grounding. However, IP20 protection is not sufficient for protection class 2, which means that the modules only become real protection class 2 devices when used with a control cabinet or an installation box.

7.1.2 Functional earth ground (FE)

Functional earth ground is a low-impedance current path between circuits and ground. It is not designed as a safety measure but rather for the improvement of immunity to interference.

Functional earth ground is used in the 24 V area (protective extra low voltage).

To ensure reliable functional earth grounding, please observe the following:

1 The modules have at least one FE spring (metal clip, 1 in Figure 7-1) at the bottom. This spring establishes an electrical connection to the DIN rail when the module is mounted. The bus coupler has one FE spring, the I/O modules have one or two FE springs. Use grounding terminal blocks to connect the DIN rail to protective earth ground. The modules are then also grounded when they are snapped onto the DIN rail.

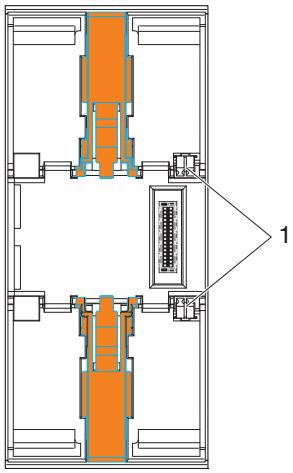


Figure 7-1 FE spring (1)

2 When using modules for surge protection (TRABTECH), connect their functional earth ground directly to the grounded DIN rail.
Do not connect the functional earth ground of the modules for surge protection to an Axioline F module (e.g., to an FE contact of an Axioline F connector).
This ensures that interference is discharged before it enters the Axioline F module. Only then is good electromagnetic compatibility ensured.

7.2 Shielding concept

Shielding is used to reduce the effects of interference on the system.

7.2.1 Shielding with Axioline F

In the Axioline F system, shielded cables are used with the following modules:

- Network cables
- Connecting cables
  - On modules for analog signals (analog input, analog output, temperature recording)
  - On special-function and acquisition modules

Observe the following points when shielding:

- Connect the shield to a module before the signal connection.
- Ensure a large surface connection of the shield.
- Make sure there is good contact between the shield and shield bus (synonyms: neutral busbar, busbar).
- Do not damage or squeeze the wires.
- When connecting the shielding, observe the specifications for wiring.
- Make sure the shield is as close as possible to the signal terminal point.

7.2.2 Shielding when connecting analog sensors and actuators

- Always connect analog sensors and actuators with shielded, twisted pair cables.
- Connect the shield via a shield bus. (See Figure 7-9)

When connecting the cables, observe the information in the module-specific data sheet.

- As a rule, shielding must only be connected directly to the PE potential on one side. This is to prevent any occurrence of equipotential bonding currents via the shielding (see Figure 7-9 and Figure 7-10).
- If necessary, integrate the shielding concept for analog I/O cables in the system concept. For example, it is advisable to use a central FE shield connection at the control cabinet entry (see Figure 7-10).

For connecting the shield, Phoenix Contact recommends the AXL SHIELD SET Axioline F shield connection set or the shield connection clamp products from the “Marking systems, tools, and mounting material” catalog.

7.2.3 Connecting the shield using the Axioline F shield connection set

The shield connection set consists of two shield bus holders and two SK 5 shield connection clamps. This shield connection set can be used to connect cable shields in an Axioline F station in the vicinity of the modules.

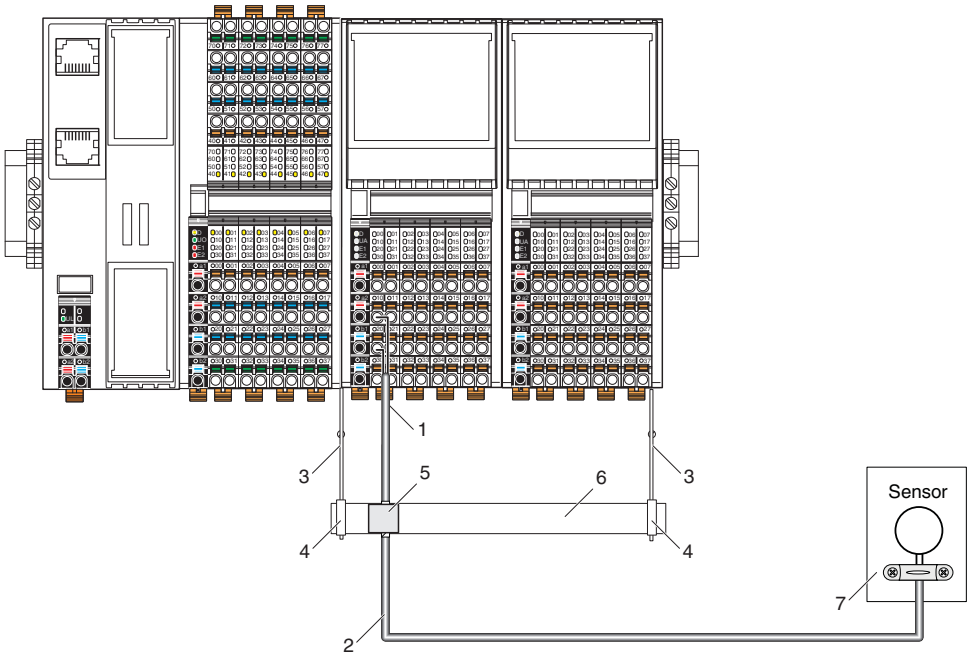


Figure 7-2 Connecting the shield with AXL SHIELD SET

1 Lead the analog cable into the connector, making sure to maintain the cable insulation.

2 Use shielded twisted pair cables.

3 Shield bus holder

4 SK 5 shield connection clamps (2 pcs. included in the AXL SHIELD SET) for securing the busbar (accessory) on the shield bus holder

5 Shield connection clamp for shield support on the busbar (SKS ..., see Section “Ordering data for accessories” on page 111)
Connect the shield directly to the FE potential.
Connect the shield for the entire analog transmission path to FE potential at only one point. In this example, this point is the busbar.

6 Busbar (NLS-CU 3/10 ..., see Section “Ordering data for accessories” on page 111)

7 Lead the sensor cable into the sensor, making sure to maintain the cable insulation.

Axioline F shield connection set

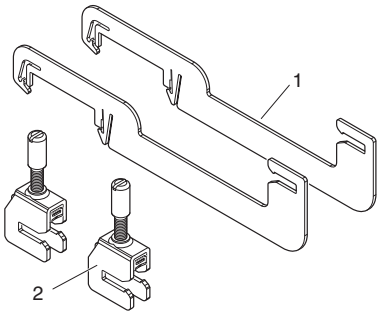


Figure 7-3 Set components

1 Shield bus holders (2 pcs.)

2 SK 5 shield connection clamps for securing the busbar on the shield bus holder (2 pcs.)

Contact is made with the shield on the busbar using shield connection clamps (both are available as accessories). Select the shield connection clamp according to the cable cross section and type (SK or SKS), see Section “Material for shield connection” on page 112.

Mounting

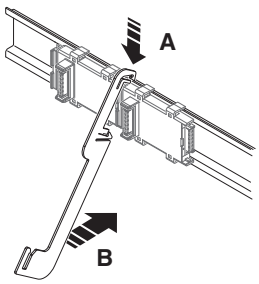
Mount the shield bus holders after mounting the bus base modules and before mounting the electronics modules.

Polished surfaces indicate the positions of the shield bus holders on the bus base modules.

The maximum distance between two adjacent shield bus holders should not exceed 215 mm (e.g., four modules with four connectors next to each other).

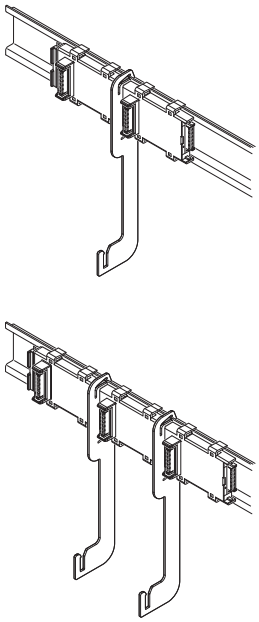
If the busbar is secured using more than two shield bus holders, distribute the holders equally over the width of the busbar.

If using a shield bus holder at the end of an Axioline F station, mount the shield bus holder after the last module. In this case, it is not positioned above a bus base module. Secure the shield bus holder using an end bracket (accessory).



- Hook the shield bus holder onto the DIN rail.

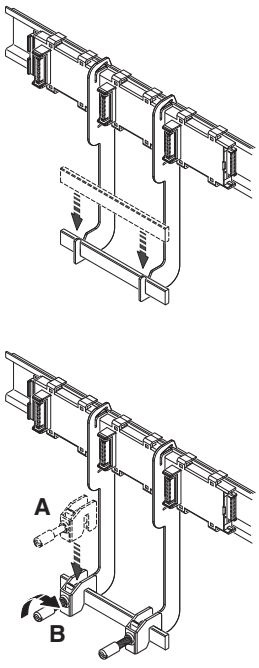
Figure 7-4 Hooking the shield bus holder on



- Snap the shield bus holder onto the DIN rail.

- Then snap on the second shield bus holder.

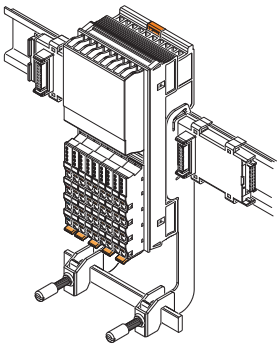
Figure 7-5 Snapping on the shield bus holders



- Push the busbar into the shield bus holder.

- Secure the busbar using the SK 5 shield connection clamps included in the scope of supply.

Figure 7-6 Mounting the busbar

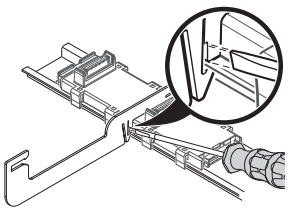


- Mount the electronics modules.

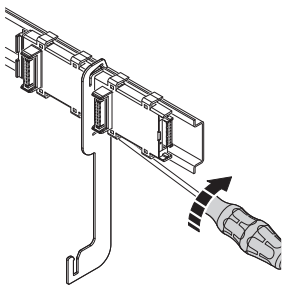
Figure 7-7 Mounting the electronics modules

Removal

For removal, use a screwdriver with a blade width of 4 mm (see accessories for examples).



- First, remove the adjacent electronics modules (to the right and left of each shield bus holder).
- Insert the screwdriver in the release slot.



- Turn the screwdriver to release the locking clip from the DIN rail. (Abb. 9)
- Remove the shield bus holder.

Figure 7-8 Removing the shield connection

The locking clip may become deformed following contact with the screwdriver. In this case, bend it back into shape prior to reassembly.

7.2.4 Connecting the shielding to a busbar

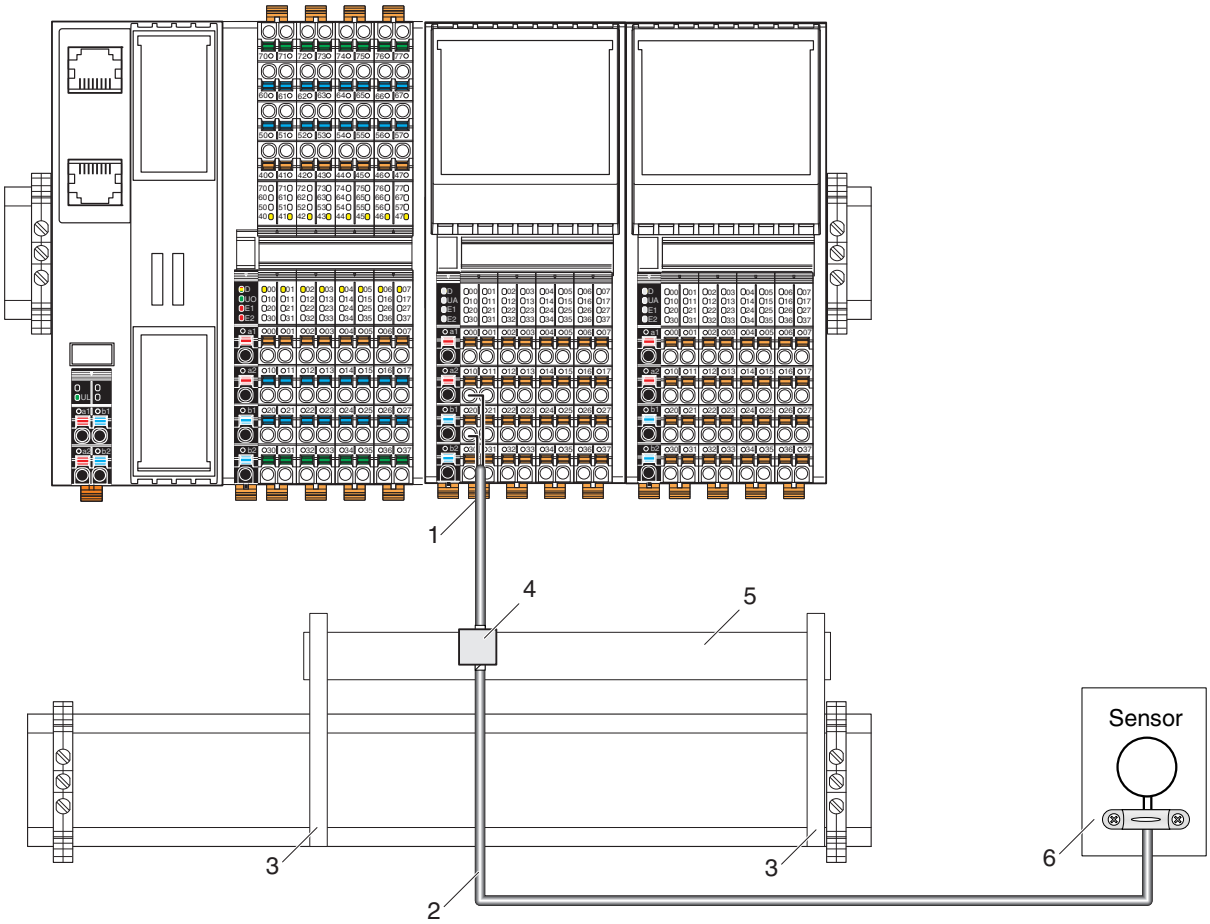


Figure 7-9 Connecting the shielding to a busbar

1 Lead the analog cable into the connector, making sure to maintain the cable insulation.

2 Use shielded twisted pair cables.

3 Support bracket (AB ..., see Section “Ordering data for accessories” on page 111)

4 Shield connection clamp for shield support on the busbar (SKS ..., see Section “Ordering data for accessories” on page 111)
Connect the shield directly to the FE potential.
Connect the shield for the entire analog transmission path to FE potential at only one point. In this example, this point is the busbar.

5 Busbar

6 Lead the sensor cable into the sensor, making sure to maintain the cable insulation.

7.2.5 Integrating analog shielding in a concept with central equipotential bonding at the control cabinet entry

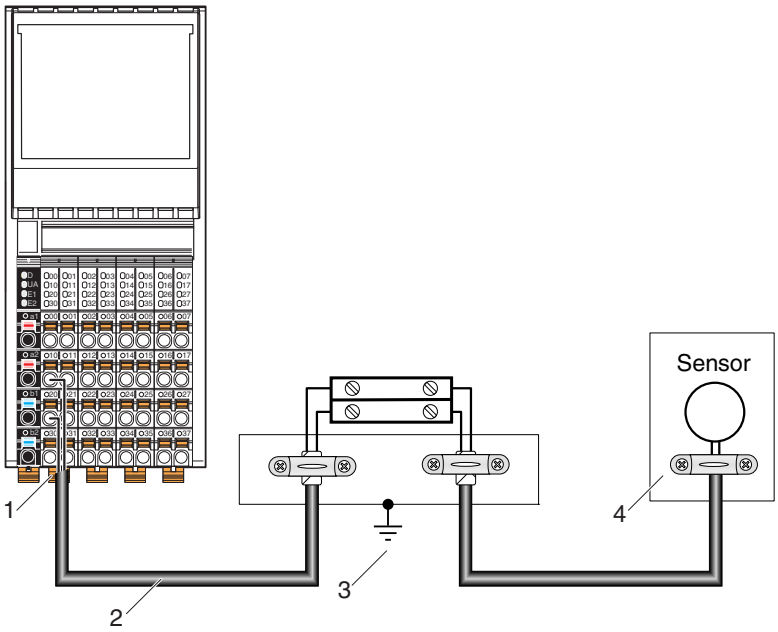


Figure 7-10 Integration of analog shielding in a concept with central equipotential bonding at the control cabinet entry

1 Lead the analog cable into the connector, making sure to maintain the cable insulation.

2 Use shielded twisted pair cables.

3 Connect the strain relief directly to the FE potential.
Connect the shield for the entire analog transmission path to FE potential at only one point. In this example, this point is the jumpering level.

4 Lead the sensor cable into the sensor, making sure to maintain the cable insulation.

NOTE: Functions may be impaired

When integrating the shielding of analog I/O cables in an equipotential bonding concept, make sure that direct connection to the FE potential is only made at one point (e.g., at the central grounding point of the jumpering level).

8 Diagnostics and status indicators

All Axioline F modules are provided with diagnostics and status indicators for quick local error diagnostics. They enable the clear localization of system errors (bus errors) or I/O errors.

Diagnostics

The diagnostics indicators (red, yellow or green) provide information about the state of the module and, in the event of an error, provide information about the type and location of the error. The module is functioning correctly if all of the green LEDs are on.

Status

The status indicators (yellow) display the status of the relevant input/output and the connected I/O device.

Extended diagnostics

Some modules have extended diagnostics. For example, a short circuit or an overload of the sensor supply can be detected and reported. If a short circuit occurs at an output, some output modules can diagnose each channel individually. Information about the supply voltage is also reported. Information about I/O errors is sent to the controller with precise details of the error type and is displayed using status indicators.

The diagnostics indicators D, UA, E1, E2 show the current status.
This status is not saved. This means, for example, that an open circuit or overrange is indicated via the LEDs. If the respective error has been removed and no other error has occurred, the LEDs indicate the errorfree state again.

The error is not saved on the module. For some modules, however, the DiagState object (0018_{hex}) is used to report some specific errors to the controller.

All possible positions for diagnostics and status indicators are equipped with light guides on the S20 connectors.
Since not every position has its own LED on the printed-circuit board, there are some light guides without any function.

Examples:

AXL F AI8 1F: The light guides 00 ... 07, 10 ... 17, 20 ... 27, and 30 ... 37 do not have any function.

AXL F DI32/1 1F: The light guides 00 ... 07, 10 ... 17, 20 ... 27, and 30 ... 37 have a function.

Refer to the module-specific documentation for information about the diagnostics and status indicators on each module and their meaning.

8.1 Indicators on controllers

Please refer to the corresponding documentation for more information on the controller's diagnostics and status indicators.

8.2 Indicators on bus couplers

Bus couplers have power supply indicators, as well as network and module indicators.

Indicators for the power supply are located on the power connector. The other indicators are located on the module.

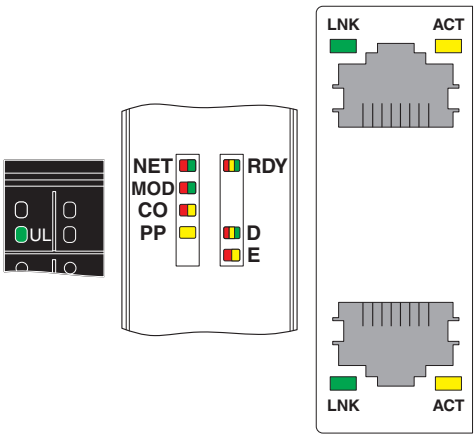


Figure 8-1 Indicators on a bus coupler (example: AXL F BK EIP)

All bus couplers in a F-BK housing have the following indicators:

Designation	Color	Meaning	State	Description
U_L	Green	U_{Logic}	On	Communications power supply present.
			Off	Communications power supply not present.
RDY	Green/ yellow/ red	Ready	Green on	Device is ready to operate.
			Flashing green/yellow	Communications power undervoltage or surge voltage
				Overtemperature.
			Yellow on	Firmware/bus coupler is booting.
			Flashing yellow	Firmware update is being performed.
			Flashing yellow/red	Firmware update has failed.
			Flashing red	Faulty firmware.
			Red on	Rotary coding switches are set to an invalid/reserved position.
			Off	Device is not ready for operation.

Designation	Color	Meaning	State	Description
D	Red/yellow/green	Diagnostics for local bus communication		
		Run	Green on	The station is ready for operation, communication within the station is OK. All data is valid. There are no faults.
		Active	Flashing green	The station is ready for operation, communication within the station is OK. The data is **not** valid. Valid data from the controller/higher-level network is not available. There is no fault in the module.
		Ready	Yellow on	The station is ready for operation, no data exchange taking place.
			Flashing yellow	Access from Startup+ in I/O check mode
			Flashing yellow/red	Local bus error during active I/O check
			Flashing red	Local bus error on startup
				Possible causes: – Configuration cannot be generated, information is missing from a device – Chip version of a device is <V1.1 – The desired and actual configuration are different – No local bus device connected – The maximum number of local bus devices is exceeded
			Red on	The station is ready for operation but has lost connection to at least one device.
				Possible causes: – Communication error – Local bus device has been removed or configured device is missing. – Reset at a local bus device – Serious device error at a local bus device (local bus device can no longer be accessed)
		Power down	Off	Device is in (power) reset.
E	Yellow/red	Error	Yellow on	I/O warning at a local bus device.
			Red on	I/O error at a local bus device.
			Off	No I/O messages present.

Further diagnostics and/or status indicators may also be available.

Please refer to the bus coupler documentation for the diagnostics and status indicators on the bus coupler and their meanings.

8.3 Indicators on input/output modules

The LEDs of the input/output modules are located on the connectors.

8.3.1 LEDs on the power connectors

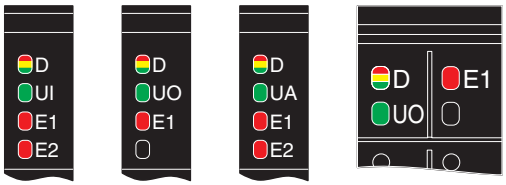


Figure 8-2 LEDs on the power connectors (examples)

Designation	Color	Meaning	State	Description
D	Red/yellow/green	Diagnostics for local bus communication		
		Run	Green on	The device is ready for operation, communication within the station is OK. All data is valid. There are no faults.
		Active	Flashing green	The device is ready for operation, communication within the station is OK. The data is **not** valid. Valid data from the controller/higher-level network is not available. There is no fault in the module.
		Device application not active	Flashing green/yellow	The device is ready for operation, communication within the station is OK. Output data **cannot** be output and/or input data **cannot** be read. There is a fault on the I/O side of the module.
		Ready	Yellow on	The device is ready for operation but has still not detected a valid cycle after power-on.
		Connected	Flashing yellow	The device is not (yet) part of the active configuration.
		Reset	Red on	The device is ready for operation but has lost the connection to the bus head.
		Not connected	Flashing red	The device is ready for operation but there is no connection to the previously existing device.
		Power down	Off	Device is in (power) reset.
U_x	Green	U_x	On	I/O supply is present.
			Off	I/O supply is not present.

Designation	Color	Meaning	State	Description
E1	Red/yellow	Device error or warning Indicates messages that apply to the entire device.		
			Red on	Error (priority 1)
			Yellow on	Warning (priority 2)
E2	Red/yellow	Peripheral or channel error or warning (group message) Indicates messages that only apply to a single channel.		
			Red on	Error (priority 1)
			Yellow on	Warning (priority 2)

Voltages U_x:

U_I	(U_{Input})	Supply for digital input modules; sensor/encoder supply
U_O	(U_{Output})	Supply for digital output modules
U_{IO}	($U_{Input/Output}$)	Supply for digital input and output modules
U_A	(U_{Analog})	Supply for analog modules

Refer to the module-specific documentation for information about the diagnostics and status indicators on each module and their meaning.

8.3.2 LEDs on the I/O connectors

The LEDs on the I/O connectors are numbered according to the terminal points.
All LED locations are numbered even when they are not used.
Exception: For modules with secure inputs and outputs, see the module-specific documentation.

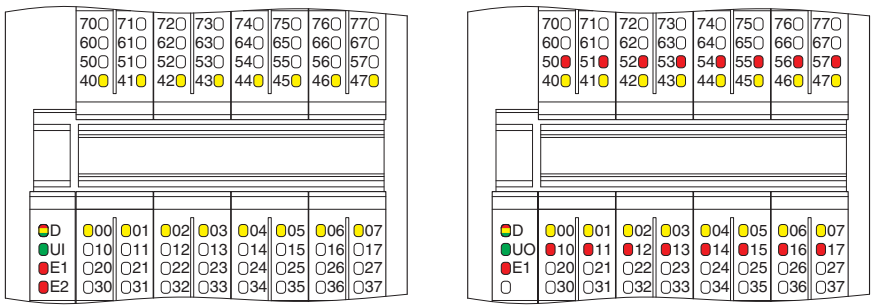


Figure 8-3 LEDs on the I/O connectors (e.g., AXL DI 16/4, AXL DO 16/3)

Table 8-1 LEDs on the I/O connector

Designation	Color	Meaning	State	Description
xx	**Yellow**	Status of the input or output	On	Corresponding input/output set.
			Off	Corresponding input/output not set.
	Green	At modules with safe inputs or outputs: Status of the input or outputg	On	Corresponding input/output set.
			Off	Corresponding input/output not set.
yy	**Red**	Diagnostics of the output	On	Error at the output.
			Off	No error at the output.

xx Channel identification

yy Channel identification

Table 8-1 lists commonly used LEDs. More LEDs may also be found on the modules.

Refer to the module-specific documentation for information about the available LEDs on each module and their meanings.

8.4 Reporting diagnostics via PDI

The malfunctions indicated by the local diagnostics and status indicators are also mapped in PDI object 0018_{hex} (DiagState).

Detailed information can be found in Section “Objects for diagnostics” on page 122 and in the module-specific data sheet.

9 Process, parameter, and diagnostic data

The Axioline F local bus is used for the transmission of process data and parameter data.

9.1 Process data

Axioline F devices have at least eight bits of process data. If less than eight bits are used, they occupy the least significant bits of the byte.

The significance of the data corresponds to the Motorola format (Big Endian).

The significance of the data bytes declines as the number goes up.

For the process data assignment and the assignment of the process data to the terminal points of a module, please refer to the module-specific data sheet.

9.2 Parameter and diagnostic data (PDI channel)

Parameter and diagnostic data as well as other information is transmitted via the PDI channel (PDI = Parameters, Diagnostics and Information).

The PDI channel is used in addition to the process data channel in the Axioline F system for the demand-oriented, acyclic transmission of parameter and diagnostic data as well as other information. Each Axioline F I/O module has this channel and can use it independently of the process data.

Services can be used to access communication objects created in the Axioline F I/O module via the PDI channel. These objects can be used, for example, to set measuring ranges, to specify the substitute value behavior of outputs in the event of a bus error, or to read I/O diagnostics details.

In most cases, the objects are accessed automatically, e.g., when writing the start parameterization during the bus coupler's startup.

The objects created in the Axioline F I/O module are:

– General standard objects (index 0001_{hex} up to $003D_{hex}$)
  Every I/O module has these objects.
  For more detailed information on these objects, please refer to Section “General standard objects” on page 119.
– Manufacturer-specific application objects (index 0080_{hex} up to $5FFF_{hex}$, $FF8F_{hex}$)
  These objects are specified by the device manufacturer and have device-specific variables.
  For more detailed information on these objects, please refer to the module documentation.

You can access these objects using services.

Table 9-1 Services

Service	Meaning
Read	Reading an object
Write	Writing an object
Fetch	Fetching an object that has been reported by the slave via the PDI messaging mechanism without the master application knowing which object is meant.
Write/read	Writing/reading an application object. If access in the application is successful, instead of the positive response, an object and the corresponding data are transferred to the master.

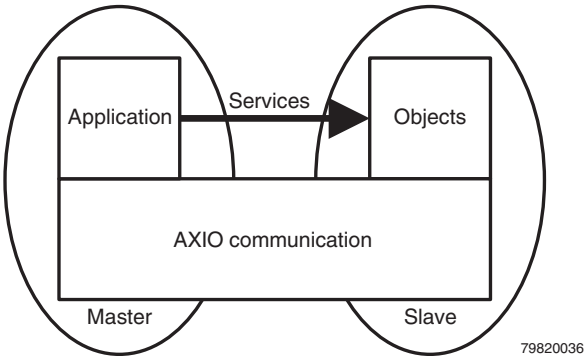


Figure 9-1 PDI components

Every service access consists of a request and the associated confirmation. Only one service can be processed for an I/O module at a time.

The service structure depends on the higher-level system. For more information, please refer to your system documentation.

9.3 Saving data: startup and other parameters

Defined parameters and other parameters are available as startup parameters for each Axioline F module.

Startup parameters (Flash)

Startup parameters are stored retentively (in a non-volatile way, permanently) in the Flash memory.

Startup parameters include the application object parameters, e.g., parameter table, substitute value, filter time etc. As soon as valid parameters are specified for these objects, they are stored retentively on the module.

Due to the storage technology used, parameters that are stored retentively can only be written for a specific number of times (100,000 up to 1,000,000 times, typically). They are not suitable for being changed cyclically.

NOTE: Damage to the Flash memory during cyclic write access

The Flash memory is only designed for a limited number of write access operations. Make therefore sure that write access operations are not performed too often and, in particular, not cyclically.

Observe this behavior when programming function blocks.

Other parameters (RAM)

Other parameters are stored temporarily (in a volatile way) in the RAM.

10 Software support

10.1 Overview of the software

Axioline F is supported by the following software from Phoenix Contact:

– Startup+
– PC Worx
– CLIP PROJECT

You can also integrate Axioline F into any other system, e.g., via GSDML in STEP 7 or via DTM (Device Type Manager) in FDT framework applications.

For the software for supporting modules with secure inputs or outputs, please refer to the module-specific documentation.

10.2 FDT/DTM and Startup+

FDT/DTM is a non-proprietary concept which enables parameterization of field devices from various manufacturers with only one program, an FDT framework application.

Any DTMs from various manufacturers can be integrated into an FDT framework application. Point-to-point communication, even beyond network boundaries, enables user-friendly parameterization and diagnostics of devices and sensors/actuators via, e.g., Ethernet, INTERBUS, PROFIBUS, HART, and in future PROFINET or IO-Link protocol.

FDT (Field Device Tool) defines the interfaces between the FDT framework application and the DTM.

A **DTM** (Device Type Manager) incorporates all functions, the structure, parameterization and graphical user interface for a device.

DTM is available for all Axioline F modules. They can be integrated into each FDT framework application.

The **Startup+** software is an FDT framework application, which is best suited to Axioline F. It enables easy selection and configuration of an Axioline F station via a Windows user interface. The tool offers the following functions:

– Connection to the bus coupler via RJ45 or via the service interface
– Reading the connected bus; all modules will be displayed
– Reading and forcing module process data
– Parameterization of the modules (only online, no adoption in PC Worx or STEP 7)
– Diagnostics of the I/O modules and the bus coupler
– Detailed online help for the documentation of software functions

Startup+ and the device-specific DTM can be downloaded at phoenixcontact.net/products.

Here you will also find a quick start guide for using the Axioline F station under Startup+.

10.3 PC Worx

Additional information can be found in the latest “Control technology, I/O systems, and automation infrastructure” catalog or on the Internet at phoenixcontact.net/products.

Axioline F is supported by AX SW Suite 1.50, Service Pack 3, or later.

PC Worx is the integrated programming tool for Phoenix Contact controllers. It includes I/O configuration for INTERBUS and PROFINET, programming according to IEC 61131-3 (IL, FBD, LD, ST, SFC), as well as diagnostics and startup tools. Data can be imported and exported to other tools via numerous interfaces.

In addition to the familiar functions, the tool offers the following special functions for Axioline F:

- Reading the connected bus; all modules will be displayed
- Startup parameterization of the module via a drop-down menu.
- Automatic checking of the maximum number of modules
- Automatic checking of the communications power
- Display of the device rating plates stored on the modules; access via read and write services

10.4 CLIP PROJECT

Additional information can be found in the latest “Marking systems, tools, and mounting material” catalog or on the Internet at phoenixcontact.net/products.

The CLIP PROJECT program enables easy selection, configuration, and ordering of Phoenix Contact products and complete terminal strips, via a Windows user interface. The tool offers the following functions:

- Intelligent product selection with photo support
- Configuration of terminal strips including logic tests
- Immediate color visualization of the created terminal strip
- Autocorrect function, whereby the cover, end bracket, and separating disks are positioned automatically
- Generation of parts lists, CAD drawings, and labeling data
- Data output to a printer, plotter or as a file
- Data output in AutoCAD.dxf format
- Data transfer to MS Excel and MS Word
- CSV interface for data exchange with other CAE systems
- Management of custom databases and material numbers

11 Technical data and ordering data

Observe additional documentation.
For the system data of your network, please refer to the corresponding documentation.

If you are using Axioline F in a system with other product groups, also observe the technical data for these product groups. Please refer to the associated documentation for this technical data.

For safety applications, please refer to the documentation for the safety modules used.

Please refer to the associated documentation when using an AXC controller.

The following values are standard values for the preferred mounting position (wall mounting on horizontal DIN rail).
For different values, please refer to the module-specific documentation.

The technical data does not claim to be complete. Technical modifications reserved.

11.1 Technical data

System data	
Number of devices supported in an Axioline F station	63 devices, maximum
Maximum current consumption of the Axioline F modules	See module-specific data sheet

When configuring an Axioline F station, observe the logic power supply through the bus coupler, the controller or the power module, as well as the current consumption of each device. This data may vary depending on the module and is given in the module-specific documentation. Create a new station or install a power module for the communications power if the maximum current consumption at U_{Bus} is reached.
In addition, the maximum number of devices may be limited by the controller/bus coupler system data. Observe the information in the module-specific documentation.
See also Section “Maximum number of modules” on page 52.

General data (standard values; for deviations see module-specific documentation)	
Ambient temperature	
Ambient temperature (operation)	-25°C ... +60°C
Ambient temperature (operation) for XC versions	-25°C ... +60°C (standard) -40°C ... +70°C (extended, see Section “Tested successfully: Use under extreme ambient conditions” on page 29 and information in the module-specific data sheet)
Ambient temperature (storage/transport)	-40°C ... +85°C
Temperature change	5 K/min (non-condensing permitted)
Permissible humidity (operation/storage/transport)	5% ... 95% (non-condensing)
Permissible air pressure (operation/storage/transport)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20
Protection class	Low-level signal: III, IEC 61140, EN 61140, VDE 0140-1 Low voltage, mounted in an adequate housing with at lease IP54 protection: II, IEC 61140, EN 61140, VDE 0140-1

General data (standard values; for deviations see module-specific documentation) [...]	
Air clearances and creepage distances	Low-level signal: according to EN 60664-1 Low voltage: according to EN 61010-2-201
Housing material	Plastic
Pollution degree	Low-level signal: 2, EN 60664-1 Low voltage: 2, EN 61010-1
Overvoltage category	Low-level signal: II, EN 60664-1 Low voltage: III, EN 61010-1

Mechanical tests (standard values; for deviations see module-specific documentation)	
Vibration resistance according to EN 60068-2-6/IEC 60068-2-6	5g
Shock test according to EN 60068-2-27/IEC 60068-2-27	30g
Bump endurance test according to EN 60068-2-27/IEC 60068-2-27	10g

Conformance with EMC Directive 2004/108/EC (for deviations and detailed values see module-specific documentation)	
Noise immunity test according to EN 61000-6-2	
Electrostatic discharge (ESD), EN 61000-4-2/IEC 61000-4-2	Criterion B
Electromagnetic fields, EN 61000-4-3/IEC 61000-4-3	Criterion A
Fast transients (burst), EN 61000-4-4/IEC 61000-4-4	Criterion B
Transient surge voltage (surge), EN 61000-4-5/EN 61000-4-5	Criterion B
Conducted interference, EN 61000-4-6/IEC 61000-4-6	Criterion A
Noise emission test according to EN 61000-6-3	
Radio disturbance characteristics, EN 55022	Class B

Low-voltage modules: developed according to IEC 61850-3 (for deviations and detailed values see module-specific documentation)	
Electrostatic discharge (ESD) EN 61000-4-2/IEC 61000-4-2	Criterion A
Electromagnetic fields, EN 61000-4-3/IEC 61000-4-3	Criterion A
Fast transients (burst), EN 61000-4-4/IEC 61000-4-4	Criterion A
Transient surge voltage, EN 61000-4-5/IEC 61000-4-5	Criterion A
Conducted interference, EN 61000-4-6/IEC 61000-4-6	Criterion A
Immunity against magnetic fields, EN 61000-4-8/IEC 61000-4-8	300 A/m continuous, 1000 A/m for 1 s
Immunity against attenuated oscillating magnetic fields, EN 61000-4-10/IEC 61000-4-10	100 A/m
Immunity to conducted common mode interference, EN 61000-4-16/IEC 61000-4-16	30 V continuous, 300 V for 1 s
Attenuated oscillating waves, EN 61000-4-18/IEC 61000-4-18	1 kV symmetrical, 2.5 kV asymmetrical
Radio disturbance characteristics, EN 55022	Class B

Interface for Axioline F local bus	
Connection method	Bus base module
Transmission speed	100 Mbps

24 V supply (U_L, U_I, U_O, U_{IO}, U_A)

Nominal voltage	24 V DC
Ripple	± 5%
Maximum permissible voltage range	19.2 V DC ... 30.0 V DC (including all tolerances, ripple included)
Connection	Axioline F connector

The Axioline F local bus supply (communications power) U_{Bus} is generated from communications power U_L (24 V).

230 V supply (U_O)

Nominal voltage	230 V AC
Maximum permissible voltage range	-300 V AC ... 300 V AC (including all tolerances, 50 Hz ... 60 Hz)
Connection	Axioline F connector

NOTE: Damage to the electronics

Provide external protection for the module.

Axioline F local bus supply (supplies the bus logic of the connected modules)

Remark	The U_L communications power is supplied on the bus coupler, controller or power module for the communications power. The communications power U_{Bus} is generated from this communications power U_L and distributed over the bus base modules. These two voltages are not electrically isolated. The current through the local bus I_{Bus} is short-circuit-proof.
Connection	Bus base modules
Communications power (U_{Bus})	5 V DC
Maximum load current in the local bus (I_{Bus})	Please refer to the controller, bus coupler or power module documentation

Voltage dips and interruptions of the I/O supply

Intensity PS1	Interrupt time <1 ms
Time interval between voltage dips	<1 s
Behavior	Criterion A A supply voltage dip of <1 ms has no effect.
Intensity PS2	Interrupt time <10 ms
Time interval between voltage dips	<1 s
Behavior	Criterion C Bus disconnection, all system outputs are reset.

Axioline F connector/connection method/cable cross section

For electrical and/or thermal reasons, it may not be possible to use the minimum conductor cross sections specified here for certain modules. Therefore, always observe the information in the module-specific documentation.

Designation	Axioline F connector
Connection method	Push-in connection
Maximum load capacity of the contacts	8 A
Cable cross section (typical)	0.2 mm² ... 1.5 mm²; AWG 24 ... 16; See Section “Conductor cross sections and stripping/insertion lengths” on page 66
Stripping lengths	8 mm or 10 mm; See Section “Conductor cross sections and stripping/insertion lengths” on page 66

Electrically isolated areas

See module-specific documentation

Test voltages (standard values for the 24 V area; for deviations and low-voltage area see module-specific documentation)

For information about the test voltages between the network and other potential areas, please refer to the documentation for the bus coupler.

Isolating distance	Test voltage
5 V local bus, 24 V communications power/functional earth ground	500 V AC, 50 Hz, 1 min
5 V local bus, 24 V communications power/24 V voltage of the digital or analog inputs/outputs	500 V AC, 50 Hz, 1 min
24 V voltage of the digital or analog inputs/outputs/functional earth ground	500 V AC, 50 Hz, 1 min

Approvals

For the latest approvals, please visit phoenixcontact.net/products.

11.2 Ordering data

The complete product catalog is available in electronic form at phoenixcontact.net/products.

Ordering data for the Axioline F modules and corresponding connectors

For the ordering data for the Axioline F modules and corresponding connectors, please refer to the module-specific documentation or the “Control technology, I/O systems, and automation infrastructure” catalog.

Ordering data for accessories

Description	Type	Order No.	Pcs./Pkt.
Tools			
Screwdriver, bladed, VDE-insulated, size: 0.4 x 2.5 x 80 mm, 2-component grip, with non-slip grip	SZS 0,4x2,5 VDE	1205037	1
Crimping pliers for ferrules according to DIN 46228 Parts 1+4, 0.25 - 6.0 mm², lateral entry, trapezoidal crimp	CRIMPFOX 6	1212034	1
Crimping pliers for ferrules according to DIN 46228 Parts1+4, 0.5 - 6 mm², lateral entry, trapezoidal crimp	CRIMPFOX 6T	1212037	1
Crimping pliers for ferrules according to DIN 46228 Parts 1+4, 0.25 - 6 mm², front entry, trapezoidal crimp	CRIMPFOX 6T-F	1212038	1
Measuring probes	MPS-MT 1-S4-B RD	1982800	50
Marking material			
Zack marker strip for Axioline (device marking), in 2 x 20.3 mm pitch, unprinted, 25-section, for individual marking with B-STIFT 0.8, X-PEN, or CMS-P1-PLOTTER	ZB 20,3 AXL:UNPRINTED	0829579	25
Zack marker strip flat for Axioline (connector/slot marking), in 1 x 5.8 mm + 4 x 10.0 mm pitch, unprinted, 50-section, for individual marking with B-STIFT 0.8, X-PEN, or CMS-P1-PLOTTER	ZBF 10/5,8 AXL:UNPRINTED	0829580	50
Zack marker strip, unprinted: 10-section, for individual marking with B-STIFT, ZB-T or CMS system, enough to mark 100 terminal blocks, for terminal block width of 10.2 mm, color: white	ZB 10:UNBEDRUCKT	1053001	10 strips with 10 markers
Zack marker strip, flat, unprinted: 10-section, for individual marking with B-STIFT or ZBF T, for 100 terminal blocks, color: white	ZBF 5:UNBEDRUCKT	0808642	10 strips with 10 markers
Insert label, Roll, white, unlabeled, can be labeled with: THERMOMARK ROLL, THERMOMARK ROLL X1, THERMOMARK X, THERMOMARK S1.1, mounting type: snapped into marker carrier, lettering field: 35 x 28 mm (for H housing)	EMT (35X28)R	0801602	500 individual labels
Insert label, Roll, white, unlabeled, can be labeled with: THERMOMARK ROLL, THERMOMARK ROLL X1, THERMOMARK X, THERMOMARK S1.1, mounting type: snapped into marker carrier, lettering field: 35 x 46 mm (for F housing)	EMT (35X46)R	0801604	500 individual labels
Insert label, Roll, white, unlabeled, can be labeled with: THERMOMARK ROLL, THERMOMARK ROLL X1, THERMOMARK X, THERMOMARK S1.1, mounting type: snapped into marker carrier, lettering field: 35 x 18.7 mm (for F-BK housing)	EMT (35X18,7)R	0801831	500 individual labels
Mounting material			
Patch cable, CAT6, pre-assembled, different lengths	FL CAT6 PATCH ... see “Interface technology and switching devices” catalog		
Power supplies	QUINT-PS ...	See “Interface technology and switching devices” catalog	
DIN rail DIN EN 50022, 2 meters (corresponds to TH 35-7.5 according to EN 60715)	NS 35/7,5 gelocht NS 35/7,5 ungelocht	0801733 0801681	

Description	Type	Order No.	Pcs./Pkt.
Lütze: Mounting straps with low DIN rail, height 7.5 mm, according to DIN EN 50022 Plate width 120 mm Plate width 160 mm	Lütze: SN 120 SN 160	Lütze: 330498 330738	
Standard end bracket; snapped on without tools	CLIPFIX 35-5	3022276	50
End bracket for use in the event of vibrations or installation on vertical DIN rail; to be secured with screws	E/AL-NS 35	1201662	50
Ground terminal block, connection method: screw connection, cross section: 0.2 mm^2 - 4 mm^2, AWG 24 - 12, 5.2 mm wide, Color: green-yellow, mounting type: NS 35/7.5, NS 35/15, NS 32 (can be used as end bracket)	USLKG 2,5 N	0441119	50
Ground terminal block: connection method: screw connection, cross section 0.2 mm^2 - 6 mm^2, AWG 24 - 10, 6.2 mm wide, Color: green-yellow, mounting type: NS 35/7.5, NS 35/15, NS 32 (can be used as end bracket)	USLKG 5	0441504	50
Connection terminal block, connection method: screw connection, load current: 41 A, cross section: 0.5 mm^2 - 6 mm^2, width: 7 mm, color: green-yellow	AK G GNYE	0421029	50
Ferrules			
Ferrules with insulating collar (plastic collar); according to DIN 46228-4; sleeve length: 8 mm	AI ...	See “Marking systems, tools, and mounting material” catalog	
Cross section 0.5 mm^2	AI 0,5 - 8 WH -1000	3200881	1000
Cross section 0.75 mm^2	AI 0,75- 8 GY -1000	3200894	1000
Cross section 1.0 mm^2	AI 1 - 8 RD -1000	3200904	1000
Ferrules without insulating collar (plastic collar), according to DIN 46228-1; length: 8 mm	A ...	See “Marking systems, tools, and mounting material” catalog	
Cross section 0.5 mm^2	A 0,5 - 8	3202481	1000
Cross section 0.75 mm^2	A 0,75- 8	3202504	1000
Cross section 1.0 mm^2	A 1 - 8	3202517	1000
Ferrules with insulating collar (plastic collar); according to DIN 46228-4; sleeve length: 10 mm	AI ...	See “Marking systems, tools, and mounting material” catalog	
Cross section 0.5 mm^2	AI 0,5 -10 WH	3201275	100
Cross section 0.75 mm^2	AI 0,75-10 GY	3201288	100
Cross section 1.0 mm^2	AI 1 -10 RD	3200182	100
Cross section 1.5 mm^2	AI 1,5 -10 BK	3200195	100
Ferrules without insulating collar (plastic collar), according to DIN 46228-1; length: 10 mm	A ...	See “Marking systems, tools, and mounting material” catalog	
Cross section 0.5 mm^2	A 0,5 -10	3202494	1000
Cross section 0.75 mm^2	A 0,75-10	3200234	1000
Cross section 1.0 mm^2	A 1 -10	3200250	1000
Cross section 1.5 mm^2	A 1,5 -10	3200276	1000
Material for shield connection		See “Marking systems, tools, and mounting material” catalog	

Please observe the available space when selecting the shield connection clamps.

Axioline shield connection set (contains 2 shield bus holders and 2 SK 5 shield connection clamps)	AXL SHIELD SET	2700518	1

Description	Type	Order No.	Pcs./Pkt.
Shield connection clamp for applying the shield on busbars; automatic fixing with spring	SKS ...		
3 mm ... 8 mm diameter	SKS 8	3240210	10
3 mm ... 14 mm diameter	SKS 14	3240211	10
5 mm ... 20 mm diameter	SKS 20	3240212	10
Shield connection clamp for applying the shield on busbars; to be secured with screw	SK ...		
8 mm diameter	SK8	3025163	10
14 mm diameter	SK14	3025176	10
20 mm diameter	SK20	3025189	10
35 mm diameter	SK35	3026463	10
Support bracket (on mounting plate or for busbar)	AB	See “Marking systems, tools, and mounting material” catalog	
Neutral busbar, 10 mm x 3 mm, 1 m long	NLS-CU 3/10 SN 1000 MM	0402174	1
Connection terminal block, connection method: screw connection, load current: 41 A, cross section: 0.5 mm² - 6 mm², width: 7 mm, color: silver	AK 4	0404017	50
Cable for connecting PLC relays			
System cable for eight channels	VIP-CAB-FLK14/AXIO/0,14/ ...		
Cable length: 1 m	VIP-CAB-FLK14/AXIO/0,14/1,0M	2901605	
Additional cable lengths	VIP-CAB-FLK14/AXIO/0,14/ ..		
Connecting cable			
Connecting cable for connecting the controller to a PC for PC Worx, USB A to micro USB B, 2 m in length	CAB-USB A/MICRO USB B/2,0M	2701626	

Ordering data for documentation

Description	Type	Order No.	Pcs./Pkt.
“INTERBUS & AUTOMATION - Terms and definitions” user manual	IBS TERM RG UM E	2743695	1
“Axioline F: Diagnostic registers, and error messages” user manual	UM EN AXL F SYS DIAG	–	–

The comprehensive documentation listed above and all module-specific documentation can be downloaded at phoenixcontact.net/products.

Make sure you always use the latest documentation.

A Technical appendix

A 1 Use of Axioline F modules at an elevation of more than 3000 meters

This section applies to modules of the Axioline F product group that are operated with a DC voltage of < 60 V DC.

WARNING: Dangerous contact voltage/loss of safety function

This section does **not** apply to the following modules or applications:

- Modules that are not operated with PELV (Protective Extra Low Voltage) (e.g. 120 V or 230 V)
- Modules with safety functions (e.g. SafetyBridge, Profisafe)
- Use of a safe signal path
- Use in potentially explosive areas (IEC Ex, ATEX, Hazardous Location).
- XC variants

In these cases, consider the individual module or application separately.

The Axioline F modules are approved for use up to an elevation of 3000 m above sea level, see “Technical data” on page 107.

The maximum permissible ambient temperature decreases at elevations above this level. Therefore, keep temperature derating in mind when using the modules at an elevation greater than 3000 m up to 5000 m.

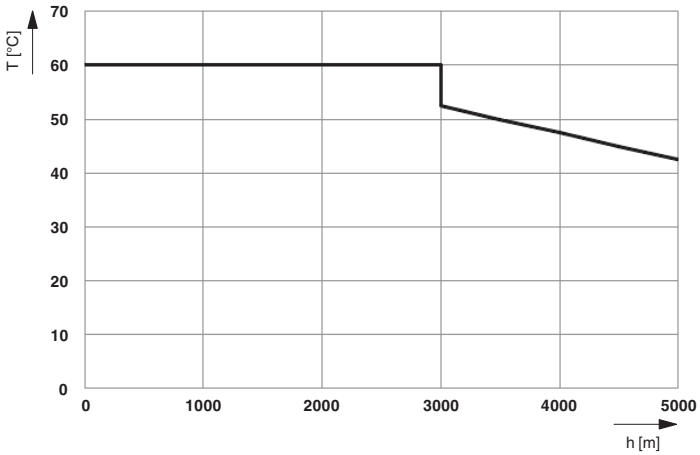


Figure A-1 Derating of the permissible ambient temperature depending on the operating elevation

Key:

T [°C]	Maximum ambient temperature (operation) in °C
h [m]	Elevation in m

A 2 Transmission speed

Within an Axioline F station communication takes place over a fast, cyclic and equidistant local bus. The typical cycle time is less than 50 µs.

A 3 Typical cycle time on the local bus

The typical cycle time on the local bus is calculated according to the formula:

$$t = 2\ \mu s + n * 1\ \mu s$$

Where:

t	Typical cycle time on the local bus
n	Number of modules attached to the bus coupler

The typical cycle time for a station of five modules is:

$$t = 2\ \mu s + n * 1\ \mu s$$

$$t = 2\ \mu s + 5 * 1\ \mu s$$

$$t = 7\ \mu s$$

A 4 Response times for an Axioline F system

In general, the response time for an I/O system is the time from reading in the input, processing in the controller to setting the output.

It includes:

– The time for copying to the bus heads (bus coupler or controller; 1 in Figure A-2)
– The cycle time of the local bus (2)
– The conversion time in the I/O modules (3)
– The update time of the higher-level network (4)
– The processing time (cycle time) in the controller (5)
– If applicable, the required synchronization latency periods between the individual subsystems (Shannon sampling theorem)

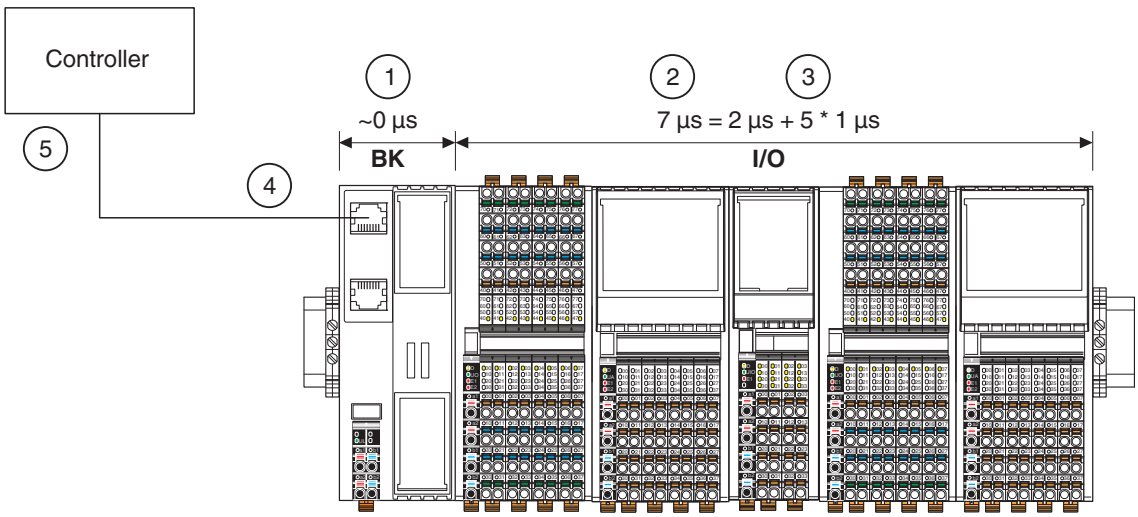


Figure A-2 Response times of the overall system

Typical processing times for an Axioline F system:

Table A-1 Typical processing times in the overall system (example)

1	Time for copying to the Axioline F bus head	~ 0 µs
2	Cycle time of the Axioline F local bus	Here: 7 µs
3	Conversion time in the Axioline F I/O modules (depends on the I/O application)	E.g., 100 µs, 10 µs, 1 µs here: 1 µs per module
4	Cycle time of the higher-level network (depends on the higher-level network)	E.g., PROFINET IRT with 250 µs
5	Controller cycle time	1 ms
6	Synchronization times	In the worst case, the times of all individual components are double

The example makes it clear that when determining the response time of the overall system, Axioline F represents the smallest proportion by far and therefore can normally be ignored.

A 5 Communication objects

Communication objects are stored on each module. You can access these objects with read, write or read and write services via the PDI channel or via the hardware configurator (e.g., PC Worx or STEP 7).

For a detailed description of all communication objects, please refer to the basic profile on the Internet at www.interbusclub.com under “Downloads, INTERBUS Profiles”.

This document describes only the objects used for Axioline F. These include general standard objects and manufacturer-specific application objects.

The following applies for the tables below:

Table A-2 Key for the following tables

Abbreviation	Meaning
A	Number of elements
L [bytes]	Length of the element in bytes
R	Read
W	Write

Table A-3 Object and data types

Object type	Data type	Meaning
Var		Object with only one element (simple variable)
Array		Object with several simple variables of the same data type with the same length
Record		Object with several simple variables of different data types or of the same data type with different lengths
	Visible string	Byte string with only printable ASCII characters The byte string finishes with 00_{hex} (null-terminated) and is therefore one byte longer than the user data.
	Octet string	Byte string with any contents
	Unsigned 8	Value without sign, only positive values from 00_{hex} ... FF_{hex}
	Unsigned 16	Value without sign, only positive values from 0000_{hex} ... $FFFF_{hex}$
	Unsigned 32	Value without sign, only positive values from 0000 0000_{hex} ... FFFF $FFFF_{hex}$

Visible string:

In the following tables and the module-specific data sheets, the null termination of a visible string is not provided in the Content column, only the pure user data is stated. This means that there is always one byte more stated for the length of the object than is available as user data. In the following tables this is indicated by “+1”. In the data sheets, the entire length of the object is always stated.

A 5.1 Function blocks for access to the objects under PC Worx

Under PC Worx, you can access the PDI objects via function blocks that are stored in the axl_pdi_vx_yy library. The library can be downloaded at phoenixcontact.net/products.

Select the pc_worx_6_x_AXL_PDI_x_yy.exe file to install the library under PC Worx in the download area of an Axioline F bus coupler.

Detailed documentation is provided as online help for each of the function blocks.

When you access an object that is not implemented, you will receive a corresponding error message.

A 5.2 General standard objects

The standard objects include:
- Objects for identification
- Object for multilingual support
- Objects with object descriptions
- Objects for diagnostics
- Objects for process data management

A 5.2.1 Objects for identification

These objects describe the manufacturer, the device, and device application and form the device rating plate.

The bold entries in Table A-4 are identical for all Axioline F modules from Phoenix Contact. All other entries may vary depending on the individual module.

Table A-4 Objects for identification (device rating plate)

Index [hex]	Object name	Object type	Data type	A	L [bytes]	Rights	Meaning	Content/example
Manufacturer								
0001	VendorName	Var	Visible string	1	15 + 1	R	Manufacturer name	**Phoenix Contact**
0002	VendorID	Var	Visible string	1	6 + 1	R	Manufacturer ID	**00A045**
0003	VendorText	Var	Visible string	1	48 + 1	R	Manufacturer text	**Components and systems for industrial automation**
0012	VendorURL	Var	Visible string	1	29 + 1	R	Manufacturer URL	**www.phoenixcontact.com**
Module - General								
0004	DeviceFamily	Var	Visible string	1	57 + 1, max.	R	Device family	... (e.g., I/O analog IN)
0006	ProductFamily	Var	Visible string	1	32 + 1	R	Product range	**AXL F or AXL F XC**
000E	CommProfile	Var	Visible string	1	3 + 1	R	Communication profile	**633**
000F	DeviceProfile	Var	Visible string	1	4 + 1	R	Device profile	**0010**
0011	ProfileVersion	Record		2		R	Profile version	
.1	BuildDate	Var	Visible string	1	10 + 1	R	Version date	2011-12-07
..2	Version	Var	Visible string	1	19 + 1 39 + 1, max.	R	Version ID	Basic profile V2.0

Table A-4 Objects for identification (device rating plate)

Index [hex]	Object name	Object type	Data type	A	L [bytes]	Rights	Meaning	Content/example
003A	VersionCount	Array		4		R	Version count; Unique consecutive numbering for the version of the corresponding component	E.g., 0007 0001 0000 0000
.1	ProfileVersion	Var	Unsigned 16	1	2	R	Profile 06 for basic profile V2.0	xx xx_{hex} (e.g., 0007)
.2	PChVersion	Var	Unsigned 16	1	2		PDI version	xx xx_{hex} (e.g., 0001)
.3	HardwareVersion	Var	Unsigned 16	1	2		Hardware version	xx xx_{hex} (e.g., 0001)
.4	FirmwareVersion	Var	Unsigned 16	1	2		Firmware version	xx xx_{hex} (e.g., 0001)
Module - Specific (for a specific module)								
0005	Capabilities	Array	Visible string	N	8	R	Properties	... (e.g.: Nothing) See “Properties ($0005_{hex: capabilities}$)” on page 121
0007	ProductName	Var	Visible string	1	57 + 1, max.	R	Product name	... (e.g., AXL F AI4 I 1H)
0008	SerialNo	Var	Visible string	1	10 + 1	R	Serial number	xxxxxxxxxx (e.g., 12345123456)
0009	ProductText	Var	Visible string	1	57 + 1, max.	R	Product text	... (e.g., 4 analog input channels)
000A	OrderNumber	Var	Visible string	1	7 + 1	R	Order No.	xxxxxxx (e.g., 2688491)
000B	HardwareVersion	Record		2		R	Hardware version	
.1	BuildDate	Var	Visible string	1	10 + 1	R	Version date	YYYY-MM-DD
..2	Version	Var	Visible string	1	39 + 1, max.	R	Version ID	xxx (e.g., 01)
000C	FirmwareVersion	Record		2		R	Firmware version	
.1	BuildDate	Var	Visible string	1	10 + 1	R	Version date	YYYY-MM-DD
..2	Version	Var	Visible string	1	39 + 1, max.	R	Version ID	xxx (e.g., --, V1.10)
000D	PChVersion	Record		2		R	Parameter channel version	
.1	BuildDate	Var	Visible string	1	10 + 1	R	Version date	YYYY-MM-DD
..2	Version	Var	Visible string	1	39 + 1, max.	R	Version ID	xxx (e.g., --, V1.00)
0037	DeviceType	Var	OctetString	1	8	R	Module identification	xx xx xx xx xx xx xx xx_{hex} (e.g., 00 20 00 08 00 00 00 $A6_{hex}$)
Use of the device								
0014	Location	Var	Visible string	1	57 + 1, max.	R/W	Installation location	... (e.g., Please fill in ...); Can be filled out by the user.
0015	EquipmentIdent	Var	Visible string	1	57 + 1, max.	R/W	Equipment identifier	... (e.g., Please fill in ...); Can be filled out by the user.
0016	ApplDeviceAddr	Var	Unsigned 16	1	2	R/W	Application-specific device address	... (e.g., Please fill in ...); Can be filled out by the user.

Properties (0005_{hex}: capabilities)

This object indicates the properties and functions the device has in addition to the basic functions. At the moment, the following properties exist:

Table A-5 Properties

Content	Meaning
Nothing	No additional functions
SyncI_0	The slave supports synchronization of the inputs.
SyncO_0	The slave supports synchronization of the outputs.

A 5.2.2 Object for multilingual support

With this object you can read the currently valid language and, if more languages are available, select one.

Table A-6 Object for multilingual support

Index [hex]	Object name	Object type	Data type	A	L [bytes]	Rights	Meaning	Content/example
0017	Language	Record		2		R/W	Object for language selection of the device; The currently valid language may be accessed or changed here.	
.1	LanguageCode	Var	Visible string	1	5 + 1	R/W	Language code	**en-us**
.2	NameLanguage	Var	Visible string	1	49 + 1, max.	R/W	Language name	**English**

A 5.2.3 Object with object descriptions

For startup and servicing it is not only necessary to know the target parameterization, but also the actual parameterization of the device. This requires that you know the implemented application objects. These objects and their descriptions can be read with the object description. These objects are only applicable to tools and are therefore not described in more detail here. For a more detailed description, please refer to the basic profile, if necessary.

Table A-7 Objects for object description

Index [hex]	Object name	Object type	Data type	A	L [bytes]	Rights	Meaning
0038	ObjDescrReq	Record	Record	2	2; 1	R/W	Description of the object requested
0039	ObjDescr	Record	Record	16		R/W	Description of the object whose index was requested

A 5.2.4 Objects for diagnostics

These objects describe the diagnostic state of the device and any connected I/O devices, as well as options for resetting diagnostics.

Table A-8 Objects for diagnostics

Index [hex]	Object name	Object type	Data type	A	L [bytes]	Rights	Meaning
0018	DiagState	Record		6		R	Diagnostic state
.1	Lfd.Nr.	Var	Unsigned 16	1	2	R	Consecutive error number since the last reset or error memory reset
.2	Priority	Var	Unsigned 8	1	1	R	Priority of the message. 1: highest priority
.3	Channel/ Group/Module	Var	Unsigned 8	1	1	R	Channel, group or module on which the error occurred. FF: entire device
.4	Code	Var	Octet string	1	2	R	Error code
.5	MoreFollows	Var	Bit string 8	1	1	R	Additional information on malfunction; not used with Axioline F up to now
.6	Text	Var	Visible string	1	50 + 1, max.	R	Plain text message. Default: status OK
0019	ResetDiag	Var	Unsigned 8	1	1	W	Reset diagnostics: deletes the corresponding diagnostics memory and acknowledges the message

For the specific content of these objects, please refer to the module-specific data sheet.

A 5.2.5 Objects for process data management

These objects describe the IN and/or OUT process data.

Table A-9 Objects for process data management

Index [hex]	Object name	Object type	Data type	A	L [bytes]	Rights	Meaning
0024	ResetCode	Array	Unsigned 16	N	N * 2	R/W	Substitute value behavior when process data is missing
0025	PDIN	Octet string	Octet string	1	PD length	R	IN process data (from the device to the master) If the process data is structured (e.g., several channels), this object should also be structured and individual structure elements should be accessed via the subindex.
0026	PDOUT	Octet string	Octet string	1	PD length	R/W	OUT process data (from the master to the device) If the process data is structured (e.g., several channels), this object should also be structured and individual structure elements should be accessed via the subindex.
0027	GetExRight	Simple variable	Unsigned 8	1	1	R/W (access-protected)	Request exclusive write access
002F	PDOUT_Subst	Octet string	Octet string	1	PD length	R/W	Substitute value for the OUT process data in the event of an error
0031	PDIN_Subst	Octet string	Octet string	1	PD length	R/W	Substitute value for the IN process data in the event of an error
003B	PDIN_Descr	Record	Record	N x 3		R	Description of the IN process data structure N = number of elements of the PDIN object
.1	Type	Visible string	Visible string	1	7 + 1	R	Type of I/O data item
.2	ChNo	Unsigned 16	Unsigned 16	1	2	R	Number of channels
.3	ChLength	Unsigned 16	Unsigned 16	1	2	R	Length of a channel
003C	PDOUT_Descr	Record	Record	N x 3			Description of the OUT process data structure N = number of elements of the PDOUT object
.1	Type	Visible string	Visible string	1	7 + 1	R	Type of I/O data item
.2	ChNo	Unsigned 16	Unsigned 16	1	2	R	Number of channels
.3	ChLength	Unsigned 16	Unsigned 16	1	2	R	Length of a channel

For the specific content of objects 0024_{hex} to 0031_{hex}, please refer to the module-specific data sheet.

Objects $003B_{hex}$ and $003C_{hex}$ are only applicable to tools. For a more detailed description, please refer to the basic profile, if necessary.

A 5.3 Manufacturer-specific application objects

Manufacturer-specific application objects are module-specific and are documented in each of the module-specific data sheets.

For example, parameterization of individual channels for analog modules or parameterization of filter times for digital input modules is implemented using these objects.

A 5.4 Value ranges

Make sure to observe the permissible value ranges during module parameterization.
If invalid values are specified for an object, these are not saved and an error message is generated.

A 6 Synchronization

A 6.1 Synchronization in general

Some Axioline F modules offer a synchronization option.

To use this property, synchronization must be consistently supported from the clock master in the higher-level network to the I/O modules.

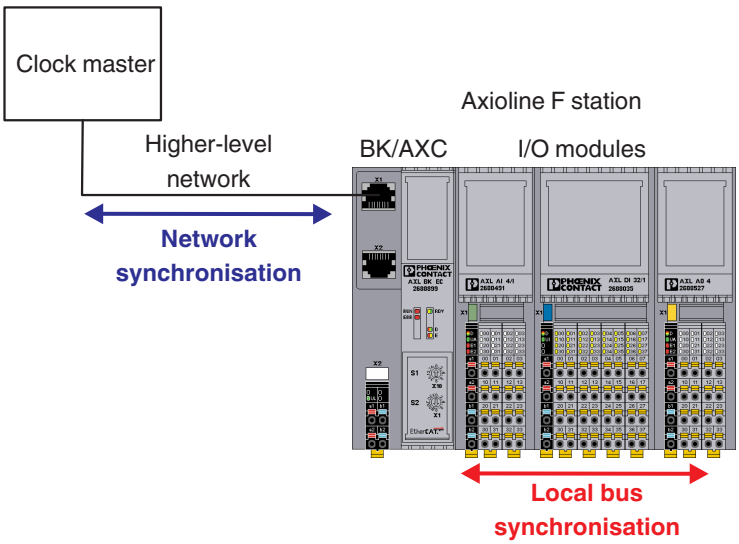


Figure A-3 Network and local bus synchronization

Clock master

In the overall system, the clock master is the unit which determines the synchronization times and time points and sends out a synchronization clock signal. Generally this is the network controller.

Higher-level network

The higher-level network is the communication system which links the controller and the head of the Axioline F station. This network must support synchronization.

The head of an Axioline F station can be a bus coupler or an AXC controller. Currently, only some bus couplers support synchronization.

Bus coupler

The bus coupler is the link between the higher-level network and the Axioline F station. It must support synchronization according to the definition of the higher-level network and transfers the synchronization parameters and signals to the Axioline F station.

Examples of bus couplers which support the synchronization mechanisms for a network

Table A-10 Synchronization mechanisms of the bus couplers

Network	Bus coupler	Synchronization mechanism of the network	Remark
EtherCAT®	AXL F BK EC	SM-synchronous	Asynchronous
		DC-synchronous	The bus cycle of the local bus is synchronized with the EtherCAT® cycle. The implemented distributed clock unit is used to synchronize the processes in a temporal manner.
Sercos	AXL F BK S3	Asynchronous	Asynchronous
		Clock-synchronous	Cyclical master-slave communication with one of the cycle times to be selected during initialization.

I/O modules

Not all I/O modules support local bus synchronization
In the case of modules which support local bus synchronization, the property SyncI_0 (synchronization of the inputs) or SyncO_0 (synchronization of the outputs) is specified in object 0005_{hex} Capabilities.

In the case of an I/O module which works asynchronously, its input or output signals are read or output at a time point determined by the higher-level network. The data is consistent, i.e., all data for a module is processed at the same time point.

In order for the clock master in the higher-level network to calculate the exact time point for an input/output, the module provides the bus coupler/Axiocontrol with various information, such as the minimum possible repeat time, signal processing length, and required run-up for the transfer of the data. These values are either permanently set in the module or are dynamically determined based on the parameterization.

The values are read by the bus coupler/Axiocontrol and made available to the clock master. The synchronization time point determined by the clock master, which can be different for each module, is set by the bus coupler/Axiocontrol in each module that can be synchronized.

In this way, synchronism requirements within a station of a few nanoseconds are achieved. The precision of the overall system is essentially determined by the higher-level network options and its clock master.

Modules which do not support synchronous processing do not affect a synchronous system. They do not accept or transfer the values at a specific time, instead they do this as fast as possible.

A 6.2 Synchronization options

Modules can either support synchronization or not. When a module can be synchronized, you can use the function or deactivate it, depending on the application.

Table A-11 Synchronization options

Module property	Use	Remark
Cannot be synchronized	Asynchronous	
Can be synchronized	Asynchronous	If synchronization is not required for your application or not useful, then deactivate synchronous mode.
	Synchronous	The modules are to be synchronized. Select the modules in a suitable manner and set their parameters accordingly. See also Section A 6.3, “Conditions for local bus synchronization”.

A 6.3 Conditions for local bus synchronization

To make good use of this function, the following conditions must be met:

1. The higher-level controller must support synchronization mechanisms for the network.
2. The bus coupler must support synchronization mechanisms for the network.
3. At least one module in the local bus must support local bus synchronization.

A 7 Switch-on behavior and substitute value behavior

Substitute values for Axioline F

The term substitute value is used for the behavior when switching on the power supply as well as for the behavior when valid process is missing.

Switch-on behavior (power-on behavior)

The switch-on behavior defines the module behavior after switching on the power supply.

An Axioline F module has this behavior until it receives valid process data.

Substitute value behavior (failsafe behavior)

The substitute value behavior defines the module behavior when process data is missing.

Once a module has exchanged valid process data for the first time after switching on the power supply, the substitute value behavior is activated.

If valid process data is missing (e.g., in the event the connection is aborted), the module changes to the substitute value behavior.

Typically, the substitute value behavior is parameterized using the engineering tool or object 0024_{hex} "Substitute value behavior when process data is missing". The following values are available:

Table A-12 Possible settings for the substitute value behavior

Code (hex)	Behavior	Example: AXL F AO4 1H
0000	Output of zero values	Output of zero values (0 V/0 mA/4 mA) at the output
0001	Output of final values	Output of final values (10 V/5 V/20 mA) at the output
0002	Hold last value	Hold last value
0003	Substitute value	Acceptance of the substitute values of the "Replace OUT process data" object ($002F_{hex}$)

To determine whether, and if yes, which substitute value behavior can be parameterized for a module, please refer to the module-specific data sheet.

B Appendix for document lists

B 1 List of figures

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Section 3

Section 4

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Section 8

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Appendix A

B 2 List of tables

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Section 9

Appendix A

Appendix C

B 3 Stichwortverzeichnis

Numerics

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C Revision history

Table C-1 Revision history

Revision	Date	Contents		
00	2010-02-16	First publication		
01	2011-08-22	Entire document		Corrections Addition: new modules, housings, connectors
02	2011-09-08	Entire document		Corrected terminology (push-in technology)
03	2013-12-19	Entire document		Complete revision Change: Axioline -> Axioline F Change: Axio bus -> Axioline F local bus Addition: new modules, housings, connectors Addition: AWG
		Section 1.2	Documentation on the Internet	Correction
		Section 4.4	Color and marking	Addition: colors, function identification, marking
		Section 5.4	Reporting diagnostics via PDI	New: reporting diagnostics via PDI
		Section 6.1	Basic information about mounting	Addition: Warning “NOTE: Disregarding this warning may result in malfunction”
				Revision: mounting position
				Revision: maximum number of modules
		Section 6.3	Mounting/removal	Addition: F-BK bus coupler housing
		Section 9	Technical data and ordering data	Corrections/additions
		Appendix A3	Response times for an Axioline F system	Revision
		Appendix A5	Communication objects	Addition: visible string
		Appendix A 5.2	General standard objects	Corrections/additions
		Appendix A 6	Synchronization	New
05	2015-06-18	Entire document		Complete revision of all sections Additions – New modules, housings, connectors – Low voltage area – Safety notes

Table C-1 Revision history

Revision	Date	Contents		
06	2017-02-22	Section 6.2	Stripping/ insertion lengths	Warning message: recommendation for Crimping
		Section 8	Diagnostics and status indicators	Addition: notes
		Section 8.3.1	LEDs on the power connectors	Correction LEDs E1 and E2
		Appendix A	Technical appendix	New: Use of Axioline F modules at an elevation of more than 3000 meters
		Entire document		Notes on safety modules