

Installing, starting up, and operating the **AXC F 2152** controller

User manual

User manual

Installing, starting up, and operating the AXC F 2152 controller

UM EN AXC F 2152, Revision 00

2018-01-17

This user manual is valid for:

Description	As of version (HW)	As of version (FW)	Order No.
AXC F 2152	02	1.0.0	2404267

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1 For your safety

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

1.1 Marking 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.
- Qualified application programmers and software engineers. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.

1.3 Field of application of the product

1.3.1 Intended use

The AXC F 2152 controller is a modular small-scale controller that can be used for smaller and medium-sized applications. The device has IP20 protection class and is designed for use in closed control cabinets or control boxes (terminal boxes) with IP54 degree of protection or higher.

The device is designed for use in industrial environments.

1.3.2 Modifications

Modifications to hardware 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.

1.4 Safety notes

Observe the country-specific installation, safety, and accident prevention regulations.

During commissioning and maintenance work, proceed in accordance with the five safety rules of DIN EN 50110-1. In general, the rules should be observed in the specified order:

- Disconnect safely
- Ensure power cannot be switched on again
- Verify safe isolation from the supply
- Ground and short circuit
- Cover or safeguard adjacent live parts

Once the work is complete, perform the above steps again in reverse order.



NOTE: Property damage due to impermissible load

The IP20 degree of protection (IEC 60529/EN 60529) requires that the device be used in a clean and dry environment. If you use device in an environment that is outside of the specified limits, this may cause damage to the device.

- Do not subject the device to mechanical and/or thermal loads that exceed the specified limits.

**NOTE: Risk of unauthorized network access**

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

Therefore, please check your application for an option for deactivating active communication channels (for instance SNMP, FTP, BootP, DCP, HTTP, HTTPS, etc.) or setting passwords, to prevent third parties from accessing the controller without authorization and modifying the system.

Because of the controller's communication interfaces, we advise against using the controller in safety-critical applications without additional security appliances.

Please take additional protective measures according to the IT security requirements and the standards applicable to your application (for instance 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 or German Stock Corporation Act (hereinafter collectively referred to as "Phoenix Contact") from all third-party claims that are made due to improper use.

For the protection of networks for remote maintenance via VPN, Phoenix Contact offers the mGuard product series security appliances which you can find described in the latest Phoenix Contact catalog (phoenixcontact.net/products).

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

**NOTE: Device failure due to foreign objects in device**

Foreign objects in device can lead to malfunctions or even device failure.

- Make sure that no foreign objects find their way into the device (e.g., into the cooling openings).

**NOTE: Device failure if operated outside the permitted range for the ambient temperature**

If you operate the device in ambient temperatures that are not within the permitted range, this may lead to malfunctions or even device failure.

- Make sure the device is operated in the permitted ambient temperature range, see Section 13.2.

**NOTE: Device failure if operated above the permitted specifications for vibrations and shock**

If you operate the device in ambient temperatures that are above the permitted specifications for vibrations and shock, this may lead to malfunctions or even device failure.

- Make sure when operating the device that the permitted specifications for vibrations and shocks are adhered to, see Section 13.2.

2 From transport to unpacking

2.1 Transport

The device is delivered in cardboard packaging.

- Only transport the device to its destination in its original packaging.
- On the packaging, please note the instructions regarding handling as well as moisture, shock, tilt, and temperature indicators.
- Observe the humidity specifications and the temperature range specified for transport (see Section 13.2).
- If necessary, protect the surfaces to prevent damage.
- When transporting the equipment or storing it temporarily, make sure that the surfaces are protected from the elements and any external influences, and that they are kept dry and clean.

2.2 Storage

The storage location must meet the following requirements:

- Dry
- Protected from unauthorized access
- Protected against harmful environmental influences such as UV light
- Temperature range: -40°C ... +85°C
- Air pressure: 58 kPa ... 106 kPa (up to 4500 m above sea level)
- Permissible humidity: 5% ... 95% (according to DIN EN 61131-2)

2.3 Checking the delivery

- Check the delivery for transport damage.

Damaged packaging is an indicator of potential damage to the device that may have occurred during transportation. This could result in a malfunction.

- Submit claims for any transport damage immediately, and inform Phoenix Contact or your supplier as well as the shipping company without delay.
- Enclose photos which clearly document the damage to the packaging/delivery together with your claim.
- Immediately after delivery, refer to the delivery note to check the completeness of the contents of the packaging.
- Keep the box and packaging material in case it is necessary to return the product.
- We strongly recommend using the original packaging to return equipment.
- If the original packaging is no longer available, observe the following points:
 - Observe the humidity specifications and the temperature range specified for transport (see Section 13.2).
 - If necessary, use dehumidifying agents.
 - Use appropriate ESD packaging to protect components that are sensitive to electrostatic discharge.

- Make sure that the packaging you select is large enough and sufficiently thick.
- Only use plastic bubble wrap sheets as filler material.
- Attach warnings to the transport packaging so that they are clearly visible.
- Please be aware that the delivery note is to be placed inside the package in the case of packages that are to remain within the same country. However, if the package is being sent abroad, the delivery note must be placed inside a delivery note pocket and attached to the outside so that it is clearly visible.

Scope of supply

- AXC F 2152 controller
- AXL F BS BK bus base module
- AXL CN S/UL supply plug
- SD FLASH 2GB PLCNEXT MEMORY SD card

2.4 Unpacking

The AXC F 2152 is supplied in the packaging together with a packing slip with installation instructions.

- Read the complete packing slip carefully before unpacking the controller.

**NOTE: Electrostatic discharge!**

The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and IEC 61340-5-1.

**NOTE: Property damage due to noncompliance with ESD notes**

If the ESD notes are not observed during unpacking and packaging, the device may be damaged.

- Observe the ESD notes during unpacking and packaging.

3 Description of the AXC F 2152

3.1 General description of the controller

The AXC F 2152 is a modular small-scale controller with integrated Ethernet and Axioline F local bus connections.

The controller consists of an electronics module (1) and a bus base module (2).

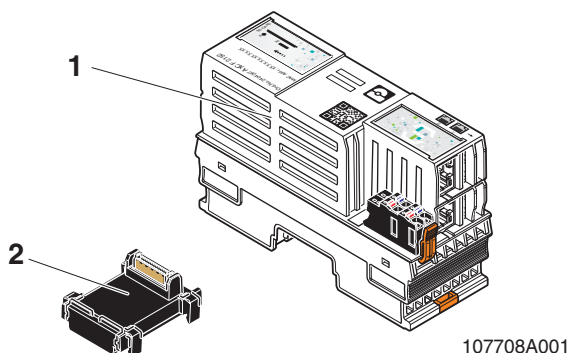


Figure 3-1 Components of the controller

Axioline F station

An Axioline F station is automatically created by connecting Axioline F modules to the controller side-by-side. The Axioline F local bus (referred to as local bus in this document) is implemented by arranging bus base modules side-by-side.

Programming

The controller can be configured and programmed in accordance with IEC 61131 using the PC Worx Engineer automation software.

In addition or as an alternative to the programming languages specified in IEC 61131-3, you can also use the C++ or MATLAB® Simulink® programming languages. The individual programs or program parts can be programmed in any development environment (e.g., Eclipse, Microsoft® Visual Studio®, etc.). Then import the programs or program parts into PC Worx Engineer as a library.

Integrated Ethernet interfaces

The controller features two Ethernet interfaces for TCP/IP/UDP/IP communication in the Ethernet network.

PROFINET controller/device functions

The PROFINET protocol can be used via the Ethernet interfaces of the controller. In this case, the controller can be used as a PROFINET controller or PROFINET device, depending on the configuration.



For additional information on how to integrate the AXC F 2152 as a PROFINET controller or device, please refer to the online help of PC Worx Engineer.

Axioline F local bus

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

Up to 63 Axioline F modules can be connected to the controller. The maximum number of modules that can be operated depends on the current consumption of the modules. The total current consumption of all devices connected to the controller must not exceed the maximum current that the controller supplies for the local bus.

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

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

**Axioline F/
System and firmware**

For system-specific information on the Axioline F system, please refer to the online help for PC Worx Engineer and the “Axioline F: system and installation” (UM EN AXL F SYS INST) and “Axioline F: Diagnostic registers and error messages” (UM EN AXL F SYS DIAG) user manuals.

The user manuals can be downloaded at phoenixcontact.net/products.

**Parameterization memory/
SD card**

The AXC F 2152 has an internal parameterization memory and an SD card. Directories and files that are provided by Phoenix Contact (also through firmware updates) are stored on the internal parameterization memory of the AXC F 2152.

Settings that you have configured yourself (e.g., network configuration, project bus configuration, PC Worx Engineer project, etc.) are stored as directories and files on the SD card. The SD card is supplied as standard and is already inserted in the controller by default when delivered. It is essential for operation of the controller.

**NOTE: Damaging the SD card after formatting**

The SD card is already formatted (ext4 format) and is intended for use with Phoenix Contact controllers from the PLCnext Control product range. When you format the SD card, certain information on the SD card that is required for use with Phoenix Contact devices is lost. After formatting, you can no longer use the SD card to operate the controller.

- Make sure that the SD card is not reformatted.

Visualization

You can create visualizations for the controller using the HMI integrated into PC Worx Engineer.

Real-time clock

In the event that the supply voltage fails, the real-time clock integrated in the controller is buffered, see Section “Technical data” on page 112.

3.2 Licensing information on open source software

The AXC F 2152 controller works with a Linux operating system. License information for the individual Linux packages can be found in the file system of the AXC F 2152 under the path /usr/share/common-licenses



Information on the directory structure of the file system can be found in Section 3.5.

Alternatively, you can also call up the license information via the web-based management of the AXC F 2152, see Section 9.2

Notes on LGPL software libraries

All open-source software used in the product is subject to the respective license terms that are not affected by the end user license agreement (EULA) for the product. In particular, the license holder can change the respective open-source software in accordance with the applicable license terms. If the license holder wishes to change an LGPL software library contained in this product, reverse engineering is permitted for debugging such modifications.

Notes for OpenSSL

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (<http://www.openssl.org/>)

3.3 Requesting source code

This AXC F 2152 contains software components which are licensed by the rights holder as free software or open source software under the GNU General Public License.

You can request the source code of these software components in the form of a CD or DVD-ROM for a processing fee of 50 euros within three years after delivery of the AXC F 2152. Contact the After Sales Service of Phoenix Contact in writing about this at the address

PHOENIX CONTACT GmbH & Co. KG
After Sales Service
Flachsmarktstraße 8
32825 Blomberg
GERMANY

Subject: Source code AXC F 2152

3.4 Hardware and software requirements

Hardware/software	Description
Controller	AXC F 2152
SD card	Program and configuration memory
Ethernet cable	Ethernet cable for connecting the controller to a PC
PC Worx Engineer	≥ 7.2

3.5 Directory structure of the file system

The AXC F 2152 controller works with a Linux operating system. You can access the controller via SFTP or via SSH and view the directories and files on the file system (on the internal parameterization memory and on the SD card) and modify them, if necessary. Directories and files that are provided by Phoenix Contact (also through firmware updates) are stored on the internal parameterization memory of the AXC F 2152. Settings that you have configured yourself (e.g., network configuration, project bus configuration, PC Worx Engineer project, etc.) are stored as directories and files on the SD card. Directories and files that you modify on the internal parameterization memory are stored on the SD card. The Linux operating system generates from the directories changed on the internal parameterization memory and files a higher-level directory structure (overlay file system) on the SD card.

Table 3-1 Directory structure on the internal parameterization memory and the SD card

Directory	Description
/usr/local/lib	Directory of for storing open source libraries additional that are used by customized C++ programs. Detailed information for programming the AXC F 2152 using C++ can be found in the PLCnext community at plcnext-community.net .
/usr/share/common-licenses	License information for the individual Linux packages of the AXC F 2152
/opt/plcnext	Home directory of the Linux user “admin” and working directory of the device firmware Files that write the application program are stored in this directory when the specified file name does not contain a memory path.
/opt/plcnext/logs	Log files of the device firmware
/opt/plcnext/projects/PCWE	Directory for storing PC Worx Engineer projects All files and subdirectories in this directory are administered exclusively by PC Worx Engineer. <ul style="list-style-type: none"> Do not make any changes to this directory.

3.6 Using SFTP to access the file system

The file system (on the internal parameterization memory and on the SD card of the AXC F 2152) is accessed via the SFTP protocol. You need SFTP client software to do this (e.g., WinSCP).

Access to the file system via SFTP requires authentication with a user name and password.



Please note:

The authentication with a user name and password is **always** required for SFTP access and cannot be deactivated.

Only users with administrator rights can access the file system.

You can create additional users with administrator rights with the User Manager in the web-based management of the AXC F 2152, see Section 9.5.2.1.

The following access data are set by default with administrator rights:

User name: admin

Password: Printed on the controller (see Figure 3-2).

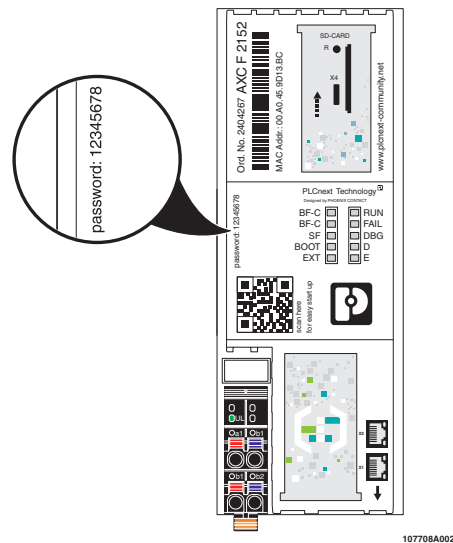


Figure 3-2 Administrator password on the controller

3.7 Firewall



This firewall of the AXC F 2152 is deactivated by default.

Recommended:

- Activate the firewall.

Please note:

If you use the AXC F 2152 as a PROFINET controller, you must authorize all incoming connections over all UDP ports if the firewall is activated. Otherwise, establishing a connection to certain PROFINET devices is not possible.

The firewall of the AXC F 2152 is based on internal Linux mechanisms (network filters) and is configured in shell using nftables. Access is via SSH (Secure Shell).

Access via SSH requires authentication with a user name and password.



Please note:

The authentication with a user name and password is **always** required for SSH access and cannot be deactivated.

Administrator rights are required for SSH access.

You can create additional users with administrator rights with the User Manager in the web-based management of the AXC F 2152, see Section 9.5.2.1.

The following access data is set by default with administrator rights:

User name: admin

Password: Printed on the controller (see position 1 in the Figure 3-2 on page 16).

You can control the firewall with the following shell commands:

Table 3-2 Shell commands for controlling the firewall

Shell commands	Description
sudo /etc/init.d/firewall start	Temporarily activates firewall This setting is no longer active after a re-boot.
sudo /etc/init.d/firewall stop	Temporarily deactivates firewall This setting is no longer active after a re-boot.
sudo /etc/init.d/firewall activate	Permanently activates firewall The firewall remains activated even after a restart of the AXC F 2152.
sudo /etc/init.d/firewall deactivate	Permanently deactivates firewall The firewall remains deactivated even after a restart of the AXC F 2152.

When the controller is delivered, the following rules for the firewall are stored in the “plcnxt-filter” file in the /etc/nftables directory:

Table 3-3 Default rules for the firewall when delivered

Permitted packets/connections	Blocked packets/connections
Outgoing ICMP echo requests and the associated ICMP echo replies Ping commands can be issued by the controller.	Incoming ICMP echo requests The controller cannot be reached using a ping command.
Incoming SSH connections (Port 22) (e.g., for SSH od SFTP connection)	All incoming connections via TCP ports (except for explicitly approved ports, see left column of table)
Incoming HTTPS connections (port 443) Web server access (PC Worx Engineer HMI and WBM)	All incoming connections via UDP ports
Incoming HTTP connections (port 80) The connections are diverted directly to port 443.	
Incoming connections via TCP port 41100 Common remoting (TLS-encoded), e.g., by PC Worx Engineer	
Incoming connections via TCP port 17725 The TCP port 17725 is the standard port for the external mode of MATLAB® Simulink®.	
Incoming connections via TCP port 4840 Standard port for connections to the OPC UA server of the controller	
Incoming connections via all TCP and UDP ports	

3.8 Possible fields of application of the controller

3.8.1 The AXC F 2152 as a distributed controller of an Axioline F station

The controller can be used as a distributed controller of an Axioline F station which is connected to an Ethernet system. A maximum of 63 devices (Axioline F modules) can be connected to the controller. The maximum number of devices that can be aligned depends on the current consumption of the devices. The total current consumption of all devices aligned on the controller must not exceed the maximum current that the controller supplies for the local bus (1 A at an ambient temperature $\leq 55^{\circ}\text{C}$).

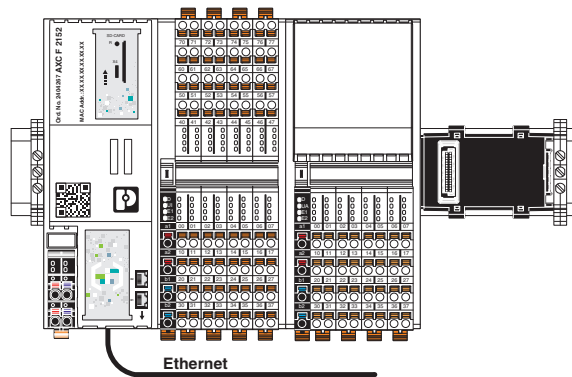


Figure 3-3 Axioline F station with AXC F 2152 controller

3.8.2 The AXC F 2152 as a PROFINET controller in a PROFINET network

Figure 3-4 shows the example of an AXC F 2152 as a PROFINET controller in a PROFINET network.

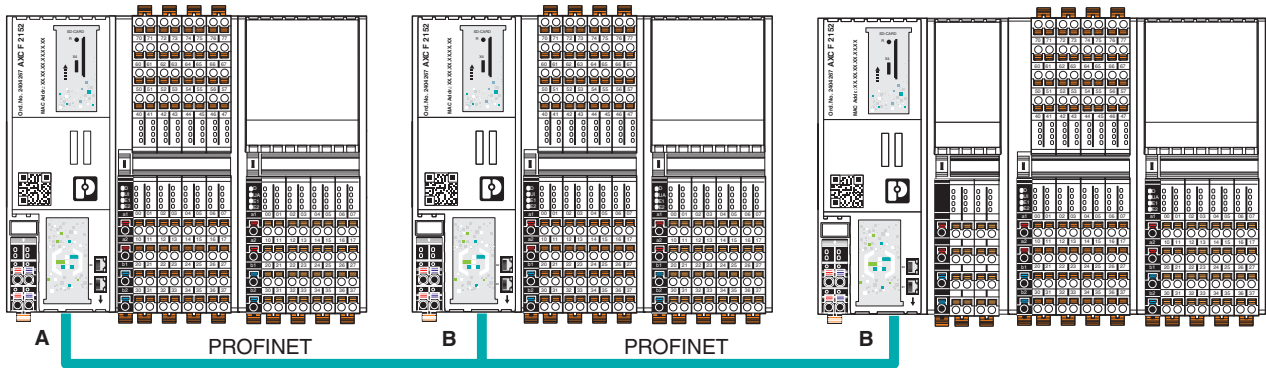


Figure 3-4 AXC F 2152 as a PROFINET controller

Key:

- A** AXC F 2152 PROFINET controller
- B** PROFINET device (in the example: AXC F 2152 with connected Axioline F I/O modules)



For additional information on how to integrate the AXC F 2152 as a PROFINET controller in a PROFINET network, please refer to the online help of PC Worx Engineer.

3.8.3 The AXC F 2152 as a PROFINET device in a PROFINET network

Figure 3-5 shows the example of an AXC F 2152 as a PROFINET device in a PROFINET network.

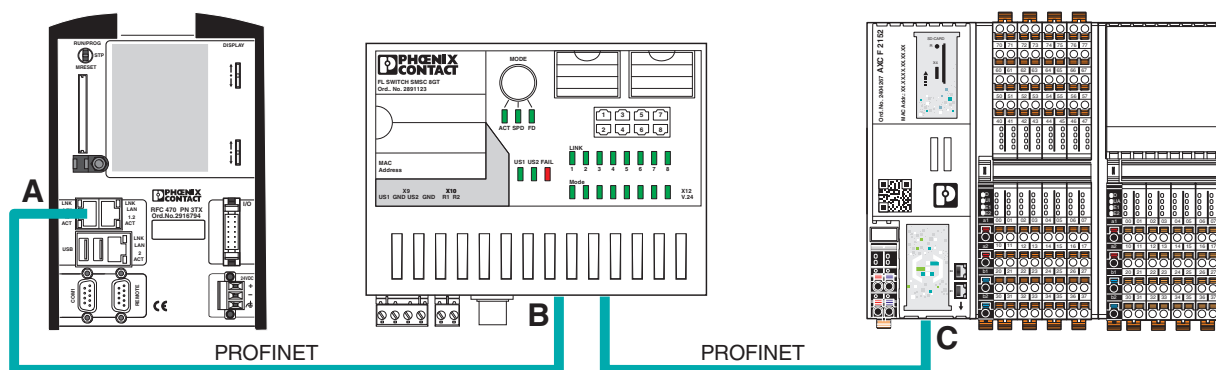


Figure 3-5 AXC F 2152 as a PROFINET device

Key:

- A** PROFINET controller (in the example: RFC 470 PN 3TX Remote Field Controller)
- B** Managed switch (in the example: FL SWITCH SMCS ...)
- C** AXC F 2152 PROFINET device



For additional information on how to integrate the AXC F 2152 as a PROFINET controller in a PROFINET network, please refer to the online help of PC Worx Engineer.

3.9 Components of the controller

3.9.1 Connection and operating elements

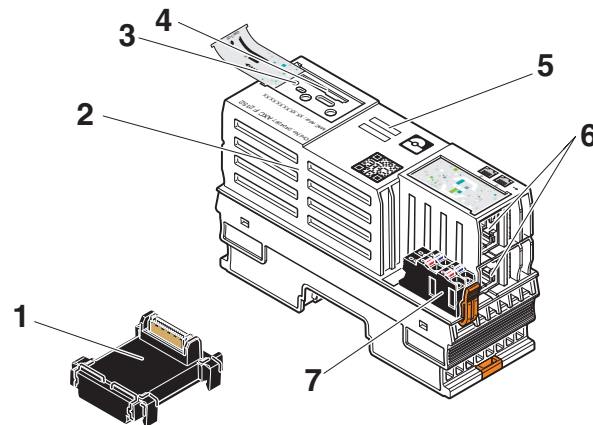


Figure 3-6 Connection and operating elements of the controller

The controller consists of the following components:

- 1 Bus base module
- 2 Electronics module
- 3 Reset button
- 4 SD card holder



Please note:

The SD card is supplied as standard and is already inserted in the controller by default when delivered. It is essential for operation of the controller.

- 5 Diagnostics and status indicators
- 6 Ethernet interfaces (X1, X2)
- 7 Supply plug (connector for connecting the supply voltage (communications power U_L))

3.9.2 Printing

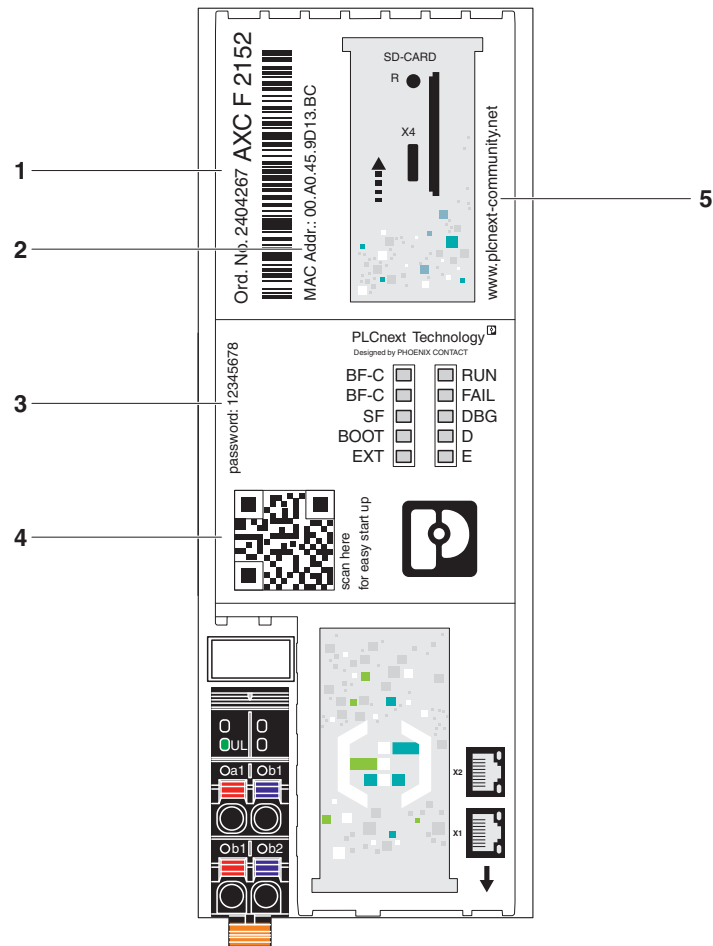


Figure 3-7 Printing

107708A003

The following information is printed on the controller:

- 1 Order number and order designation
- 2 MAC address
- 3 Administrator password
- 4 QR code
- 5 Link to the PLCnext community

Administrator password

You need the administrator password (in combination with the “admin” user name) for initial access to:

- The file system of the controller
- Certain functions in PC Worx Engineer
- PC Worx Engineer HMI (in preparation)
- Web-based management (WBM)
- The OPC UA server for the AXC F 2152



Recommended:

- Only use the administrator password for the initial access.
- Once you have gained access successfully, change the administrator password to prevent unauthorized administrator access (see Section 9.5.2.1).

QR code

The QR code helps you go directly to the PLCnext community.

In the PLCnext community, you can find

- Information on PLCnext Technology
- Information on PC Worx Engineer
- Information on programming with AXC F 2152 with C++
- Operating instructions
- Tutorials
- Example projects
- FAQs

3.10 Diagnostics and status indicators

The diagnostics and status indicators are used for quick local error diagnostics.

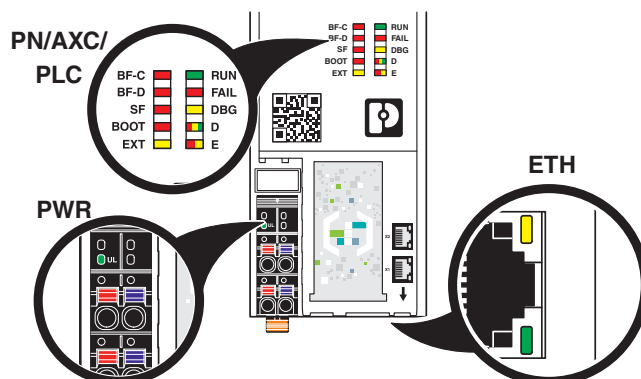


Figure 3-8 Diagnostics and status indicators

Table 3-4 Diagnostics and status indicators of the controller

Description	Color	Meaning	Status	Description
PN: PROFINET controller/device function				
BF-C	Red	Status of PROFINET communication/communication errors	AXC F 2152 as a PROFINET controller	
			Off	The AXC F 2152 has established an active communication connection to each configured PROFINET device.
			On	No link status on the Ethernet interfaces and/or no 100 Mbit transmission and/or no full duplex mode.
			Flashing (1 Hz)	– Link status present, at least one configured PROFINET device has no communication connection.
BF-D	Red	Status of PROFINET communication/communication errors	AXC F 2152 as a PROFINET device	
			Off	A PROFINET controller has established an active communication connection to the AXC F 2152 (PROFINET device).
			On	No PROFINET communication (no link status at the Ethernet interfaces).
			Flashing (1 Hz)	Link status present, no communication connection to the PROFINET controller. The SF LED is not flashing.
SF	Red	Group error (PROFINET)	Off	PROFINET diagnostics not present.
			On	PROFINET diagnostics present.

Table 3-4 Diagnostics and status indicators of the controller

Description	Color	Meaning	Status	Description
PLC: controller diagnostics				
RUN	Green	RUN status of the controller	Off	PLCnext runtime system not ready to operate.
			Flashing (0.5 Hz)	PLCnext runtime system successfully initialized. Controller in READY/STOP state, application program not processed.
			Flashing (2 Hz)	Controller reset to default state (see Section "Reset button (concealed)" on page 29).
			On	PLCnext runtime system successfully initialized and an application program is running. The controller is in the RUN state.
FAIL	Red	Failure	On	A runtime error has occurred in the application program of the PLCnext runtime system.
			Off	A runtime error has not occurred in the application program of the PLCnext runtime system.
DBG	Yellow	Debug mode (troubleshooting)	On	The PLCnext runtime system/controller is in debug mode, i.e., debug mode has been activated in PC Worx Engineer (break-point(s) set). The state of the RUN LED is not affected.
BOOT	Red	Load status of the device firmware	On	Device firmware is faulty.
			Flashing (2 Hz)	Device firmware is being downloaded (boot process).
			Off	Device firmware running.

Table 3-4 Diagnostics and status indicators of the controller

Description	Color	Meaning	Status	Description
AXC: Axioline F diagnostics				
D	Red/yel-low/green	Axioline F: diagnostics for local bus communication	Green on	Run: The Axioline F station is ready for operation; communication within the Axioline F station is OK. All data is valid. There is no error.
			Flashing green	Active: The Axioline F station is ready for operation; communication within the Axioline F station is OK. The data is not valid. Valid data from the controller is not available. There is no malfunction in the device.
			Yellow on	Ready: The Axioline F station is ready for operation; 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
			Flashing red	Local bus error during startup Possible causes: <ul style="list-style-type: none"> – Configuration cannot be generated, information is missing from a device – Chip version of a device is < V 1.1 – Deviation between actual and required configuration – No local bus device connected – The maximum number of local bus devices is exceeded
			Red on	Bus error in RUN state The Axioline F station is ready for operation but has lost connection to at least one local bus device. Possible causes: <ul style="list-style-type: none"> – Communication error – Local bus device has been removed or configured local bus 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)
			Off	Power down: Local bus device is in (power) reset
E	Yel-low/red	Error/warning	Yellow on	I/O warning at a local bus device
			Red on	Peripheral fault at a local bus device
EXT	Yellow			Currently without function

Table 3-4 Diagnostics and status indicators of the controller

Description	Color	Meaning	Status	Description
PWR: Supply voltage (communications power U_L)				
UL	Green	U_{Logic}	Off	24 V communications power supply not present or too low.
			On	24 V communications power supply present.
ETH: Ethernet interfaces				
	Green	Link status	Off	Connection not established successfully
			On	Connection established successfully (link): The controller is able to contact another network device.
	Yellow	Activity status	Off	Data transmission inactive
			On/flashing	Data transmission active (activity): The Ethernet interface is sending or receiving data

3.11 Reset button (concealed)

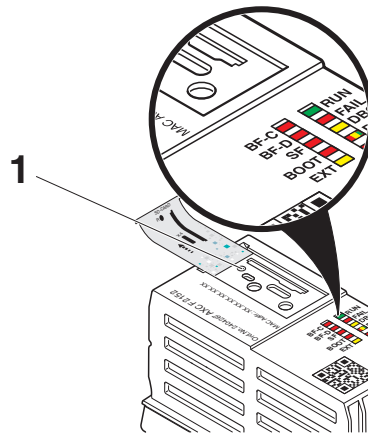


Figure 3-9 Reset button (1, concealed)

The reset button on the controller can only be operated with a pointed item (e.g., a pen) and is therefore protected against accidental activation.

If the reset button is actuated during operation for ≥ 2 s, the controller is restarted.

The reset button can also be used to reset the controller to the default settings. A distinction is made between two types of default settings:

- Type 1:
All user-specific data is deleted.
- Type 2:
The controller is restored to the delivery state.

Default setting type 1

When restoring the controller to factory default setting 1, all settings that you have configured are deleted. This includes, for example

- The PC Worx Engineer project including all applications that have been programmed in accordance with IEC 61131-3
- All applications that were programmed using high-level languages
- The project bus configuration
- The network configuration of the controller
- Changes and extensions that you have made to the operating system or to the firmware

To restore the controller to default setting type 1, proceed as follows:

- Switch off the supply voltage of the controller.
- After the LEDs have gone out press the reset button.
- Hold down the reset button and switch the supply voltage on.

The RUN and FAIL LEDs light up.

- Release the reset button.

The controller is reset to default setting 1.

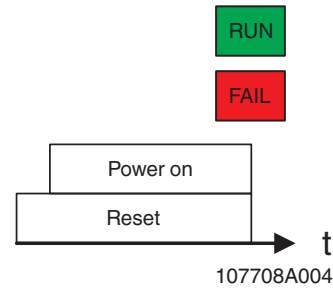


Figure 3-10 Timing when resetting to default setting type 1 and LED indicators

Default setting type 2

When restoring to default setting type 2, the controller is reset to the delivery state. In doing so, all settings that you have configured are deleted.



Please note:

The operating system and all firmware components of the controller are reset to the delivery state.

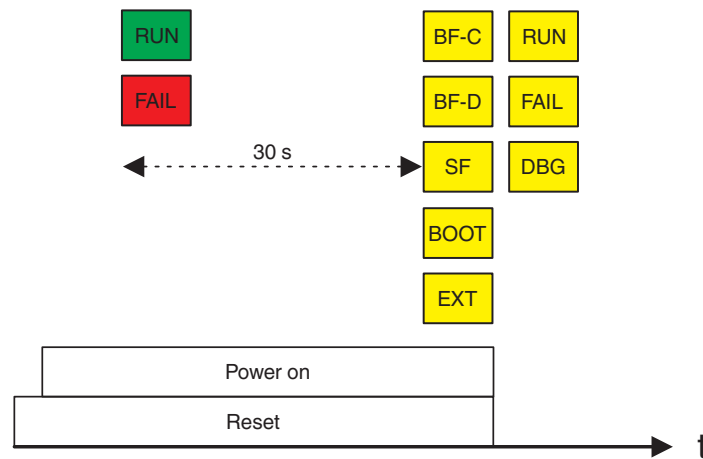
To restore the controller to default setting type 2, proceed as follows:

- Switch off the supply voltage of the controller.
- After the LEDs have gone out press the reset button.
- Hold down the reset button and switch the supply voltage on.

The RUN and FAIL LEDs light up.

- Press and hold the Reset button until (approx. 30 s) all LEDs (except E and D LEDs) light up.
- Release the reset button.

The controller is reset to default setting 2.



107708A005

Figure 3-11 Timing when resetting to default setting type 2 and LED indicators

3.12 SD card

All application-specific data (e.g., the PC Worx Engineer project) is stored on the SD card of the controller. The SD card is supplied as standard and is already inserted in the controller by default when delivered. It is essential for operation of the controller.

**NOTE: Damaging the SD card after formatting**

The SD card is already formatted (ext4 format) and is intended for use with Phoenix Contact controllers from the PLCnext Control product range. When you format the SD card, certain information on the SD card that is required for use with Phoenix Contact devices is lost. After formatting, you can no longer use the SD card to operate the controller.

- Make sure that the SD card is not reformatted.

**NOTE: Data loss due to removing the SD card**

If you remove the SD card during operation, this results in a loss of data.

- Do not remove the SD card during operation.



The SD card is recognized during initialization of the controller.

- Make sure that the SD card has been inserted before switching on the controller to enable the controller to use it.
- Only insert and remove the SD card when the controller supply voltage is disconnected.
- Only use an SD card provided by Phoenix Contact (for ordering data, see Section 13.1).

**Please note:**

The SD card can be read with a conventional SD card reader. Sensitive data on the SD card can be seen if you do not physically protect the SD card against unauthorized access.

- Make sure that unauthorized persons do not have access to the SD card.

3.13 Internal basic circuit diagram

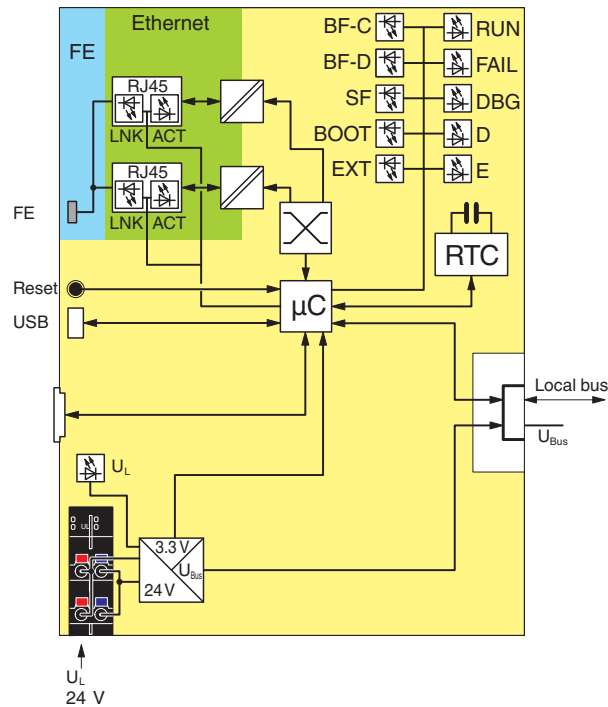


Figure 3-12 Internal basic circuit diagram

Key:

	Microprocessor		Transmitter
	Service interface (Micro-USB type C)		LED
	Reset button		Real-time clock
	RJ45 interface		Power supply unit
	Functional earth ground connection		Ethernet Switch
	SD card holder		Axioline F local bus

The colored areas in the basic circuit diagram represent electrically isolated areas:

	Logic
	Ethernet interface
	Functional ground

3.14 Communication paths

The following communication paths are available on the controller (see Figure 3-13):

- | | | |
|-----|---|---|
| (1) | 2 x Ethernet | X1/X2: 10/100 BASE-T(X) (switched internally) |
| (2) | Service interface
(Micro-USB type C) | Currently without function |

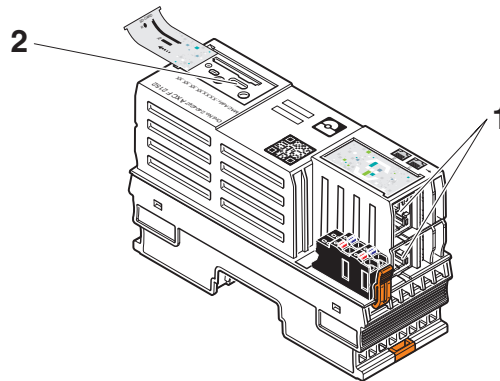


Figure 3-13 Communication paths: (1) Ethernet, (2) service interface (Micro-USB type C)

3.14.1 Ethernet

Two Ethernet interfaces (X1/X2) are available on the controller for connecting the Ethernet network.

The Ethernet network is connected via RJ45 sockets.



- Use an Ethernet cable which corresponds to CAT5 of IEEE 802.3 at least.
- Observe the bending radii of the Ethernet cables used.

The contact assignment of the interface is as follows:

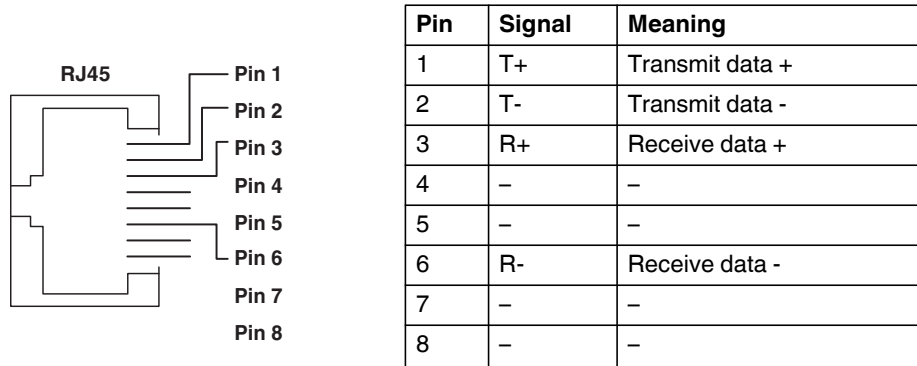


Figure 3-14 Ethernet interface and pin assignment



The Ethernet interfaces are able to switch over the transmitter and receiver automatically (auto crossover).

3.15 Supply connector

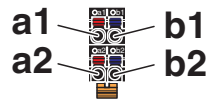


Figure 3-15 Terminal points for the supply voltage (communications power U_L)

Terminal point assignment

Table 3-5 Terminal point assignment of the supply connector

Terminal point	Color	Assignment
a1, a2	Red	24 V DC (U_L)
b1, b2	Blue	GND

Key:

- U_L Supply of communications power (jumped internally)
GND Reference potential of the supply voltage (jumped internally)

3.16 Bus base module

Bus base modules carry the communications power and the bus signals from the controller through the Axioline F station (local bus). A bus base module is supplied with the controller.

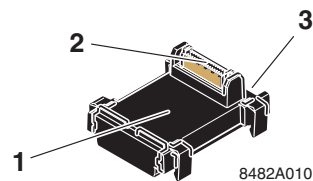


Figure 3-16 Structure of the bus base module of the controller

- 1 Bus base module
- 2 Connection of the local bus to the controller (socket)
- 3 Connection to the following bus base module (socket)

4 Mounting hardware



For basic information about the Axioline F system and its installation, particularly mounting/removing Axioline F modules, please refer to the UM EN AXL F SYS INST user manual ("Axioline F: system and installation").

4.1 Safety notes



NOTE: Electrostatic discharge!

The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and IEC 61340-5-1.



NOTE: Electrical damage due to inadequate external protection – No safe fuse trip in the event of an error

The electronics in the device are damaged due to inadequate external protection.

- Protect the supply voltage externally in accordance with the connected load (number of Axioline F devices/amount of logic current consumption for each device).
- Make sure the external fuse blows safely in the event of an error.



NOTE: Damage to the contacts when tilting

If the modules tilt, you can damage the contacts.

- Place the modules onto the DIN rail **vertically** (see Figure 4-1).



Please note:

During all work on the Axioline F station, the controller or a module, switch off the power supply to the Axioline F station and make sure the supply voltage is protected against unauthorized re-activation.



The controller is automatically grounded (FE) when it is snapped onto a grounded DIN rail.

On the back of the controller there are two FE springs that make contact with the DIN rail when the controller is placed on the DIN rail.

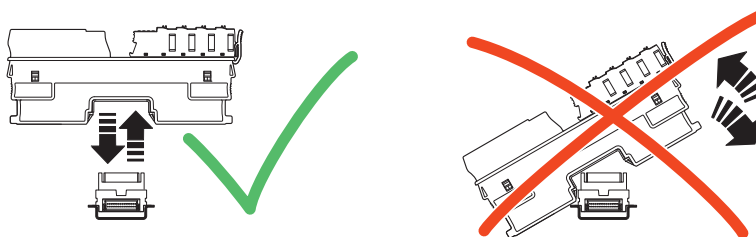


Figure 4-1 Placing the module **vertically**

4.2 Basics

Mounting location

The controller meets the requirements for the IP20 degree of protection. The compact design means that the controller can be installed in standard terminal boxes.

Mounting/DIN rail

The controller is mounted on a 35 mm standard DIN rail without any tools using the bus base module. The controller is mounted perpendicular to the DIN rail.

The local bus is created automatically when the bus base modules of the controller and Axioline F devices are installed next to one another.



Observe the notes on securing the DIN rail and fastening elements, and the notes on mounting distances in the UM EN AXL F SYS INST user manual.

Supply plug

The controller has a supply plug for connecting the power supply. The plug has spring-cage terminal blocks. With suitable conductors, the conductor can be connected using the direct connection technology (PT = push-in technology).



For additional information, please refer to Section 5.1.2.

FE connection

On the bottom of the controller there are two FE springs (metal contacts) which establish the connection to functional earth ground when the controller is snapped onto a grounded DIN rail.

End brackets

Mount end brackets on both sides of the Axioline F station. They ensure that the Axioline F station is correctly mounted. End brackets fix the station on both sides and keep it from moving from side to side on the DIN rail. Phoenix Contact recommends using the following end brackets:

Table 4-1 Recommended end brackets

Mounting position	Ambient conditions	End bracket
Horizontal; A in Figure 4-2 on page 39:	Normal	CLIPFIX 35, CLIPFIX 35-5
	High shock and vibration load	E/AL-NS 35
Other; B in Figure 4-2 on page 39	Normal	E/AL-NS 35
	High shock and vibration load	

Mounting position

As standard, mount the controller in a horizontal position on the DIN rail provided for that purpose (A in Figure 4-2).

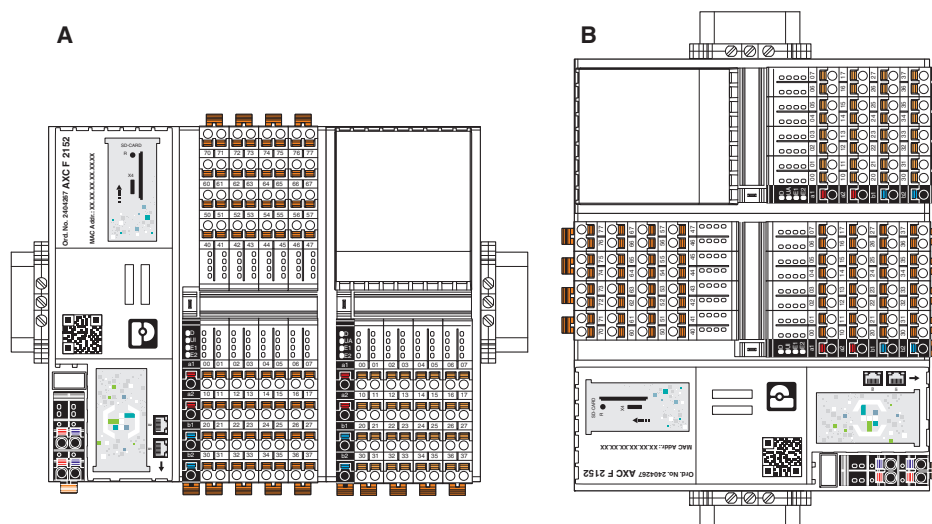


Figure 4-2 Horizontal (A) and vertical (B) mounting position

Note the ambient temperatures and any other special features (e.g., derating) specified in the device/module-specific documentation for the Axioline F devices.

4.3 Structure of an Axioline F station

Figure 4-3 shows an example structure of an Axioline F station:

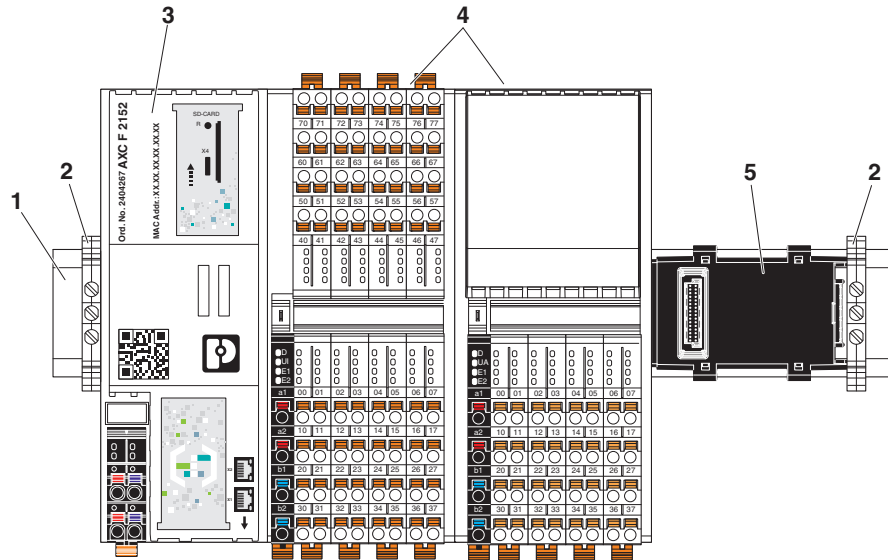


Figure 4-3 Structure of an Axioline F station

Key:

- 1 DIN rail
- 2 End bracket (e.g., CLIPFIX 35-5; Order No. 3022276)
- 3 Controller
- 4 I/O modules (Axioline F devices) corresponding to the application
- 5 Bus base module

An Axioline F station is set up by mounting the individual components side by side. No tools are required. Mounting the components side by side automatically creates potential and bus signal connections between the individual components of the Axioline F station.

4.4 Mounting the controller

Mounting bus base modules

- Disconnect the power to the Axioline F station.
- Mount the left end bracket on the Axioline F station.
- First install the bus base module for the controller and then all bus base modules necessary for the Axioline F station on the DIN rail (A in Figure 4-4).
- Push each subsequent bus base module into the connection of the previous bus base module (B in Figure 4-4).

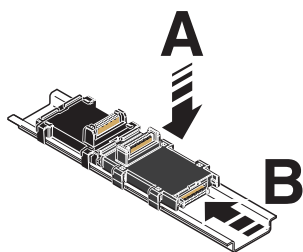


Figure 4-4 Mounting the bus base modules

Snapping on the controller

- Place the controller vertically on the first bus base module until it snaps into place with a click.
- Make sure that the device plug for the bus base connection is situated above the corresponding socket on the bus base module.

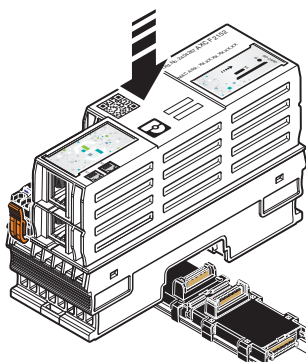


Figure 4-5 Snapping on the controller

4.5 Inserting the SD card



Please note:

The SD card is supplied as standard and is already inserted in the controller by default when delivered. It is essential to the operation of the controller.

- Disconnect the power to the Axioline F station.

The controller has an SD card holder with push/push technology.

- Remove the upper marking field of the controller (pos. 1 in Figure 4-6).

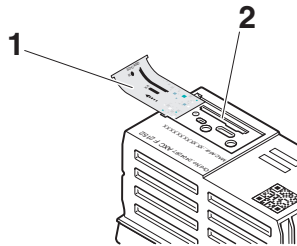


Figure 4-6 Removing the marking field

- Gently push the SD card into the SD card holder (pos. 2 in Figure 4-6) until it engages with a click in the SD card holder (see Figure 4-7, “Click”).

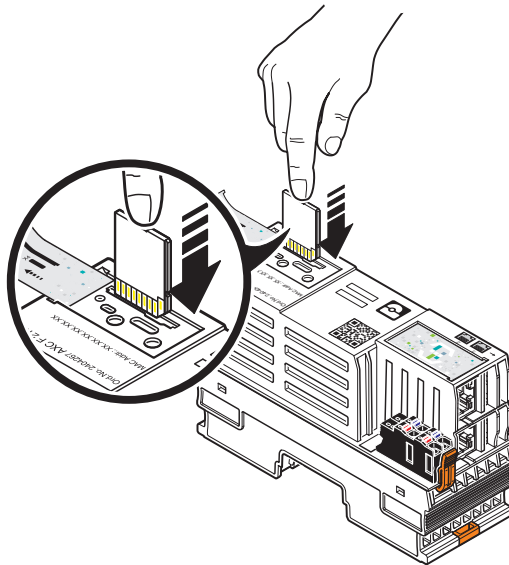


Figure 4-7 Inserting the SD card

5 Connecting and wiring hardware

5.1 Supply voltage

5.1.1 Sizing of the power supply

- 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

The controller is designed exclusively for protective extra-low voltage (PELV) operation in accordance with EN 60204-1. Only PELV in accordance with the defined standard may be used for supply purposes.

The following applies to the network (PROFINET) and the I/O devices used in it:

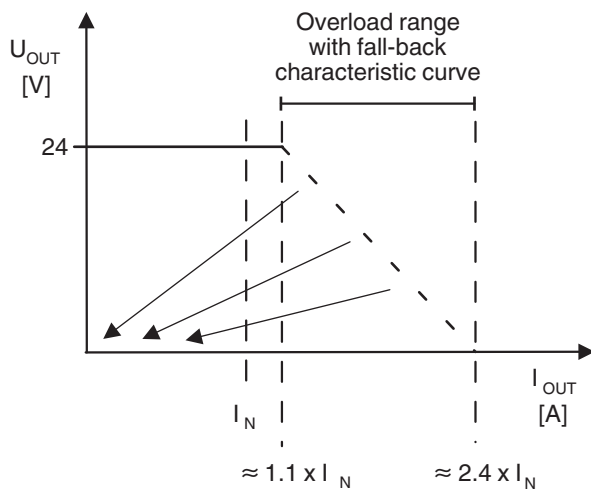
Only use power supply units that meet EN 61204 with safe isolation and PELV in accordance with EN 50178 or EN 61010-2-201. This prevents short circuits between primary and secondary sides.



A power supply without a fall-back characteristic curve must be used for correct operation of the controller (see Figure 5-2).

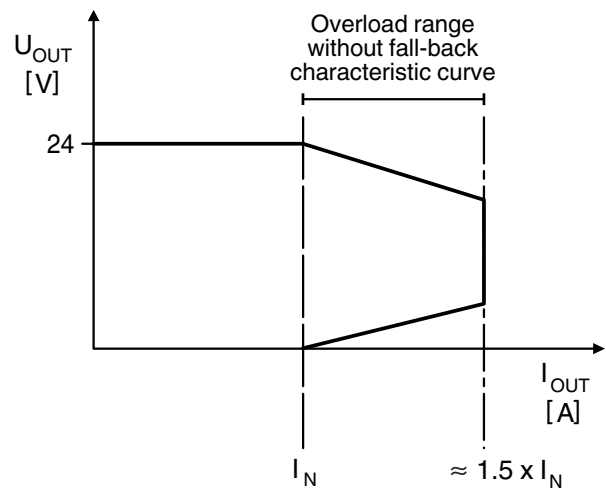
When the controller is switched on, an increased inrush current is temporarily triggered. The controller behaves like a capacitive load when it is switched on.

Some electronically controlled power supplies have a fall-back characteristic curve (see Figure 5-1). They are not suitable for operation with capacitive loads.



6219C070

Figure 5-1 Overload range **with** fall-back characteristic curve



6219C071

Figure 5-2 Overload range **without** fall-back characteristic curve

5.1.2 Connecting the power supply

Observe the notes in Section 3.15 when assembling the connector for the supply voltage.

- Strip 8 mm of the wire. Fit a ferrule to the cable, if required.



When you use ferrules:

- Use the ferrules in accordance with the specifications in the UM EN AXL F SYS INST user manual.
- Make sure the ferrules are properly crimped.

Solid cable/ferrule

- Insert the cable into the terminal point. The wire is clamped automatically.



Figure 5-3 Connecting a solid cable

Stranded cable

- Open the spring by pressing on the spring lever with a screwdriver (A in Figure 5-4).
- Insert the cable into the terminal point (B in Figure 5-4).
- Remove the screwdriver to fasten the cable (recommended: bladed screwdriver, blade width of 2.5 mm (e.g., SZS 0.4x2.5 VDE, Order No. 1205037)

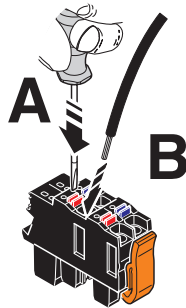


Figure 5-4 Connecting a stranded cable

Connecting the supply plug

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

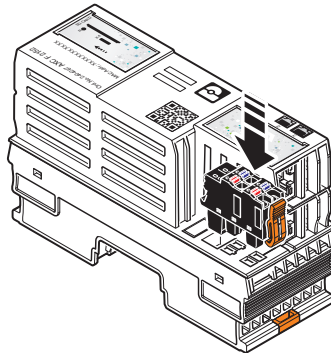


Figure 5-5 Connecting the supply plug

Supply the controller using external 24 V DC voltage sources. The permissible voltage ranges from 19.2 V DC to 30 V DC (ripple included). The power consumption of the controller at 24 V is typically 4.8 W (no local bus devices connected).



Only use power supplies that are suitable for operation with capacitive loads (increased inrush current) (see Section 5.1.1).

1. Connect the power supplies to the supply plug as shown in Figure 5-3 and in Figure 5-4. Please observe the information in Section 3.15.
2. Switch on the power supplies.

The controller is now fully initialized.

If the LEDs do not light up or start flashing, there is a serious fault on the controller. In this case, please contact Phoenix Contact.

5.2 Connecting Ethernet

- Connect the Ethernet network to the RJ45 socket.

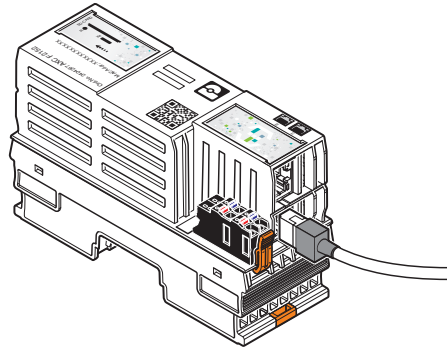


Figure 5-6 Connecting Ethernet

6 Startup



Detailed information on PC Worx Engineer and on PLCnext Technology can be found in the PLCnext community at plcnext-community.net.

You must have the PC Worx Engineer software to start up the controller.

6.1 Installing PC Worx Engineer

The software is available to download at phoenixcontact.net/products.

- Download the software onto your computer.
- Double-click on the *.exe file to start installation.
- Follow the instructions of the installation wizard.

6.2 PC Worx Engineer licenses

Once installed, a demo version of PC Worx Engineer is available to you for 30 days. You can use the demo version once on a PC.

You must register PC Worx Engineer within 30 days to continue using the software. To do this, proceed as follows:

- Log in with your access data on the product page at phoenixcontact.net/products.
- Select the necessary license(s).

Free and purchased licenses are available. The licenses are bound to the hardware of a PC.

Once you have sent your order, within 48 hours you will receive an email from Phoenix Contact that contains a ticket ID. You need the ticket ID to activate a license.

To register PC Worx Engineer, you must activate the license.

Activation is done through the Phoenix Contact Activation Wizard.

The Phoenix Contact Activation Wizard can be downloaded at phoenixcontact.net/products (stand-alone or as component from PC Worx Engineer).

- To activate a license, follow the instructions in the Phoenix Contact Activation Wizard.

6.3 User interface

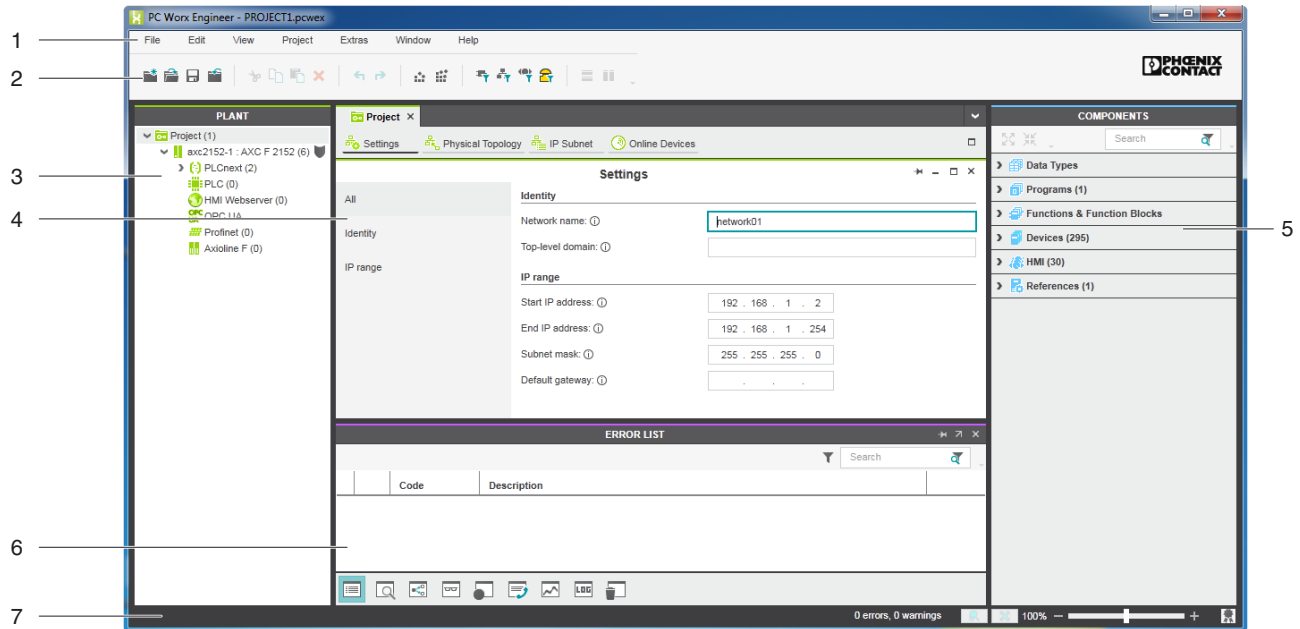


Figure 6-1 The PC Worx Engineer user interface

1. Menu bar
2. Tool bar
3. "PLANT" area
4. Editor area
5. "COMPONENTS" area
6. Cross-functional area
7. Status bar

"PLANT" area

You build all physical and logical components of your application in the form of a hierarchical tree structure in the "PLANT" area.

Editor area

If a node in the "PLANT" area or an element in the "COMPONENTS" area is double-clicked, the associated editor group opens in the editor area. Editor groups are always displayed in the center of the user interface. You can identify by the color of the editor group whether it is an instance editor (green; opened from the "PLANT" area) or is a type editor (blue; opened from the "COMPONENTS" area). Each editor group contains several editors which can be opened and closed using buttons in the editor group.

“COMPONENTS” area

The “COMPONENTS” area contains all the components available for the project. The components can be divided into the following types based on their function:

- Developing program code (“Data Types”, “Program” and “Functions & Function Blocks”)
- Showing all devices available for the “PLANT” area and adding (“Devices”) via GSDML or FDCML
- Editing HMI pages (“HMI”)
- Adding libraries such as firmware libraries, International Electrotechnical Commission (IEC) user libraries or libraries provided by Phoenix Contact (“References”)

Cross-functional area

The cross-functional area contains functions that extend across the entire project.

- **ERROR LIST:**
Shows all errors, warnings and messages of the current project.
- **GLOBAL FIND AND REPLACE:**
Finding and replacing strings in the project.
- **CROSS REFERENCES:**
Displays all cross-references within the project, for example, the use and declaration of all variable types or HMI tags.
- **WATCHES:**
Debug tool; shows the current values of the added variables in online mode.
- **BREAKPOINTS:**
Debug tool for setting and resetting break points when debugging within the application.
- **CALL STACKS:**
Debug tool that shows the order for calling up when executing the code and contains commands for debugging with breakpoints.
- **LOGIC ANALYZER (in preparation):**
Recording and visualizing variable values at runtime.
- **LOGGING:**
Shows all errors, warnings and messages. A distinction is made between “online” (messages from the runtime environment, as well as errors and warnings that concern online communication) and “engineering” (messages on events concerning software, for example, GSDML or FDCML files; not project-related).
- **RECYCLE BIN:**
Elements that have been recently deleted from the “PLANT” or “COMPONENTS” areas are moved to the recycle bin. When required, you can restore deleted elements.

6.4 Creating a new project

- Open PC Worx Engineer.
- Click on the “Empty AXC F 2152 project” project template on the start page.

The project template for an empty AXC F 2152 project opens.

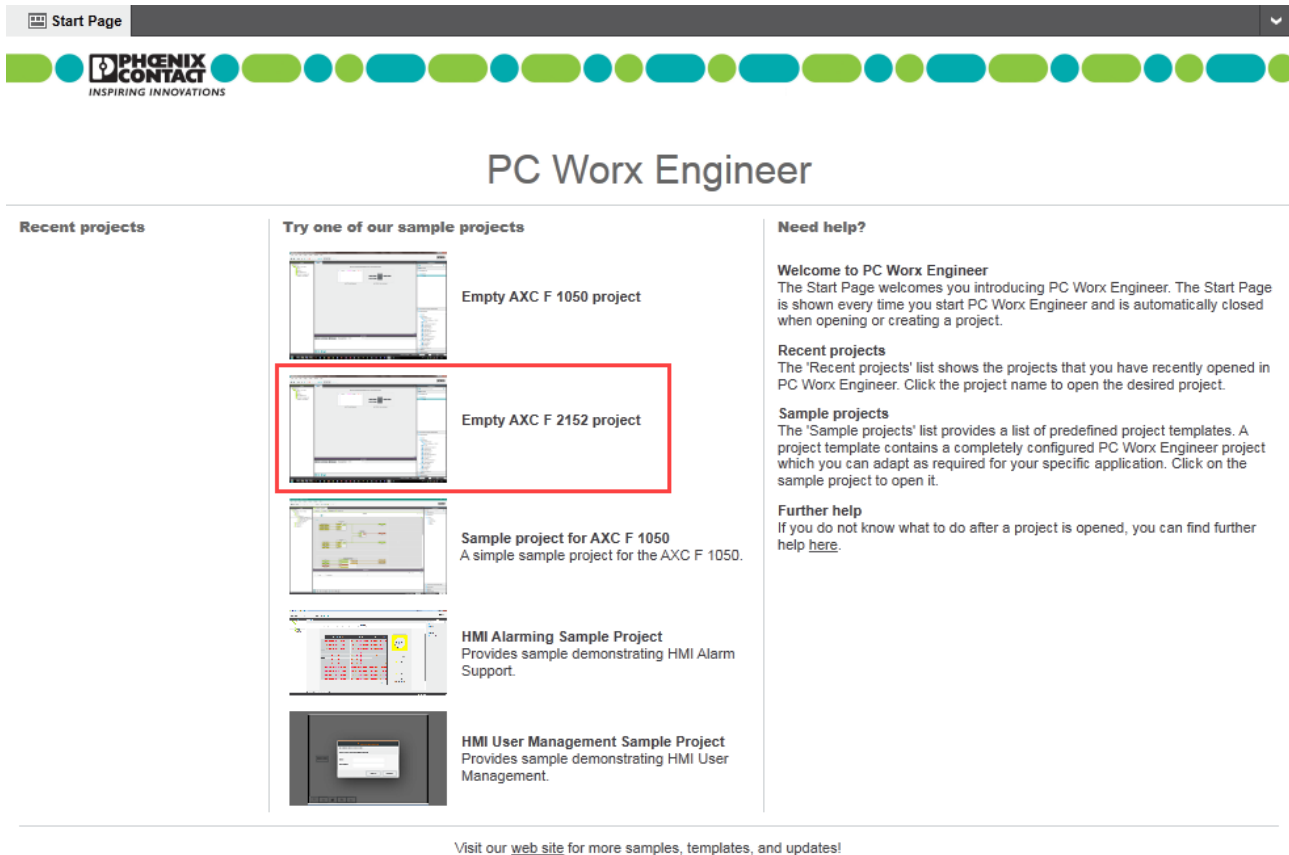


Figure 6-2 Start Page, “Empty AXC F 2152 project” project template

- Open the “File, Save Project As...” menu.
- Enter a unique and meaningful name for the project.
- Click “Save”.

6.5 Configuring the IP settings

6.5.1 Setting the IP address range

- Double-click on the “Project (x)” node in the “PLANT” area.

The “Project” editor group opens.

- Select the “Settings” editor.
- Set the desired IP address range and the subnet mask for your project.

The screenshot shows the 'Settings' window with a sidebar on the left containing 'All', 'Identity', and 'IP range'. The 'IP range' section is selected. The main area is titled 'Settings' and contains the following fields:

Identity	
Network name: ⓘ	network01
Top-level domain: ⓘ	

IP range	
Start IP address: ⓘ	192 . 168 . 1 . 2
End IP address: ⓘ	192 . 168 . 1 . 254
Subnet mask: ⓘ	255 . 255 . 255 . 0
Default gateway: ⓘ	. . .

Figure 6-3 Setting the IP address range

6.5.2 Setting the IP address

- Double-click on the controller node in the “PLANT” area.

The editor group of the controller opens.

- Select the “Settings” editor.
- Select the “Ethernet” view.

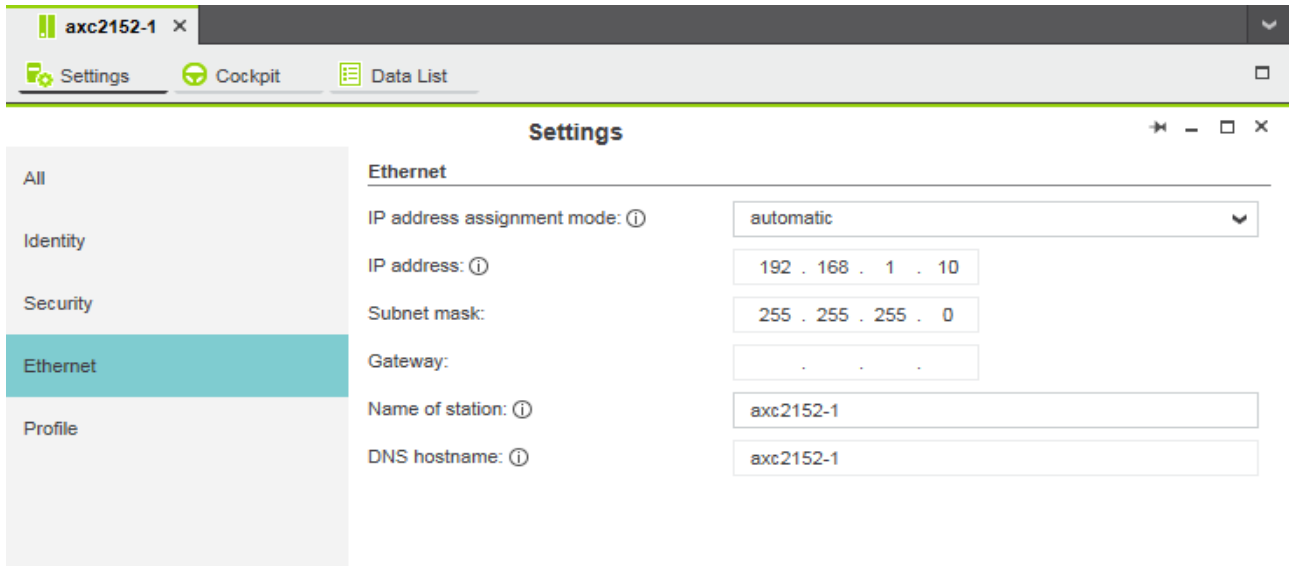


Figure 6-4 Setting the IP address

The IP address of the controller can be automatically or manually set. The IP address is assigned to the controller when you have connected PC Worx Engineer to the controller, see Section 6.6.

Setting the IP address automatically

- Select “automatic” in the “IP address assignment mode” drop-down list.

PC Worx Engineer automatically assigns an IP address to the controller from the set IP address range (see Section 6.5.1, “Setting the IP address range”) as soon as a connection to the controller is established (see Section 6.6).

Setting the IP address manually

- Select “manual” in the “IP address assignment mode” drop-down list.
- In the respective input fields, enter the IP address, subnet mask and gateway.

PC Worx Engineer assigns a manually set IP address to the controller as soon as a connection to the controller is established (see Section 6.6).

6.6 Connecting to the controller

To transfer a project to the controller, you must first connect PC Worx Engineer to the controller. To do this, proceed as follows:

- Double-click on the “Project (x)” node in the “PLANT” area.

The “Project” editor group opens.

- Select the “Online Devices”.
- Select the desired network card from the drop-down list.

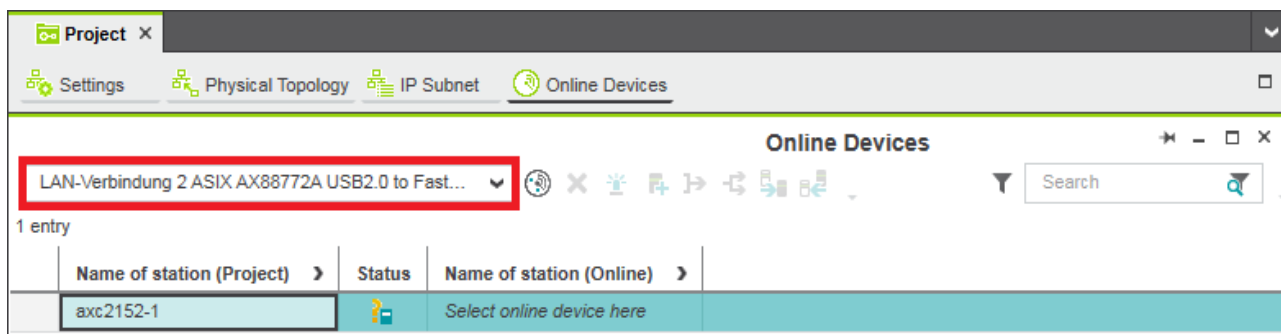


Figure 6-5 Selecting the network card



By clicking on the arrow next to “Name of station (Project)” and “Name of station (Online)” (see Figure 6-5), you can show or hide the detailed information.

- Click on the button to search the network for connected devices.

You can see the project devices under “Name of station (Project)”.

You can see the devices that have been found online in the network under “Name of station (Online)”.

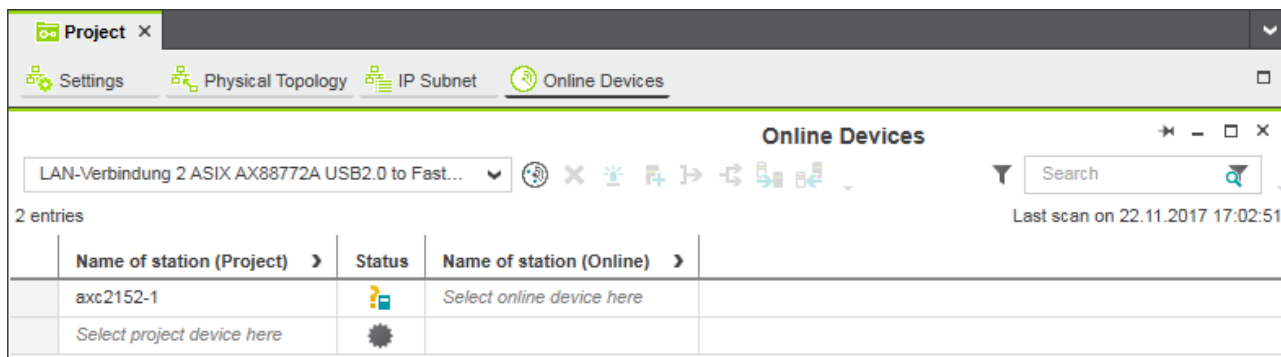


Figure 6-6 Assigning online devices

When you select the device under “Name of station (Online)” (“Select project device here”), the controller found in the network (the online device) receives the IP settings of the project controller.

When you select the device under “Name of station (Project)” (“Select project device here”), the project controller receives the IP settings of the online device found in the network.

- Select the desired device.

The configured controller has now been assigned to an online device.



When the IP address of an online device found in the network already matches the IP address of the project controller, the online device is automatically assigned to the configured controller. In this case, you do not need to select the desired device for the assignment.

Successful assignment is shown in the “Status” column by the icon.

Name of station (Project)	Status	Name of station (Online)
axc2152-1		axc2152-1

Figure 6-7 Successful assignment of the configured controller to an online device

Once the configured controller has been assigned to an online device, you can connect PC Worx Engineer to the controller:

- Double-click on the controller node in the “PLANT” area.

The editor group of the controller opens.

- Select the “Cockpit” editor.
- Click on the button to connect PC Worx Engineer to the controller.

A successful connection is shown by the icon on the node of the controller in the “PLANT” area.

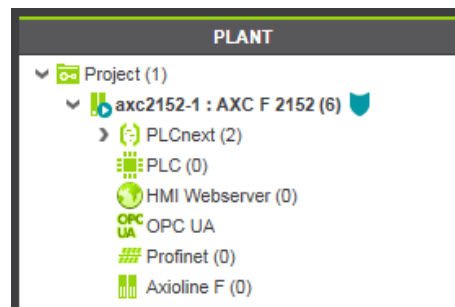


Figure 6-8 Connection to the controller was established successfully

6.7 Configuring Axioline F I/O modules

You display all physical and logical components of your application in the form of a hierarchical tree structure in the “PLANT” area.

Role picker: Adding Axioline F modules

Proceed as follows to add the Axioline F modules:

- Double-click on the “Axioline F (x)” node in the “PLANT” area.

The editor group of the controller “/ Axioline F” opens.

- Select the “Device List” editor.
- Select “Select type here” in the first row in the “Device List” editor.

The role picker opens. Only the elements from the “COMPONENTS” area that you can actually use are shown to you in the role picker.

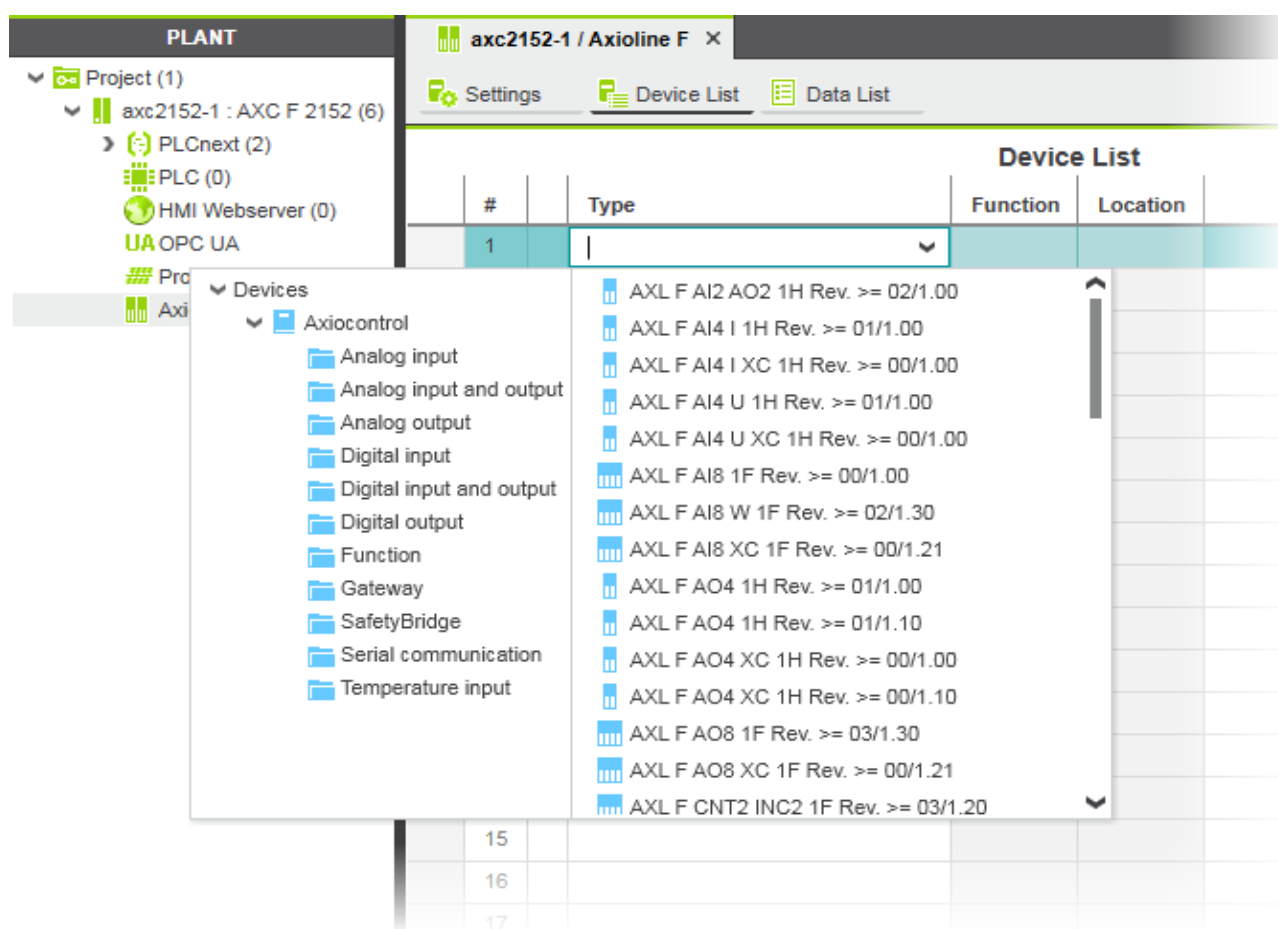


Figure 6-9 The role picker for selecting the Axioline F modules

- Select the relevant Axioline F module in the role picker.

The Axioline F module is added and shown under the node “Axioline F (x)” in the “PLANT” area (see Figure 6-10).

- Proceed as described for other Axioline F modules.

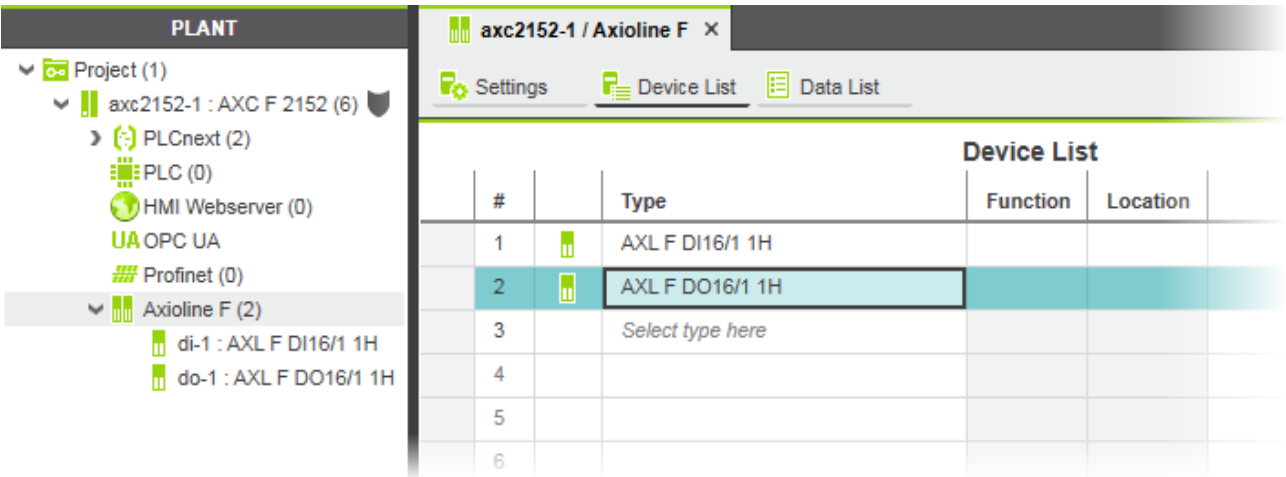


Figure 6-10 Axioline F modules in the “PLANT” area and in the device list

6.8 Configuring PROFINET devices

6.8.1 Adding PROFINET devices

- Double-click on the “Profinet (x)” node in the “PLANT” area.

The editor group of the controller “/ Profinet” opens.

- Select the “Device List” editor.

In the “Device List” editor, add the PROFINET devices. To do this, proceed as follows:

- Select “Select type here” in the first row in the “Device List” editor.

The role picker opens. Only the elements from the “COMPONENTS” area that you can actually use are shown to you in the role picker.

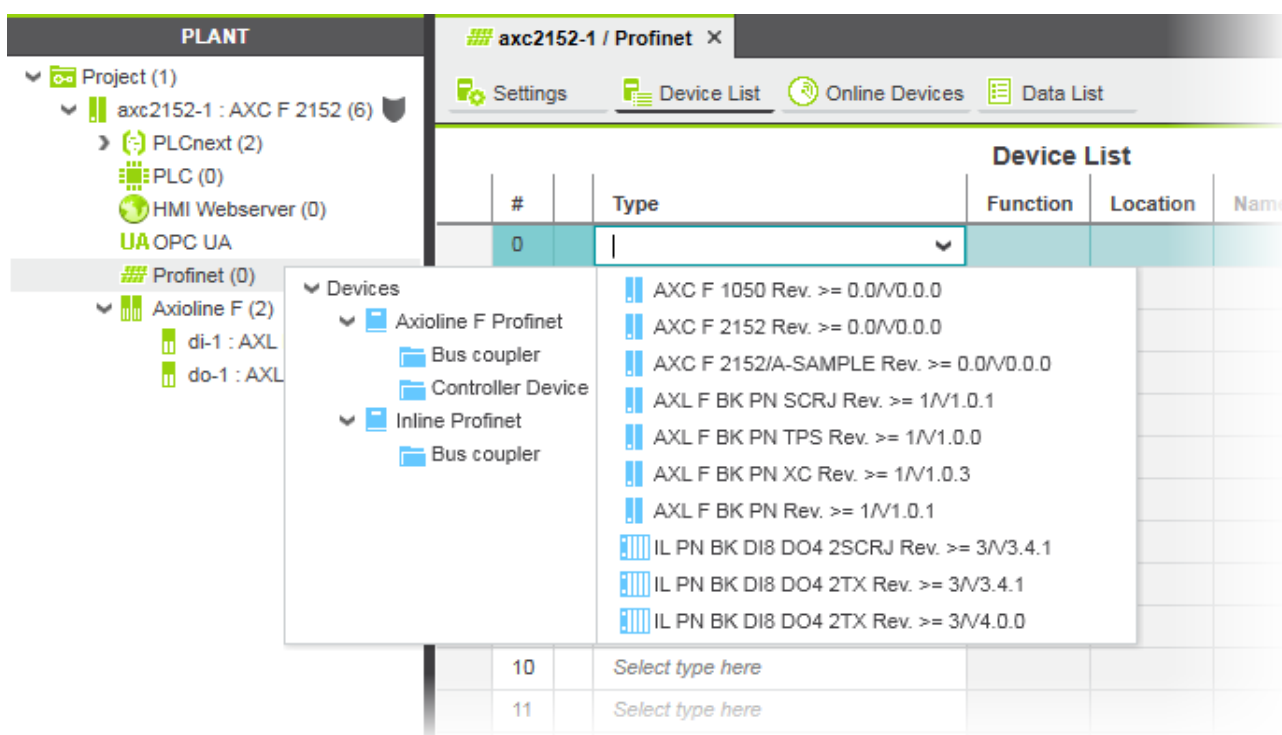


Figure 6-11 The role picker for selecting the PROFINET devices

- Select the relevant PROFINET device in the role picker.

The PROFINET device is automatically added and shown under the node “Profinet (x)” in the “PLANT” area.

- Proceed as described for other PROFINET devices.

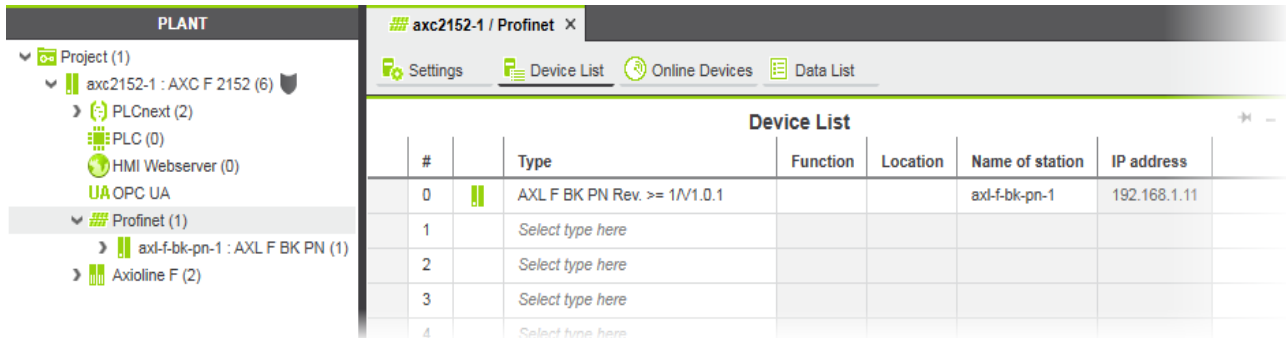


Figure 6-12 PROFINET devices in the “PLANT” area and in the device list

6.8.2 Assigning online devices

After you have added the PROFINET devices, you must assign each configured PROFINET device to the corresponding PROFINET device of your actual bus structure (online device). You are giving the PROFINET devices their IP settings and their PROFINET device names when making the assignment. To do this, proceed as follows:

- Double-click on the “Profinet (x)” node in the “PLANT” area.

The editor group of the controller “/ Profinet” opens.

- Select the “Online Devices” editor.
- Select the desired network card from the drop-down list.

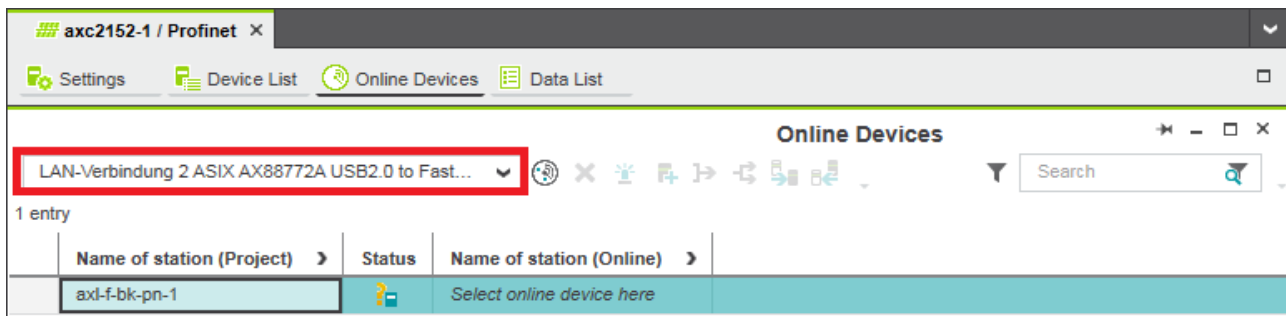



Figure 6-13 Selecting the network card

- Click on the  button to search the network for connected PROFINET devices.

You can see the configured PROFINET devices under “Name of station (Project)”.

You can see the PROFINET devices that have been found online in the network under “Name of station (Online)”.

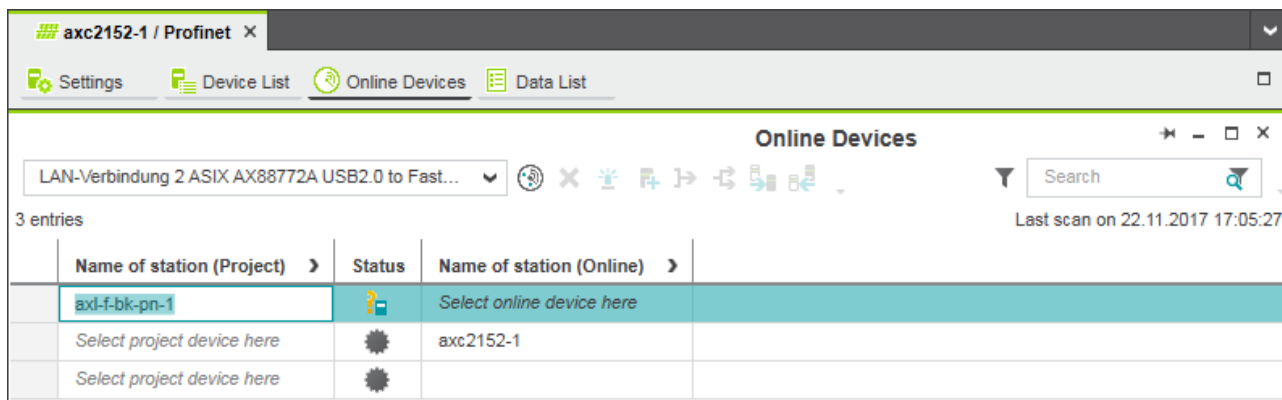


Figure 6-14 Assigning online devices

When you select the PROFINET device under “Name of station (Online)” (“Select project device here”), the PROFINET device found in the network (the online device) receives the IP settings of the configured PROFINET device.



Please note:

By default, the PROFINET device has no IP address.

- On initial start-up of the PROFINET device, choose the device under “Name of station (Online)”.

The PROFINET device receives the IP settings of the configured PROFINET device.

When you select the device under “Name of station (Project)” (“Select project device here”), the configured PROFINET device receives the IP settings of the online device found in the network.

- Select the desired device.

The configured PROFINET device has now been assigned to an online device. Successful assignment is shown in the “Status” column by the ✓ icon.

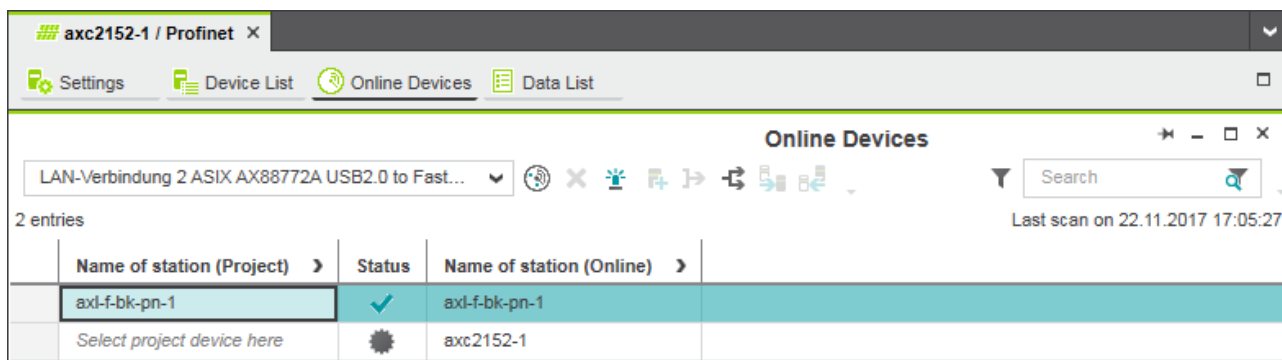


Figure 6-15 Successful assignment of the configured PROFINET device to an online device

6.8.3 Adding I/O modules

After you have added all PROFINET devices of your bus structure to the project, you can add the I/O modules connected to the PROFINET. There are two options to add I/O modules. You can add I/O modules manually or automatically.

Adding I/O modules manually

Proceed as follows to add I/O modules manually:

Double-click in the “PLANT” area on the PROFINET device of whose I/O modules you wish to add.

The editor group of the selected PROFINET device opens, “axf-f-bk-pn-1” in the example.

- Select the “Module List” editor.
- Select “Select type here” in the first row in the “Module List” editor.

The role picker opens. Only the elements from the “COMPONENTS” area that you can actually use are shown to you in the role picker.

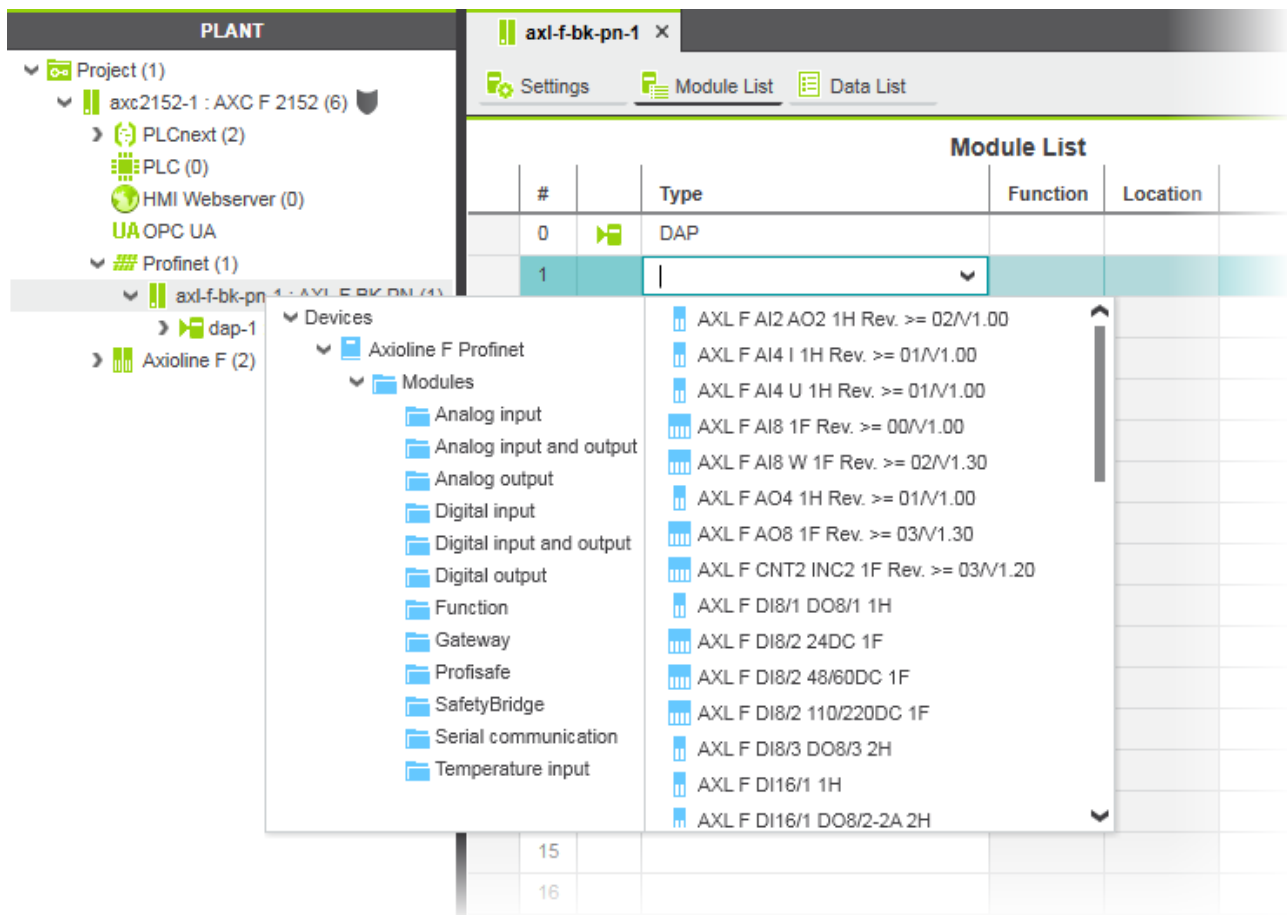


Figure 6-16 The role picker for selecting I/O modules

- Select the relevant I/O module in the role picker.

The I/O module is added and shown in the “PLANT” area under the node “Profinet (x)” for the corresponding PROFINET device (see Figure 6-17).

- Proceed as described for adding additional I/O modules.

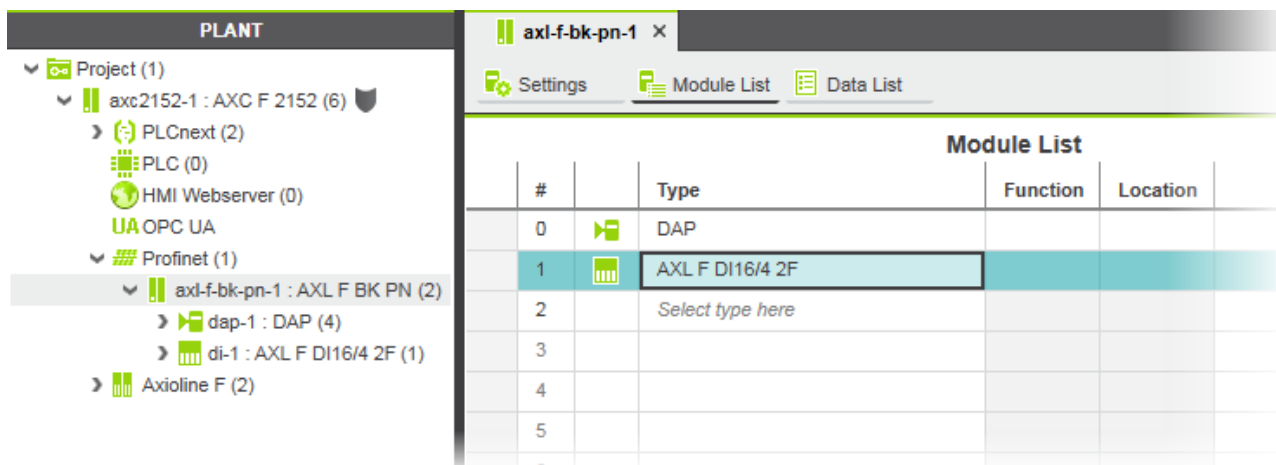


Figure 6-17 I/O modules of a PROFINET device in the “PLANT” area and in the module list

Reading I/O modules automatically

In order to read the I/O modules of a PROFINET device, the following requirements must be met:

- The controller has valid IP settings (see Section 6.5).
- The PROFINET device has valid IP settings and is connected with PC Worx Engineer (see Section 6.8.2).

In order to read the I/O modules of a PROFINET device, proceed as follows:

- Right-click in the “PLANT” area beneath the “Profinet” node on the PROFINET device of whose I/O modules you wish to read.
- Then in the context menu, select the entry “Read Profinet modules”.

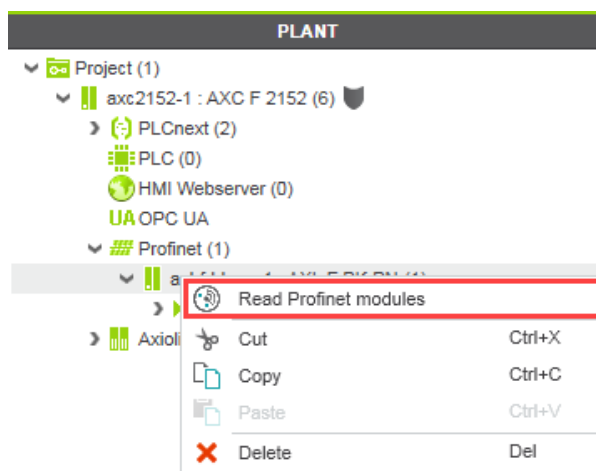


Figure 6-18 Reading I/O modules of a PROFINET device automatically

The I/O modules connected to the PROFINET device are now read automatically.

6.9 Programming according to IEC 61131-3



Please note:

Programming with C++ or MATLAB® Simulink® is not described in this user manual. Detailed information for programming of the AXC F 2152 with C++ or MATLAB® Simulink® can be found in the PLCnext community at plcnext-community.net. You will find operating instructions, tutorials, FAQs, and software and firmware downloads in the PLCnext community.

6.9.1 Opening and creating POU, creating variables

When you create a project, a program organization unit (POU) with the name “Main” is created in the “COMPONENTS” area under “Programs” automatically.

Opening the POU

To open a POU, proceed as follows:

- Click on “Programs” in the “COMPONENTS” section and then on “Local”.
- Double-click on the desired POU, for example “Moving_Light_Prog”.

The editor group of the selected POU opens. You are prompted to select the programming language for the first worksheet of the POU.

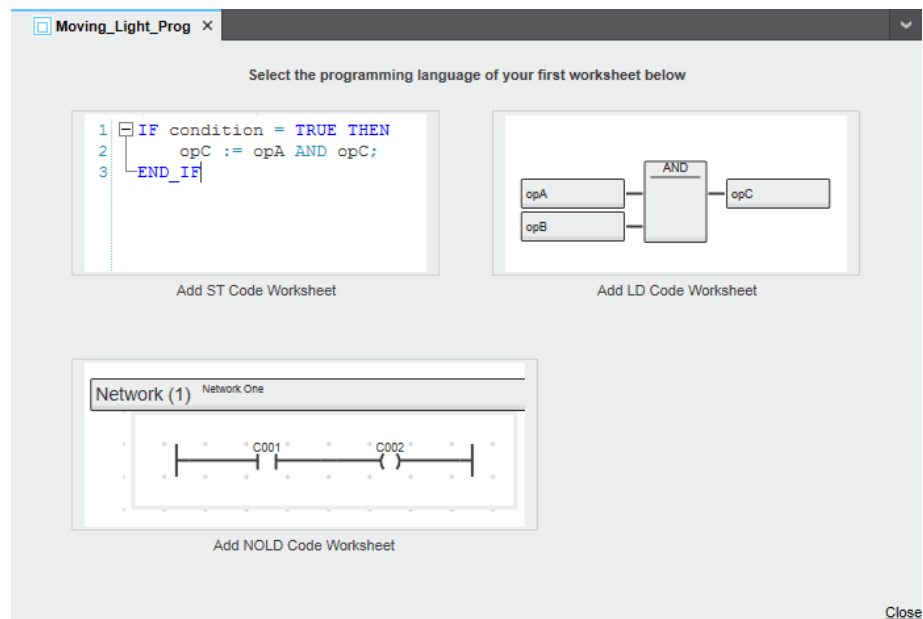


Figure 6-19 Selecting the programming language for the first worksheet

- Double-click on the desired programming language.

Creating a New POU

To create a new POU, proceed as follows:

- Click on “Programs” in the “COMPONENTS” section.
- Right-click on the “Local”.
- In the context menu, select “Add Program”.

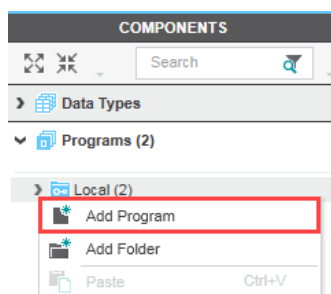


Figure 6-20 “Add Program” context menu

Creating variables

Once you have created a POU, the editor group of the POU opens.

- Select the “Variable” editor.
- Create the variables that you need for the selected POU.

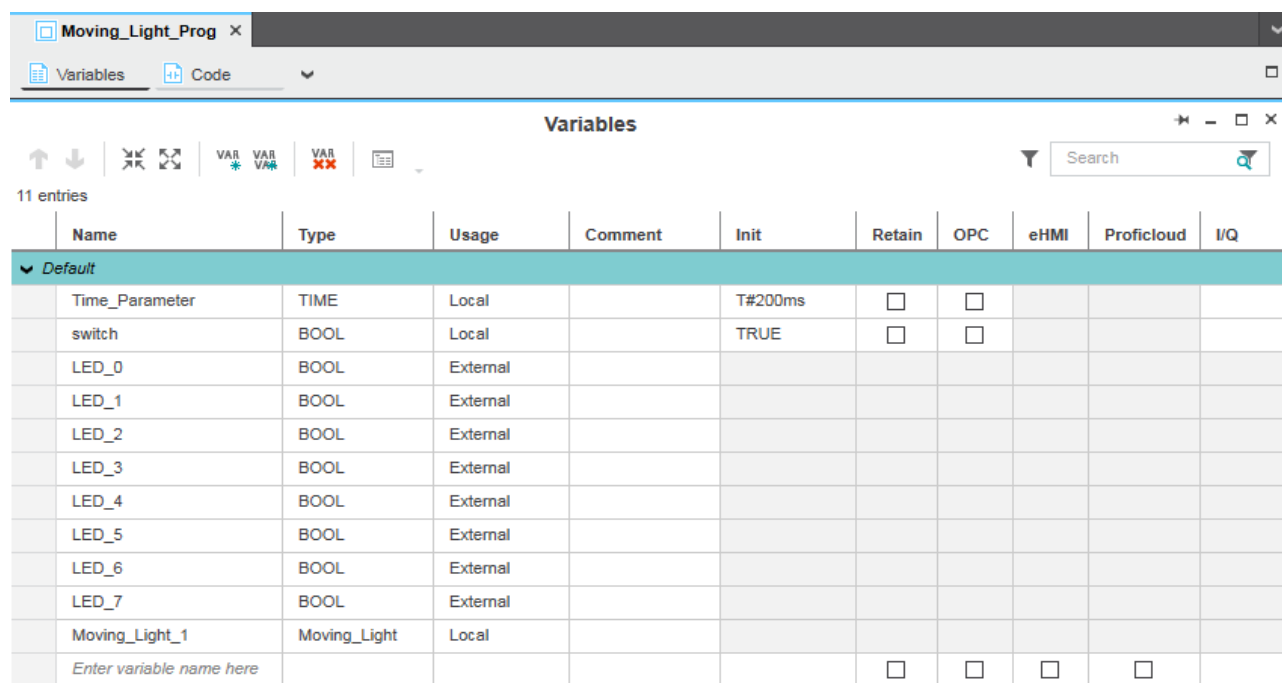


Figure 6-21 Create variables for a POE (“Moving_Light_Prog” in the example for the POU)

Once you have created all the necessary variables, create the program for the selected POU, see Section 6.9.2.

6.9.2 Creating the program

Creating the program

To create a program, proceed as follows:

- Select the program editor.

By default, the program editor is labeled with “Code”. Optionally, you can change the description of the program editor.

- Create the program.

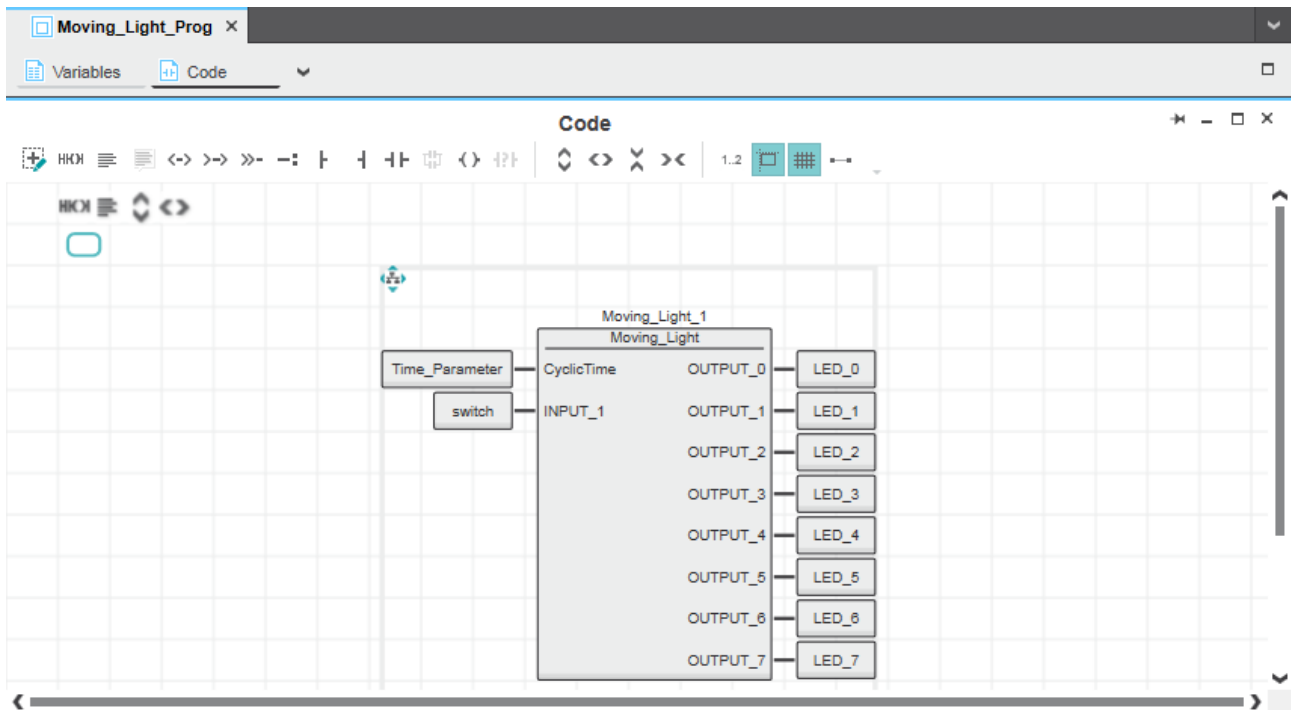


Figure 6-22 Example program in FBD

Adding worksheets

The program for a POU can consist of several worksheets and of different programming languages. For each required programming language you add a corresponding worksheet (code worksheet) to the POU. Each worksheet is inserted in the editor group of the POU as another “Code” editor.

Proceed as follows to add additional worksheets to a POU:

- Select a worksheet in the program editor (in the Figure 6-23, “Code” editor).
- Click on the arrow on the right next to the description of the program editor.
- From the opening drop-down list, select the desired code worksheet.

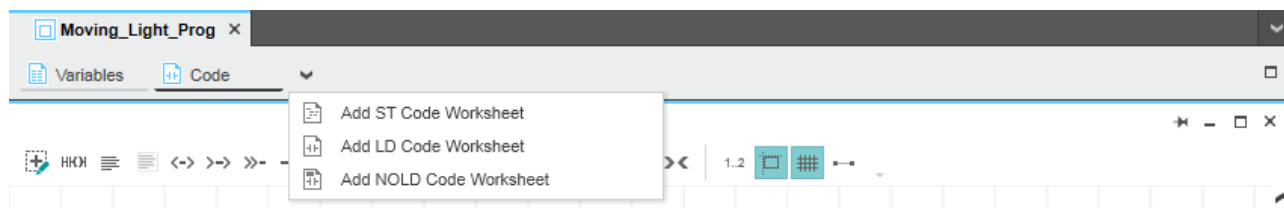


Figure 6-23 Adding the code worksheet to a POU

6.9.3 Creating functions and function blocks

Creating a function or function block

To create several functions and function blocks, proceed as follows:

- Click on “Functions & Function Blocks” in the “COMPONENTS” section.
- Right-click on the “Local”.
- In the context menu, select the suitable entry for the new function to be created or the new function block to be created.

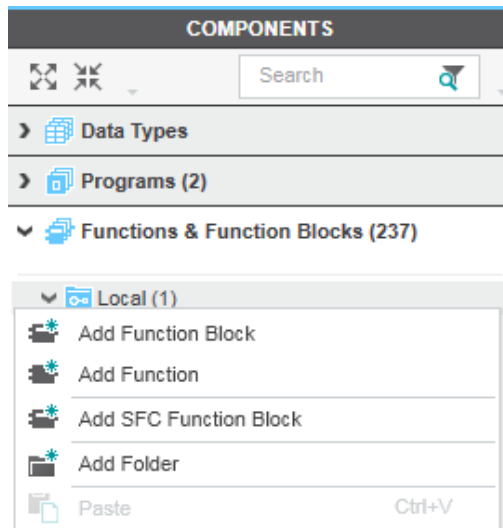


Figure 6-24 Context menu for adding a function or a function block

The newly created function or the newly created function block is inserted below the “Local” entry in the “COMPONENTS” area.

- Right-click to open the context menu for the newly created function or the newly created function block.
- Select “Rename”.
- Enter a unique and meaningful name, “Moving_Light” in the example.

No spaces are allowed within a name.

- Press the “Enter” key to accept the entry.

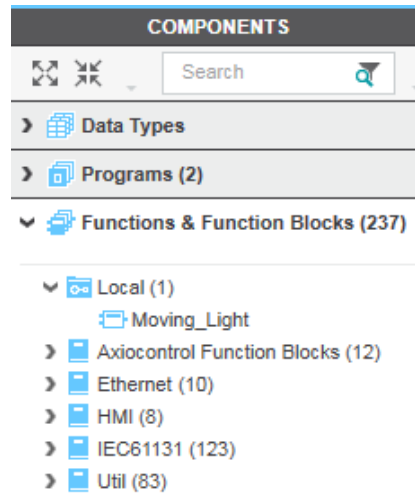


Figure 6-25 Newly created function block in the “COMPONENTS” area

After you have created a new function or a new function block, you must program the logic for the function or the function block. To do this, select the programming language for the first worksheet.

Selecting the programming language for the first worksheet

- Double-click on the function or the function block in the “COMPONENTS” area.

The editor group of the function or the function block opens. You are prompted to select the programming language for the first worksheet of the function or function block.

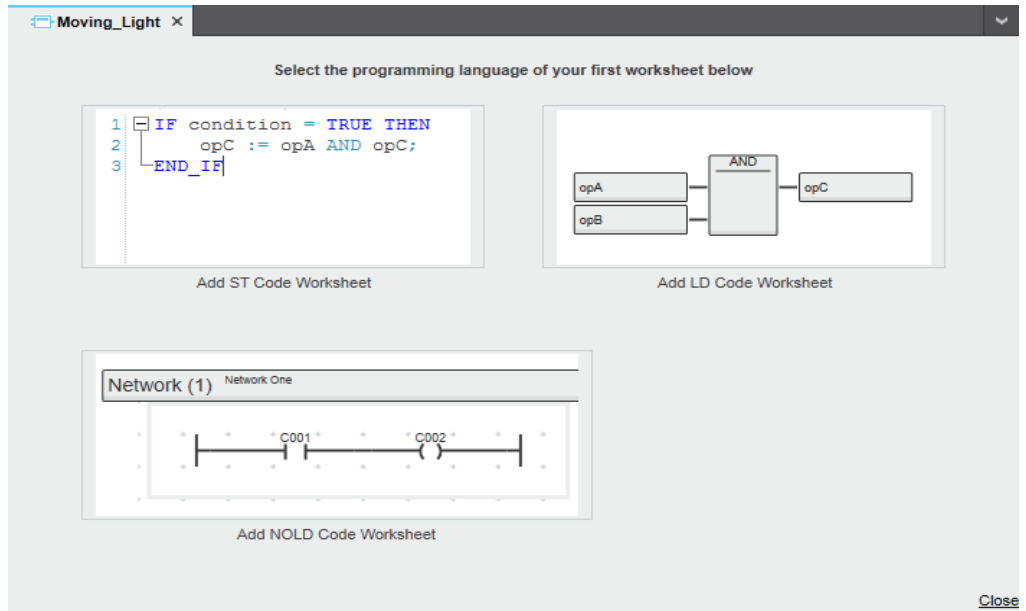


Figure 6-26 Selecting the programming language for the first worksheet

- Double-click on the desired programming language.

Creating variables

Once you have chosen the programming language, create the required variables. To do this, proceed as follows:

- Select the “Variable” editor.
- Create the variables that you need for programming the function or the function block.

Name	Type	Usage	Comment	Init	Access	Retain	OPC	I/Q
▼ Default								
Schrittkette	INT	Local		INT#0	Private	<input type="checkbox"/>	<input type="checkbox"/>	
OUTPUT_0	BOOL	Output		FALSE		<input type="checkbox"/>	<input type="checkbox"/>	
OUTPUT_1	BOOL	Output		FALSE		<input type="checkbox"/>	<input type="checkbox"/>	
OUTPUT_2	BOOL	Output		FALSE		<input type="checkbox"/>	<input type="checkbox"/>	
OUTPUT_3	BOOL	Output		FALSE		<input type="checkbox"/>	<input type="checkbox"/>	
OUTPUT_4	BOOL	Output		FALSE		<input type="checkbox"/>	<input type="checkbox"/>	
OUTPUT_5	BOOL	Output		FALSE		<input type="checkbox"/>	<input type="checkbox"/>	
OUTPUT_6	BOOL	Output		FALSE		<input type="checkbox"/>	<input type="checkbox"/>	
OUTPUT_7	BOOL	Output		FALSE		<input type="checkbox"/>	<input type="checkbox"/>	
CyclicTime	TIME	Input		T#0s		<input type="checkbox"/>	<input type="checkbox"/>	

Figure 6-27 Creating variables for a function block (“Moving_Light” in the example for the function block)

Once you have created all the required variables, program the logic for the function or the function block.

Programming the logic

- Select the “Code” editor.
- Create the program.

```
1 | TOF_2 (IN:=TOF_2.IN, PT:=CyclicTime);
2 | TOF_2.ET:=TOF_2.ET;
3 |
4 |
5 | IF INPUT_1 = True THEN TOF_2.IN := True;
6 |
7 |
8 | If Schrittkette = 0 then Schrittkette := 10;
9 | end_if;
10 |
11 | CASE Schrittkette OF
12 |
13 | 10:
14 |   Output_0:= True;
15 |   Output_1:= False;
16 |   Output_2:= False;
17 |   Output_3:= False;
18 |   Output_4:= False;
```

Figure 6-28 Example code for a function block

Adding worksheets

The program can consist of several worksheets and of different programming languages. For each required programming language, you add a corresponding worksheet (code worksheet) to the function or the function block. Each worksheet is inserted in the editor group of the function or function block as another “Code” editor.

Proceed as follows to add additional worksheets to a function or a function block:

- Select a worksheet in the program editor.
- Click on the arrow on the right next to the description of the program editor.
- From the opening drop-down list, select the desired code worksheet.

6.10 Instantiating a program

Instantiate the program in the editor “Tasks and Events”. To instantiate a program, create the required task and assign this to the desired program. Individual tasks are coordinated and processed in the Execution & Synchronization Manager (ESM). The AXC F 2152 works with a dual core processor and has one ESM (“ESM1” and “ESM2” in the “Tasks and Events” editor) per processor kernel.

Opening the “Tasks and Events” editor

- To open the “Tasks and Events” editor, proceed as follows:
- Double-click on the “PLCnext” node in the “PLANT” area.
- The “PLCnext” editor group opens.
- Select the “Tasks and Events” editor.

Creating tasks

- To create a new task, proceed as follows:
- Enter a name for the new task in the “Name” column in the “Enter task name here” input field.
- No spaces are allowed within a name.
- Click in the input field in the “Task Type” column.
 - Select the “Task Type” from the drop-down list.
 - Make all the required settings for the task in the other columns.

Instantiating a program

- To instantiate a program, proceed as follows:
- In the “Name” column, enter a name for the program instance below a task in the “Enter program instance name here” input field (“Program1_Moving_Light” in the example in Figure 6-29).
- No spaces are allowed within a name.
- Click on “Select program type here” in the “Program Type” column.
 - Select the program to be instantiated in the drop-down list (“Moving_Light_Prog” in the example in the Figure 6-29).

The selected program is instantiated and assigned to a task.

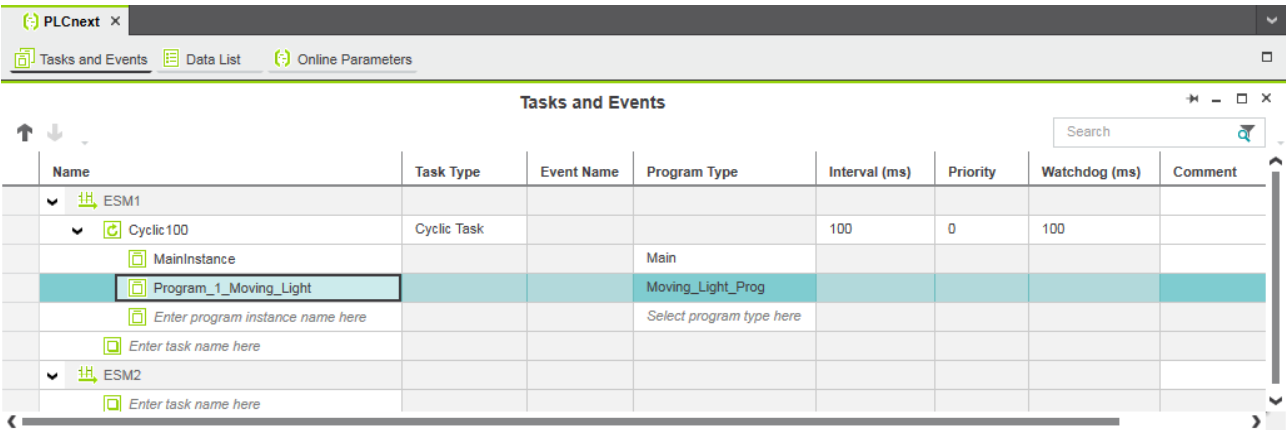


Figure 6-29 Tasks and program instances in the “Tasks and Events” editor

6.11 Assigning process data

6.11.1 For programs according to IEC 61131-3 without IN and OUT ports

There are two options for assigning process data:

- You assign a process data item to a variable.
- You assign a variable to a process data item.

You assign the process data in the “Data List” editor.

Assigning a process data item to a variable

In order to assign a process data item to a variable, proceed as follows:

- Double-click on the “PLC” node in the “PLANT” area.

The editor group of the controller “/ PLC” opens.

- Select the “Data List” editor.

You can see an overview of all available variables in the “Data List” editor.

Variable (PLC)	Process Datum	HMI Tag	Function
Default			
axc2152-1 / PLC.LED_0	Select Process Datum here		
axc2152-1 / PLC.LED_1	Select Process Datum here		
axc2152-1 / PLC.LED_2	Select Process Datum here		
axc2152-1 / PLC.LED_3	Select Process Datum here		
axc2152-1 / PLC.LED_4	Select Process Datum here		
axc2152-1 / PLC.LED_5	Select Process Datum here		
axc2152-1 / PLC.LED_6	Select Process Datum here		
axc2152-1 / PLC.LED_7	Select Process Datum here		
Enter variable name here	Enter variable name here		
System Variables			
axc2152-1 / PLC.PND_S1_PLG_RUI	axc2152-1 / Profinet / PND_S1_PLG_RUN		
axc2152-1 / PLC.PND_S1_VALID_D	axc2152-1 / Profinet / PND_S1_VALID_DATA_CYCLE		
axc2152-1 / PLC.PND_S1_OUTPUT	axc2152-1 / Profinet / PND_S1_OUTPUT_STATUS_GOOD		

Figure 6-30 Example: Overview of all available variables



You get an overview of all available variables when you click on the node of the controller in the “PLANT” area and also open the “Data List” editor there. You can also assign the process data at this point.

- In order to assign a process data item to a variable, click on “Select process data item here” in the “Process Data” column.

The role picker opens. Only the process data that you can actually assign to each variable are shown to you in the role picker.

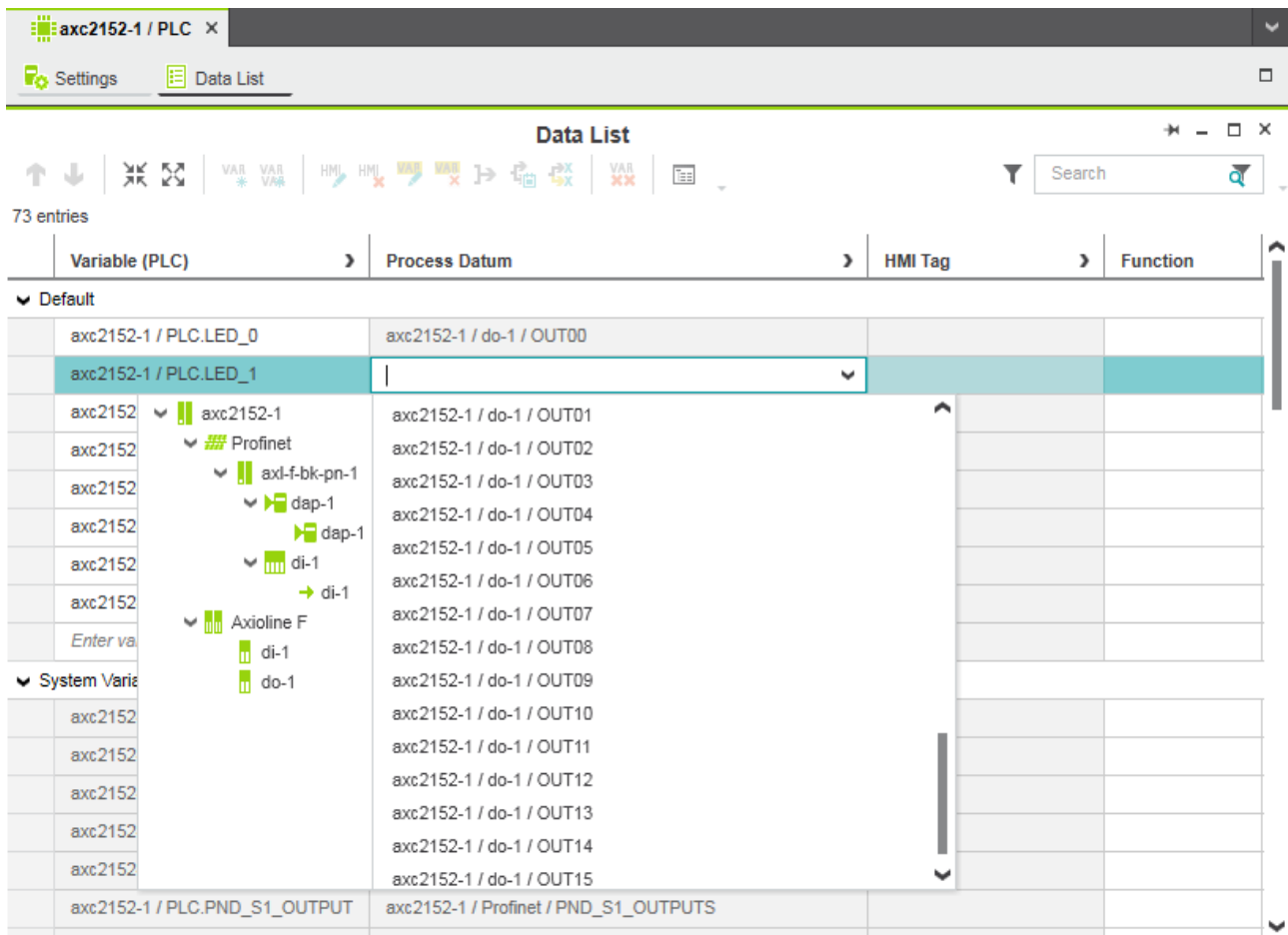


Figure 6-31 The role picker for selecting the process data

- Select the process data item in the role picker that you want to assign to the relevant variable.

The process data item is assigned to the variable.

- Proceed as described for other variables.

Assigning a variable to a process data item

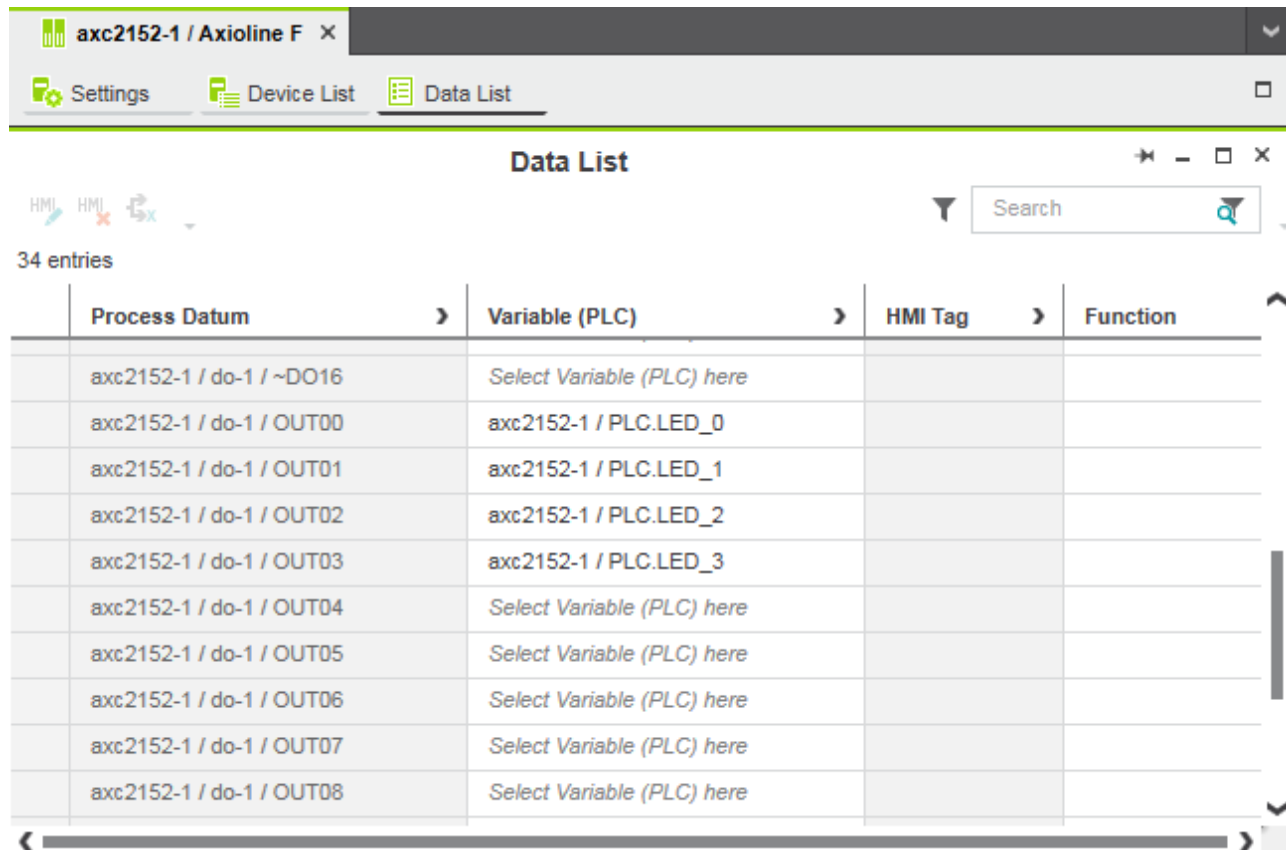
In order to assign a variable to a process data item, proceed as follows:

- Double-click on the “Axioline F (x)” node in the “PLANT” area (for Axioline F modules) or
- double-click on the “Profinet (x)” node in the “PLANT” area (for PROFINET devices).

The editor group of the controller “/ Axioline F” (for PROFINET devices: “/ Profinet”) opens.

- Select the “Data List” editor.

You can see an overview of all available process data in the “Data List” editor.



Data List

34 entries

Process Datum	Variable (PLC)	HMI Tag	Function
axc2152-1 / do-1 / ~DO16	Select Variable (PLC) here		
axc2152-1 / do-1 / OUT00	axc2152-1 / PLC.LED_0		
axc2152-1 / do-1 / OUT01	axc2152-1 / PLC.LED_1		
axc2152-1 / do-1 / OUT02	axc2152-1 / PLC.LED_2		
axc2152-1 / do-1 / OUT03	axc2152-1 / PLC.LED_3		
axc2152-1 / do-1 / OUT04	Select Variable (PLC) here		
axc2152-1 / do-1 / OUT05	Select Variable (PLC) here		
axc2152-1 / do-1 / OUT06	Select Variable (PLC) here		
axc2152-1 / do-1 / OUT07	Select Variable (PLC) here		
axc2152-1 / do-1 / OUT08	Select Variable (PLC) here		

Figure 6-32 Example: Overview of all available process data

- In order to assign a variable to a process data item, click on “Select variable (PLC) here” in the “Variable (PLC)” column.

The role picker opens. Only the variable that you can actually assign to each process data item are shown to you in the role picker.

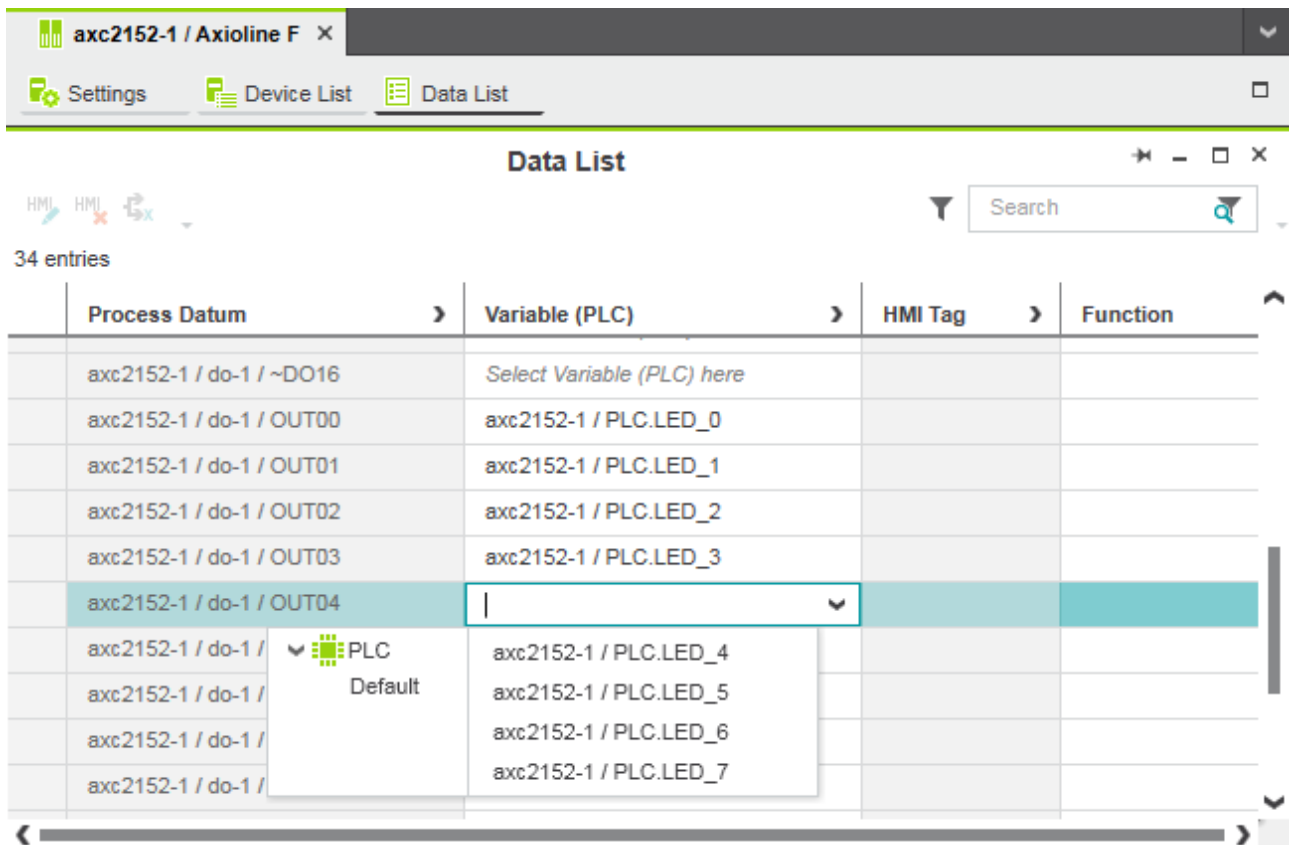


Figure 6-33 The role picker for selecting the variables

- Select the variable in the role picker that you want to assign to the relevant process data item.

The variable is assigned to the process data item.

- Proceed as described for other process data.

6.11.2 For programs according to IEC 61131-3 with IN and OUT ports

If you have created variables as IN and/or OUT ports in your program, the process data is assigned in the “Data List” of the “PLCnext” node.

There are two options for assigning process data:

- You assign an IN port to an OUT port.
- You assign an OUT port to an IN port.

Open the “Data List” editor

- Double-click on the “PLCnext” node in the “PLANT” area.

The “PLCnext” editor group opens.

- Select the “Data List” editor.

You can see an overview of all available IN and OUT ports in the “Data List” editor.



IN and OUT ports are **only** in the “Data List” editor of the “PLCnext” node.

The screenshot shows the 'Data List' editor window. At the top, there's a tab bar with 'Tasks and Events', 'Data List' (selected), and 'Online Parameters'. Below the tab bar is a toolbar with icons for undo, redo, and other actions. The main area displays a table with 42 entries. The table has four columns: 'OUT Port', 'IN Port', 'Function', and an empty column. The first row is highlighted in blue. The 'OUT Port' column lists various ports like 'Arp.Plc.Eclr / Prog_1 : LED_0' through 'LED_7', and 'axc2152-1 / di-1 / ~DI16' and 'IN00'. The 'IN Port' column for all rows contains the text 'Select IN Port here'.

OUT Port	IN Port	Function	
Arp.Plc.Eclr / Prog_1 : LED_0	Select IN Port here		
Arp.Plc.Eclr / Prog_1 : LED_1	Select IN Port here		
Arp.Plc.Eclr / Prog_1 : LED_2	Select IN Port here		
Arp.Plc.Eclr / Prog_1 : LED_3	Select IN Port here		
Arp.Plc.Eclr / Prog_1 : LED_4	Select IN Port here		
Arp.Plc.Eclr / Prog_1 : LED_5	Select IN Port here		
Arp.Plc.Eclr / Prog_1 : LED_6	Select IN Port here		
Arp.Plc.Eclr / Prog_1 : LED_7	Select IN Port here		
axc2152-1 / di-1 / ~DI16	Select IN Port here		
axc2152-1 / di-1 / IN00	Select IN Port here		

Figure 6-34 Example: Overview of all available IN and OUT ports

Assigning an IN port to an OUT port

- In order to assign an IN port to an OUT port, click on the “IN Port” in the “IN Port” column. The role picker opens. Only the IN ports that you can actually assign to each OUT port are shown to you in the role picker.

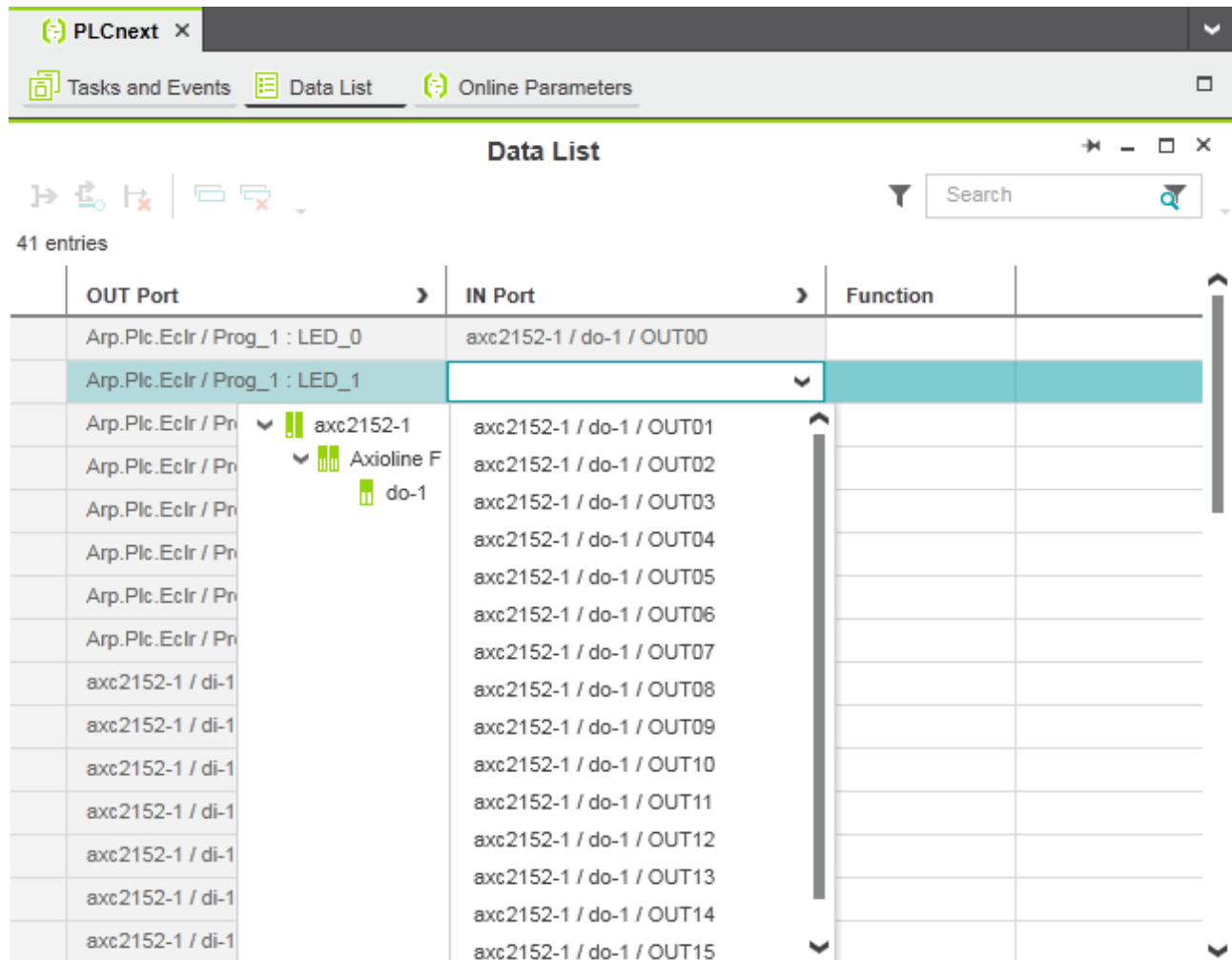


Figure 6-35 The role picker for selecting the IN ports

- Select the IN port in the role picker that you want to assign to the relevant OUT port. The IN port is assigned to the OUT port.
- Proceed as described for other IN ports.

Assigning an OUT port to an IN port

- In order to assign an OUT port to an IN port, click on the “OUT Port” in the “OUT Port” column.

The role picker opens. Only the OUT ports that you can actually assign to each IN port are shown to you in the role picker.

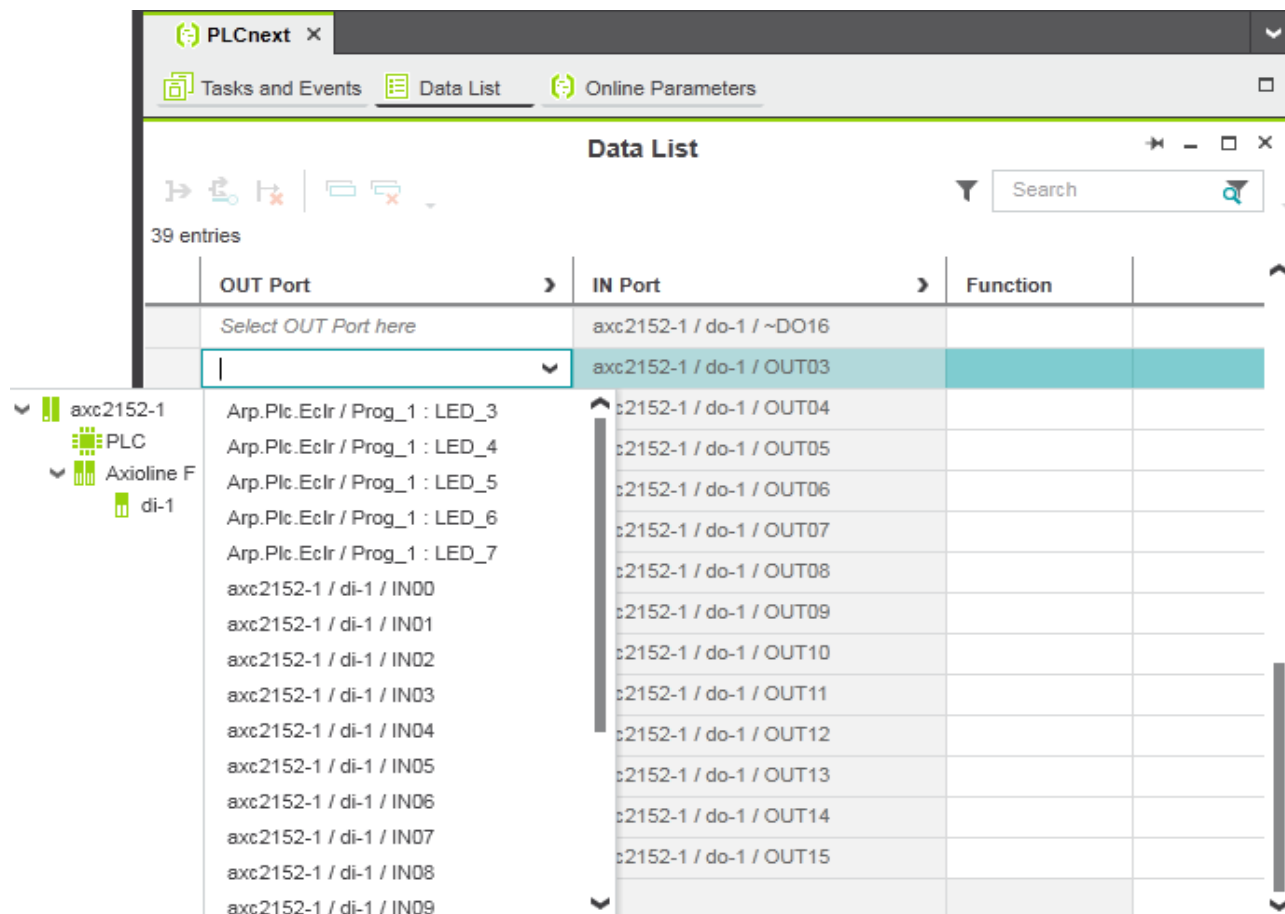


Figure 6-36 The role picker for selecting the OUT ports


- Select the OUT port in the role picker that you want to assign to the relevant IN port. The OUT port is assigned to the IN port.
- Proceed as described for other OUT ports.

6.12 Transferring the project to the controller

To transfer the project to the controller, proceed as follows:

- Double-click on the controller node in the “PLANT” area.

The editor group of the controller opens.

- Select the “Cockpit” editor.
- Click on the  button (“Write project to controller and start execution. (F5)”).



Please note:

When user authentication is enabled, authentication with a user name and password is required for executing this function.

User authentication is enabled by default. You can disable user authentication via the User Manager.

If user authentication is enabled, the function can only be executed by users whose user roles contain the required permission.

- Enter your user name and your password in the dialog that opens.

If you do not have the required user permission for executing the function, PC Worx Engineer indicates this to you in a message.

For information on the User Manager and the user roles, please refer to Section 9.5.2.1.

The project is compiled, transferred to the controller and executed.

6.13 Creating an PC Worx Engineer HMI application

In PC Worx Engineer, you can create a PC Worx Engineer HMI application with which you can visualize, watch and control your application on your controller.



Information on creating a PC Worx Engineer HMI application can be found in “Installation and Operation of PC Worx Engineer software” quick start guide and in the online help of PC Worx Engineer.

7 Transferring variable values into the PROFICLOUD

In PC Worx Engineer, you can define variables whose values should be transferred as a metric into the PROFICLOUD. The variable values are stored in the PROFICLOUD. The metrics can be represented graphically using the open platform Grafana.

7.1 Creating variables in PC Worx Engineer as OUT port

Variables that are to be transferred out of a PC Worx Engineer project and into the PROFICLOUD must be created as OUT ports in PC Worx Engineer.

Proceed as follows to create a variable in PC Worx Engineer as OUT port:

- Click on “Program” in the “COMPONENTS” section and then on “Local”.
- Double-click on the desired POU from which variables are to be transferred into the PROFICLOUD.
- Select the “Variable” editor.
- Enter the name and data type of the variable.
- Select “Out Port” in the “Usage” column.
- Click the check box in the “Proficloud” column.

Main

Variables

Code

Variables

9 entries

↑

↓

↶

↷

VAR

VAR

VAR

Search

Name	Type	Usage	Comment	Init	Retain	OPC	eHMI	Proficloud	I/Q
Default									
xCount_UP	BOOL	Local		FALSE	<input type="checkbox"/>	<input type="checkbox"/>			
xCount_Down	BOOL	Local		FALSE	<input type="checkbox"/>	<input type="checkbox"/>			
rAngle	REAL	Local		REAL#1.0	<input type="checkbox"/>	<input type="checkbox"/>			
rASin	REAL	OUT Port		REAL#0.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
rACos	REAL	OUT Port		REAL#0.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
rATan	REAL	OUT Port		REAL#0.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
rSin	REAL	OUT Port		REAL#0.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
rCos	REAL	OUT Port		REAL#0.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
rTan	REAL	OUT Port		REAL#0.0	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Enter variable name here					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Figure 7-1 Creating variables as OUT ports

7.2 Editing the configuration file

To transfer variable values from a PC Worx Engineer project into the PROFICLOUD, you must edit the configuration file *metrics.json*. The variables correlating to the values to be transferred from the PC Worx Engineer project to the PROFICLOUD are defined in the *metrics.json* file. The variable values are transferred into the PROFICLOUD as a metric.

Configuring the metrics.json file

Match the port and the metric in the metrics.json file according to the variables specified in PC Worx Engineer. To do this, proceed as follows:

- In the shell, open the metrics.json file in the directory `/opt/plcnext/projects/ProfiCloud`.
- Enter the name of the program instance as the port and the variable name in the following form:
"port": "Arp.Plc.Eclr/program instance name:variable name".
- Enter the variable name for the metric in the following form:
"metric": "Variable name".
- Repeat this procedure for all variables whose values should be transferred as metric into the PROFICLOUD.

```
GNU nano 2.2.5                               File: /opt/plcnext/projects/ProfiCloud/metrics.json
[
  {
    "port"   : "Arp.Plc.Eclr/MainInstance:rSin",
    "metric" : "rSin"
  },
  {
    "port"   : "Arp.Plc.Eclr/MainInstance:rCos",
    "metric" : "rCos"
  }
]
```

Figure 7-2 Example: Configure the port and metric in the metrics.json file

Restarting the controller

Once the metrics.json file has been configured, you need to restart the controller:

- Enter the shell command `"sudo /etc/init.d/plcnext restart"`.

7.3 Configuring the PROFICLOUD

Before you can transfer the metric in the PROFICLOUD, you must register the AXC F 2152 in the PROFICLOUD. To do this, proceed as follows:

Establishing a connection to the web interface

- Open the web browser on your PC.
- In the address line, enter the URL “https://www.proficloud.net”.

Logging in

- Enter your user name and your password.
- Click the “Sign In” button to sign into the PROFICLOUD.

Adding a AXC F 2152

- To add the AXC F 2152 as a PROFICLOUD device, select the PROFICLOUD service “TSD Device Manager” in the “Home/Solutions” menu.

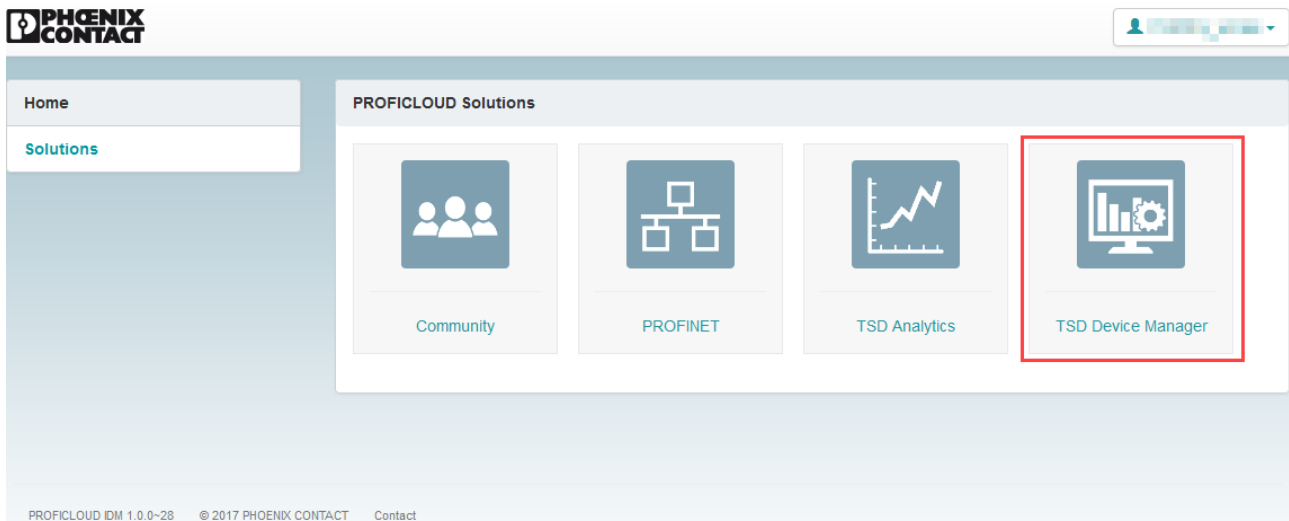


Figure 7-3 Choosing the PROFICLOUD service “TSD Device Manager”

The “Appliances” page opens.

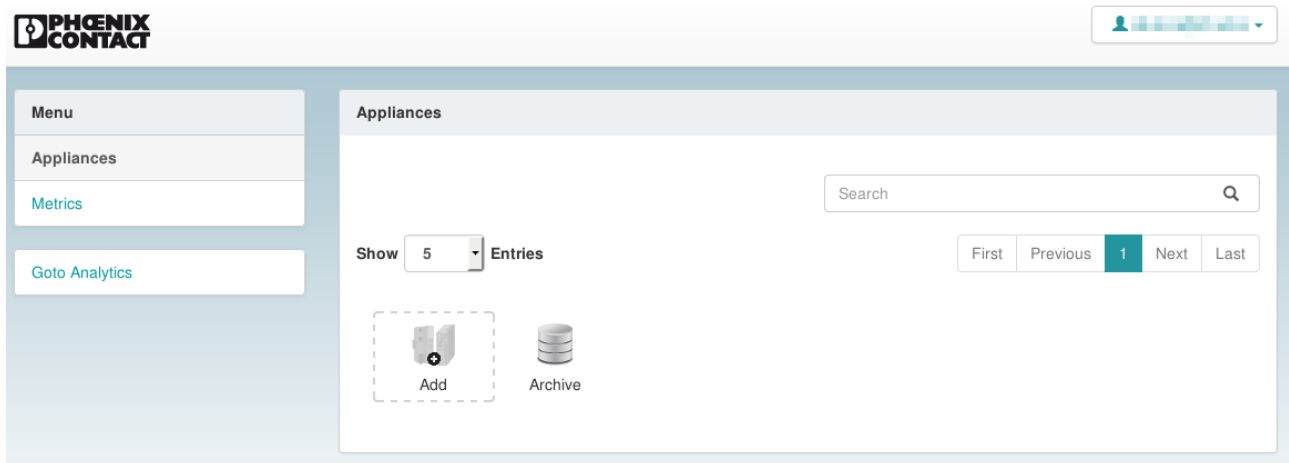
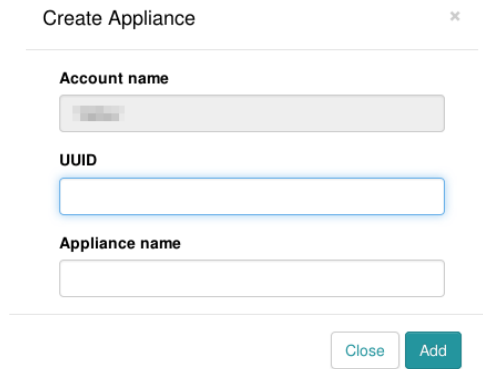


Figure 7-4 “Appliances” page

Registering a AXC F 2152

- Click the “Add” button.
- The “Create Appliance” dialog opens.



Create Appliance ×

Account name

UUID

Appliance name

Close Add

Figure 7-5 “Create Appliance” dialog

- Enter the UUID of the AXC F 2152 in the “UUID” input field.
The UUID of the AXC F 2152 is printed on the side of the device.
- Enter a unique name for the AXC F 2152 in the “Appliance name” input field.
- Click on the “Add” button to save your entries.

7.4 Viewing the overview of the metrics of a PROFICLOUD device

When the AXC F 2152 is switched on, the metrics are automatically transferred into the PROFICLOUD.

To see an overview of all metrics of a PROFICLOUD device, proceed as follows:

- Select the PROFICLOUD service “TSD Device Manager” in the “Home/Solutions” menu.

The “Appliances” page opens.

- On the “Appliances” page, click on the AXC F 2152 with the metrics you would like to see.

The “Appliances / Device Name” page opens.

Menu

- Appliances
- Metrics
- Goto Analytics

Appliances / AXC F 2152

AXC F 2152

Edit Delete

Metrics

Auto-Discover

Search

Show 5 Entries

First Previous 1 Next Last

Metric name	Comment	Edit
.rSin	Automatically generated description.	Edit Delete
.rCos	Automatically generated description.	Edit Delete

Figure 7-6 “Appliances / Device Name” page

The received metrics are shown in the “Metrics” area.

7.5 Representing the metrics in Grafana graphically

The metrics can be represented graphically using the open platform Grafana.

To graphically represent a metric with Grafana, proceed as follows:

Establishing a connection with Grafana

- Select the PROFICLOUD service “TSD Device Manager” in the “Home/Solutions” menu.
- Select the “Goto Analytics” entry in the menu.

The homepage of Grafana is opened.

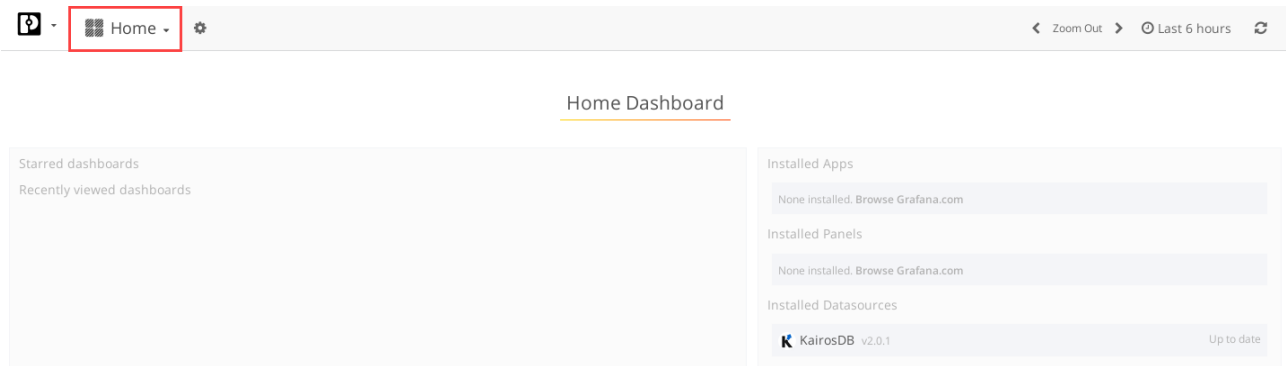


Figure 7-7 Grafana: Homepage

Creating a new dashboard

- Click on the “Home” button.

The “Home” page opens.

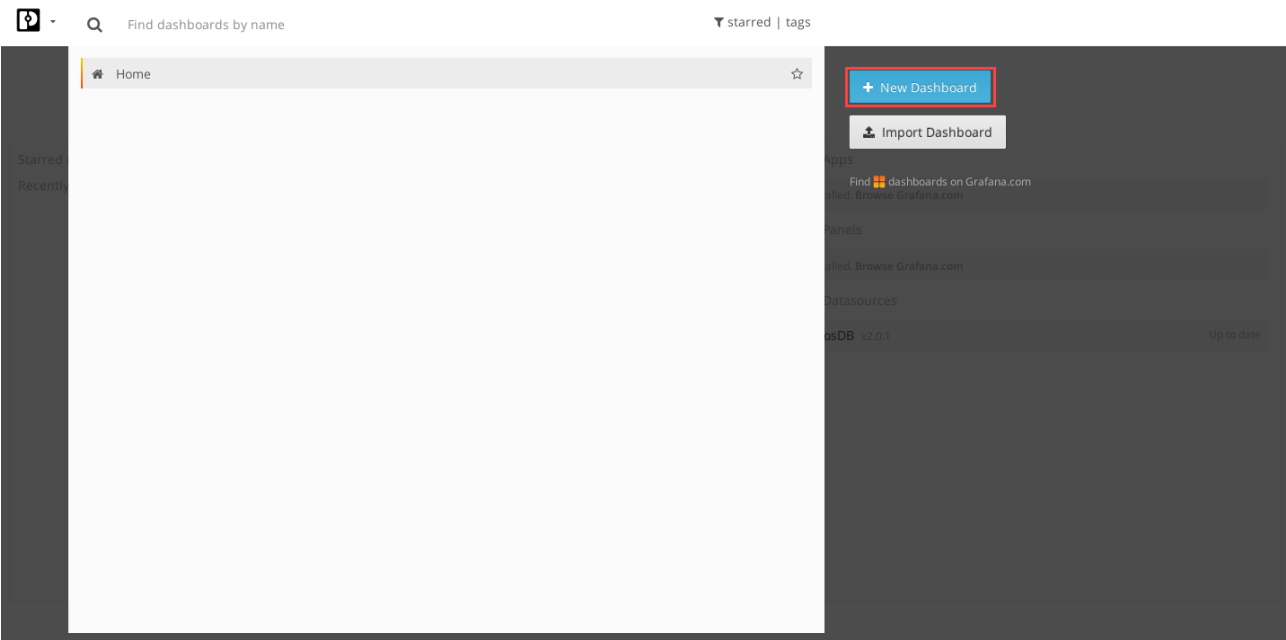


Figure 7-8 Grafana: “Home”

- Click on “New Dashboard” to create a new dashboard.

The “New Dashboard” page opens.

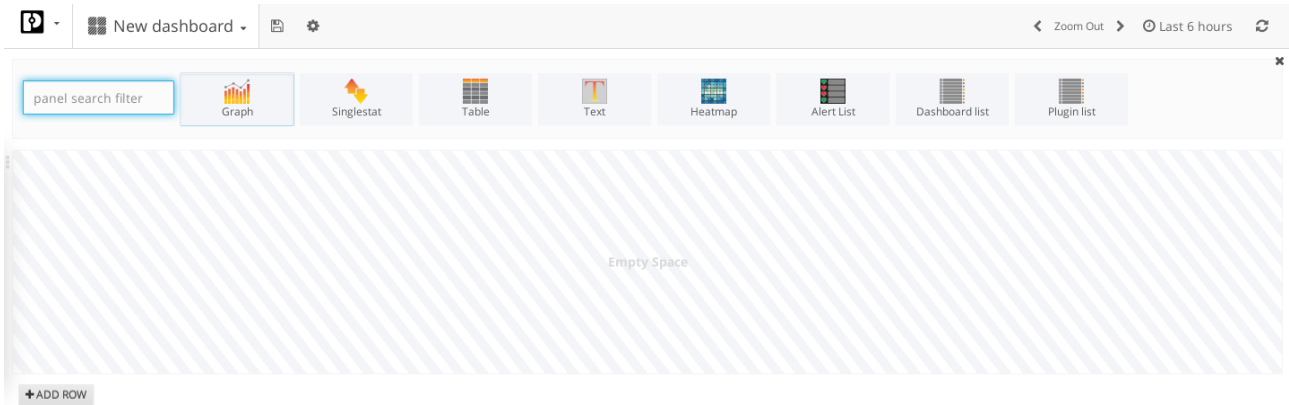


Figure 7-9 Grafana: “New Dashboard” page

Selecting the type of display

- Use the button to select a type of display (e.g., graph, etc.).
- An example display opens for the selected graphical display (see Figure 7-10).

Selecting a metric

- Click on “Panel Title” to select the metric to be displayed.
- Click on the “Edit” button.

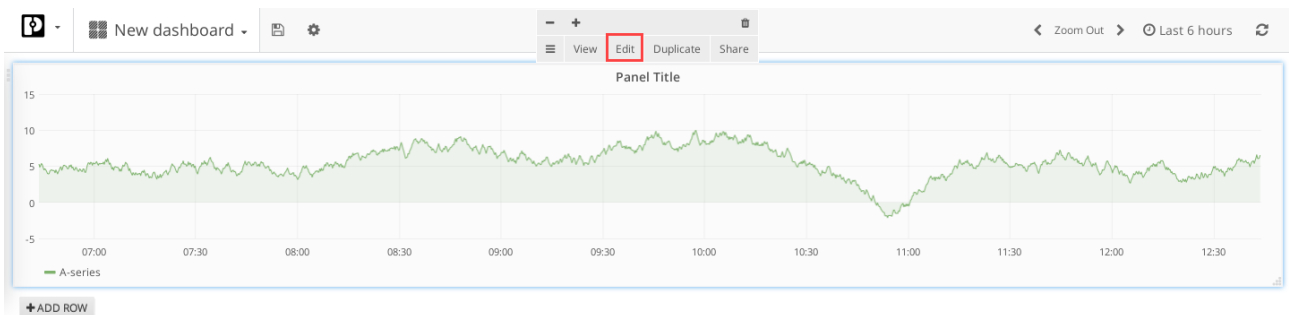


Figure 7-10 Grafana: Example graph; Edit Panel Title

An area where you can edit the details of the selected graphical display opens below the example display.

- Switch to the “Metrics” tab.
- Select the metric to be displayed.

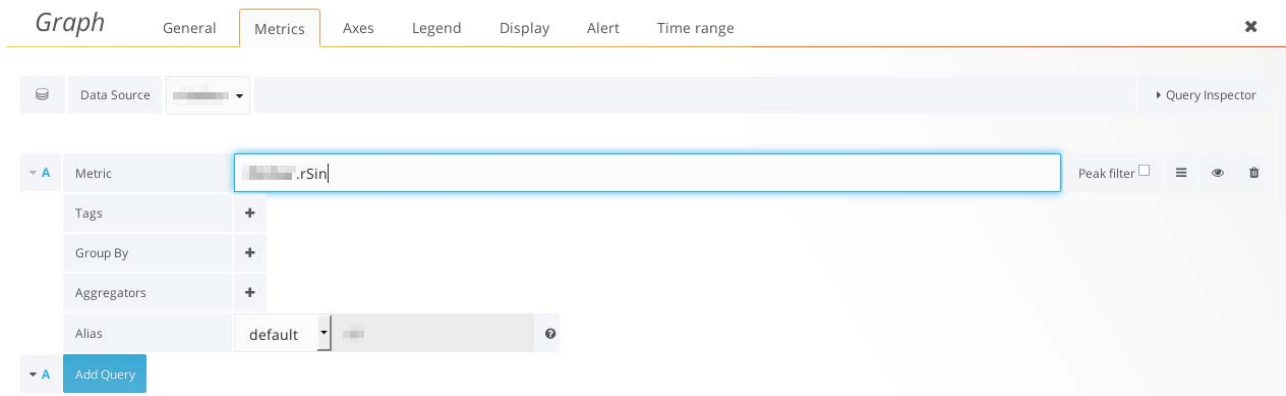


Figure 7-11 Grafana: Selecting the metric to be displayed

- Close the bottom area by clicking on the “X” button.

The selected metric is now displayed graphically.

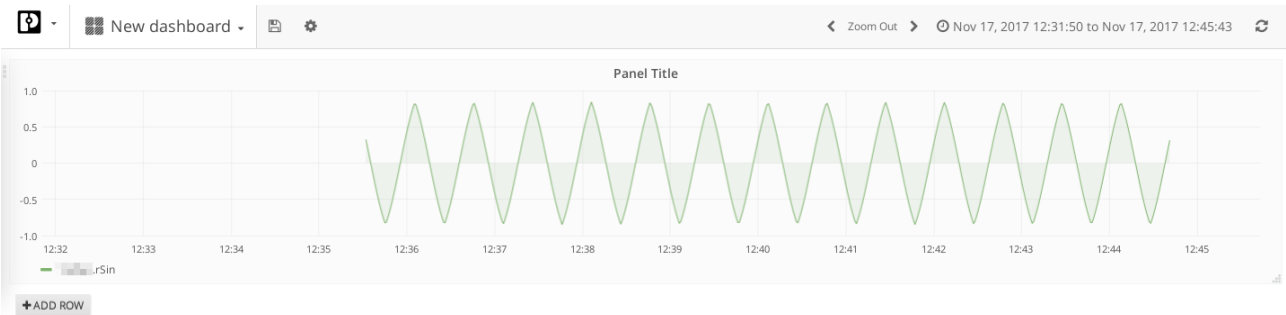


Figure 7-12 Grafana: Graphical representation of the selected metric

8 System variables and status information

8.1 General information

This section describes the system variables that are available for the controller.

The controller has a register set, which is used for diagnostics and easy control of the controller and Axioline F local bus.

The diagnostic data is stored in the diagnostic status register and the diagnostic parameter register. These registers are available to the application program as system variables (system flags, global variables).

8.2 Diagnostic status register

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

The following system variables can be used to read the diagnostic status register information.

Table 8-1 System variables of the diagnostic status register

System variable	Type	Description
AXIO_DIAG_STATUS_REG_HI	BYTE	Diagnostic status register (high byte)
AXIO_DIAG_STATUS_REG_LOW	BYTE	Diagnostic status register (low byte)
AXIO_DIAG_STATUS_REG_PF	BOOL	Peripheral fault
AXIO_DIAG_STATUS_REG_PW	BOOL	I/O warning
AXIO_DIAG_STATUS_REG_BUS	BOOL	Bus error
AXIO_DIAG_STATUS_REG_RUN	BOOL	Data transmission is active
AXIO_DIAG_STATUS_REG_ACT	BOOL	Selected configuration is ready to operate
AXIO_DIAG_STATUS_REG_RDY	BOOL	Axioline F local bus is ready to operate
AXIO_DIAG_STATUS_REG_SYSFAIL	BOOL	The Axioline F local bus switches to the SYSFAIL state when the controller is in the STOP state or there is no program present on it.

8.3 Diagnostic parameter register

The diagnostic parameter register provides additional information on the error indicated in the diagnostic status register. The error code is stored in the diagnostic parameter register and the error location in the extended diagnostic parameter register. The error location is stored as a slot number. This starts at 1 and corresponds to the sequential number of the Axioline F modules that are installed one after another.



Exception: if an interface error cannot be located, the value 128 is displayed in the diagnostic parameter register (bit 7 is set).

The diagnostic parameter register is rewritten whenever an error occurs. If no error has been detected, the diagnostic parameter register contains the value 0.

Table 8-2 System variables of the diagnostic parameter register

System variable	Type	Description
AXIO_DIAG_PARAM_REG_HI	BYTE	Diagnostic parameter register (high byte)
AXIO_DIAG_PARAM_REG_LOW	BYTE	Diagnostic parameter register (low byte)
AXIO_DIAG_PARAM_2_REG_HI	BYTE	Extended diagnostic parameter register (high byte)
AXIO_DIAG_PARAM_2_REG_LOW	BYTE	Extended diagnostic parameter register (low byte)

8.4 PROFINET system variables

Table 8-3 shows the PROFINET system variables of the integrated PROFINET controller functionality.

Table 8-3 PROFINET system variables (PROFINET controller functionality)

System variable	Type	Description
PNIO_SYSTEM_BF	BOOL	No connection to a configured PROFINET device An error has occurred in the PROFINET network, i.e., a connection could not be established to at least one configured PROFINET device. This value is not set if the "Control BF" parameter was set to FALSE for a PROFINET device. The PROFINET device has therefore been excluded from connection monitoring.
PNIO_SYSTEM_SF	BOOL	Diagnostic alarm on a configured PROFINET device At least one PROFINET device is indicating a system error (diagnostic alarm or maintenance alarm). The error priority can be determined from the PNIO_DIAG_AVAILABLE, PNIO_MAINTENANCE_DEMANDED, and PNIO_MAINTENANCE_REQUIRED variables.
PNIO_MAINTENANCE_DEMANDED	BOOL	Maintenance demanded At least one PROFINET device is indicating the "maintenance demanded" alarm (high-priority maintenance alarm) for the active connection. The PROFINET device can be identified using the RALRM diagnostic block.
PNIO_MAINTENANCE_REQUIRED	BOOL	Maintenance required At least one PROFINET device is indicating the "maintenance required" alarm (low-priority maintenance alarm) for the active connection. The PROFINET device can be identified using the RALRM diagnostic block.
PNIO_FORCE_FAILSAFE	BOOL	All PROFINET devices are prompted to set their configured substitute values.
PNIO_CONFIG_STATUS	WORD	Configuration status of the PROFINET controller
PNIO_CONFIG_STATUS_READY	BOOL	This variable is set if the PROFINET controller has been initialized correctly. No desired configuration has been loaded by PC Worx Engineer yet.
PNIO_CONFIG_STATUS_ACTIVE	BOOL	This variable is set if the desired configuration for the PROFINET controller has been loaded. In this state the PROFINET controller attempts to establish a connection cyclically to all devices in the desired configuration (under the PROFINET icon).
PNIO_CONFIG_STATUS_CFG_FAULT	BOOL	The desired PROFINET controller configuration has not been applied due to a serious error. In this case, please contact Phoenix Contact.

Table 8-4 shows the PROFINET system variables of the integrated PROFINET device functions.

Table 8-4 PROFINET system variables (PROFINET device functions)

System variable	Type	Description
PND_S1_PLC_RUN	BOOL	Status of the higher-level PROFINET controller Information indicating whether the higher-level PROFINET controller is active. The value is TRUE if the higher-level PROFINET controller is in the RUN state (program is being processed). The display only applies when there is an existing PROFINET connection (PND_S1_VALID_DATA_CYCLE).
PND_S1_VALID_DATA_CYCLE	BOOL	The higher-level PROFINET controller has established the connection Information indicating whether a connection exists and cyclic data is being exchanged between the PROFINET controller and PROFINET device (AXC F 2152) and whether the last frame received contains valid data.
PND_S1_OUTPUT_STATUS_GOOD	BOOL	IOP status of the higher-level PROFINET controller Information indicating whether the input process data (PND_S1_INPUTS) was received by the PROFINET device with the "valid" status. The value is TRUE if the output data of the higher-level PROFINET controller is valid (provider status).
PND_S1_INPUT_STATUS_GOOD	BOOL	IOC status of the higher-level PROFINET controller
PND_S1_DATA_LENGTH	WORD	Process data length that was configured for the PROFINET device
PND_S1_OUTPUTS	PND_IO_512	Output process data Memory area for output process data that the PROFINET device sends to the higher-level PROFINET controller
PND_S1_INPUTS	PND_IO_512	IN process data Memory area for input process data that the PROFINET device receives from the higher-level PROFINET controller

8.5 TCP_SOCKET and UDP_SOCKET function blocks

Using the TCP_SOCKET and UDP_SOCKET function blocks open and close the IP sockets that are used for IP communication via TCP (Transmission Control Protocol) or via UDP (User Datagram Protocol). You can request the number of opened IP sockets using a system variable:

Table 8-5 System variables for the TCP_SOCKET and UDP_SOCKET function blocks

System variable	Type	Description
IP_ACTIVE_SOCKETS	UINT	Number of IP sockets opened with the TCP_SOCKET and UDP_SOCKET function blocks

8.6 Task handling

Programs and program parts are treated like tasks in PC Worx Engineer. Individual tasks are coordinated and processed in the Execution & Synchronization Manager (ESM). The following system variables can be used to read the task handling of the ESM:

Table 8-6 System variables of the task handling of the ESM

System variable	Type	Description
ESM_COUNT	UDINT	Number of ESM (one ESM for each processor core)
ESM1_TASKS_USED	UDINT	Number of tasks that have been configured for the first ESM
ESM1_TASK1 ... ESM1_TASK16	TASK_INFO	Information on a specific task. The information is displayed in the TASK_INFO data structure, see Table 8-7.
ESM2_TASKS_USED	UDINT	Number of tasks that have been configured for the second ESM
ESM2_TASK1 ... ESM2_TASK16	TASK_INFO	Information on a specific task. The information is displayed in the TASK_INFO data structure, see Table 8-7.

Table 8-7 TASK_INFO data structure

Parameters	Type	Description
PRIORITY	INT	Priority of the task
INTERVAL	LINT	For cyclic tasks: Interval time in μs For acyclic tasks: 0
WATCHDOG	LINT	Watchdog-time in μs (0 = no watchdog)
MIN_EXEC_DURATION	LINT	Minimum execution duration of tasks in μs (including interruptions due to higher priority tasks)
MAX_EXEC_DURATION	LINT	Maximum execution duration of tasks in μs (including interruptions due to higher priority tasks)
LAST_EXEC_DURATION	LINT	Execution duration of tasks in previous cycle (including interruptions due to higher priority tasks)
MIN_ACTIVATION_DELAY	LINT	Minimum delay of tasks in μs (delay occurs if at the time of task activation higher priority tasks are pending)
MAX_ACTIVATION_DELAY	LINT	Maximum delay of tasks in μs (delay occurs if at the time of task activation higher priority tasks are pending)
LAST_ACTIVATION_DELAY	LINT	Delay of task in previous cycle in μs
NAME	STRING	Name or description of task

9 Web-based management (WBM)

In web-based management (WBM), you receive general information on the controller and maintain the access data of users who are permitted access to the controller. WBM can be called up via the Ethernet interfaces of the controller.

9.1 Establishing a connection with the WBM

To establish a connection with the WBM, proceed as follows:

- Open the web browser on your PC.
- In the address field, enter the URL “http://IP address of the controller” (example: “http://192.168.1.10”).



Please note:

The WBM can only be called up if the controller has a valid IP address. By default, the controller has the IP address 192.168.1.10.



If there is a PC Worx Engineer HMI application on the controller, entering the URL “http://IP address of the controller” calls up the PC Worx Engineer application.

- To call up the WBM, enter the URL “http://IP address of the controller/wbm” in this case.

First access: TLS certificate

The web server of the controller uses a self-signed TLS certificate automatically generated by the controller for secure communication. Before the web server of the controller can be accessed, you must authorize the TLS certificate in your web browser.

First access: Welcome page

The AXC F 2152 welcome page is shown first when accessing the web server of the controller.



Figure 9-1 AXC F 2152 welcome page

The welcome page contains

- a link to the WBM
- a link to the PLCnext community
- a link to the PLCnext website



If you do not want the welcome page to be displayed when the web server of the controller is accessed:

- Click the check box “Do not show this page in the future and go directly to the WBM”.

The next time you access the web server of the controller, the login page of the WBM opens, see Section 9.4.

Alternatively, in the address field of your browser, enter the URL “http://IP address of the controller/wbm” (example: “http://192.168.1.10/wbm”).

You are directly shown the WBM in this case.

The welcome page can continue to be accessed at the URL “http://IP address of the controller/welcome”.

9.2 Licensing information on open source software

The AX C F 2152 controller works with a Linux operating system.

All license information can be called up using the link “Legal Information” on every page of the WBM:

- Click on the “Legal Information” link on the bottom-left of the WBM page.

All licenses of the open source software are shown.

9.3 Changing the language

The WBM is available in German and English.



Figure 9-2 WBM: Changing the language

- Click the “Deutsch” or “English” link to change the language.

The WBM then immediately switches to the desired language.

9.4 Login

The login page of the WBM is shown when

- You access the WBM for the first time
- You have disabled the user authentication of the WBM, see Section 9.5.2.1.

If you disable user authentication, logging in is not required for access to the WBM. The start page of the WBM is shown when accessing the WBM in this case, see Section 9.5.

Figure 9-3 WBM: Login page

First access as an administrator

When you access the WBM for the first time, log in as the administrator.

- Enter the user name “admin” in the “Username” input field.
- In the “Password” input field, enter the administrator password.
The administrator password is printed on the controller (see Figure 9-4 on page 95).
- To open the WBM, click on the “Login” button.

The start page of the WBM opens (see Section 9.5).



Recommended:

- Only use the administrator password for the initial log in.
- Once you have logged in successfully, change the administrator password to prevent unauthorized administrator access (see Section 9.5.2.1).



Please note:

After changing the access data for the administrator, it is no longer possible to login with the user name “admin” and the administrator password printed on the controller.

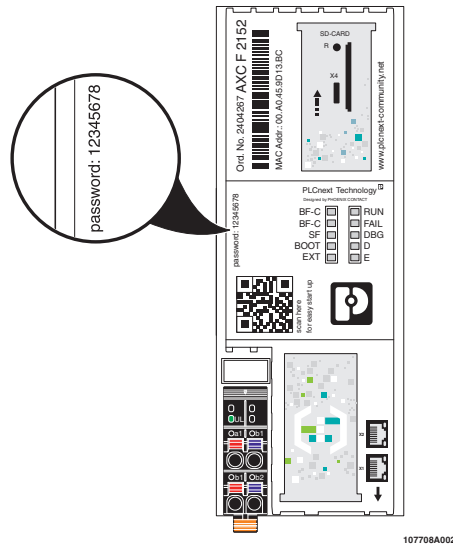


Figure 9-4 Administrator password on the controller

Logging in as user

If you have enabled user authentication of the WBM, log in using your user name.

- Enter your user name in the "Username" input field.
- Enter your password in the "Enter password" input field.
- To open the WBM, click on the "Login" button.

The start page of the WBM opens (see Section 9.5).

9.5 Areas and functions



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Figure 9-5 WBM: Start page

The WBM is split into the following areas:

- Information
- Configuration

9.5.1 “Information” area

This area includes general device information.

9.5.1.1 “General Data” page

On the “General Data” page, you will find general details on the device, e.g., hardware and firmware versions, the order number as well as manufacturer details.

Deutsch English Logout

PHOENIX CONTACT

HW: 02 FW: 1.0.0
MAC: 00:A0:45:9C:9B:43

AXC F 2152
2404267

General Data

General Data	
Vendor	Phoenix Contact GmbH & Co. KG
Address	Flachsmarktstr. 8, 32825 Blomberg, Germany
Internet	http://www.phoenixcontact.com
Type	AXC F 2152
Order No.	2404267
Serial No.	1355293466
Firmware Version	1.0.0
Hardware Version	02
FPGA Version	1.1.64

Information
[General Data](#)

Configuration
[User Manager](#)

Figure 9-6 WBM: “General Data” page

9.5.2 “Configuration” area

This area includes the User Manager.

9.5.2.1 “User Manager” page

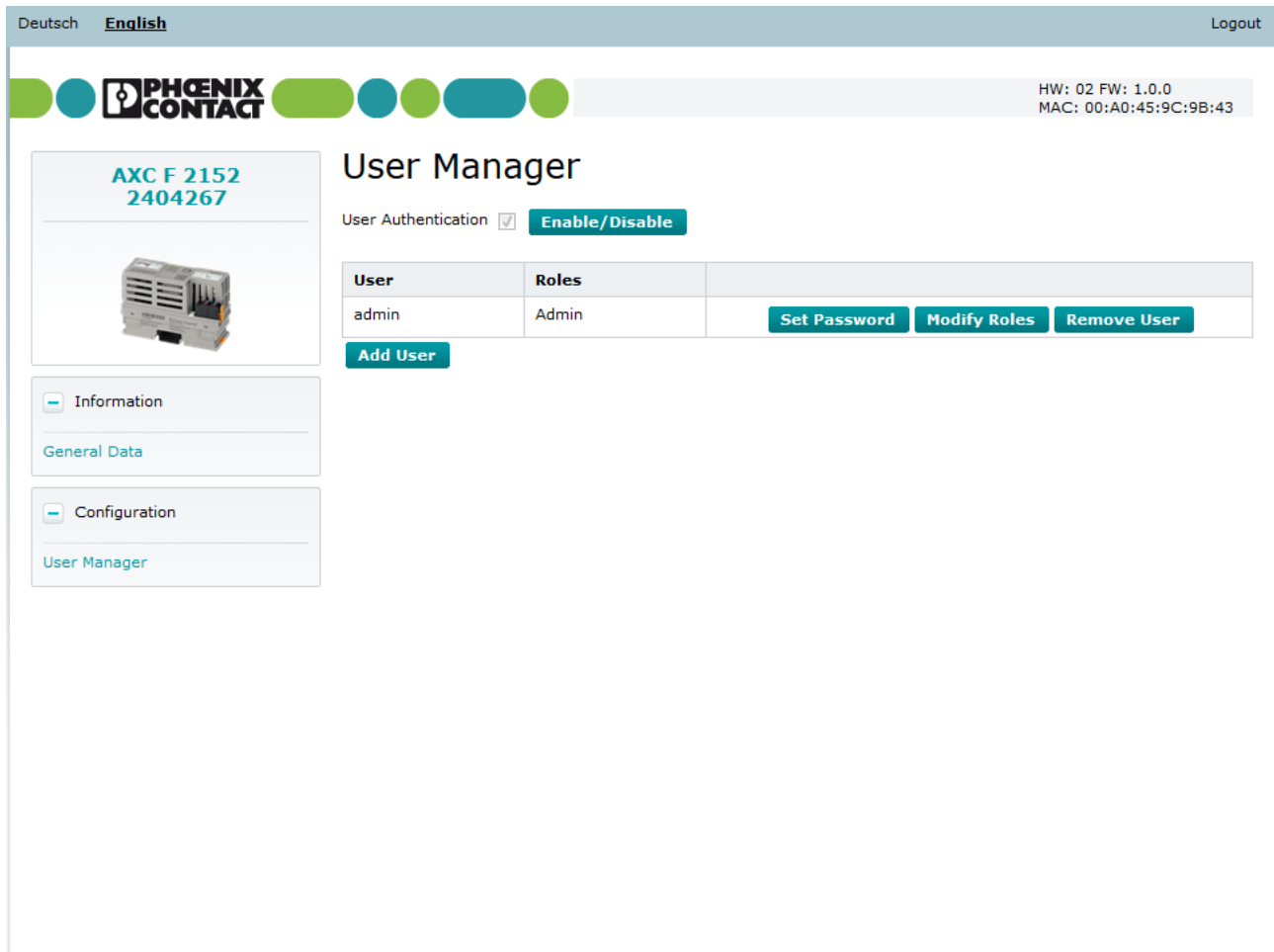


Figure 9-7 WBM: “User Manager” page

User Authentication

Enable or disable user authentication on the “User Manager” page. When user authentication is enabled, authentication with a user name and password is required for access to certain components of the AXC F 2152 and certain functions in PC Worx Engineer.

When user authentication is disabled, authentication is not required for access to the WBM, to the OPC UA server of the AXC F 2152 and to PC Worx Engineer. Access to the file system via SFTP and access to the shell via SSH requires authentication (with administrator rights) even if user authentication is disabled.

User authentication is enabled by default. The user “admin” with administrator rights has been created by default.

**Recommended:**

- Only use the administrator password printed on the controller for the first login to the WBM.
- Once you have logged in successfully, change the administrator password to prevent unauthorized administrator access.

The modified access data of the administrator is stored on the SD card.

**Please note:**

Enabled user authentication only provides a limited degree of protection against unauthorized network access.

Because of the controller's communication interfaces, we advise against using the controller in safety-critical applications without additional security appliances.

- Make sure you always use the controller with the latest firmware version.
- Follow the security advice on unauthorized network access in the Section 1.4.

Enabling/disabling user authentication

To enable/disable user authentication, proceed as follows:

- Click on “Enable/Disable” next to the “User Authentication” check box.

The “Enable/disable User Authentication” dialog opens.

Enable/Disable User Authentication

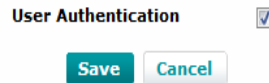


Figure 9-8 WBM: “Enable/Disable User Authentication” dialog

- To enable user authentication, enable the “User Authentication” check box.
- To disable user authentication, disable the “User Authentication” check box.
- Click the “Save” button to adopt the settings.

User management

In the User Manager, you maintain the access data of all users who are permitted to access the AXC F 2152 and assign the required access permissions to each user.

The access data of all newly created users is stored on the SD card.

When the SD card is inserted in another AXC F 2152, the access data stored on the SD card is used for access to the controller.



Please note when inserting the SD card into another AXC F 2152:

If you have changed the access data of the administrator after the first login to the WBM, the modified access data stored on the SD card is used for accessing the controller. It is no longer possible to login with the user name “admin” and the administrator password printed on the device in this case.

Adding users

Proceed as follows to add a user:

- Click on the “Add User” button in the user manager.

The “Add User” dialog box opens.

Add User

Username	<input type="text" value="TeDo"/>
Password	<input type="password" value="*****"/>
Confirm Password	<input type="password" value="*****"/>
<div><div>Add</div><div>Cancel</div></div>	

Figure 9-9 “Add User” dialog

- Enter the desired user name in the “User name” input field.
- Enter the desired new password in the “Password” input field.
- Re-enter the desired password in the “Confirm Password” input field.
- To add the user in the User Manager, click on the “Add” button.

Setting a password

Proceed as follows to change the password of a user:

- Click on the “Set Password” button in the row of the desired user in the User Manager.

The “Set User Password” dialog box opens.

Set User Password

Username	<input type="text" value="admin"/>
New Password	<input type="password" value="Enter Password"/>
Confirm Password	<input type="password" value="Enter Password again"/>
<div><div>Save</div><div>Cancel</div></div>	

Figure 9-10 “Set User Password” dialog box

- Enter the desired new password in the “New Password” input field.
- Re-enter the desired new password in the “Confirm Password” input field.
- To save the new password, click on the “Save” button.

Modifying roles

You can choose one or more user roles for each user that includes different permissions. These permissions control access to

- The file system of the controller
- PC Worx Engineer
- PC Worx Engineer HMI (in preparation)
- WBM
- The OPC UA server for the AXC F 2152

To assign one or more user role(s) to a user, proceed as follows:

- Click on the “Modify Roles” button in the row of the desired user in the User Manager.

The “Modify Roles” dialog box opens.

Modify Roles

Username	TeDo
Roles	Admin <input type="checkbox"/> UserManager <input type="checkbox"/> Engineer <input type="checkbox"/> Commissioner <input type="checkbox"/> Service <input type="checkbox"/> DataViewer <input type="checkbox"/> DataChanger <input type="checkbox"/> Viewer <input type="checkbox"/> EHmiLevel1 <input type="checkbox"/> EHmiLevel2 <input type="checkbox"/> EHmiLevel3 <input type="checkbox"/> EHmiLevel4 <input type="checkbox"/> EHmiLevel5 <input type="checkbox"/> EHmiLevel6 <input type="checkbox"/> EHmiLevel7 <input type="checkbox"/> EHmiLevel8 <input type="checkbox"/> EHmiLevel9 <input type="checkbox"/> EHmiLevel10 <input type="checkbox"/>
<input type="button" value="Save"/> <input type="button" value="Cancel"/>	

Figure 9-11 “Modify Roles” dialog

- Enable the check box of the user role(s) that you would like to assign to the user.



The EHmiLevel1 ... EHmiLevel10 user roles are in preparation and are currently without function.

Authentication with a user name and password is currently not required to call up a PC Worx Engineer HMI application. A PC Worx Engineer HMI application is freely accessible to all users.



Recommended:

- Use an upstream firewall (e.g., in a switch) to enable access to the PC Worx Engineer HMI application only through certain devices.

Detailed information on the prepared security functions in a PC Worx Engineer HMI application can be found in the online help of the PC Worx Engineer.

- Click on the “Save” button to save the selected user role(s) for the user.

Table 9-1 User roles and their assigned access permissions in the various applications

Application or component of the AXC F 2152	Access permission	User role								
		Admin	UserManager	Engineer	Commissioner	Service	Data Viewer	DataChanger	Viewer	EHmiLevelIX ¹
SD card/parameter-ization memory	SFTP access to the file system with a SFTP client  Please note: The authentication with a user name and password is always required for SFTP access, even when user authentication is disabled.	Yes								
Shell	SSH access to the shell  Please note: The authentication with a user name and password is always required for SSH access, even when user authentication is disabled.	Yes								
PC Worx Engineer	View values in the cockpit (e.g., full utilization, etc.)	Yes		Yes	Yes	Yes	Yes	Yes	Yes	
PC Worx Engineer	Transfer the project to the controller	Yes		Yes						
PC Worx Engineer	Start (cold/warm start) or stop controller	Yes		Yes	Yes	Yes				
PC Worx Engineer	Restart the controller (reboot)	Yes								
PC Worx Engineer	Reset the controller to default setting 1	Yes								
PC Worx Engineer	View online variable values	Yes		Yes		Yes	Yes	Yes	Yes	
PC Worx Engineer	Overwrite variables	Yes		Yes		Yes		Yes		
PC Worx Engineer	Set and delete breakpoints	Yes		Yes		Yes				
WBM	View “General Information” page	Yes	Yes	Yes						
WBM	Manage users	Yes	Yes							
OPC UA Client	View online variable values	Yes		Yes		Yes	Yes	Yes	Yes	
OPC UA Client	Overwrite variables	Yes		Yes		Yes		Yes		

¹ The EHmiLevel1 ...EHmiLevel10 user roles are currently without function.

Removing a user

Proceed as follows to remove a user:

- In the User Manager, click on the “Remove User” button in the row of the user to be deleted.

The “Remove User” dialog box opens.

Remove User



Username

Figure 9-12 “Remove user” dialog box

- Click on the “Remove” button to delete the user.

10 Removing hardware



For basic information about the Axioline F system and its installation, particularly mounting/removing Axioline F modules, please refer to the UM EN AXL F SYS INST user manual ("Axioline F: system and installation").

10.1 Safety notes



NOTE: Electrostatic discharge!

The device contains components that can be damaged or destroyed by electrostatic discharge. When handling the device, observe the necessary safety precautions against electrostatic discharge (ESD) in accordance with EN 61340-5-1 and IEC 61340-5-1.



NOTE: Electrical damage due to inadequate external protection – No safe fuse trip in the event of an error

The electronics in the device are damaged due to inadequate external protection.

- Protect the supply voltage externally in accordance with the connected load (number of Axioline F devices/amount of logic current consumption for each device).
- Make sure the external fuse blows safely in the event of an error.



NOTE: Damage to the contacts when tilting

If the modules tilt, you can damage the contacts.

- Remove the modules, keeping them **perpendicular** to the DIN rail when doing so.



Please note:

- During all work on the Axioline F station, the controller or a module, switch off the power supply to the Axioline F station and make sure the supply voltage is protected against unauthorized re-activation.

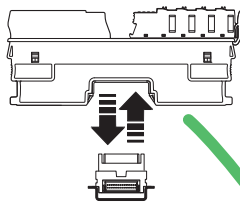


Figure 10-1 Removing the module so that it is **perpendicular** to the DIN rail

10.2 Removing cables

- Disconnect the power to the Axioline F station.

The cables should only be removed from the supply connector if you wish to change the terminal point assignment or no longer wish to use the supply connector.

- Open the spring by pressing on the spring lever with a screwdriver (A in Figure 10-2).
- Remove the cable (B in Figure 10-2).

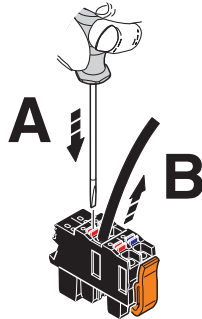


Figure 10-2 Removing the cable

10.3 Removing the plug

Removing the supply plug

- Release the locking latch (A in Figure 10-3), tilt the plug upwards slightly (B in Figure 10-3), and remove it from the controller (C in Figure 10-3).

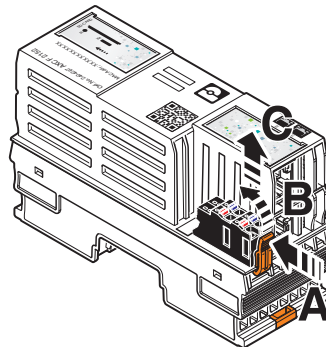


Figure 10-3 Removing the supply plug

Removing the Ethernet connector

- Release the RJ45 connector by pressing on the snap-in latch and remove the connector.

10.4 Removing the SD card

- Lightly push the SD card far enough into the SD card holder until the snap-on mechanism releases the SD card and partially ejects the SD card from the SD card holder.
- Remove the SD card.

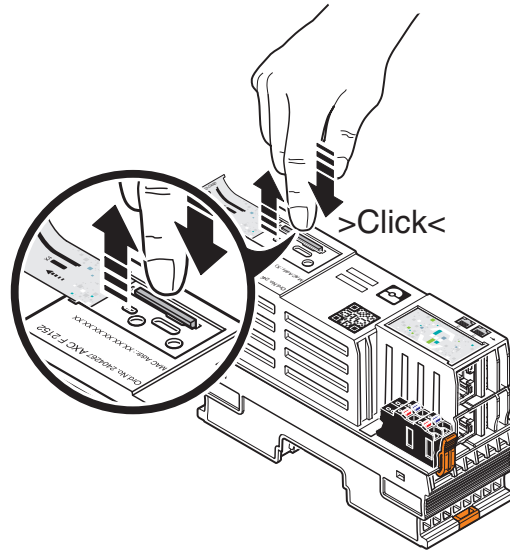


Figure 10-4 Removing the SD card

10.5 Removing the controller

- Insert a suitable tool (e.g., bladed screwdriver) into the upper and lower snap-on mechanisms (base latches) of the controller one after the other and release it (A in Figure 10-5).

The base latches are locked in place in the open position.

- Remove the controller perpendicular to the DIN rail (B in Figure 10-5).

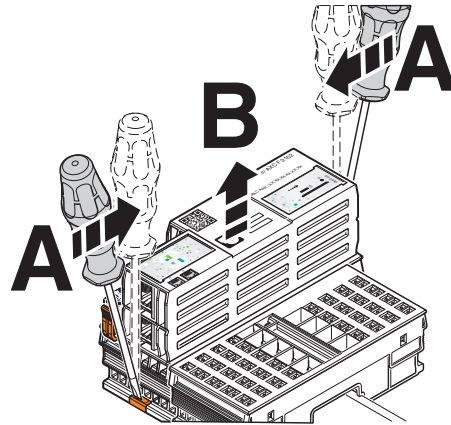


Figure 10-5 Removing the controller

11 After usage

11.1 Maintenance and servicing

The controller is maintenance-free.

11.2 Device replacement

The controller can be replaced as required.

If you want to replace a controller in a Axioline F station, follow the steps described in Section 10, "Removing hardware" and Section 4, "Mounting hardware".

- Disconnect the power to the Axioline F station.
- Remove the SD card of the controller to be replaced.
- Replace the controller in your application with an identical controller (same order number).
- To accept the settings stored on the SD card, place the SD card in the new controller.
- Once replaced, restore all the necessary connections.

11.3 Device faults and repair

Repairs may only be carried out by Phoenix Contact.

- Send defective devices back to Phoenix Contact for repairs or to receive a replacement device.
- We strongly recommend using the original packaging to return equipment.
- Include a note on the packaging indicating that the contents are returned goods.
- If the original packaging is no longer available, observe the following points:
 - Observe the humidity specifications and the temperature range specified for transport (see Section 13.2).
 - If necessary, use dehumidifying agents.
 - Use appropriate ESD packaging to protect components that are sensitive to electrostatic discharge.
 - Secure any loose parts.
 - Make sure that the packaging you select is large enough and sufficiently thick.
 - Only use plastic bubble wrap sheets as filler material.
 - Attach warnings to the transport packaging so that they are clearly visible.
 - Please be aware that the delivery note is to be placed inside the package in the case of packages that are to remain within the same country. However, if the package is being sent abroad, the delivery note must be placed inside a delivery note pocket and attached to the outside so that it is clearly visible.

11.4 Disposal

Controller disposal

- Do not dispose of the device with household waste; it should instead be disposed of in accordance with the currently applicable national regulations.

Packaging disposal

- Dispose of packaging materials that are no longer needed (cardboard packaging, paper, bubble wrap sheets, etc.) with household waste in accordance with the currently applicable national regulations.

SD card disposal

Sensitive data is stored on the SD card. This data can even be restored after formatting the SD card. To ensure that your data does not fall into unauthorized hands, you should physically destroy the SD card before disposal.

- Physically destroy the SD card, e.g. by cutting up the SD card.
- Dispose of the irreparably damaged SD card in accordance with the applicable national regulations.

11.5 Take-back

As an alternative, you can dispose of the device by returning it to Phoenix Contact.

- Include a note on the packaging indicating that the device should be disposed of.



Please note:

The device must not have any traces of being contaminated by oils, greases etc.

12 Troubleshooting and frequently asked questions (FAQs)



Information on troubleshooting and responses to frequently asked questions (FAQs) can be found in the PLCnext community plcnext-community.net.

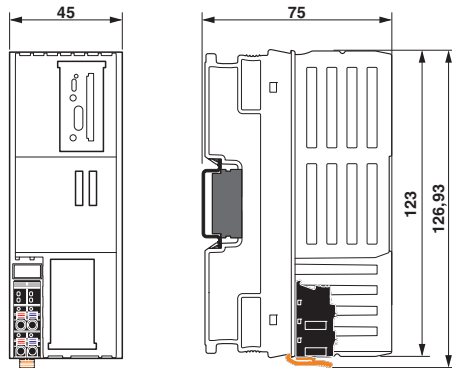
13 Ordering data and technical data

13.1 Ordering data

Description	Type	Order No.	Pcs./Pkt.
PLCnext Control for the direct control of Axioline F I/Os. With two Ethernet interfaces. Complete with connector and bus base module.	AXC F 2152	2404267	1
Accessories	Type	Order No.	Pcs./Pkt.
Program and configuration memory (Memory)	SD FLASH 2GB PLCNEXT MEMORY	1043501	1
Engineering software platform for Phoenix Contact automation controllers. PC Worx Engineer is IEC 61131-3-compliant and its functionality can be expanded using add-ins. (Software)	PC WORX ENGINEER 7	1046008	1
Axioline F, Power module for the logic supply U_{Bus} , max. 4 A, degree of protection: IP20, including bus base module and Axioline F connector	AXL F PWR 1H	2688297	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	-	-
Application note, English, Measures to protect network-capable devices with Ethernet connection against unauthorized access	AH EN INDUSTRIAL SECURITY	-	-

13.2 Technical data

Dimensions (nominal sizes in mm)



Width	45 mm
Height	126.93 mm
Depth	75 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	gray
Weight	215 g
Type	Axioline
Mounting type	DIN rail mounting
Realtime clock	Yes

Ambient conditions

Ambient temperature (operation)	-25 °C ... 60 °C up to 2000 m above mean sea level (observe derating) -25 °C ... 55 °C up to 3000 m above mean sea level (observe derating) ≤ 55 °C (with max. 1 A on U _{Bus}) > 55 °C ... 60 °C (only in conjunction with an Axioline F power module AXL F PWR 1H (order number 2688297))
Ambient temperature (storage/transport)	-40 °C ... 85 °C
Permissible humidity (operation)	5 % ... 95 % (according to DIN EN 61131-2)
Permissible humidity (storage/transport)	5 % ... 95 % (according to DIN EN 61131-2)
Air pressure (operation)	70 kPa ... 106 kPa (up to 3000 m above mean sea level)
Air pressure (storage/transport)	58 kPa ... 106 kPa (up to 4500 m above mean sea level)
Degree of protection	IP20
Protection class	III, IEC 61140, EN 61140, VDE 0140-1
Vibration (operation)	5g

Ambient conditions

Vibration (storage/transport)	5g
Shock	30g, 11 ms period, half-sine shock pulse, according to IEC 60068-2-27
Shock (operation)	10g (Bump endurance test according to EN 60068-2-29)

Processor

Processor	ARM® Cortex®-A9 2x 800 MHz
-----------	----------------------------

Connection data

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

Interface Axioline F local bus

Number of interfaces	1
Connection method	Bus base module
Transmission speed	100 Mbps
Electrical isolation	No
Number of supported devices	max. 63

Interface Ethernet

Number of interfaces	2
Connection method	RJ45 socket
Note on the connection method	Auto negotiation and autocrossing
Bus system	RJ45
No. of channels	2
Transmission speed	10/100 Mbps (full duplex)
Transmission length	max. 100 m
Transmission physics	Ethernet in RJ45 twisted pair

System limits

Amount of process data	max. 8192 Bit (per station) max. 4096 Bit (Input) max. 4096 Bit (Output)
Number of supported devices	max. 63 (per station)

**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 controller, PROFINET device
Number of supported devices	max. 64 (at PROFINET controller)
Specification	Version 2.3
Conformance class	A
Update rate	min. 1 ms (4 devices) min. 16 ms (64 devices)
Number of slots	1
Vendor ID	00B0 _{hex}
Device ID	0142 _{hex}

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. 200 mA (without I/Os and $U_L = 24$ V) max. 442 mA (with 1 A at U_{Bus} for the I/Os and $U_L = 24$ V)
Power consumption	typ. 4.8 W (without I/Os) max. 10.6 W (with 1 A load at U_{Bus} for the I/Os)
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. The power supply unit must be able to supply four times the nominal current of the external fuse to ensure that it blows in the event of an error.

Supply of the Axioline F local bus U_{Bus}

Supply voltage	5 V DC (via bus base module)
Power supply unit	1 A

Realtime clock

Accuracy realtime clock	1.73 s/day = 20 ppm at 25 °C
Power reserve	240 h

Error messages to the higher level control or computer system

None

IEC 61131 runtime system

Module classification	PLCnext Control for direct control of Axioline F I/Os.
Application type	Distributed control technology
Programming tool	PC WORX ENGINEER / Eclipse (C++)
Application interface	OPC UA
Number of data blocks	depends on mass storage
Number of control tasks	32 (16 per processor core)
Cycle time	500 µs (for cyclical task)
Program memory	4 Mbyte
Retentive mass storage	48 kByte (NVRAM)
Mass storage	8 Mbyte
Parameterization memory	min. 4 Mbyte (depending on storage media)

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 as per EN 61000-6-4

Radio noise emission EN 55032	Class A
-------------------------------	---------

**NOTE: radio interference**

This is a Class A item of equipment. This equipment can cause radio interference in residential areas, and the operator may be required to take appropriate measures.

Approvals

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

A Appendix

A 1 Updating the firmware

To update the controller firmware, proceed as follows:

- Download the *.exe setup file from phoenixcontact.net/products on the page of the controller.
- Run the setup file *.exe file.
- Follow the instructions of the installation wizard.

When installing, the update file and PDF files with device-specific information will be copied in the selected destination directory.

- Copy the *.rauc update file with a SFTP client software (e.g., WinSCP) in the /opt/plcnext directory (home directory of the Linux user “admin”).
- Open the shell.
- Switch to the /opt/plcnext directory.
- Enter the “sudo update-axcf2152” command.

The firmware update will be executed. Following this, the controller is restarted. The update file is deleted automatically from the /opt/plcnext directory.

A 2 Shell commands for controlling the firmware

The plcnext script in the /etc/init.d directory controls the firmware of the controller.

You can control the firmware with the following shell commands:

Table A-1 Shell commands for controlling the firmware

Shell commands	Description
sudo /etc/init.d/plcnext stop	Stops all PLCnext firmware processes If all PLCnext firmware processes are stopped, you will no longer be able to access the controller from PC Worx Engineer.
sudo /etc/init.d/plcnext start	Starts all PLCnext firmware processes
sudo /etc/init.d/plcnext restart	Restarts all PLCnext firmware processes

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