Axioline F: system and installation

User manual

User manual

Axioline F: system and installation

UM EN AXL F SYS INST, Revision 07 2018-11-22

This user manual is valid for::

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

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1 For your safety

Read this user manual carefully and keep it for future reference.

1.1 Identification of warning notes

This symbol indicates hazards that could lead to personal injury.

There are three signal words indicating the severity of a potential injury.

DANGER
Indicates a hazard with a high risk level. If this hazardous situation is not avoided, it will result in death or serious injury.

WARNING
Indicates a hazard with a medium risk level. If this hazardous situation is not avoided, it could result in death or serious injury.

CAUTION
Indicates a hazard with a low risk level. If this hazardous situation is not avoided, it could result in minor or moderate injury.

This symbol together with the **NOTE** signal word warns the reader of actions that might cause property damage or a malfunction.

Here you will find additional information or detailed sources of information.

1.2 Qualification of users

The use of products described in this user manual is oriented exclusively to electrically skilled persons or persons instructed by them. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.

1.3 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. Phoenix Contact accepts no liability if the modules are used for anything other than their designated use.

1.4 Product changes

Modifications to hardware and firmware of the device are not permitted.

Incorrect operation or modifications to the device can endanger your safety or damage the device. Do not repair the device yourself. If the device is defective, please contact Phoenix Contact.

2 Documentation landscape of Axioline F

2.1 Available documents

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

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

Table 2-1 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 messages for the system and provides remedial measures.
Module: basic information on a specific module	
Packing slips	A packing slip is provided with the module upon delivery. It contains key information for the electrical installation of a module or group of modules. This includes, for example: – Short description – Safety notes – Mounting and removal – Terminal point assignment
User manuals for safety modules and controllers	The user manual for each safety module or controller contains the complete information needed for use. This includes at the very least: – Description – Mounting, removal and power supply – Startup under PC Worx – Technical data and ordering data
Module-specific data sheets	The data sheet for each module contains the complete information needed for use. This includes at the very least: – Function description – Accessories – Technical data – Connection assignment or terminal point assignment – Local diagnostic and status indicators – Connection examples

Table 2-1 Axioline F documentation [...]

Document	Contents
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 module step by step using an example.
Application notes	Application notes provide additional information about special topics.
Up-to-date pdf	
Generate product PDF	By clicking the “Generate product PDF” button on the Internet, you can access up-to-date information on the product (see Section “Documentation on the Internet” on page 11). This includes at the very least: – Short description – Technical data – Drawings – Approvals

2.2 Documentation on the Internet

The 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 selected up-to-date 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

On 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 bus coupler.

2.3 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.

3 The Axioline F product group

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

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 with regard to response times and installation, robust in terms of 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.

3.2 Features

Axioline F is fast

Axioline F features shortest response times and fast 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.

- 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 is particularly robust with regard to its design and mechanics. 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, provide an extended temperature range. The coated modules open up even more applications.

- Vibration and shock resistant
- High noise immunity even in environments subject to strong electromagnetic influences
- Future-proof – thanks to reduced radiation it can even be used when reducing the 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 block. The color coding of the contact points enables fast and intuitive wiring – this saves installation time and therefore 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 the application

3.3 Structure of an Axioline F station

An Axioline F station consists of individual modules, which 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.

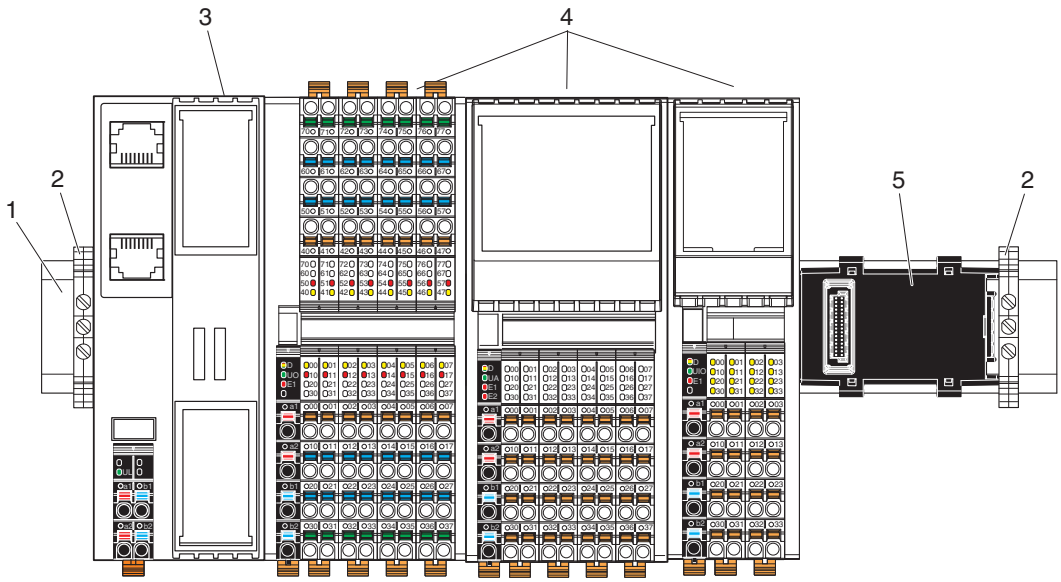


Figure 3-1 Example of an Axioline F station

1 DIN rail
2 End bracket (for securing the station; see “End brackets” on page 53)
3 Bus head (bus coupler or controller)
4 Input or output modules
5 Bus base module

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

3.4 Product description

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

The Axioline F modules consist of an electronics 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.

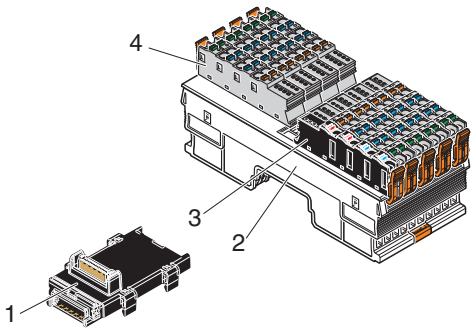


Figure 3-2 Components of an Axioline F I/O module

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:

- Controllers
- 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 measurement
- 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 range and the low voltage range. You can use low-voltage modules and extra-low voltage modules directly next to each other within an Axioline F station.

Table 3-1 Voltage ranges for Axioline F

Voltage range	Product groups	Nominal voltage used	Permissible voltage range	Examples
Protective extra-low voltage	Low-level signal modules	24 V DC	19.2 V DC … 30 V DC	AXL F DI16/4 2F
		48 V DC, 60 V DC	-100 V DC … 100 V DC	AXL F DI8/2 48/60DC 1F
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 and removal” on page 49.

Mounting location

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

The compact structure means that the Axioline F modules can be installed in standard junction 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 49.

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 49.

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.

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 54.

Connectors

Axioline F modules have connectors for connecting 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 and 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 voltage for the module’s I/O is supplied separately to each I/O module (see Section “Connecting the power supplies” on page 72).

I/O connection

Sensors and actuators are connected using connectors (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

On the bottom of each module, there is at least one FE spring (metal contact) which establishes the connection to functional ground 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.

Startup+

For information on Startup+, please refer to Section 11, “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 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 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 pluggable 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.

3.5 Approvals

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

Observe any notes and restrictions on the approvals in the module-specific packing slip or in the module-specific documentation.

Searching 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 3-3 Searching for order number 2688310

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

The current approvals of the product are listed.

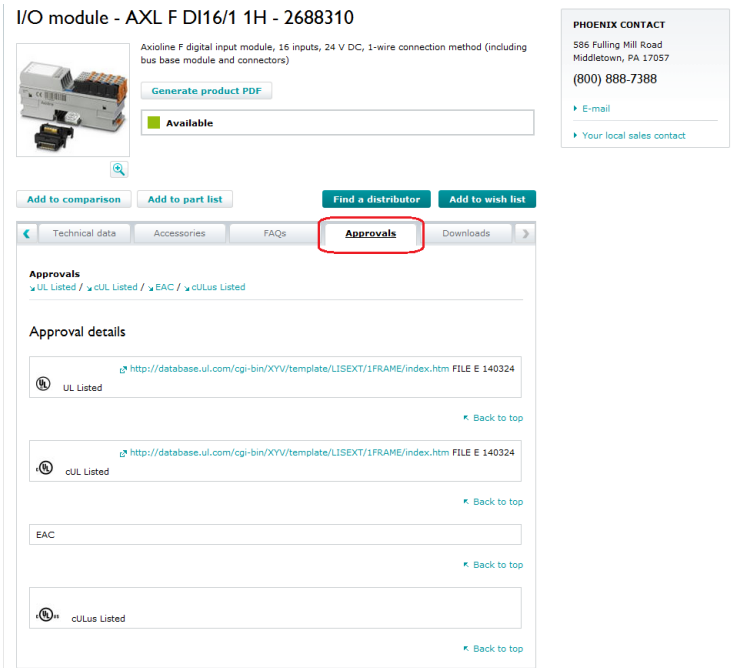


Figure 3-4 Current approvals of product 2688310

Searching 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 3-5 Searching for AXL F

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

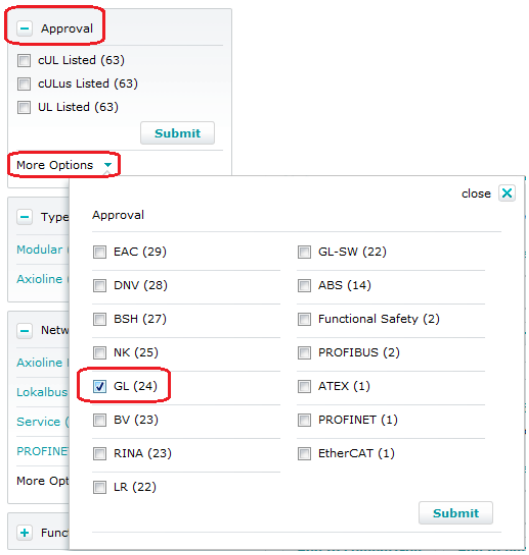


Figure 3-6 Selecting GL approval

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

4 Overview of Axioline F modules

4.1 Axioline F order designation

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

	Product group	Function and number of inputs or 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 4-1 Structure of the order designations

Product group	AXL F	Axioline F
	AXC	Axiocontrol for the direct control of Axioline F I/Os
	AXC F	PLCnext Control for direct control of Axioline F I/Os
Function	BK	Bus coupler
	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 RS-485/422
	PWR	Supply
	PM	Power measurement
	MA	Master
	IOL	IO-Link
	SGI	Strain gauge acquisition
	PWM	Pulse width modulation
	XT ETH	Left-alignable Ethernet interface
	XT IB	Left-alignable INTERBUS master
	IL ADAPT	Inline adapter terminal
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)
	SAS	Ethernet (IEC 61850, MMS, and GOOSE)
	EIP	EtherNet/IP™

Table 4-1 Structure of the order designations [...]

Function extensions (for controllers)	1xxx	Performance class 1000
	3xxx	Performance class 3000
	2152	Performance class 2000
Function extension (for other modules)	HS	High speed
	XC	Extreme conditions (extreme ambient conditions)
	S	Speed
	I	Current
	U	Voltage
	2A	2 A outputs
	FLK	FLK connection
	AC	Low voltage range AC (nominal voltage 230 V AC)
	AC/220DC	Low voltage range AC and DC (nominal voltage 230 V AC, 220 V DC)
	110/220DC	Low voltage range DC (nominal voltage 110 V DC, 220 V DC)
	IB	INTERBUS
	DALI	DALI
Connection technology (for controllers)	1TX	1 Ethernet interface
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, F housing (narrow housing), cable outlet at the bottom
	2H	2 terminal fields, F housing (narrow housing), cable outlets at the bottom and top

4.2 Controller

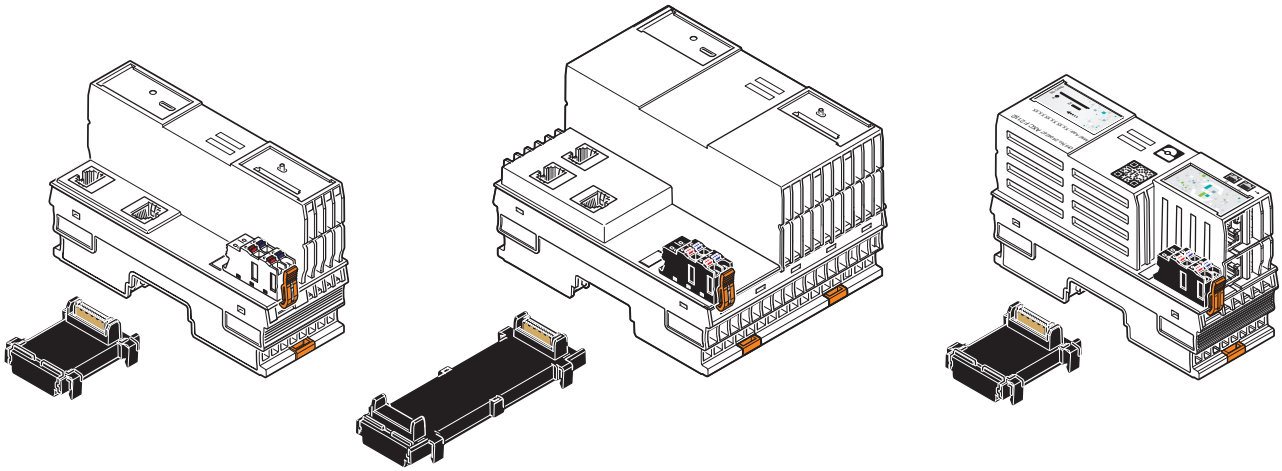


Figure 4-1 Example: AXC 1050, AXC 3050, and AXC F 2152

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

The PLCnext AXC F 2152 controller is fast, robust and easy to use. It has been consistently designed for maximum performance, easy handling and use in harsh industrial environments.

4.3 Bus coupler

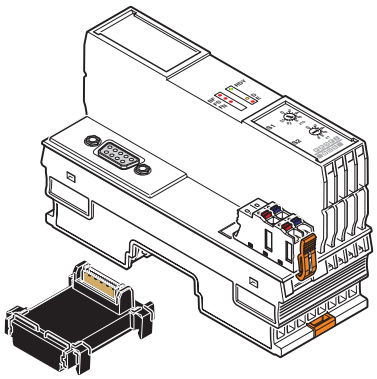


Figure 4-2 Example: AXL F BK PB

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

Table 4-2 Supported bus systems/networks

Bus system/network	Bus coupler (examples)
PROFINET	AXL F BK PN TPS
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

4.4 Input and output modules

4.4.1 Overview

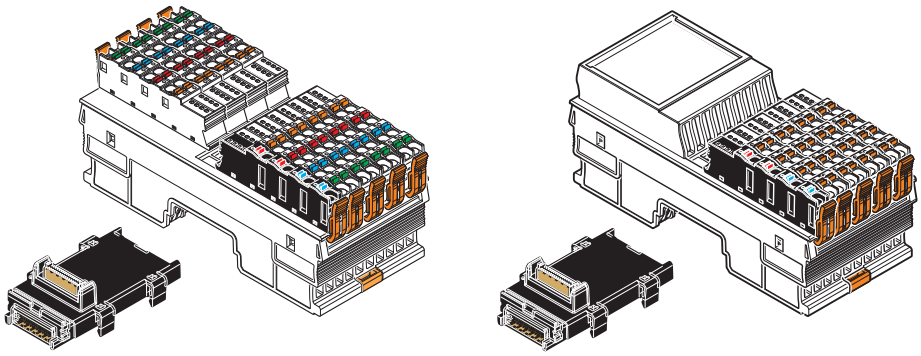


Figure 4-3 Example: AXL F DI16/4 2F and AXL F AO8 XC 1F

Modules are available with various functions. These include the modules listed below, for example. 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 (220 DC, AC)
- Temperature measurement 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 modules 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)
- ...

4.4.2 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 observe 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 wired with a minimum conductor cross section of 0.5 mm²
- The Axioline F station was mounted 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)

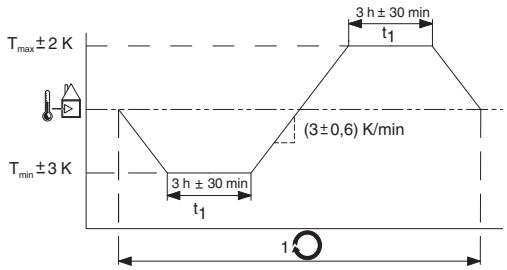


Figure 4-4 Temperature change cycle

Temperature in the control cabinet/ambient temperature

Cycle

Observe the information in the module-specific documentation.

4.4.3 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.

4.5 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.

4.6 Master

Masters are used to integrate lower-level systems in the Axioline F station.

Examples:

AXL F MA DALI2 1H	The 2-channel DALI master enables communication with two DALI networks including their bus power supply.
AXC F XT IB	The INTERBUS master is designed to be directly mounted to the left of an Axioline F controller. The INTERBUS master can be used to integrate INTERBUS devices in the Axioline F station.

5 Housing versions, design, and dimensions

5.1 Housing versions

Various housing versions are available in the Axioline F portfolio; they are shown in Figure 5-1.

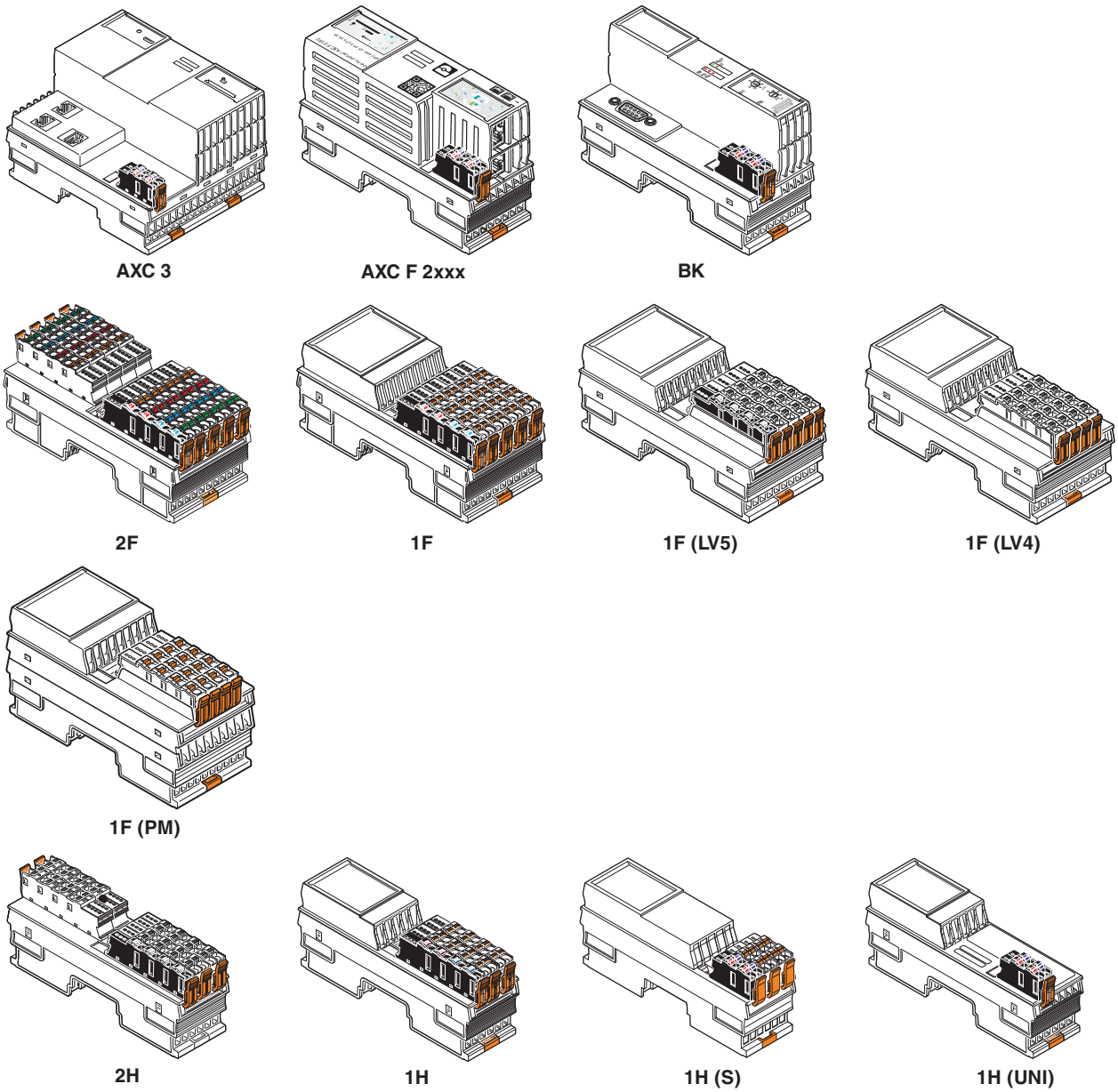


Figure 5-1 Housing versions

Table 5-1 Housing versions

Housing type	Special feature	Example	Design	Dimensions
AXC 3	Class 3000 AXC controller	AXC 3050, AXC 3051	Figure 5-2 on page 33	Figure 5-6 on page 37
AXC F 2xxx	Class 2000 AXC F controller	AXC F 2152	Figure 5-3 on page 34	Figure 5-7 on page 37
BK	AXL F BK ... bus coupler Class 1000 AXC controller	AXL F BK PB, AXC 1050	Figure 5-4 on page 35	Figure 5-8 on page 37
2F	Wide housing, 2 terminal fields	AXL F DI16/4 2F AXL F DO16/3 2F	Figure 5-5 on page 36	Figure 5-9 on page 38
1F	Wide housing, 1 terminal field	AXL F AI8 XC 1F AXL F DI32/1 1F		Figure 5-10 on page 38
1F (LVx)	Wide housing, 1 terminal field, **l**ow **v**oltage			
1F (LV5)	5 connectors	AXL F DO4/3 AC 1F		Figure 5-16 on page 40
1F (LV4)	4 connectors	AXL F DI8/2 110/220DC 1F AXL F DOR4/2 AC/220DC 1F		Figure 5-17 on page 40
1F (PM)	Wide housing, 1 terminal field, power measurement	AXL F PM EF 1F		Figure 5-18 on page 41
2H	Narrow housing, 2 terminal fields	AXL F DI16/1 DO16/1 2H AXL F DI32/1 2H		Figure 5-11 on page 38
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 5-12 on page 39
1H (S)	Short connectors	AXL SSI 1/AO 1		Figure 5-13 on page 39
1H (UNI)	Universal	AXL F PWR 1H AXC F XT IB 1H		Figure 5-14 on page 39
		AXL F DO16 FLK 1H		Figure 5-15 on page 40

5.2 Basic design of Axioline F modules

5.2.1 Class 3000 AXC controller

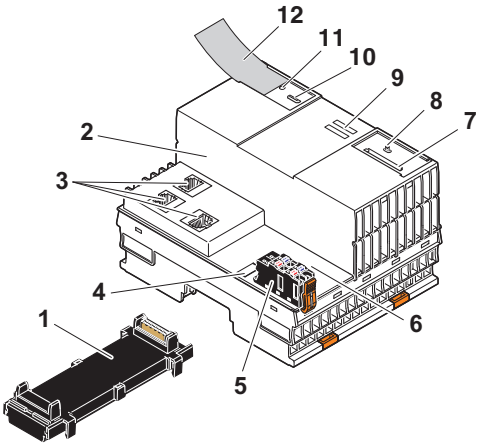


Figure 5-2 Design of an AXC 3050 controller

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 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 Diagnostic and status indicators (here: LEDs)
10 Programming interface
11 Reset button
12 Insert label

5.2.2 Class 2000 AXC F controller

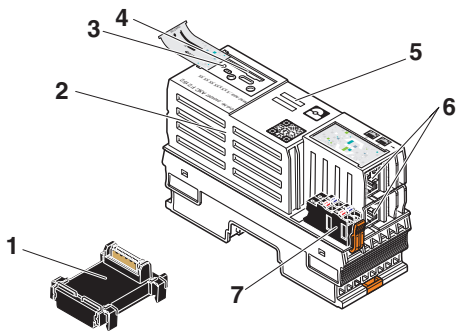


Figure 5-3 Design of an AXC F 2152 controller

1 Bus base module
2 Electronics module
3 Reset button
4 SD card holder (the SD card is optional and not supplied as standard)
5 Diagnostic and status indicators
6 Ethernet interfaces
7 Supply connector (connector for connecting the communications power U_L)

5.2.3 Bus coupler and class 1000 AXC controller

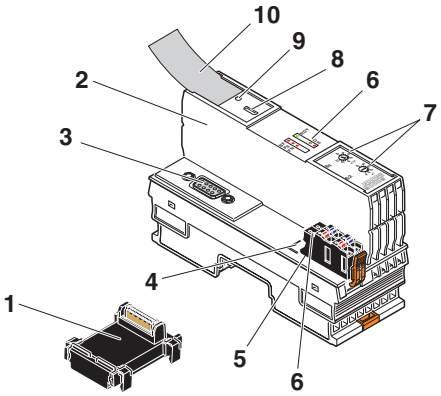


Figure 5-4 Design of a bus coupler

BK housing Example: AXL F BK PB, AXC 1050

1 Bus base module
2 Electronics module
3 Bus connection (here: Ethernet connections, PROFIBUS connection)
4 Function identification
5 Connector for connecting the communications power U_L
6 Diagnostic and status indicators (here: LEDs)
7 Rotary coding switch
8 Service interface
9 Reset button
10 Insert label

There are two FE springs on the bottom of the module for connecting the functional ground via the DIN rail. These are not shown in Figure 5-4. They are illustrated in Figure 8-1 on page 86.

5.2.4 I/O module (electronics module)

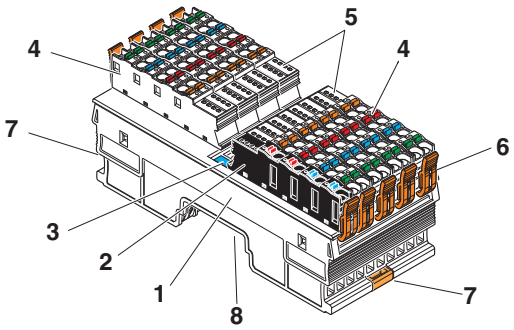


Figure 5-5 Design of an I/O module (example: AXL F DI16/4 2F)

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 Diagnostic 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)

There is at least one FE spring on the bottom of the module for connecting the functional ground via the DIN rail. This is not shown in Figure 5-5. It is illustrated in Figure 8-1 on page 86.

5.3 Axioline F module dimensions

5.3.1 AXC controller and bus coupler

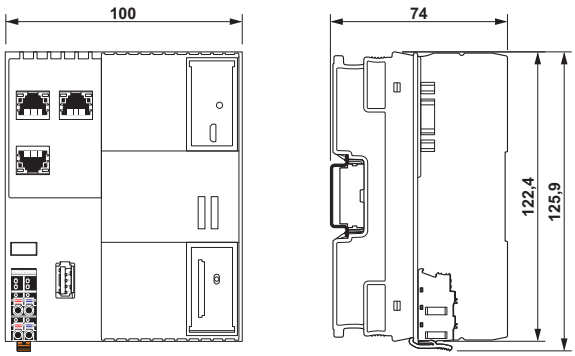


Figure 5-6 Nominal dimensions of a class 3000 AXC controller housing (type AXC 3, e.g., AXC 3050, AXC 3051)

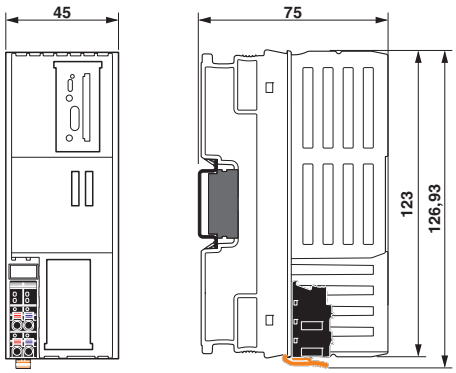


Figure 5-7 Nominal dimensions of a class 2000 AXC controller housing (type AXC F, e.g., AXC F 2152)

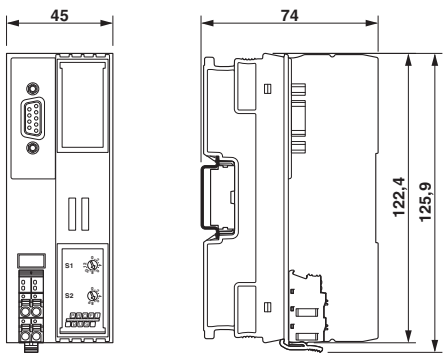


Figure 5-8 Nominal dimensions of a controller/bus coupler housing with separate bus base
(type BK, e.g., AXL F BK PB, AXC 1050)

5.3.2 I/O modules for the 24 V area

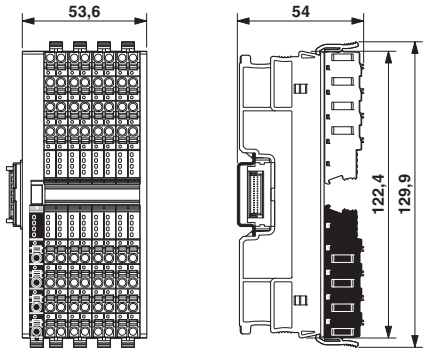


Figure 5-9 Nominal dimensions of the F housing with two terminal fields (type 2F, e.g., AXL F DI16/4 2F, AXL F DO16/3 2F)

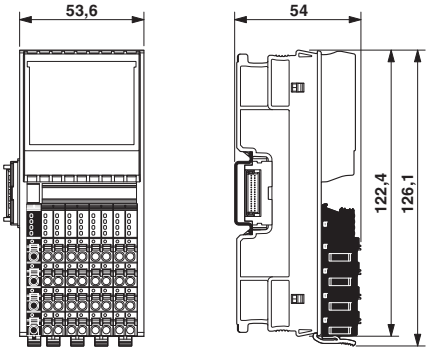


Figure 5-10 Nominal dimensions of the F housing with one terminal field (type 1F, e.g., AXL F AI8 XC 2H, AXL F DI32/1 2H)

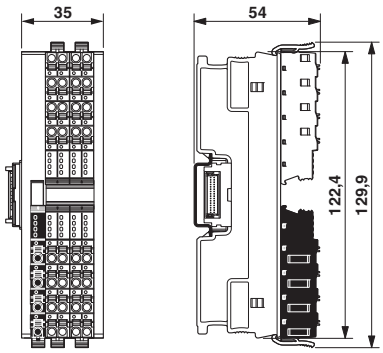


Figure 5-11 Nominal dimensions of the H housing with two terminal fields (type 2H, e.g., AXL F DI16/1 DO16/1 2H)

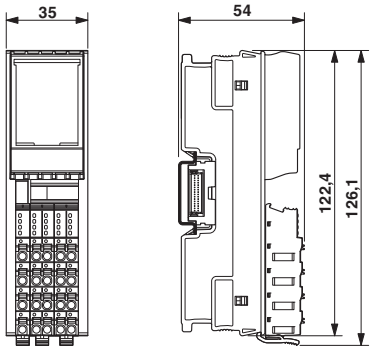


Figure 5-12 Nominal dimensions of the H housing with one terminal field
(type 1H, e.g., AXL F DI16/1 HS 1H, AXL F UTH4 1H, AXL F RS UNI 1H)

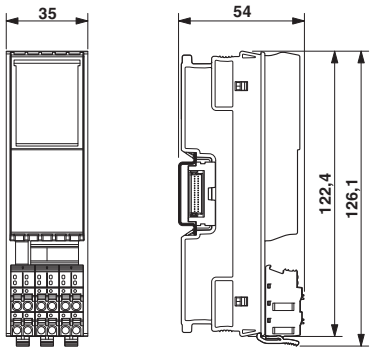


Figure 5-13 Nominal dimensions of the H housing with one terminal field and short connectors
(type 1H (S), e.g., AXL F SSI1 AO1 1H)

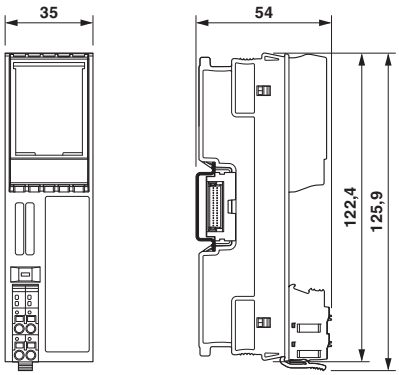


Figure 5-14 Nominal dimensions of the H housing with one terminal field and short connectors
(type 1H (UNI), e.g., AXL F PWR 1H, AXC F XT IB 1H)

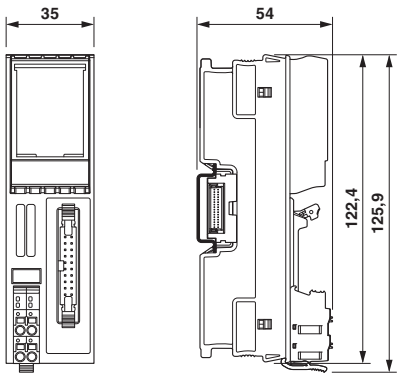


Figure 5-15 Nominal dimensions of the H housing with one terminal field and short connectors
(type 1H (UNI), AXL F DO16 FLK 1H)

5.3.3 I/O modules for the low voltage area

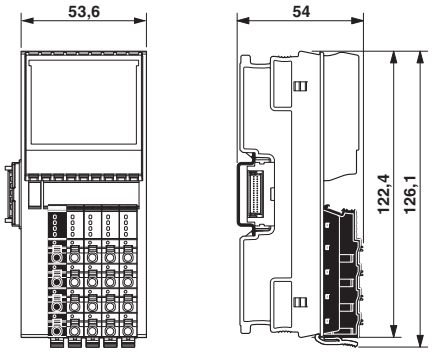


Figure 5-16 Nominal dimensions of the F housing for the low voltage area with one terminal field and five connectors (type 1F-LV5, e.g., AXL F DO4/3 AC 1F)

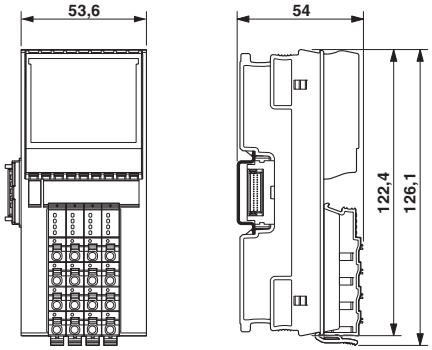


Figure 5-17 Nominal dimensions of the F housing for the low voltage area with one terminal field and four connectors (type 1F-LV4, e.g., AXL F DI8/2 110/220DC 1F, AXL F DOR4/2 AC/220DC 1F)

5.3.4 Power measurement module

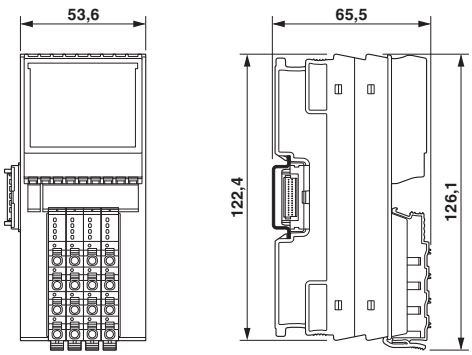


Figure 5-18 Nominal dimensions of the F housing for power measurement with one terminal field (type 1F-PM, AXL F PM EF 1F)

5.4 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 controller, bus coupler, and Axioline F module.

NOTE: Malfunction

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

Versions

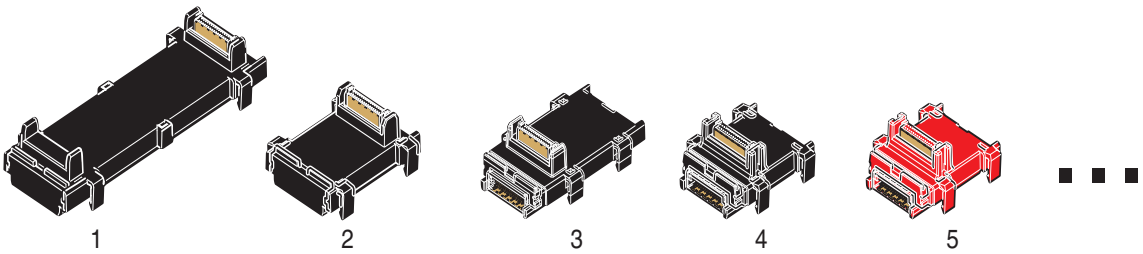


Figure 5-19 Bus base modules

Table 5-2 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 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
...	Others		See device-specific documentation

Basic design

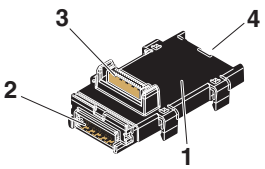


Figure 5-20 Design of a bus base module

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

5.5 Axioline F connectors

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 section and stripping lengths can be found in Section “Conductor cross sections and stripping and insertion lengths” on page 66.

5.5.1 Versions and dimensions

Various Axioline F connector versions are available.

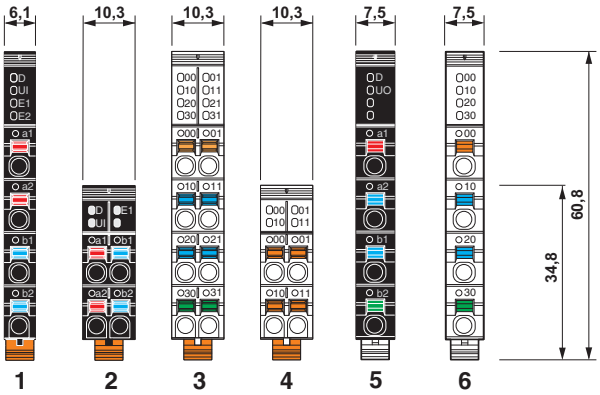


Figure 5-21 Connectors: versions and dimensions

Table 5-3 Connectors: versions and dimensions

No.	Color	Use	Examples of use
24 V area			
1	Black RAL 9005	Feed-in of the supply voltages	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 F SSI1 AO1 1H
3	Traffic gray A RAL 7042	I/O connection (protected 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, protected extra-low voltage)	AXL F PSDI8/4 1F AXL F PSDO8/3 1F
4	Traffic gray A RAL 7042	I/O connection (protected extra-low voltage)	AXL F SSI1 AO1 1H
230 V area			
5	Black RAL 9005	Feed-in of the supply voltages	AXL F DO4/3 AC 1F
6	Traffic gray A RAL 7042	I/O connection (low voltage)	AXL F DO4/3 AC 1F AXL F DOR4/2 AC/220 DC 1F

5.5.2 Basic design

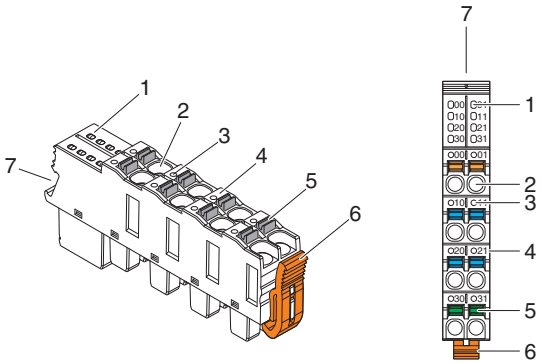


Figure 5-22 Basic design of an Axioline F connector

1 Local diagnostic and status indicators

2 Terminal point

3 Touch connection

4 Terminal point marking

5 Spring lever
The color of the spring lever corresponds to the function (see Section “Color and marking” on page 45)

6 Locking latch

7 Space for connector marking (zack marker strip ZBF 10/5,8 AXL or ZBF 5)

5.6 Color and marking

Housing

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

Table 5-4 Electronics module housing colors

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

Connectors

All the connectors for 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 on Figure 5-23).

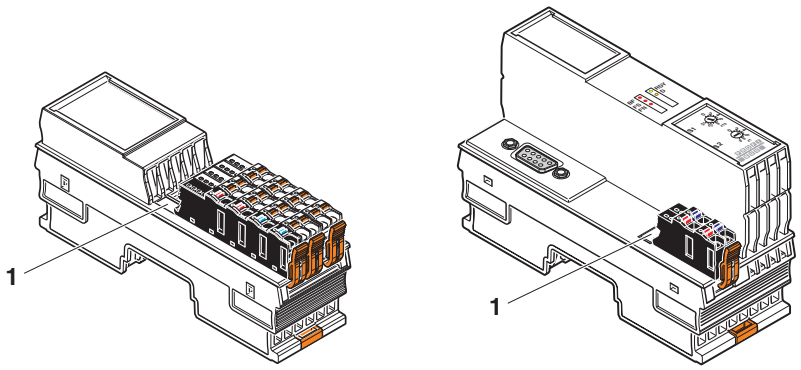


Figure 5-23 Color coding of the module function

The following colors indicate the function:

Table 5-5 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 measurement
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

Diagnostic and status indicators are marked with the function, e.g., D, E, UI, 00, 01, ... (1 in Figure 5-24).

Terminal points

The terminal points are consecutively numbered, e.g., a1, b1, 00, 01, ... (2 in Figure 5-24).

The associated colored spring lever indicates the function (signal, potential) (3 in Figure 5-24).

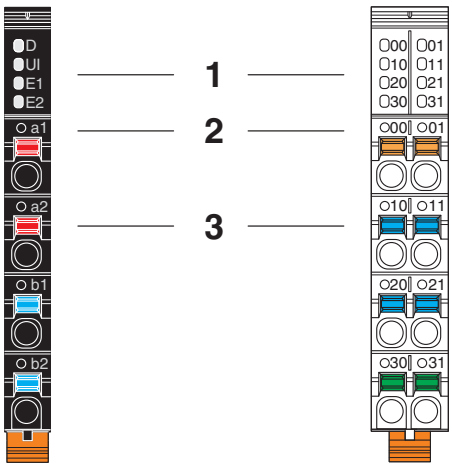


Figure 5-24 Marking of the terminal points and the LEDs on the connectors

Table 5-6 Color coding of the 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 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 marking options detailed above, you can also custom-mark the module using a zack marker strip or an insert label.

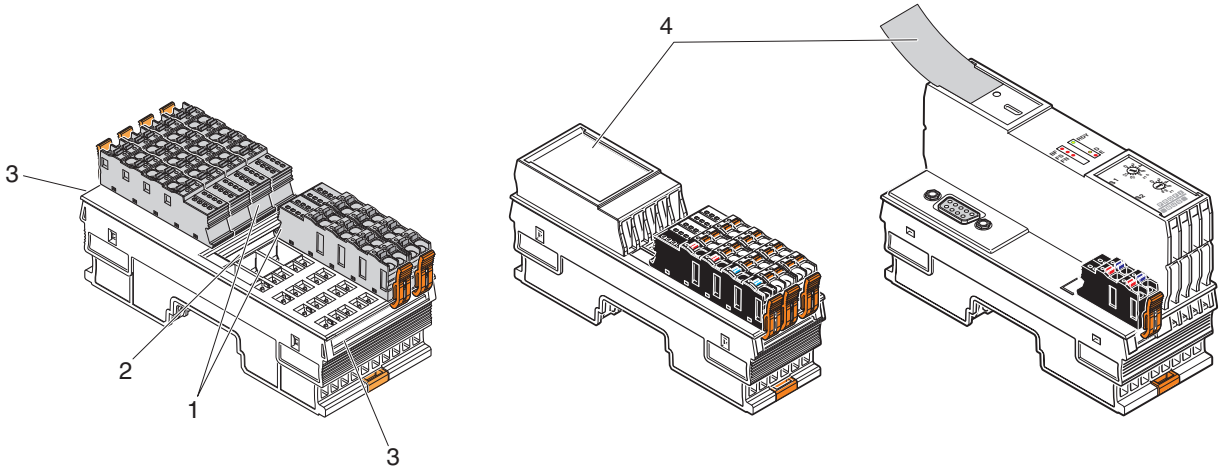


Figure 5-25 Individual marking options

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 114.

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 the connector (1 and 3 in Figure 5-25).

6 Mounting and removing modules

6.1 Unpacking the modules

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

6.2 Safety notes for mounting and removal

6.2.1 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: Damage to electronics due to inadequate external protection

No safe fuse tripping 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 four times the nominal current of the external fuse, to ensure that it trips reliably 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 the power supply.

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 or controller is still available.

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

NOTE: Damage to the contacts when tilting

Tilting the modules can damage the contacts.

- **Place the modules onto the DIN rail vertically.**
- **Remove the modules from the DIN rail vertically.**

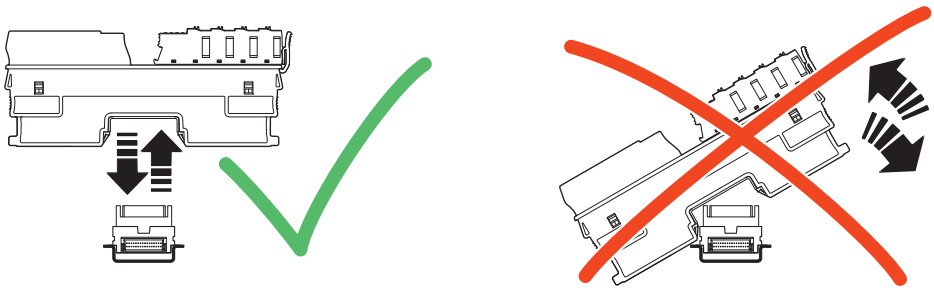


Figure 6-1 Placing and removing the module **vertically**

When using modules in the low voltage area, please also observe Section “Additional safety notes for the low voltage area” on page 51.

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

6.2.2 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.

In terms of this user manual, qualified personnel are persons who, because of their education, experience and instruction, and their knowledge of relevant standards, regulations, accident prevention, and service conditions, have been authorized to carry out any required operations, and who are able to recognize and avoid any possible dangers.

WARNING: Dangerous contact voltage

Please note that there are dangerous contact voltages when working on circuits that do not meet protected 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 on grounded networks.

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

6.3 Basic information about mounting

Mounting location

The Axioline F modules meet the requirements of IP20 degree of protection. They can therefore be used in closed control cabinets or in control boxes (junction boxes) with IP54 degree of protection according to EN 60529 or higher.

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

IP20 degree of protection

Insert the connectors onto the electronics modules in order to achieve IP20 degree of 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 114.

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

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

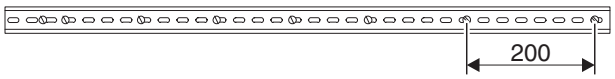


Figure 6-2 Fixing the DIN rail (in mm)

NOTE: Damage to electronics 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 6-3, 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.

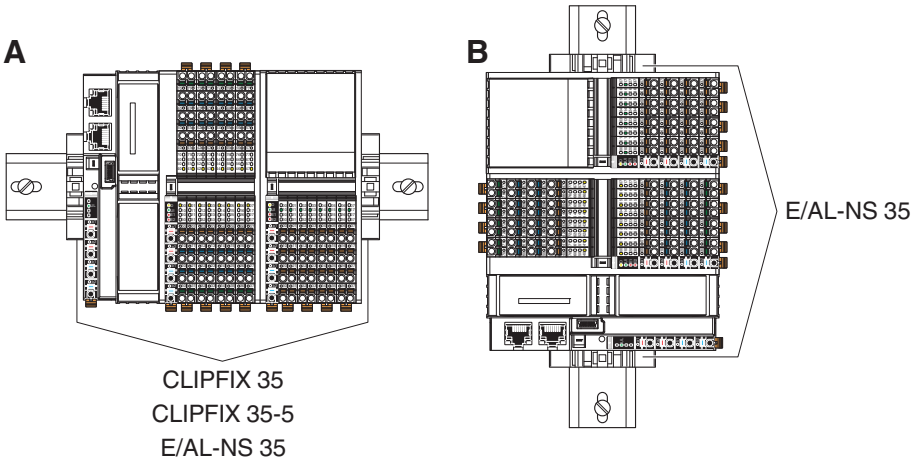


Figure 6-3 Mounting positions for an Axioline F station

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 Figure 6-3). 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.

Table 6-1 Recommended end brackets

Mounting position	Ambient conditions	End brackets
Horizontal, Figure 6-3, A	Normal	CLIPFIX 35, CLIPFIX 35-5
	High shock and vibration load	E/AL-NS 35
Other, Figure 6-3, B	Normal	E/AL-NS 35
	High shock and vibration load	

Tool

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 installed in any order behind the bus coupler. To ensure functionality, assemble the modules one after the other, 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 following factors:

– Supplied logic current
– Current consumption of the connected modules
– 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 following information is stored in the device description files (e.g., gsdml file):

– Current supplied by the bus coupler, controller or power module
– Maximum current consumption of the modules that can be connected

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 if the maximum current consumption at U_{Bus} is reached. Create another station as an alternative.

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 6-2 System limit examples

Network	Bus coupler	System limits
Sercos	AXL F BK S3	Amount of process data
PROFINET	AXL F 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.

6.4 Left alignment

The following sections describe mounting and removal of standard modules. Observe the information in the “Installation notes for electricians” for modules that are installed to the left of the controller. They are provided with the product upon delivery.

6.5 Mounting the modules

Please refer to Section “Safety notes for mounting and removal” on page 49.

No tools are required for mounting the Axioline F modules.

- First mount the end bracket on the DIN rail.

6.5.1 Controller and bus coupler

Mounting bus base modules

- First install the bus base module for the controller or bus coupler onto the DIN rail.
- Place all other bus base modules required for the station on the DIN rail (Figure 6-4, A).

NOTE: Malfunction

Insert the bus base module belonging to the relevant module.
Bus base modules with different overall widths and functions are available.

- Push each subsequent bus base module into the connection of the previous bus base module (Figure 6-4, B).

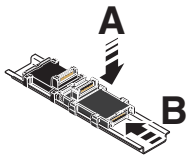


Figure 6-4 Connecting bus base modules to each other

It is not possible to snap another bus base module to 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 or bus coupler

- Place the controller or 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 positioned above the corresponding female connector on the bus base module.

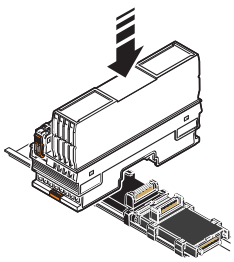


Figure 6-5 Snapping on the bus coupler

Connecting the network

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

6.5.2 I/O modules

- Place the necessary I/O modules **vertically** on the corresponding bus base module and DIN rail until they snap into place with a click.
  Pay attention to the correct position.
  Make sure that the device connectors for the bus base connection are positioned above the corresponding female connectors on the bus base module.

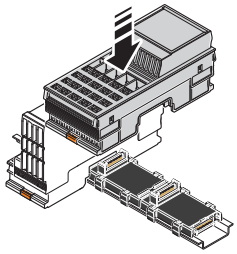


Figure 6-6 Inserting I/O modules

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 “Installation and mounting material, grounding, and shielding” product range.

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

1. Bus base module
2. Busbar holder
3. Electronics module

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

6.6 Removing modules

Please refer to Section “Safety notes for mounting and removal” on page 49.

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

6.6.1 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 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 “Removing or inserting a connector” on page 61.

6.6.2 Controller, bus coupler, and I/O 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) in the upper **and** lower snap-in mechanism (base latches) of the module one after the other and unlock it (Figure 6-7, Figure 6-8, A). The base latches are locked in place in the open position.
- Remove the electronics module **vertically** to the DIN rail (Figure 6-7, Figure 6-8, B). The base latches return to the idle position again.

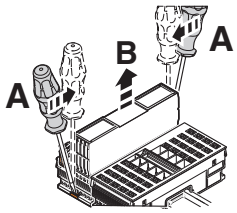


Figure 6-7 Removing the bus coupler

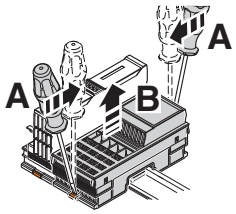


Figure 6-8 Removing an I/O module

The bus base module remains on the DIN rail.

Bus base module

Please proceed as follows if, after having removed the 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 (B, B1, B2) one after the other.
- Swivel the bus base module upward and remove it (C).

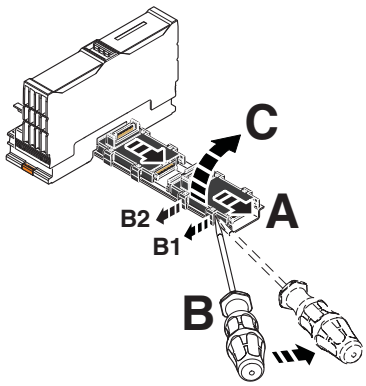


Figure 6-9 Removing the bus base module

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, remove the modules. Starting at the end of the station, remove the bus base modules.
- Disconnect the bus base module to be removed from the connection of the previous bus base module by sliding it about 5 mm to the right (A).
- Insert a suitable tool (e.g., bladed screwdriver) into the latches on one side (B, B1, B2) one after the other.
- Swivel the bus base module upward and remove it (C).
- Push the rest of the station back to the left until the bus base modules touch each other again.

6.7 Removing or inserting a connector

6.7.1 Removing a connector

- Release the locking latch (A). Tilt the connector slightly upward (B). Remove the connector from the module (C).

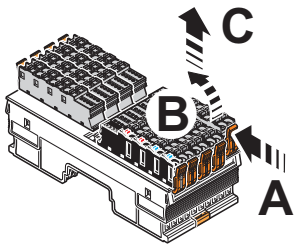


Figure 6-10 Removing the connector

6.7.2 Inserting a connector

- Insert the connector vertically into its position. Press firmly on the connector. Make sure that it engages with a click.

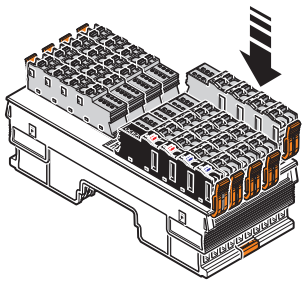


Figure 6-11 Snapping on the connector

6.8 Replacing a module

- To replace a module, proceed as described in Sections “Removing modules” on page 58 and “Mounting the modules” on page 55.
- Once replaced, restore all of the necessary connections.

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

6.9 Mounting distances

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

For the distances of the upper and lower cable ducts or the cable routing to the modules, please refer to Figure 6-13 to Figure 6-14.

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

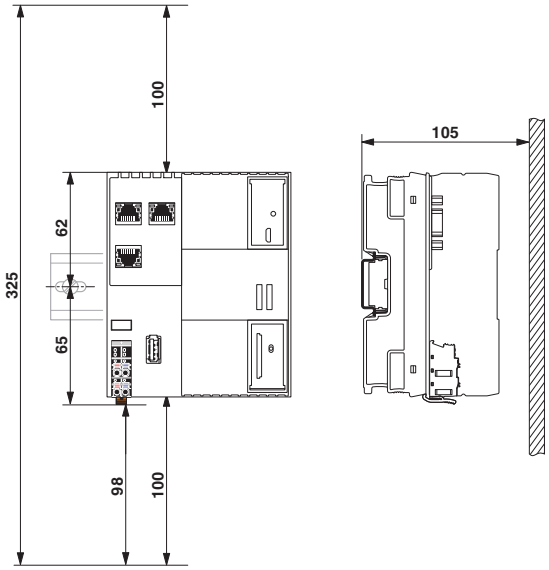


Figure 6-12 Mounting distances: AXC 305x controller (dimensions rounded)

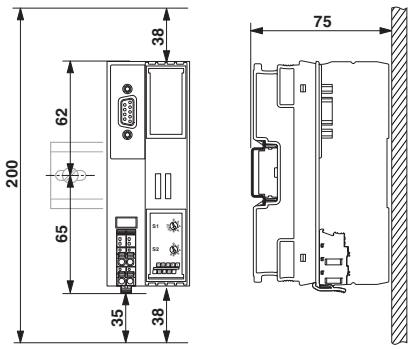


Figure 6-13 Mounting distances: bus coupler and AXC 105x controller (dimensions rounded)

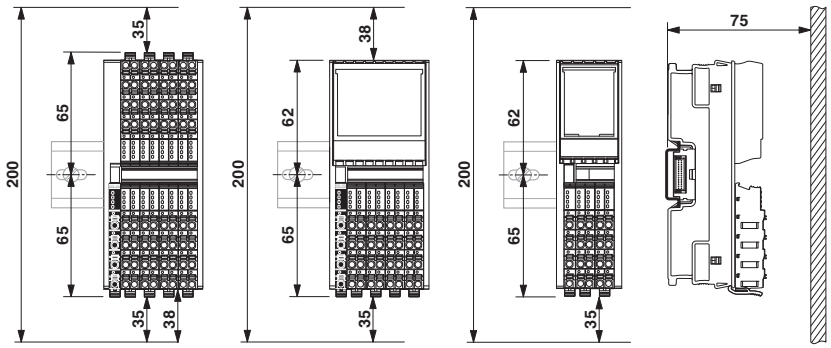


Figure 6-14 Mounting distances: I/O modules (dimensions rounded)

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

7 Connecting or removing cables

7.1 Connections and cables in the Axioline F system

All electrical connections are pluggable.

The network cables on the controller or 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 using Axioline F connectors.

Each terminal point is designed for a maximum current of 8 A. This applies to the periphery of the I/O modules (I/O connectors) as well as to the supply of the logic, sensors, and actuators (power connectors).

The current can be reduced when used in applications in which a UL approval is required. Observe any specifications in the module-specific packing 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 conductor ends.
– Make sure to install the conductor in the middle of the wiring space, especially with small cross sections.

If you want to use ferrules, use ferrules as described in Section “Conductor cross sections and stripping and insertion lengths” on page 66.

Make sure the ferrules are properly crimped.

7.2 Conductor cross sections and stripping and 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 7-1 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 only suitable for Push-in connection technology **when using the spring lever**.

Table 7-2 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 7-3 Permitted AWG conductor cross sections

Conductor	Cross section
AWG	24 ... 16

Stripping and insertion lengths

NOTE: Malfunction when the conductor is not securely fixed

To ensure secure fixing and correct function:
Make sure that the stripping length of a conductor without ferrule or the insertion length of a conductor with ferrule corresponds to the specifications.

For crimping, we recommend pliers for trapezoidal crimp: CRIMPFOX 6 or CRIMPFOX 6T(-F) (see Section “Ordering data for accessories” on page 114).
According to the current state, only these pliers meet the general conditions regarding the Axioline F wiring space (according to internal cylindrical gauge DIN EN 60947-1 (DIN VDE 0660-100)-A1).

Conductor without ferrule: stripping length 8 mm

Conductor with ferrule: insertion length 8 mm or 10 mm

Ferrules: see Section “Ordering data” on page 114.

TWIN ferrules

NOTE: Malfunction when using wrong ferrule

TWIN ferrules are not permitted in the Axioline F system.

7.3 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 signal with a measuring probe, pay attention to the position of the touch connection to the assigned terminal point.

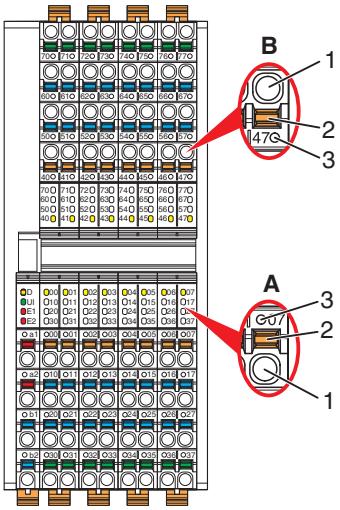


Figure 7-1 Terminal point with associated spring lever, and associated touch connection

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	

7.4 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 connection 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 into place automatically.

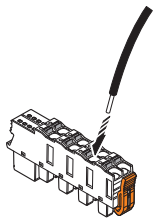


Figure 7-2 Connecting a solid unshielded cable

Stranded cable without ferrules

- When inserting a stranded cable:
  Open the spring by pressing the screwdriver onto the spring lever (Figure 7-3, 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 114).
- Insert the cable in the terminal point (B).
- Remove the screwdriver to secure the cable.

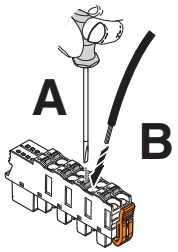


Figure 7-3 Connecting a stranded cable

After installation, it is advisable to mark the cables as well as the module and connectors. Marking the module: see Section “Color and marking” on page 45.

Inserting the connector

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

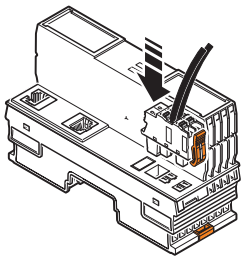


Figure 7-4 Inserting the connector

7.5 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, 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 on Figure 7-5).
  The necessary distance a depends on the distance to the busbar.
- Strip 8 mm off the wires.

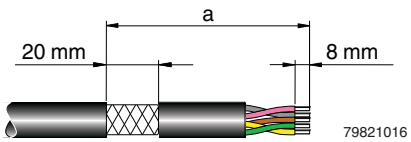


Figure 7-5 Connecting the shielded cable

- If present, remove the protective foil.
- Lay the cable with the braided shield under a shield connection clamp. Tighten it using a screw.
  Malfunctions will then be led to the support brackets via a busbar. The support brackets are connected to the grounded DIN rail.
  Ordering data can be found in Section “Ordering data” on page 114.

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 module, not for the strain relief of the connected cables.

Wiring the connector

- Connect the cables to the connector. Please proceed as described in Section “Connecting unshielded cables” on page 69.

7.6 Removing cables from the terminal point

- To remove a cable from the terminal point, press on the spring lever using a suitable tool (e.g., bladed screwdriver with a blade width of 2.5 mm). This opens the leg-spring connection of the relevant terminal point (Figure 7-6, A).
- Remove the conductor (Figure 7-6, B).

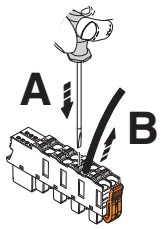


Figure 7-6 Removing the cable

7.7 Connecting the power supplies

7.7.1 Axioline F system supply

When using an Axioline F station you must provide the following supply voltages:

– Supply voltage for the bus coupler
– Supply voltage for the local bus (communications power of the connected modules)
– Supply voltage for 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.

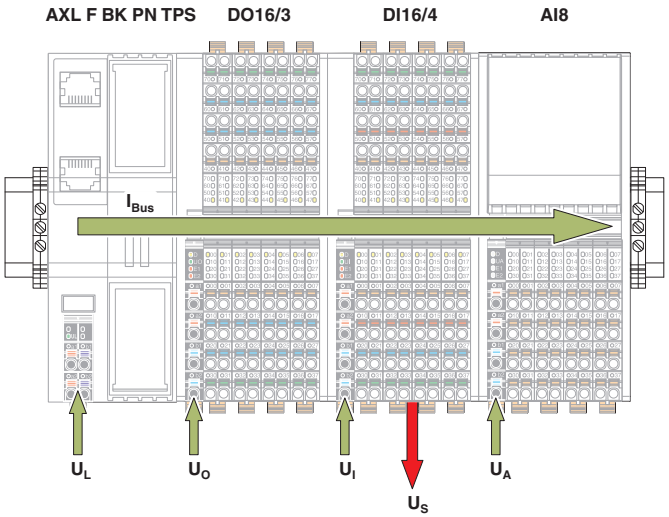


Figure 7-7 Supply voltages in the Axioline F system

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 F CNT2 INC2 1F) Encoder/analog supply (AXL F SSI1 AO1 1H)
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 (I/O 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.

7.7.2 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. Dangerous shock currents.

The Axioline F low-level signal controllers, bus couplers, and modules are designed exclusively for protected 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 on grounded networks.

Observe the information in the module-specific documentation.

7.7.3 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 disconnected, the local bus will shut down.

7.7.4 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 upstream of the power module.

7.7.5 Supply at the I/O 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 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.

7.7.6 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.

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.

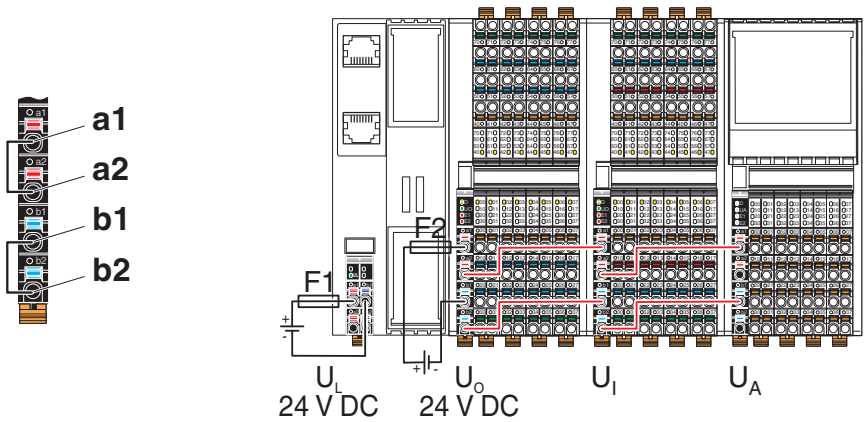


Figure 7-8 Jumpering in the power connector and example of potential forwarding

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

Considering the current carrying capacity of the terminal points, potential forwarding shown in Figure 7-8 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).

7.7.7 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.

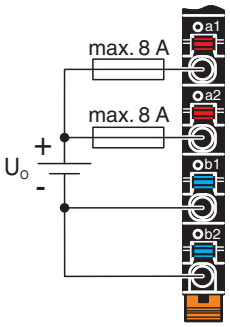


Figure 7-9 Parallel supply of the supply voltage

7.8 Connecting the network

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

Connect the network according to the module-specific documentation.

7.9 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 micro USB socket. For the type of the USB socket, please refer to the module-specific data sheet. In addition to providing the network interface, the interface 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 or bus coupler to a PC via the programming or service interface.

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

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

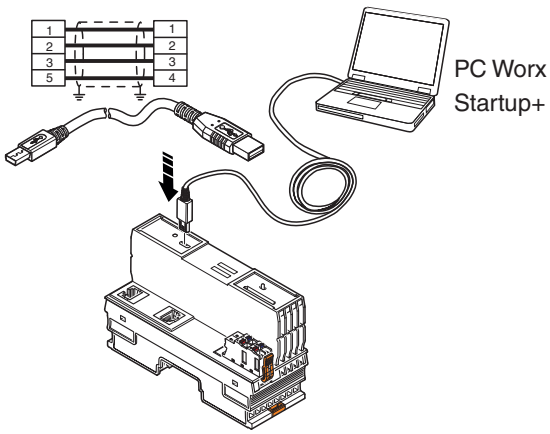


Figure 7-10 Connecting cable between PC and controller or bus coupler

7.10 Connecting sensors and actuators

Sensors and actuators are connected using 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.

7.10.1 Connection technology for sensors and actuators

The I/O modules of the Axioline F product group normally permit 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.

7.10.2 Connections used for low-level signal digital I/O modules

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

Table 7-4 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 7-5 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

7.10.3 Connecting digital sensors and actuators using the different connection technologies

1-wire technology

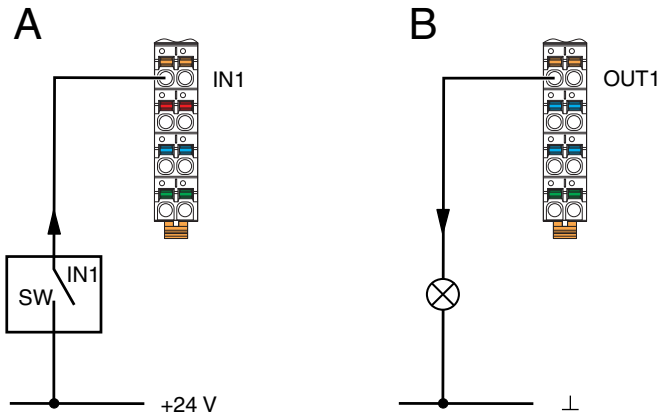


Figure 7-11 1-wire termination for digital modules

Sensor

Figure 7-11, A, shows the connection of a 1-wire sensor.

– The SW switch provides the input signal.
– The sensor signal is routed to terminal point IN1.
– 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 7-11, B, shows the connection of a 1-wire actuator.

– The actuator is supplied 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 the supply voltage U_O, which supplies the actuators, have the same potential.

2-wire technology

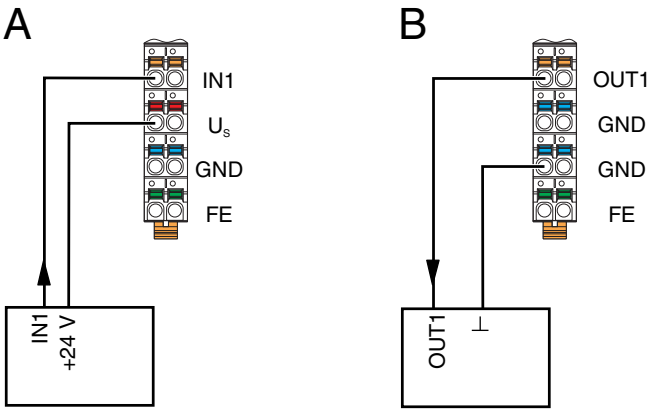


Figure 7-12 2-wire termination for digital modules

Sensor

Figure 7-12, A, shows the connection of a 2-wire sensor.

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

Actuator

Figure 7-12, B, shows the connection of an actuator.

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

3-wire technology

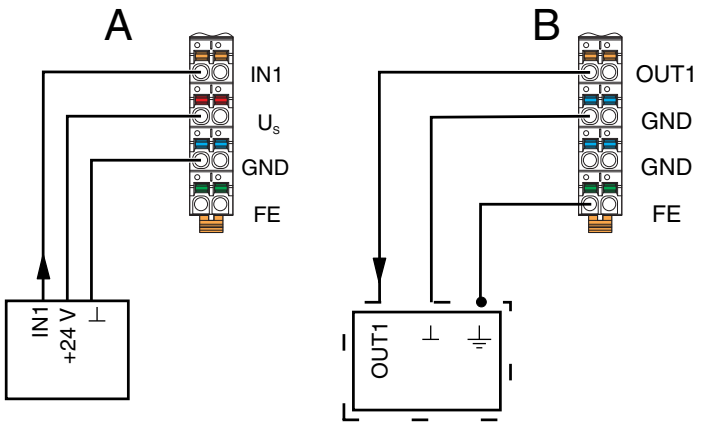


Figure 7-13 3-wire termination for digital modules

Sensor

Figure 7-13, A, shows the connection of a 3-wire sensor.

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

Actuator

Figure 7-13, 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

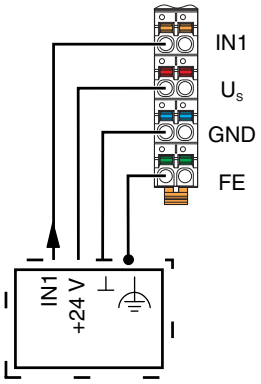


Figure 7-14 4-wire termination for digital modules

Sensor

Figure 7-14 shows the connection of a shielded 4-wire sensor.

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

7.10.4 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.

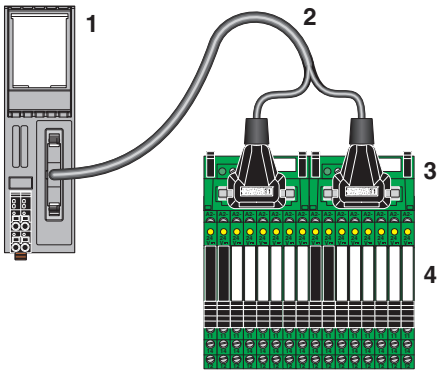


Figure 7-15 Connection of relay modules

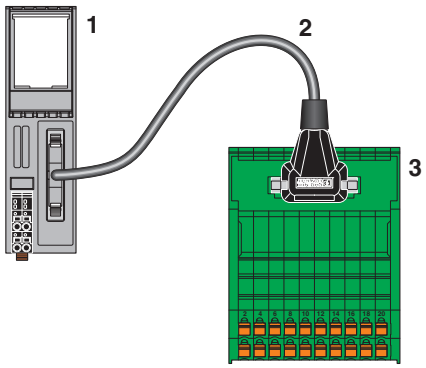


Figure 7-16 Connection of a termination board

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

7.10.5 Redundant signals

If you are using I/O modules redundantly, connect the modules as shown in Figure 7-17.

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

7.10.5.1 Redundant digital inputs

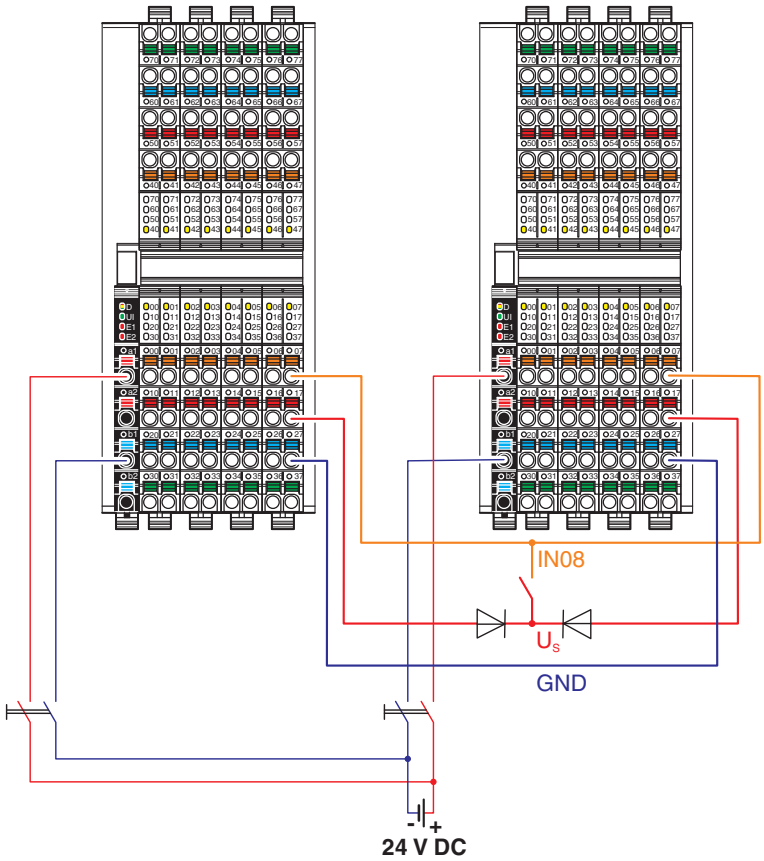


Figure 7-17 Example: connection for redundant use of digital inputs

IN08	Digital input 8
U_S	Sensor supply
GND	Reference potential

CAUTION: Malfunction

To avoid malfunction, make sure that the GND connection shown in Figure 7-17 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).

7.10.5.2 Redundant digital outputs

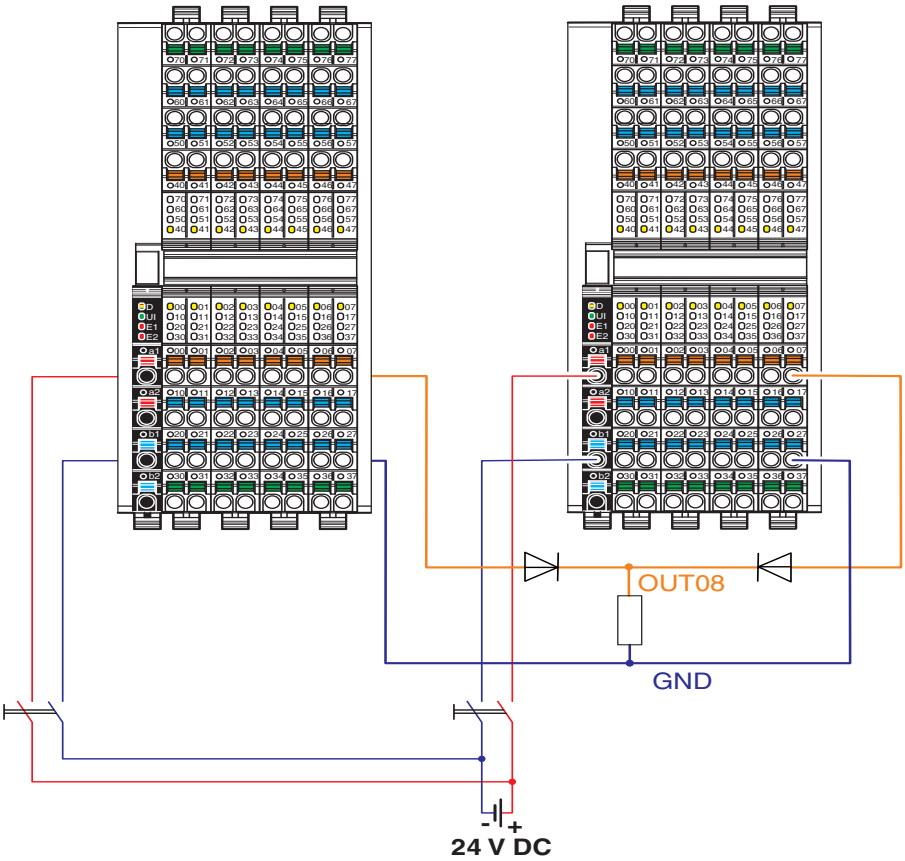


Figure 7-18 Example: connection for redundant use of digital outputs

OUT08	Digital output 8
U_O	Supply of digital outputs
GND	Reference potential

CAUTION: Malfunction

To avoid malfunction, make sure that the GND connection shown in Figure 7-18 is established as the reference potential to the redundant signal outputs.

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

8 Grounding and shielding

8.1 Grounding concept

Within an Axioline F station, a distinction is made between functional 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 grounding (FE)

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

Functional ground 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.

8.1.1 Protective earth ground (PE)

Protective earth is a low-impedance current path that minimizes the risk to the user in the event of an error. This includes a high voltage and/or high 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. This means that the modules only become real protection class 2 devices when used with a control cabinet or an installation box.

8.1.2 Functional ground (FE)

Functional ground is a low-impedance current path between circuits and ground. This current path is not intended as a protective measure but to improve immunity to interference instead, for example.

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

To ensure reliable functional grounding, please observe the following:

1 The modules have at least one FE spring (metal clip, 1 in Figure 8-1) 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. When using grounding terminal blocks to connect the DIN rail to protective earth ground, the modules are then also grounded when snapped onto the DIN rail.

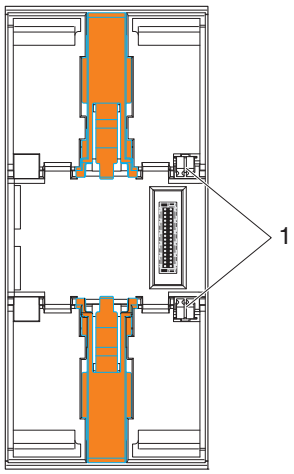


Figure 8-1 FE spring (1)

2 When using modules for surge protection (TRABTECH), connect their functional ground directly to the grounded DIN rail.
Do **not** connect the functional 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.

8.2 Shielding concept

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

8.2.1 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 measurement)
  - On function modules and acquisition modules

Observe the following points when shielding:

- Connect the shield to a module before connecting the signal.
- 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 conductors.
- When connecting the shielding, observe the specifications for wiring.
- Make sure the shield is as close as possible to the signal terminal point.

8.2.2 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 8-9)

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 8-9 and Figure 8-10).
- 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 8-10).

For connecting the shield, Phoenix Contact recommends the AXL SHIELD SET Axioline F shield connection set or the shield connection clamp products from the “Installation and mounting material, grounding, and shielding” product range.

8.2.3 Connecting the shield using the Axioline F shield connection set

The shield connection set consists of two busbar 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.

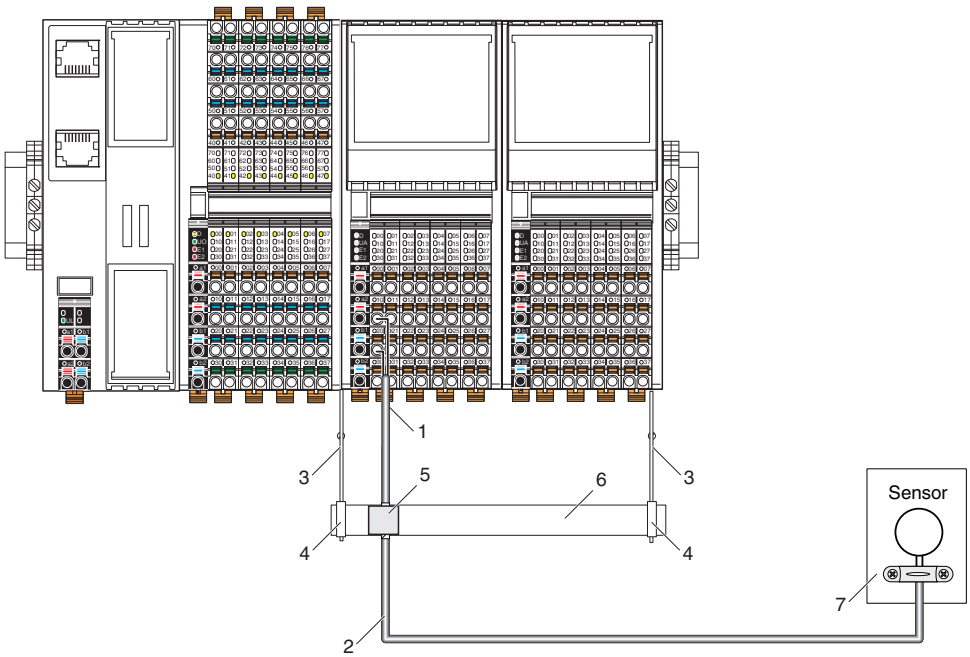


Figure 8-2 Connecting the shield with AXL SHIELD SET

1 Lead the analog cable into the connector, making sure to maintain the cable insulation.
2 Use shielded twisted pair cables.
3 Busbar holder
4 SK 5 shield connection clamps (2 pcs. included in the AXL SHIELD SET) for securing the busbar (accessories) on the busbar holder
5 Shield connection clamp for applying the shield on the busbar (SKS ..., see Section “Ordering data for accessories” on page 114)
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 114)
7 Lead the sensor cable into the sensor, making sure to maintain the cable insulation.

Axioline F shield connection set

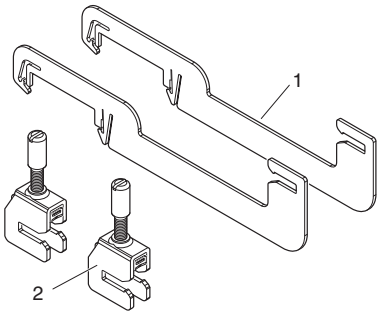


Figure 8-3 Set components

1 Busbar holders (2 pcs.)

2 SK 5 shield connection clamps for securing the busbar on the busbar 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 117.

Mounting

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

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

The maximum distance between two adjacent busbar 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 busbar holders, distribute the holders equally over the width of the busbar.

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

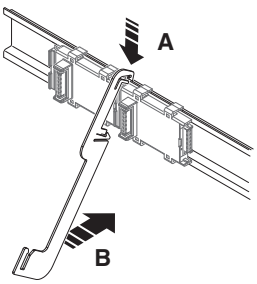
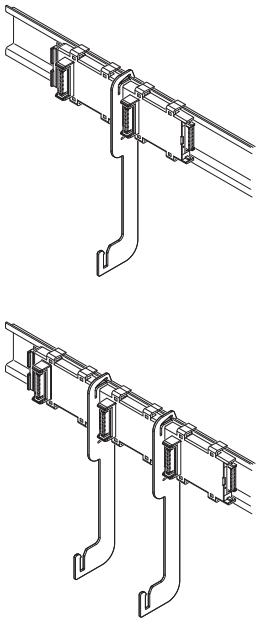


Figure 8-4 Hooking the busbar holder on

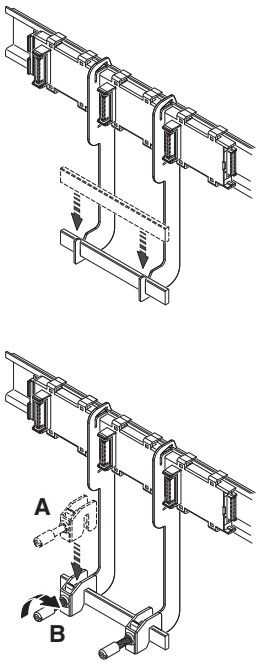
- Hook the busbar holder onto the DIN rail.



- Snap the busbar holder onto the DIN rail.

- Then snap on the second busbar holder.

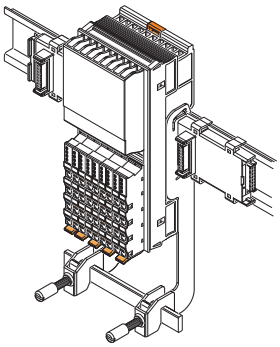
Figure 8-5 Snapping on the busbar holders



- Push the busbar into the busbar holders.

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

Figure 8-6 Mounting the busbar

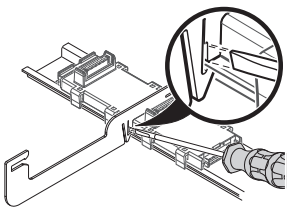


- Mount the electronics modules.

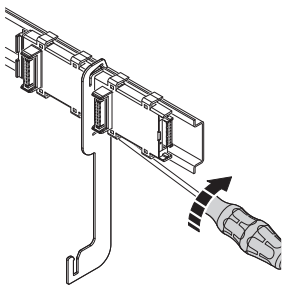
Figure 8-7 Mounting the electronic modules

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 busbar holder).
- Insert the screwdriver in the release slot.



- Turn the screwdriver to release the locking clip from the DIN rail.
- Remove the busbar holder.

Figure 8-8 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.

8.2.4 Connecting the shielding to a busbar

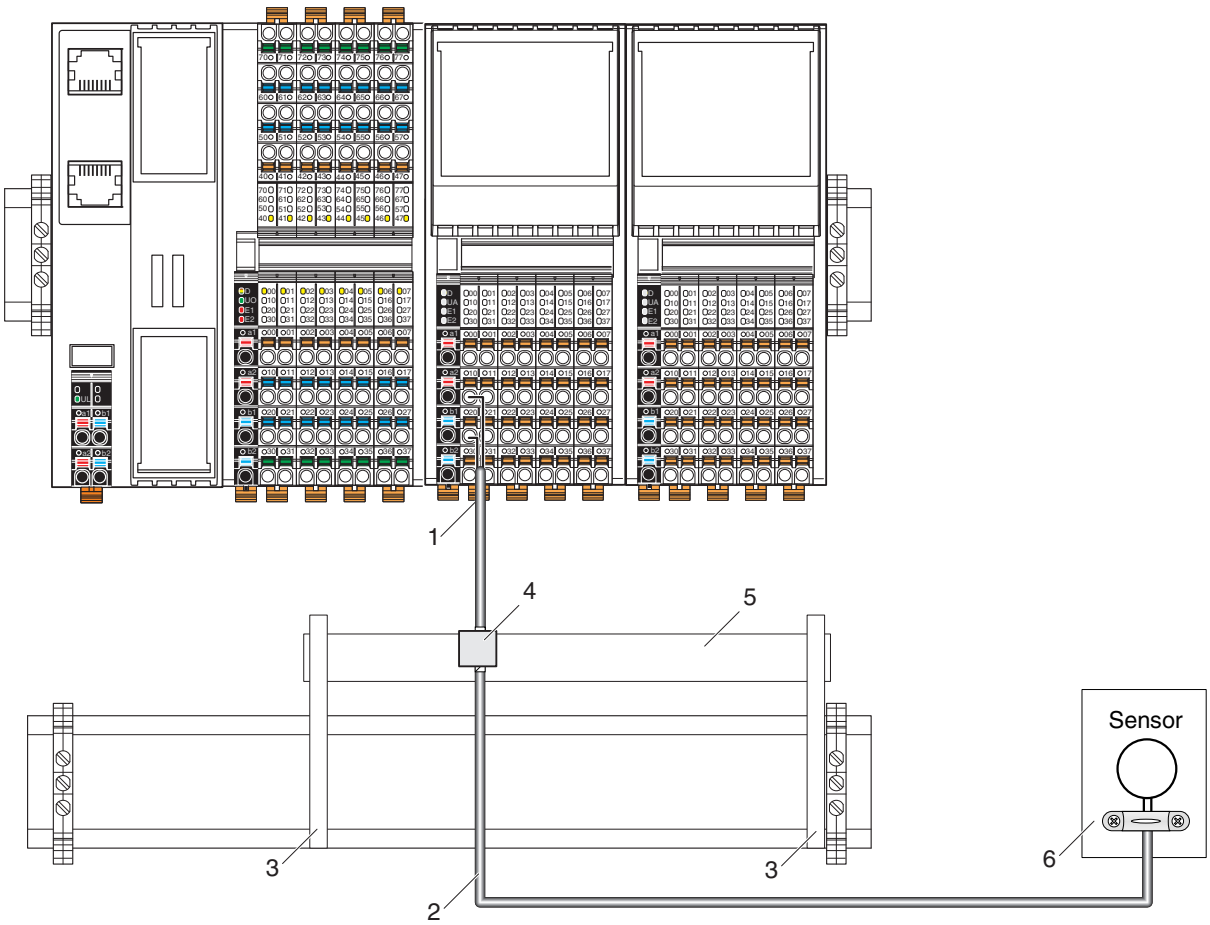


Figure 8-9 Connecting the shielding to a busbar

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 114)

4 Shield connection clamp for applying the shield on the busbar (SKS ..., see Section “Ordering data for accessories” on page 114)
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.

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

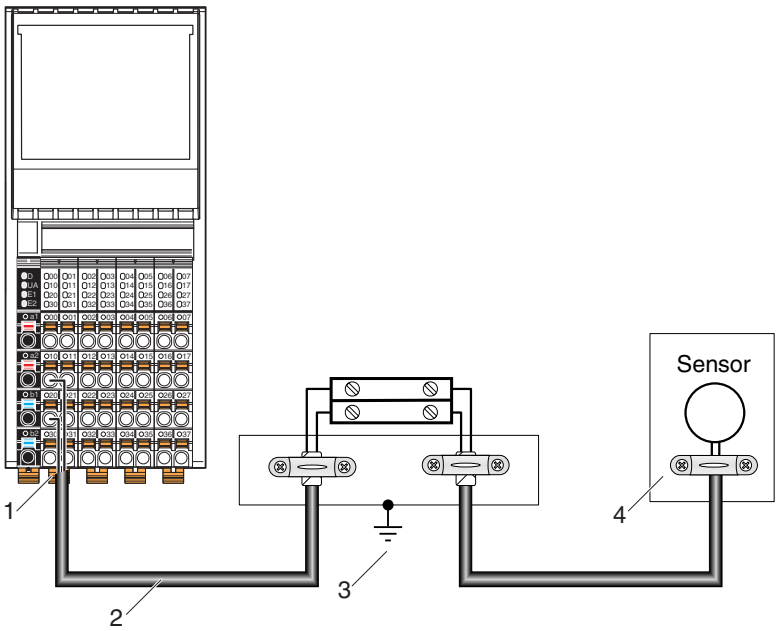


Figure 8-10 Integration of analog shielding in a concept with central equipotential bonding at the control cabinet entry

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 marshaling level.

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

NOTE: Functions may be impaired

Observe the following when integrating the shielding of analog I/O cables in an equipotential bonding concept:
Direct connection to the FE potential must only be made at one point (e.g., at the central grounding point of the marshaling level).

9 Diagnostic and status indicators

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

Diagnostics

The diagnostic indicators (red, yellow, or green) provide information on the state of the module. In the event of an error, they 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) indicate the status of the relevant input or output and of the connected I/O device.

Extended diagnostics

Some modules have extended diagnostics. Short circuit or overload of the sensor supply, for example, can be detected and reported. If a short circuit occurs at an output, some output modules can diagnose each channel individually. Information regarding 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.

Diagnostic 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 error-free 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 diagnostic and status indicators are equipped with light guides on the Axioline F 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: light guides 00 ... 07, 10 ... 17, 20 ... 27 and 30 ... 37 do not have a function.

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

For information about the diagnostic and status indicators on each module and their meaning, please refer to the module-specific documentation.

9.1 Indicators on controllers

For more information on the controller's diagnostic and status indicators, please refer to the corresponding documentation.

9.2 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 LEDs are located on the module.

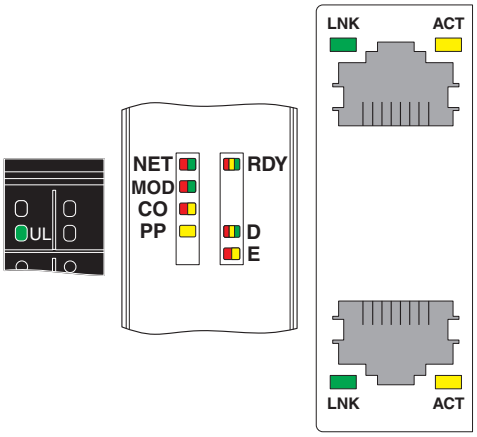


Figure 9-1 Indicators on a bus coupler (example: AXL F BK EIP)

All bus couplers 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	Undervoltage or overvoltage of communications power.
				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 encoding switches are set to an invalid/reserved position.
			Off	Device is not ready to operate.

Designation	Color	Meaning	State	Description
D	Red/yellow/green	Diagnostics of local bus communication		
		Run	Green on	The station is ready to operate, communication within the station is OK. All data is valid. No malfunction is present.
		Active	Flashing green	The station is ready to operate, communication within the station is OK. The data is **not** valid. No valid data provided by the controller or higher-level network. There is no malfunction on the module.
		Ready	Yellow on	The station is ready to operate. No data is being exchanged.
			Flashing yellow	Access from Startup+ in I/O check mode
			Flashing yellow/red	Local bus error during active I/O check (when using Startup+)
			Flashing red	Local bus error during startup
				Possible causes: – Configuration cannot be generated, information is missing from a device – Chip version of a device is <V1.1 – Deviation between actual and required configuration – Local bus device not connected – Maximum number of local bus devices exceeded
			Red on	The station is ready to operate 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 reached)
		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 diagnostic and/or status indicators may also be available.

For the diagnostic and status indicators on the bus coupler and their meanings, please refer to the documentation for the bus couplers.

9.3 Indicators on I/O modules

The LEDs of the I/O modules are located on the connectors.

9.3.1 LEDs on the power connectors

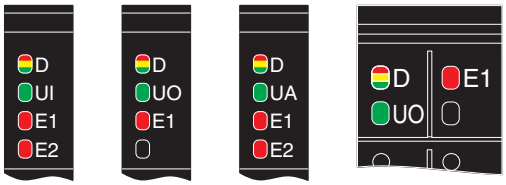


Figure 9-2 LEDs on the power connectors (examples)

Designation	Color	Meaning	State	Description
D	Red/yellow/green	Diagnostics of local bus communication		
		Run	Green on	The device is ready to operate, communication within the station is OK. All data is valid. No malfunction is present.
		Active	Flashing green	The device is ready to operate, communication within the station is OK. The data is **not** valid. No valid data provided by the controller or higher-level network. There is no malfunction on the module.
		Device application not active	Flashing green/yellow	The device is ready to operate, communication within the station is OK. Output data **cannot** be output and/or input data **cannot** be read. There is a malfunction on the I/O side of the module.
		Ready	Yellow on	The device is ready to operate, 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 to operate, but has lost the connection to the bus head.
		Not connected	Flashing red	The device is ready to operate, but there is no connection to the previous device.
		Power-down	Off	Device is in (power) reset.
U_x	Green	U_x	On	I/O supply present.
			Off	I/O supply not present.
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	I/O error 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

For information about the diagnostic and status indicators on a module and their meaning, please refer to the module-specific documentation.

9.3.2 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: modules with secure inputs or outputs (see module-specific documentation).

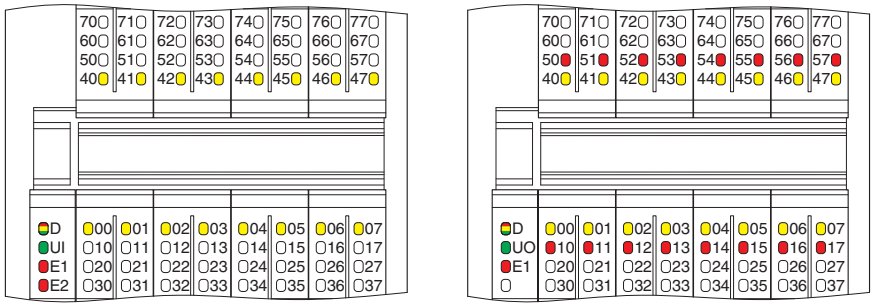


Figure 9-3 LEDs on the I/O connectors (e.g., AXL F DI16/4 2F, AXL F DO16/3 2F)

Table 9-1 LEDs on the I/O connector

Designation	Color	Meaning	State	Description
xx	**Yellow**	Status of the input or output	On	Corresponding input or output set.
			Off	Corresponding input or 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 9-1 lists commonly used LEDs. Additional LEDs may also be found on the modules.
For information about the LEDs on a module and their meaning, please refer to the module-specific documentation.

9.4 Reporting diagnostics via PDI

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

Detailed information can be found in Section “Objects for diagnostics” on page 127 and in the module-specific data sheet.

10 Process, parameter, and diagnostic data

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

10.1 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.

10.2 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 124.
– Manufacturer-specific application objects (index 0080_{hex} up to $5FFF_{hex}$, $FF8F_{hex}$)
  These objects are specified by the device manufacturer. They contain device-specific variables.
  For more detailed information on these objects, please refer to the documentation for the module.

You can access these objects using services.

Table 11-1 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.

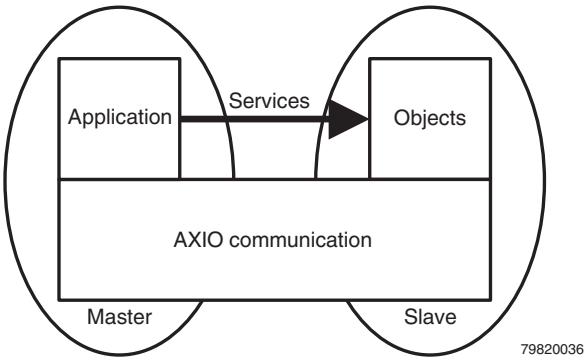


Figure 11-1 PDI components

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.

10.3 Saving of parameters

Every Axioline F module has parameters. They can be read or written or can be read and written. The parameters that can be written are saved every time a change is made.

Some parameters are defined as startup parameters in the device description file of each 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.

11 Software support

11.1 Overview of the software

The following software from Phoenix Contact supports you when working with Axioline F:

Planning and configuration

- PROJECT complete

Startup and parameterization

- Startup+

Programming

- PC Worx
- PC Worx Express
- PLCnext Engineer

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 safety modules, please refer to the module-specific documentation.

11.2 Planning and configuration: PROJECT complete

Additional information can be found in the “Marking and labeling, planning and marking software” product range or on the Internet at phoenixcontact.net/products.

The PROJECT complete planning and marking software supports the entire control cabinet manufacturing process. The program features an intuitive user interface that enables individual planning, automatic checking, and direct ordering of terminal strips.

11.3 Startup and parameterization: FDT/DTM and Startup+

FDT/DTM is a non-proprietary concept that 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 as well as sensors and actuators via Ethernet, INTERBUS, PROFIBUS, HART, for example, and PROFINET IO or IO-Link protocol in future.

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.

DTMs are 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, for example, 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+.

11.4 Programming

Detailed information can be found on the Internet at phoenixcontact.net/products or in the "Software, Programming" product range.

11.4.1 PC Worx

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

PC Worx is the consistent engineering software for all controllers from Phoenix Contact. It combines programming according to IEC 61131, fieldbus configuration for INTERBUS, PROFINET, and Modbus, as well as system diagnostics – in a single software solution.

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

11.4.2 PC Worx Express

Programming made easy: PC Worx Express from Phoenix Contact is free programming software that provides an easy way into programming according to IEC 61131.

As the little brother to the PC Worx software, it is tailored to class 100 controllers. Featuring intuitive operation, it is the ideal solution for the user-friendly and efficient creation of applications.

11.4.3 PLCnext Engineer

PLCnext Engineer is a flexible engineering platform for programming according to IEC 61131-3. In addition to programming, you can now perform all other engineering tasks using this platform, such as configuration, visualization, and diagnostics of your complete system.

12 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. For this technical data, please refer to the associated documentation.

For safety applications, 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.

12.1 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 communications 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 54.

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 (no condensation 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 least IP54 protection: II, IEC 61140, EN 61140, VDE 0140-1
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 testing 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)	
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 overvoltage (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	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 overvoltage (surge), 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).

Axioline F local bus supply (supplies the bus logic of the connected modules)	
Comment	The communications power U_L 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})	See controller, bus coupler or power module documentation

Voltage dips and interruptions of the I/O supply	
Degree of severity 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.
Degree of severity 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 sections

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 and insertion lengths” on page 66
Stripping lengths	8 mm or 10 mm; See Section “Conductor cross sections and stripping and 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 voltage, 24 V communications power/functional ground	500 V AC, 50 Hz, 1 min
5 V local bus voltage, 24 V communications power/24 V voltage of the digital or analog inputs or outputs	500 V AC, 50 Hz, 1 min
24 V voltage of the digital or analog inputs or outputs/functional ground	500 V AC, 50 Hz, 1 min

Approvals

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

12.2 Ordering data

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

Ordering data for the Axioline F modules

For the ordering data for the Axioline F modules, please refer to the module-specific documentation.
It is also available on the Internet at phoenixcontact.net/products.

Ordering data for accessories

Description	Type	Order No.	Pcs./Pkt.
Tools			
Screwdriver, slot-headed, VDE-insulated, size: 0.4 x 2.5 x 80 mm, 2-component handle, 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 Parts 1+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 :UNPRINTED	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, unmarked, can be marked with: THERMOMARK ROLL, THERMOMARK ROLL X1, THERMOMARK X, THERMOMARK S1.1, mounting type: snapped into marker carrier, lettering field size: 35 x 28 mm (for H housing)	EMT (35X28)R	0801602	500 individual labels

Description	Type	Order No.	Pcs./Pkt.
Insert label, roll, white, unmarked, can be marked with: THERMOMARK ROLL, THERMOMARK ROLL X1, THERMOMARK X, THERMOMARK S1.1, mounting type: snapped into marker carrier, lettering field size: 35 x 46 mm (for F housing)	EMT (35X46)R	0801604	500 individual labels
Insert label, roll, white, unmarked, can be marked with: THERMOMARK ROLL, THERMOMARK ROLL X1, THERMOMARK X, THERMOMARK S1.1, mounting type: snapped into marker carrier, lettering field size: 35 x 18.7 mm (for 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 perforated/unperforated, 2 meters (corresponds to TH 35-7.5 according to EN 60715)	NS 35/ 7,5 PERF 2000MM NS 35/ 7,5 UNPERF 2000MM	0801733 0801681	
Lütze: Mounting strap 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	Fa. 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 modular terminal block, connection method: screw connection, cross section: 0.2 mm² - 4 mm², AWG 24 - 12, width: 5.2 mm, 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 modular terminal block: connection method: screw connection, cross section: 0.2 mm² - 6 mm², AWG 24 - 10, width: 6.2 mm, color: green-yellow, mounting type: NS 35/7.5, NS 35/15, NS 32 (can be used as end bracket)	USLKG 5	0441504	50

Description	Type	Order No.	Pcs./Pkt.
Connection terminal block, connection method: screw connection, load current: 41 A, cross section: 0.5 mm² - 6 mm², 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 mm²	AI 0,5 - 8 WH -1000	3200881	1000
Cross section 0.75 mm²	AI 0,75- 8 GY -1000	3200894	1000
Cross section 1.0 mm²	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 mm²	A 0,5 - 8	3202481	1000
Cross section 0.75 mm²	A 0,75- 8	3202504	1000
Cross section 1.0 mm²	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 mm²	AI 0,5 -10 WH	3201275	100
Cross section 0.75 mm²	AI 0,75-10 GY	3201288	100
Cross section 1.0 mm²	AI 1 -10 RD	3200182	100
Cross section 1.5 mm²	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 mm²	A 0,5 -10	3202494	1000
Cross section 0.75 mm²	A 0,75-10	3200234	1000
Cross section 1.0 mm²	A 1 -10	3200250	1000
Cross section 1.5 mm²	A 1,5 -10	3200276	1000

Description	Type	Order No.	Pcs./Pkt.
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 busbar holders and 2 SK 5 shield connection clamps)	AXL SHIELD SET	2700518	1
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, length: 2 m	CAB-USB A/MICRO USB B/2,0M	2701626	

Ordering data for documentation

Description	Type	Order No.	Pcs./Pkt.
“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 versions

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 109.

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

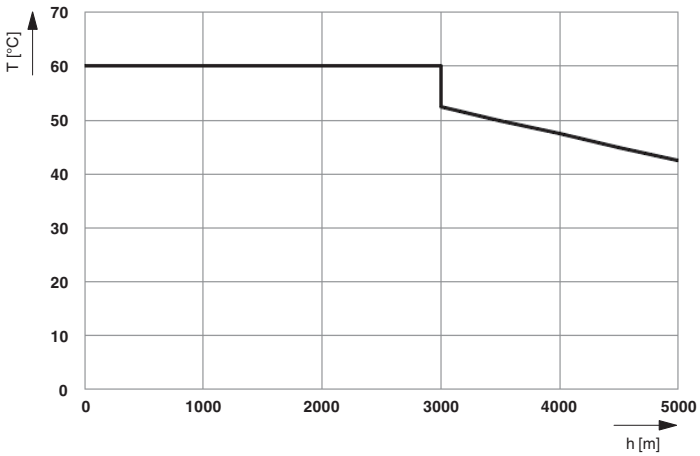


Figure A-1 Derating of the permissible ambient temperature depending on the operating elevation

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 via 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 following equation:

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

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 comprising 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.

This includes:

– The time for copying in 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 I/O modules (4)
– The update time of the higher-level network (5)
– The processing time (cycle time) in the controller (6)

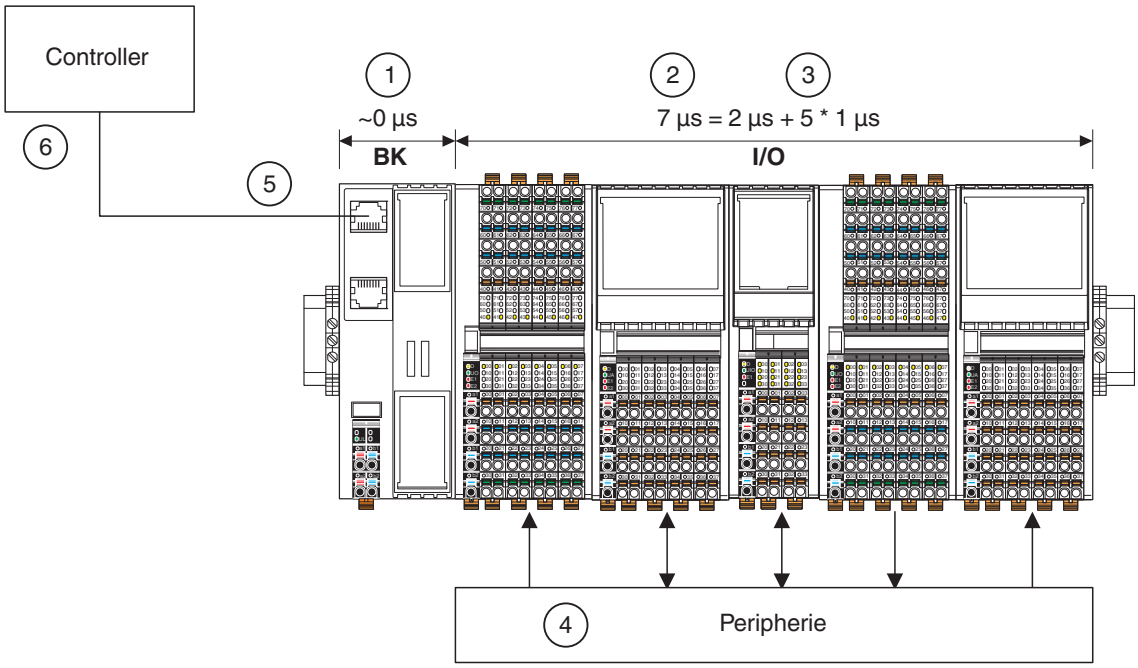


Figure A-2 Response times of the overall system

Typical processing times for an Axioline F system:

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

1	Time for copying in 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	The I/O update time	E.g., <100 µs
5	Cycle time of the higher-level network (depends on the higher-level network)	E.g., PROFINET IRT with 250 µs
6	Controller cycle time	1 ms

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

Explanation of terms

Conversion time	Signal runtime of the Axio protocol in an Axioline F module
Input filter time (e.g., RTD)	Part of the update time
Update time (DI, DO)	Signal runtime between the I/O and the protocol chip in the I/O module

A 5 Communication objects (PDI 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.

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

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 types

Object 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 the same data type with different lengths

Table A-4 Data types

Data type		Meaning
Visible string		Byte string only with printable ASCII characters The byte string finishes with 00_{hex} (null-terminated) or is filled with 00_{hex} to reach the total length. In the following tables and the module-specific data sheets, only the pure user data is provided in the “Content” column. Null termination and filling up a visible string with 00_{hex} is not shown.
Bit string		Bit strings always have a length of n x 8 bits, where n ∈ N (n element of the natural numbers).
Octet string		Byte string with any contents
Unsigned 8	UINT8	Value without prefix sign, only positive values 00_{hex} ... FF_{hex}
Unsigned 16	UINT16	Value without prefix sign, only positive values 0000_{hex} ... $FFFF_{hex}$
Unsigned 32	UINT32	Value without prefix sign, only positive values 0000 0000_{hex} ... FFFF $FFFF_{hex}$

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
– Objects for device diagnostics
– Objects for user data management
– Objects for device management
– Objects for modular devices and subsystems
– Object with object descriptions

The following only lists the objects for identification and device diagnostics, which are used for Axioline F.

If you require information in addition to the information provided in the data sheet, please refer to the basic profile on the Internet at www.interbusclub.com under “Downloads, INTERBUS Profile”.

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

The bold entries in Table A-5 are identical for all Axioline F modules from Phoenix Contact. All other entries may vary depending on the individual module.

Table A-5 Objects for identification (device rating plate) according to basic profile V3.0

Index [hex]	Object name	Data type	A	L [bytes]	Rights	Meaning	Content/example
Manufacturer							
0001	VendorName	Visible string	1	32	R	Manufacturer name	**PHOENIX CONTACT**
0002	VendorID	Visible string	1	7	R	Manufacturer ID	**00A045**
0003	VendorText	Visible string	1	58	R	Manufacturer text	**Components and systems for industrial automation**
0012	VendorURL	Visible string	1	58	R	Manufacturer URL	**www.phoenixcontact.net/qr/<Order No.>**

Table A-5 Objects for identification (device rating plate) according to basic profile V3.0 [...]

Index [hex]	Object name	Data type	A	L [bytes]	Rights	Meaning	Content/example
Module - general							
0004	DeviceFamily	Visible string	1	58	R	Device family	... (e.g., I/O analog IN)
0006	ProductFam-ily	Visible string	1	32	R	Product family	**AXL F or AXL F XC**
000E	CommProfile	Visible string	1	5	R	Communication pro-file	633
000F	DeviceProfile	Visible string	1	5	R	Device profile	0010
0011	ProfileVersion	Record	2		R	Profile version	
.1	BuildDate	Visible string	1	11	R	Version date	2011-12-07 2018-04-19
.2	Version	Visible string	1	19	R	Version ID	Basic profile V3.0
0017	Language	Record	2	6; 50, max.	R/W	Language	en-us; English
Module - specific (for a specific module)							
0005	Capabilities	Array of octet strings	N	N * 8	R	Device properties	(e.g., Nothing) See Table A-6
0007	ProductName	Visible string	1	32	R	Product name	... (e.g., AXL F AI4 I 1H)
0008	SerialNo	Visible string	1	22	R	Serial number	xxxxxxxxxx (e.g., 12345123456)
0009	ProductText	Visible string	1	58	R	Product text	... (e.g., 4 analog input channels)
000 A	OrderNumber	Visible string	1	32	R	Order No.	xxxxxxx (e.g., 2688491)
000B	HardwareVer-sion	Record	2		R	Hardware version	
.1	BuildDate	Visible string	1	11	R	Manufacturing date	YYYY-MM-DD
.2	Version	Visible string	1	11	R	Version ID	xxx (e.g., 01)
000C	FirmwareVer-sion	Record	2		R	Firmware version	
.1	BuildDate	Visible string	1	11	R	Manufacturing date	YYYY-MM-DD
.2	Version	Visible string	1	11	R	Version ID	xxx (e.g., --, V1.10)
000D	PChVersion	Record	2		R	Parameter channel version	
.1	BuildDate	Visible string	1	11	R	Manufacturing date	YYYY-MM-DD
.2	Version	Visible string	1	11	R	Version ID	xxx (e.g., 2016-12-01, PDI V1.10)
0037	DeviceType	Octet string	1	8	R	Device type	xx xx xx xx xx xx xx xx_{hex} (e.g., 00 20 00 08 00 00 00 $A6_{hex}$)

Table A-5 Objects for identification (device rating plate) according to basic profile V3.0 [...]

Index [hex]	Object name	Data type	A	L [bytes]	Rights	Meaning	Content/example
003 A	VersionCount	Array of UINT16	4	8	R	Version counter; unique consecutive numbering for the version of the corresponding component	E.g., 0009 0002 0001 0001
.1	ProfileVersion	Unsigned 16	1	2	R	0009 for basic profile V3.0	xx xx_{hex} (e.g., 0009)
.2	PChVersion	Unsigned 16	1	2		PDI version	xx xx_{hex} (e.g., 0002)
.3	HardwareVersion	Unsigned 16	1	2		Hardware version	xx xx_{hex} (e.g., 0001)
.4	FirmwareVersion	Unsigned 16	1	2		Firmware version	xx xx_{hex} (e.g., 0001)
Use of the device							
0014	Location	Visible string	1	58	R/W	Installation location	... (e.g., Please fill in ...); Can be filled in by the user.
0015	EquipmentIdent	Visible string	1	58	R/W	Equipment ID	... (e.g., Please fill in ...); Can be filled in by the user.
0016	ApplDeviceAddr	Unsigned 16	1	2	R/W	Application-specific device address	... (e.g., Please fill in ...); Can be filled in 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-6 Properties

Content	Meaning
Nothing	No additional functions
Safety0	The slave supports secure data communication. This takes place in both directions.
Energy0	The slave supports energy management.
SubMA_0	The slave is a subbus master. There is at least one additional subsystem below this slave.
FwUpdt0	The slave supports the firmware update.
SyncI_0	The slave supports synchronization of the inputs.
SyncO_0	The slave supports synchronization of the outputs.

A 5.2.1 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.

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

Table A-7 Objects for diagnostics: diagnostic state (read) according to basic profile V2.x

Index [hex]	Object name	Data type	A	L [bytes]	Meaning
0018	DiagState	Record	6		Diagnostic state
.1	Lfd.Nr.	Unsigned 16	1	2	Consecutive error number since the last reset or error memory reset
.2	Priority	Unsigned 8	1	1	Priority of the message. 1: highest priority
.3	Channel/ Group/Mod-ule	Unsigned 8	1	1	Channel, group or module where the error occurred. FF_{hex}: entire device
.4	Code	Octet string	1	2	Error code
.5	MoreFollows	Bit string 8	1	1	Additional information on malfunction; not used with Axioline F up to now
.6	Text	Visible string	1	51, max.	Plain text message. Default: status OK

Table A-8 Objects for diagnostics: diagnostic state (read) according to basic profile V3.x

Index [hex]	Object name	Data type	A	L [bytes]	Meaning
0018	DiagState		11	23 + 100, max.	Diagnostic state
.01	Lfd.Nr.	Unsigned 16	1	2	Consecutive error number since the last power-up or error memory reset
.02	Priority	Unsigned 8	1	1	Priority of the message. 1: highest priority
.03	Channel	Unsigned 8	1	1	Channel on which the error occurred. FF_{hex}: entire device
.04	Code	Octet string	1	2	Error code
.05	MoreFollows	Bit string 8	1	1	Additional information Information for interpreting the following data (see Table A-9)
.06	Reserviert	Octet string	1	2	Reserved (= 0000_{hex})
.07	SubModNo	Unsigned 8	1	1	Submodule number If the device is a modular device, the corresponding sub-module is specified here. If the device is not a modular device, “0” is entered here.

Table A-8 Objects for diagnostics: diagnostic state (read) according to basic profile V3.x [...]

Index [hex]	Object name	Data type	A	L [bytes]	Meaning
.08	Func-tionGroup	Octet string	1	8	Function group The permissible function groups are listed in objects 0x003B.1 and 0x003C.1. If there are several groups of one type (e.g., 4 channels each of a 16-channel DO module), the corresponding G number is appended. For example, a DI 32 is consists of four groups: DI-G1 ... DI-G4. The manufacturer-specific designation (e.g., “Relay OUT”) is specified in the diagnostic text (0x0018.11).
.09	AddValue	Octet string	1	4	Additional information “Additional value” regarding the current diagnostic state of the device
.0A	TextLength	Unsigned 8	1	1	Text length Length of the following diagnostic text in bytes.
.0B	Text	Visible string	1	100, max.	Diagnostic text Device-specific explanation of the malfunction that occurred. Information includes: – Type of the error – Function group or channel – Terminal point – Option for action for the user Default: “Status OK” The string is terminated 00_{hex}.

Table A-9 Index 5: additional information

Byte/bit	Value	Meaning
Byte	00_{hex}	No additional information
Bit 0	1	There is additional information on this error, which can be read via the “DiagStateLong” object.
Bit 1 ... 3	0	Reserved
Bit 4	1	There are additional simultaneously occurring diagnostic events. They can be read via the $E806_{hex}$ “ComplDiagState” object.
Bit 5 ... 6	0	Reserved
Bit 7	1	Indication that this is an extended version of object 0018_{hex} (compared to the version from basic profile V2.x).

Table A-10 Objects for diagnostics: acknowledge diagnostic messages (write)

Index [hex]	Object name	Data type	A	L [bytes]	Meaning
0019	ResetDiag	Unsigned 8	1	1	Acknowledge diagnostic massages Deletes the corresponding diagnostic memory and acknowledges the message

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

If you want to use the synchronization function, make sure that the following requirements are met simultaneously:

– The bus coupler or controller supports the function.
– There is at least one module in the Axioline F station that supports local bus synchronization.

Only the Axioline F modules that support local bus synchronization can be operated in a synchronous manner. All the other Axioline F modules of the station work in an asynchronous manner.

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.

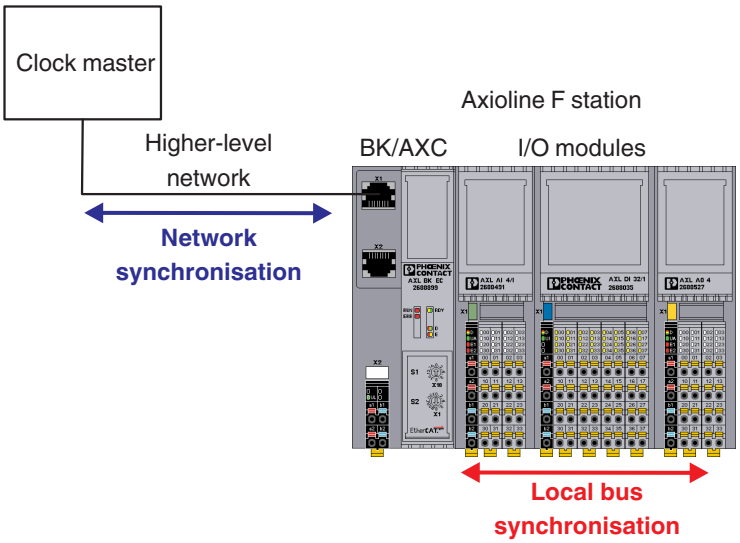


Figure A-3 Network and local bus synchronization

Clock master

In the overall system, the clock master is the unit which determines the synchronization times and synchronization time points and sends out a synchronization clock signal. Usually, 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 transfer the synchronization parameters and signals to the Axioline F station.

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

Table A-11 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 a cycle time 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 SyncI_0 (synchronization of inputs) property or SyncO_0 (synchronization of outputs) property is specified in the “Capabilities” object 0005_{hex}.

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 or output, the module provides the bus coupler or Axiocontrol with various information. This includes, for example, 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 bus coupler or Axiocontrol reads the values and makes them 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 or 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 capabilities and its clock master.

Modules that do not support synchronous processing do not affect a synchronous system. They do not accept or transfer the values at a specific point in time but 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-12 Synchronization options

Module property	Use	Remark
Cannot be synchronized	Asynchronous	
Can be synchronized	Asynchronous	If synchronization is not required for your application or is not useful, then deactivate synchronous mode.
	Synchronous	The modules are to be synchronized. Select the modules in a suitable manner. Parameterize them accordingly. See 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 on the local bus must support local bus synchronization.

A 7 Substitute value behavior and power-on 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 data is missing.

Power-on behavior

The power-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 possible:

Table A-13 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 substitute values from the “Substitute value for 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 Appendixes

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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
04	2015-05-22	Entire document		Complete revision of all sections Additions – New modules, housings, connectors – Low voltage area – Safety notes
05	2015-06-18	Entire document		Corrections

Table C-1 Revision history

Revision	Date	Contents		
06	2017-02-15	Section 6.2	Stripping lengths/insertion lengths	Warning: recommendation for crimping
		Section 8	Diagnostic and status indicators	Addition: notes
		Section 8.3.1	LEDs on the power connectors	Correction for LEDs E1 and E2
		Appendix A	Technical appendix	New: A1 use of Axioline F modules at an elevation of more than 3000 meters
		Entire document		Notes on safety modules
07	2018-10-xx	Section 4.1	Structure of the order designations	Addition: new functions
		Section 4.6	Master	New
		Section 5.1	Housing versions	Addition: housings AXC F 2xxx and 1F (PM)
		Section 5.2.2	AXC F controller	New
		Section 5.3.1	AXC F controller	New
		Section 5.3.4	Power measurement module	New
		Section 6.4	Mounting and removing modules, left alignment	New
		Section 7.2	Conductor cross sections, and stripping and insertion lengths	Addition: text in warning “NOTE: Malfunction when the conductor is not securely fixed”
		Section 7.10.5	Redundant signals	Addition: redundant digital outputs
		Section 9.2	Indicators on bus couplers	Addition: for D LED, flashing yellow/red
		Section 10.3	Saving of parameters	Revision
		Section 11	Software support	Revision
		Appendix A4	Response times for an Axioline F system	Revision
		Appendix A5	Communication objects (PDI objects)	Addition
		Appendix A 5.2	General standard objects	Conversion to basic profile V3.0
		Appendix A6	Synchronization	Addition: note
		Appendix A7	Substitute value behavior and power-on behavior	Revision
		Entire document		Deleted: description for BK housing (with integrated bus base) Renamed: F-BK housing changed to BK housing

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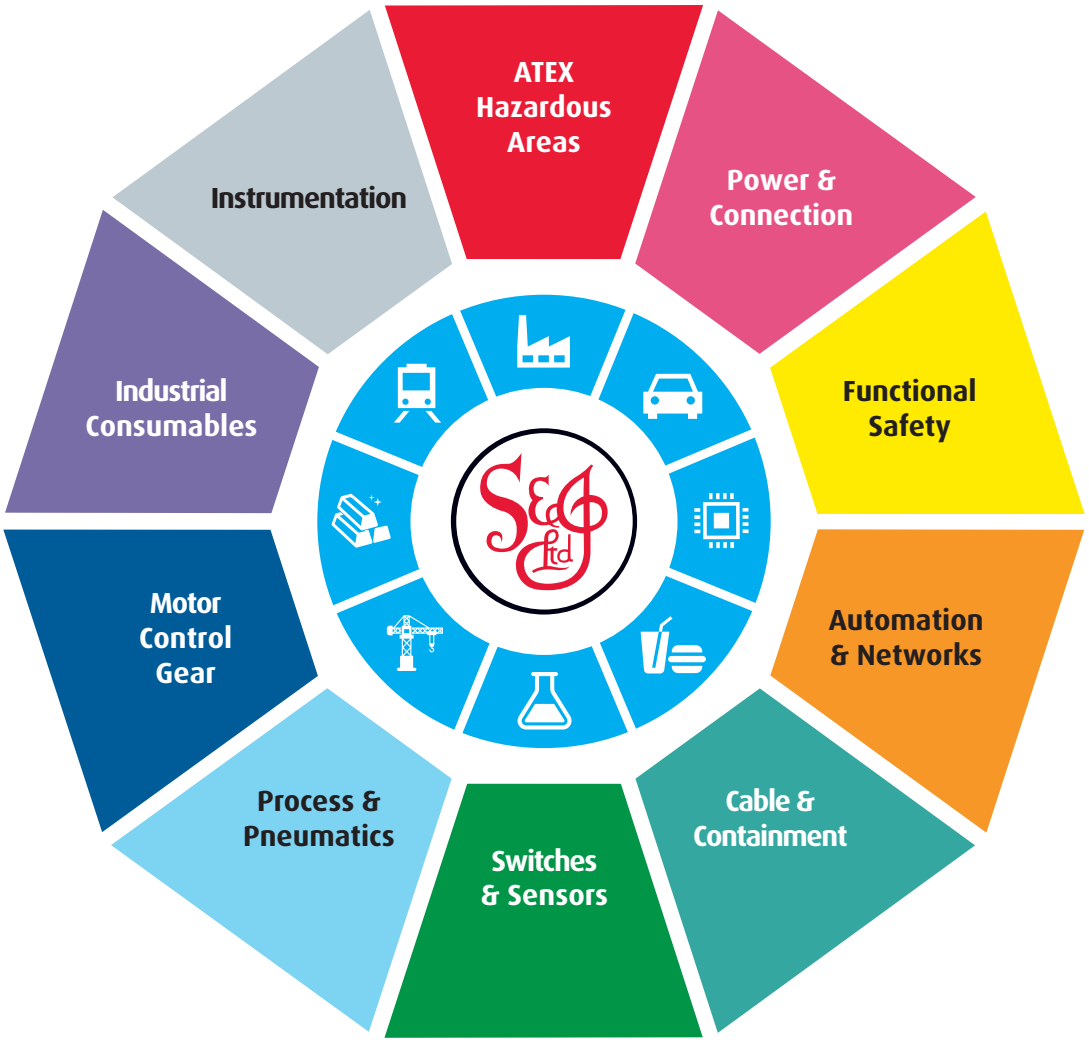

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