

AXL F BK PN

Axioline F bus coupler for PROFINET

Data sheet
105731_en_05

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1 Description

The bus coupler links a PROFINET network with the Axioline F system.

You can connect up to 63 Axioline F devices to an existing PROFINET system with the help of the bus coupler.

PROFINET features

- 2 Ethernet ports (with integrated switch)
- PROFI-safe support
- PROFINET RT and IRT
- Minimum cycle time of PROFINET for RT and IRT is 250 μ s
- Firmware can be updated
- MRP-Client
- Web-based management
- I&M 1-4
- Shared device

Features of Axioline F

- Up to 63 additional Axioline F devices can be connected
- Runtime in the bus coupler is negligible (goes to 0 μ s)
- Typical cycle time of the Axioline F local bus is around 10 μ s
- Diagnostic and status indicators



This data sheet is only valid in association with the UM EN AXL F SYS INST user manual.
For information on PROFINET basics, please refer to the UM EN PROFINET SYS user manual.



Make sure you always use the latest documentation.
It can be downloaded from the product at phoenixcontact.net/products.
Here you will also find the current GSDML file.

2	Table of contents	
1	Description	1
2	Table of contents	2
3	Ordering data	3
4	Technical data	5
5	Internal circuit diagram	8
6	Safety note	9
7	Connecting PROFINET and supply	9
	7.1 Connecting PROFINET	9
	7.2 Connecting the supply voltage - terminal point assignment.....	10
8	Connection example.....	10
9	Local status and diagnostic indicators	11
10	Diagnostic indicators for PROFINET	13
11	Diagnostic status register	14
12	Diagnostic alarms	15
13	Startup.....	15
14	Service interface.....	16
15	Parameterization	17
16	Device replacement.....	17
17	Phoenix Redundancy Layer (PRL)	17
18	Substitute value behavior	17
19	Simple Network Management Protocol - SNMP	17
20	WBM - Web-based management	18
21	Firmware update.....	18

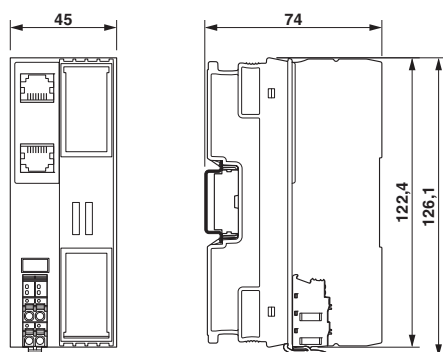
3 Ordering data

Description	Type	Order No.	Pcs./Pkt.
Axioline F bus coupler for PROFINET (including bus base module and connector)	AXL F BK PN	2701815	1
Accessories			
Axioline F bus base module for housing type BK (Replacement item)	AXL BS BK	2701422	5
Axioline F short power connector (for e.g., AXL F BK ...) (Replacement item)	AXL CN S/UL	2701421	5
RJ45 connector, shielded, with bend protection sleeve, 2 pieces, gray for straight cables, for assembly on site. For connections that are not crossed, it is recommended that you use the connector set with gray bend protection sleeve. (Connector/Adapter)	FL PLUG RJ45 GR/2	2744856	1
RJ45 connector, shielded, with bend protection sleeve, 2 pieces, green for crossed cables, for assembly on site. For connections that are crossed, it is recommended that the connector set with green bend protection sleeves is used. (Connector/Adapter)	FL PLUG RJ45 GN/2	2744571	1
CAT5-SF/UTP cable (J-02YS(ST)C HP 2 x 2 x 24 AWG), heavy-duty installation cable, 2 x 2 x 0.22 mm ² , solid conductor, shielded, outer sheath: 7.8 mm diameter, inner sheath: 5.75 mm ± 0.15 mm diameter (Cable/conductor)	FL CAT5 HEAVY	2744814	1
CAT5-SF/UTP cable (J-LI02YS(ST)C H 2 x 2 x 26 AWG), light-duty, flexible installation cable 2 x 2 x 0.14 mm ² , stranded, shielded, outer sheath: 5.75 mm ± 0.15 mm diameter (Cable/conductor)	FL CAT5 FLEX	2744830	1
Crimping pliers, for assembling the RJ45 plugs FL PLUG RJ45..., for assembly on site (Tools)	FL CRIMPTOOL	2744869	1
Zack marker strip for Axioline F (device labeling), in 2 x 20.3 mm pitch, unprinted, 25-section, for individual labeling with B-STIFT 0.8, X-PEN, or CMS-P1-PLOTTER (Marking)	ZB 20,3 AXL UNPRINTED	0829579	25
Zack marker strip, flat, in 10 mm pitch, unprinted, 10-section, for individual labeling with M-PEN 0,8, X-PEN, or CMS-P1-PLOTTER (Marking)	ZBF 10/5,8 AXL UNPRINTED	0829580	50

Accessories	Type	Order No.	Pcs./Pkt.
Insert label, Roll, white, unlabeled, can be labeled with: THERMOMARK ROLLMASTER 300/600, THERMOMARK X1.2, THERMOMARK ROLL X1, THERMOMARK ROLL 2.0, THERMOMARK ROLL, mounting type: snapped into marker carrier, lettering field size: 35 x 18.7 mm (Marking)	EMT (35X18,7)R	0801831	1
Connecting cable, for connecting the controller to a PC for PC Worx and LOGIC+, USB A to micro USB B, 2 m in length. (Cable/conductor)	CAB-USB A/MICRO USB B/ 2,0M	2701626	1
Function block library for safety-related analog value acquisition with standard I/O modules. Please contact the safety hotline (+49 5281 9-462777) before ordering the SAFE AI article.	SAFE AI	2400057	1
Documentation	Type	Order No.	Pcs./Pkt.
User manual, English, Axioline F: System and installation	UM EN AXL F SYS INST	-	-
User manual, English, Axioline F: Diagnostic registers, and error messages	UM EN AXL F SYS DIAG	-	-
Quick start guide, English, Handling an Axioline F station under Startup+	UM QS EN STARTUP+	-	-
User manual, English, Installation and operation of the PC Worx Firmware Updater software	UM EN PC WORX FIRMWARE UPDATER	-	-

4 Technical data

Dimensions (nominal sizes in mm)



Width	45 mm
Height	126.1 mm
Depth	74 mm
Note on dimensions	The depth is valid when a TH 35-7,5 DIN rail is used (according to EN 60715).

General data

Color	traffic grey A RAL 7042
Weight	177 g (with connector and bus base module)
Ambient temperature (operation)	-25 °C ... 60 °C (Mounting position: wall mounting on horizontal DIN rail) -25 °C ... 55 °C (Mounting position: any)
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Permissible humidity (operation)	5 % ... 95 % (non-condensing)
Permissible humidity (storage/transport)	5 % ... 95 % (non-condensing)
Air pressure (operation)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Air pressure (storage/transport)	70 kPa ... 106 kPa (up to 3000 m above sea level)
Degree of protection	IP20
Protection class	III, IEC 61140, EN 61140, VDE 0140-1
Mounting position	any
Mounting type	DIN rail mounting

Connection data: Axioline F connector

Connection method	Push-in connection
Conductor cross section solid / stranded	0.2 mm ² ... 1.5 mm ² / 0.2 mm ² ... 1.5 mm ²
Conductor cross section [AWG]	24 ... 16
Stripping length	8 mm



Please observe the information provided on conductor cross sections in the "Axioline F: system and installation" user manual.

Interface: PROFINET

Number	2
Connection method	RJ45 socket
Note on the connection method	Auto negotiation and autocrossing
Transmission speed	100 Mbps (full duplex)
Transmission physics	Ethernet in RJ45 twisted pair

Interface: Axioline F local bus

Connection method	Bus base module
Transmission speed	100 Mbps

Interface: Service

Number	1
Connection method	Micro USB type B
Note on the connection method	Female connector

System limits

Amount of process data	max. 524 Byte (Max. 262 bytes IN - max. 262 bytes OUT) max. 262 Byte (Input) max. 262 Byte (Output)
Number of supported devices	max. 63 (per station)
Number of local bus devices that can be connected	max. 63

**NOTE: Electronics may be damaged when overloaded**

Observe the logic current consumption of each device when configuring an Axioline F station. It is specified in every module-specific data sheet. The current consumption can differ depending on the individual module. The permissible number of devices that can be connected therefore depends on the specific station structure.

PROFINET

Device function	PROFINET device
-----------------	-----------------

Protocols supported

Protocols supported	PROFINET, TFTP, PTCP, LLDP, SNMP, MRP, DDI, BootP (BootP only for the implementation of firmware updates)
---------------------	---

Communications power U_L feed-in (the supply of the Axioline F local bus U_{BUS} is generated from U_L)

Supply voltage	24 V DC
Supply voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current draw	typ. 105 mA (without I/Os and $U_L = 24$ V) max. 570 mA (with 2 A at U_{BUS} for the I/Os and $U_L = 24$ V)
Power consumption	typ. 2.5 W (without I/Os) max. 13.7 W (with 2 A load at U_{BUS} for the I/Os)

Communications power U_L feed-in (the supply of the Axioline F local bus U_{Bus} is generated from U_L)

Surge protection of the supply voltage electronic

Polarity reversal protection of the supply voltage electronic

**NOTE: Electronics may be damaged when overloaded**

Provide external fuses for the 24 V U_L area. If you are using an external fuse, the power supply unit must be able to supply four times the nominal current of the fuse. This ensures that it trips in the event of an error.

Axioline F local bus supply (U_{Bus})

Supply voltage 5 V DC (via bus base module)

Power supply unit 2 A

Power dissipation

Maximum power dissipation for nominal condition max. 2.5 W

Mechanical testsVibration resistance in acc. with EN 60068-2-6/
IEC 60068-2-6 5g

Shock in acc. with EN 60068-2-27/IEC 60068-2-27 30g

Continuous shock according to EN 60068-2-27/
IEC 60068-2-27 10g**Conformance with EMC Directive 2014/30/EU****Noise immunity test in accordance with EN 61000-6-2**Electrostatic discharge (ESD) EN 61000-4-2/
IEC 61000-4-2 Criterion B, 6 kV contact discharge, 8 kV air discharge

Electromagnetic fields EN 61000-4-3/IEC 61000-4-3 Criterion A, Field intensity: 10 V/m

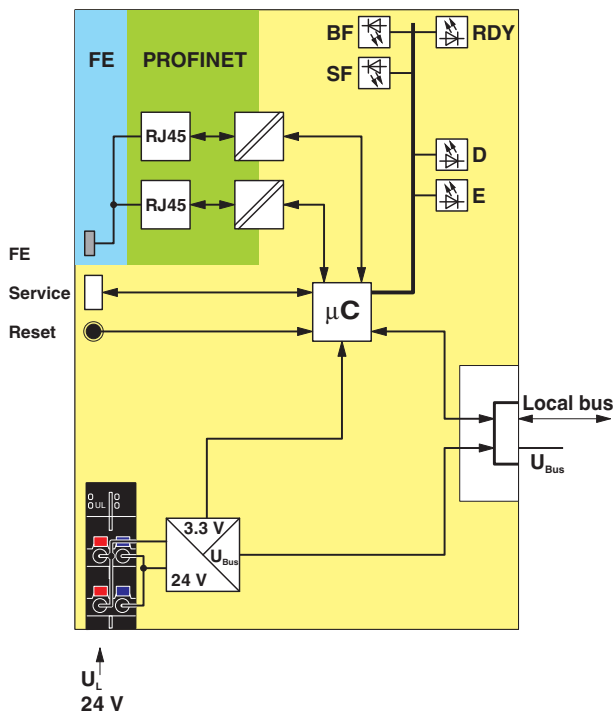
Fast transients (burst) EN 61000-4-4/IEC 61000-4-4 Criterion B, 2 kV

Transient overvoltage (surge) EN 61000-4-5/
IEC 61000-4-5 Criterion B, DC supply lines: ± 0.5 kV/ ± 0.5 kV (symmetrical/
asymmetrical), fieldbus cable shield: ± 1 kV

Conducted interference EN 61000-4-6/IEC 61000-4-6 Criterion A; Test voltage 10 V

Noise emission test according to EN 61000-6-3 Class B**Approvals**For the latest approvals, please visit phoenixcontact.net/products.

5 Internal circuit diagram



Key:

- FE Functional earth ground
- Service Service interface
- Reset Reset button
- Local bus Axioline F local bus (hereinafter referred to as local bus)
- RJ45 RJ45 interface
- Power supply unit with electrical isolation
- Microcontroller
- Power supply unit
- LED
- Electrically isolated area

Figure 1 Internal wiring of the terminal points

6 Safety note



NOTE: Risk of unauthorized network access

Connecting devices to a network via Ethernet entails the danger of unauthorized access to the network.

To prevent unauthorized network access, please read the following notes.

If possible, deactivate unused communication channels.

Assign passwords such that third-parties cannot access the bus coupler and make changes without authorization.

Due to its communication interfaces, the bus coupler should not be used in safety-critical applications without additional security appliances.

Therefore, please take additional protective measures in accordance with the IT security requirements and the standards applicable to your application (e.g. virtual networks (VPN) for remote maintenance access, firewalls, etc.) for protection against unauthorized network access.

On first request, you shall release Phoenix Contact and the companies associated with Phoenix Contact GmbH & Co. KG, Flachsmarktstrasse 8, 32825 Blomberg in accordance with §§ 15 ff. AktG (German Stock Corporation Act), hereinafter collectively referred to as "Phoenix Contact", from all third-party claims made due to improper use.

For the protection of networks for remote maintenance via VPN, Phoenix Contact offers the mGuard product series as security appliances; these are described in the latest Phoenix Contact catalog (phoenixcontact.net/products).

Additional measures for protection against unauthorized network access can be found in the AH EN INDUSTRIAL SECURITY application note. The application note can be downloaded at phoenixcontact.net/products.

7 Connecting PROFINET and supply

7.1 Connecting PROFINET

Connect PROFINET to the bus coupler via an 8-pos. RJ45 connector.

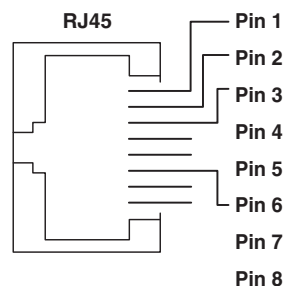


Figure 2 Pin assignment of the Ethernet socket (RJ45)

Only one twisted pair cable with an impedance of 100 Ω may be connected to each Ethernet interface in RJ45 format. The data transmission speed is 100 Mbps. The 100Base-TX port of the bus coupler is able to detect a pair of incorrectly connected receive cables (RD+/RD-) and to correct them using the auto polarity correction function.

For the pin assignment, refer to the following table:

Pin	Assignment
1	TxD + (transmit data +)
2	TxD - (transmit data -)
3	RxD+ (receive data +)
4	Reserved
5	Reserved
6	RxD- (receive data -)
7	Reserved
8	Reserved



Auto crossover

Both Ethernet interfaces are provided with the auto crossover function.



Shielding

The shielding ground of the connected twisted pair cables is electrically connected with the socket. When connecting network segments, avoid ground loops, potential transfers, and voltage equalization currents via the braided shield.



Observe bending radii
 The housing dimensions specified under "Dimensions" refer to the bus coupler with I/O connectors without Ethernet connection. When installing the bus coupler in a control box, observe the bending radii of the Ethernet cables and the connectors used (e.g., FL CAT5 FLEX: 30 mm for fixed installation and FL CAT5 HEAVY: 30 mm without outer sheath and 45 mm with outer sheath). If required, use angled RJ45 connectors to maintain these bending radii.

8 Connection example

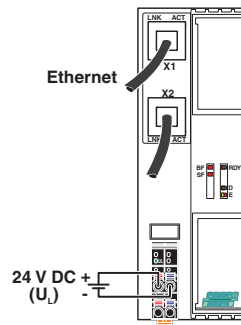


Figure 4 Connection of the cables

7.2 Connecting the supply voltage - terminal point assignment



Figure 3 Terminal point assignment

Terminal point	Color	Assignment	
Supply voltage input			
a1, a2	Red	24 V DC (U _L)	Communications power feed-in (bridged internally)
b1, b2	Blue	GND	Reference potential of the supply voltage (bridged internally)

9 Local status and diagnostic indicators

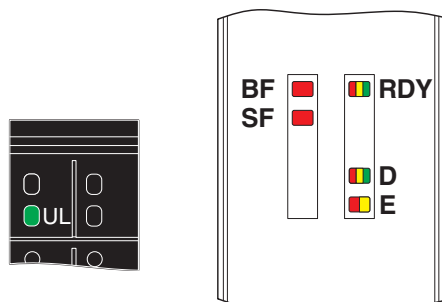


Figure 5 Local diagnostic and status indicators

Designation	Color	Meaning	State	Description
UL	Green	U_{Logic}	On	Communications power supply present.
			Off	Communications power supply not present.
BF	Red	Communication error (B us F ault)	On	No link status available on any port
			Flashing	SF LED not flashing: Link status available, no communication connection to the PROFINET controller
			Flashing	SF flashing: Hardware watchdog triggered
			Off	A PROFINET controller has established an active communication connection to the PROFINET device.
SF	Red	System failure (PROFINET)	On	PROFINET diagnostics available
			Off	PROFINET diagnostics not available
			Flashing	Flashes only together with the BF LED; watchdog triggered
RDY	Green/ yellow/ red	Ready	Green on	Device is ready for operation.
			Flashing green/ yellow	Communications power undervoltage or surge voltage
				Overtemperature
			Flashing green, LED D yellow on	Device is in standby mode.
			Yellow on	Firmware/bus coupler is booting
			Yellow flashing	Firmware update is being performed.
			Flashing yellow/ red	Firmware update has failed.
			Flashing red	Faulty firmware
Off	Device is not ready for operation.			

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

10 Diagnostic indicators for PROFINET

States during operation

LED	Meaning
SF OFF/ BF OFF	PROFINET controller was able to establish communication without errors.

States in the event of an error

LED	Meaning	Measure/remedy in the event of an error
SF OFF/ BF flashing	PROFINET device is waiting for communication with the PROFINET controller.	No error
	The logic communication connection has been interrupted. The PROFINET controller can no longer be accessed.	Check the connection between the PROFINET controller and the PROFINET device. Make sure that the PROFINET device name of the PROFINET device is identical with the configuration.
	The PROFINET device is not assigned a PROFINET device name.	Assign the PROFINET device name using the relevant tool.
SF OFF/ BF ON	The physical communication path has been interrupted. The PROFINET controller can no longer be accessed.	Restore the physical connection between the PROFINET controller and the PROFINET device.
SF ON/ BF OFF	Diagnostic data is available.	Read the diagnostic message using the relevant tool.
SF flashing/ BF flashing	Hardware watchdog has been triggered.	Execute a reset. Replace the device when the error occurs again.

States during firmware update

LED	Meaning
RDY flashing	BootP requests are sent and the firmware container is loaded via tftp.
RDY ON	Firmware is saved.



The firmware update can take several minutes.

The bus coupler is restarted automatically after a successful update.

11 Diagnostic status register

Information on the operating and error states of the Axioline F local bus is stored in the diagnostic status register of the bus coupler. A state of the Axioline F local bus is assigned to each bit in the diagnostic status register.

The states in the error bits (F_PW_BIT, F_PF_BIT, F_BUS_BIT, F_CTRL_BIT) are described in greater detail using the two diagnostic parameter registers. For information on this, please refer to the AXL F SYS DIAG user manual.

Structure of the diagnostic status register

Bit	Designation	Meaning	
00	F_PW_BIT	I/O warning	At least one device indicates an I/O warning.
01	F_PF_BIT	Peripheral fault	At least one device indicates a peripheral fault.
02	F_BUS_BIT	Bus error	A bus error has occurred.
03	-	Reserved	
04	-	Reserved	
05	F_RUN_BIT	Run	Data cycles are being exchanged, the output data is enabled.
06	F_ACTIVE_BIT	Active	Configuration is active, PDI to the devices is possible, data exchange with invalid/non-enabled process data.
07	F_READY_BIT	Ready	The local bus master is ready for operation, no data exchange over the bus.
08	F_BD_BIT	Bus different	A device which does not belong to the current configuration has been detected at the last interface.
09	F_BASP_BIT	SYS_FAIL	The controller is in the STOP state or no application program has been loaded. The output data is blocked (substitute value behavior is active).
10	F_FORCE_BIT	Force Mode	Force mode (startup tool/I/O check is active).
11	F_SYNC_BIT	Synchronization	Synchronization between higher-level system and local bus master has failed.
12	F_PARA_REQ	Module error	At least one device is requesting parameters.
13 ... 15	-	Reserved	

The diagnostic status register can be read using asynchronous services (index 2210_{hex}, 8720_{hex}).

Example in PC Worx: sending a read service

The RDREC function block is available for sending read services.

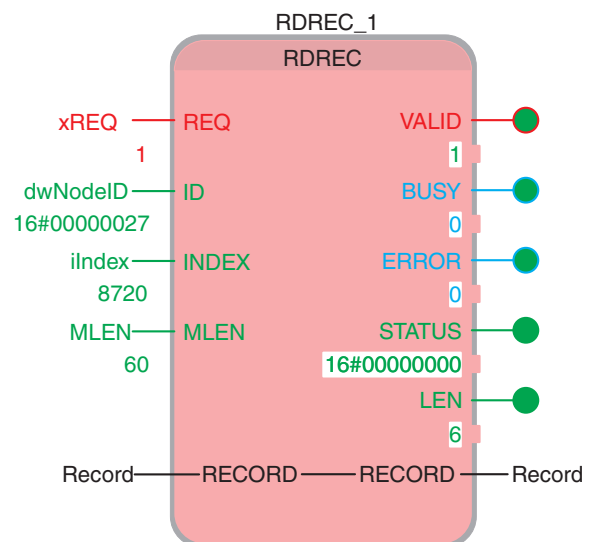


Figure 6 RDREC function block

- Open the bus configuration workspace.
- In the “Bus Structure” window, select the bus coupler.
- In the “Device Details” window, select the “Module Settings” tab.
- Read the node ID (**decimal**) of the bus coupler and enter it in **hexadecimal form** at the ID input of the function block.



Please note:

The node ID is generated automatically by PC Worx and may therefore vary in different projects.

The read service is sent on a rising edge at the REQ input of the function block. If the VALID output is TRUE, the response to the service is stored in I/O variable RECORD.

The diagnostic status register is located in byte 0 and byte 1. In the example, the following response is stored in variable RECORD:

Record	
[1]	16#00
[2]	16#E0
[3]	16#00
[4]	16#00
[5]	16#00
[6]	16#00
[7]	16#00
[8]	16#00
[9 ... 15]	16#00

In this example, the diagnostic status register has the value 00E0_{hex} (0000 0000 1110 0000_{bin}). Bits 5, 6, and 7 are TRUE. This means that data cycles are being exchanged, the configuration is active, and the local bus master is ready.

12 Diagnostic alarms

PROFINET enables the PROFINET device to store diagnostic information together with the error location and error type.

In the default upon delivery the alarms are enabled, however, they can be disabled with parameters on startup.

An incoming alarm informs the PROFINET controller that diagnostic information has been stored.

When the diagnostic information has been removed, an outgoing alarm is transmitted to the controller.

If at least one piece of diagnostic information is stored, the SF LED is on. If no diagnostic information is present, the SF LED is off.

13 Startup

Default upon delivery/default settings

By default upon delivery, the following functions and features are available:

PROFINET name: No name assigned
 IP parameters: 0.0.0.0
 Module designation: AXL F BK PN

Vendor ID: 00B0_{hex}
 Device ID: 1000_{hex}

Firmware started

Once you have supplied the bus coupler with power or pressed the reset button, the firmware is started. After completion of the firmware boot process the BF LED is either on or flashing.

Reset button

The reset button is located beneath the top marking label on the bus coupler.

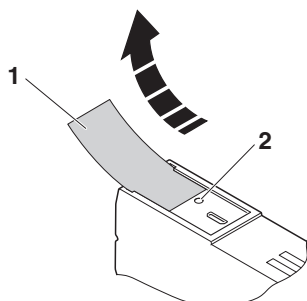


Figure 7 Reset button

- 1 Labeling field
- 2 Reset button

The reset button has two functions:

- Restarting the bus coupler
- Resetting of the default settings

Holding down the button during the initialization phase restores the default settings.

If you wish to restore the default settings, proceed as follows:

- Disconnect the power to the module.
- Press and hold the reset button.
- Switch on the power.

The LEDs indicate the initialization phase:

LED	State	Meaning
RDY	Off	Starting firmware
RDY	Yellow on	Initializing firmware
RDY	Green	Initialization complete

- When the RDY LED lights up green, release the button. The default settings are restored.

Documentation



How to assign the PROFINET names and the IP address as well as how to startup a device within a PROFINET system is described in the following documents:

- "PC WORX" quick start guide
- "Configuring INTERBUS devices in a PROFINET network using the example of STEP 7" quick start guide

For the order designations, please refer to the ordering data.

The documentation can be found on the Internet at phoenixcontact.net/products.

14 Service interface

The service interface is located beneath the top marking field on the bus coupler.

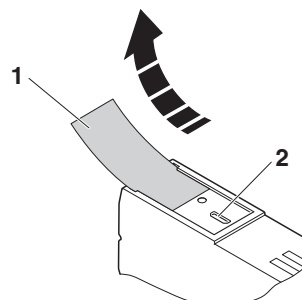


Figure 8 Service interface

- 1 Labeling field
- 2 Service interface

You can connect the bus coupler to a PC on which the Startup+ startup/diagnostic tool is running via USB using the service interface.

Startup+ offers the following functions:

- Parameterization of the station I/O modules
- I/O check
- Diagnostics



For detailed information on Startup+, please refer to the UM QS EN STARTUP+ user manual.

15 Parameterization

PC Worx

Parameterization of the PROFINET device in PC Worx requires at least PC Worx Version 6.30. This is part of the AUTOMATIONWORX Software Suite 1.80 and 1.81.

An online data sheet of the device with important technical data and a configuration file are integrated into PC Worx. If several versions of the configuration file are available, make sure that you are working with the file version that corresponds to the firmware/hardware version used.

Other tools

The PROFINET device is parameterized using the configuration tool of the PROFINET controller. Please integrate the corresponding GSDML file of the bus coupler into the relevant software tool (STEP 7/HW Config, ...).



Make sure you always use the latest version of the FDCML/GSDML file and the latest documentation for the bus coupler. The latest files and documentation can be found on the Internet at phoenixcontact.net/products.

16 Device replacement

Devices can be replaced without having to reconfigure them within the PROFINET network. The station name and address are assigned by the control system to the newly added PROFINET bus coupler using the neighborhood detection function.

17 Phoenix Redundancy Layer (PRL)

The Phoenix Redundancy Layer (PRL) makes it possible to design a redundant system with two PROFINET controllers. One controller is configured as the primary I/O controller and the other as the backup I/O controller. Depending on which PROFINET controller provides valid values, the bus coupler operated at field level adopts these values or uses failsafe values.



PRL (or shared device) and MRP can be used simultaneously if the PROFINET update time is ≥ 8 ms and the PROFINET watchdog time is > 200 ms.

18 Substitute value behavior

If Ethernet communication fails or an error occurs in the local bus, all outputs of the station are set to the substitute values previously parameterized on the module.

In order to do this, Plug and Play mode must be deactivated and the process data watchdog must be activated.



For the possible substitute values of a module, please refer to the relevant module-specific data sheet.

19 Simple Network Management Protocol - SNMP

The bus coupler supports SNMP v1 and v2c.

Management Information Base - MIB



The corresponding latest MIBs are available on the Internet at phoenixcontact.net/products.

For the object descriptions, please refer to the ASN1 descriptions for this product.

The password for read access is "public" and cannot be changed.

By default upon delivery, the password for write/read access is "private" and can be modified at any time.

20 WBM - Web-based management

The device has a web server, which generates the required pages for web-based management and, depending on the requirements of the user, sends them to a standard web browser. Web-based management can be used to access static information (e.g., technical data, MAC address) or dynamic information (e.g., IP address, status information).

Calling web-based management

The device web server can be addressed using the IP address if configured accordingly. The homepage (web page) of the device is accessed by entering the URL "http://ip-address".

Example: http://172.16.113.38



If you cannot access the WBM pages, check the connection settings in your browser and deactivate the proxy, if set.

21 Firmware update

The bus coupler firmware is updated using the "PC Worx Firmware Updater" software.



For more detailed information regarding the firmware update, refer to the "Installation and operation of the PC Worx Firmware Updater software" user manual.



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