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

User manual

PHOENIX CONTACT
INSPIRING INNOVATIONS

User manual

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

UM EN AXC F 2152, Revision 04 2019-07-17

This user manual is valid for:

Designation	As of version (HW)	As of version (FW)	Order No.
AXC F 2152	02	2019.6	2404267

107708_en_04

PHOENIX CONTACT GmbH & Co. KG • Flachsmarktstraße 8 • 32825 Blomberg • Germany
phoenixcontact.com

Table of contents

1 For your safety

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

1.1 Identification of warning notes

This symbol indicates hazards that could lead to personal injury.

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

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

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

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

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

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

1.2 Qualification of users

The use of products described in this user manual is oriented exclusively to:

– Electrically skilled persons or persons instructed by them. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.
– 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 an IP20 protection class and is designed for use in closed control cabinets or control boxes (junction boxes) with IP54 degree of protection or higher.

The device is designed for use in industrial environments.

1.4 Product changes

Modifications to the device hardware 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.

1.5 Safety notes

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

During startup 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 stress

The IP20 degree of protection (IEC 60529/EN 60529) requires that the device be used in a clean and dry environment. If you use the 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 stress that exceeds the specified limits.

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: Device failure due to foreign objects in device

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

- Ensure that no foreign objects find their way into the device (e.g., in the vents).

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

Operating the device in ambient temperatures that are not within the permitted range may lead to malfunctions or even device failure.

- Ensure that the device is operated within the permitted ambient temperature range, see Section 14.2.

NOTE: Device failure due to operation above the permitted specifications for vibrations and shock

If the device is subjected to vibrations and shock levels above the permitted specifications during operation, this may lead to malfunctions or even device failure.

- Ensure that the permitted specifications for vibrations and shocks are adhered to when operating the device, see Section 14.2.

NOTE: Device defect due to polarity reversal

Polarity reversal puts a strain on the electronics and can damage the device.

- To protect the device, avoid reversing the poles of the 24 V supply.

Please note:

The service interface is currently without function.

The service interface (USB type C) is intended for the connection of a PC. The service interface is not intended for connecting other peripheral devices.

1.6 UL warning notes

If the device is not used in the specified manner, the protection provided by the device may be impaired.

SELV - Limited energy according UL/IEC/EN 61010-1 or NEC Class 2

1.7 Security in the network

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 for the option of disabling active communication channels in your application (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.

Due to its communication interfaces, the controller should not be used in safety-critical applications unless additional security appliances are used.
Please take additional protective measures in accordance with the IT security requirements and the standards applicable to your application (e.g., virtual networks (VPN) for remote maintenance access, firewalls, etc.) for protection against unauthorized network access.

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

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

Additional measures for protection against unauthorized network access are listed in the AH EN INDUSTRIAL SECURITY application note. The application note can be downloaded at phoenixcontact.net/product/2404267.

2 Transport, storage and unpacking

2.1 Transport

The device is delivered in cardboard packaging.

- Only transport the device to its destination in its original packaging.
- Observe the instructions on how to handle the package, as well as the moisture, shock, tilt, and temperature indicators on the packaging.
- Observe the humidity specifications and the temperature range specified for transport (see Section 14.2).
- Protect the surfaces as necessary 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 from 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% (in accordance with DIN EN 61131-2)

2.3 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 become damaged.

- Observe the ESD notes during unpacking and packaging.

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 transport. 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 clearly documenting the damage to the packaging and/or delivery together with your claim.
- Immediately upon delivery, check the delivery note to ensure that the delivery is complete.
- Keep the box and packaging material in case you need to return the product.
- We strongly recommend using the original packaging to return the product.
- 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 14.2).
  - Use dehumidifying agents if necessary.
  - Use suitable 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 wadding.
  - Attach warnings to the transport packaging so that they are clearly visible.
- Please ensure that the delivery note is placed inside the package if the package is to be shipped domestically. However, if the package is being shipped internationally, 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 BS BK bus base module
- AXL CN S/UL supply connector

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 connection.

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

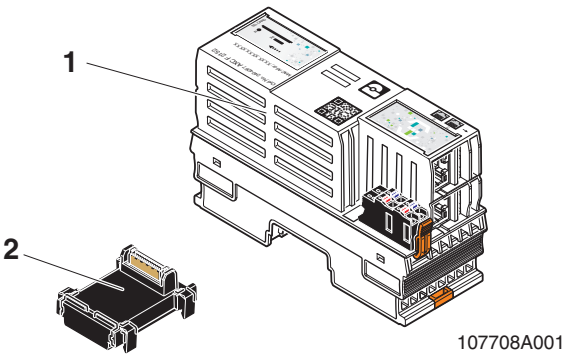


Figure 3-1 Components of the controller

Axioline F station

An Axioline F station is 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.

Inline station

As an alternative to an Axioline F station, you can create a PLCnext Inline station using the controller. To do so, you need the AXC F IL ADAPT Inline adapter terminal (Order No. 1020304). You can directly install the Inline modules in series on the Inline adapter terminal.

Programming

The controller can be configured and programmed in accordance with IEC 61131 using the PLCnext 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.). These programs or program parts must then be imported into PLCnext Engineer as a library.

Integrated Ethernet interfaces

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

PROFINET controller/ device functionality

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 PLCnext Engineer online help.

Axioline F local bus

An interface to the Axioline F local bus is provided 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 when overloaded

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

Left-alignment of Axioline F extension modules

You can connect **one** Axioline F extension module to the left of the controller using the AXC BS L 2 bus base module. The following left-alignable Axioline F extension modules are currently available:

– AXC F XT ETH 1TX (Order No. 2403115):
  Left-alignable Ethernet interface
– AXC F XT IB (Order Number 2403018):
  Left-alignable INTERBUS master for the connection of up to 255 INTERBUS remote bus devices

Please note:

The AXC BS L 2 bus base module is not supplied with the AXC F 2152. For the bus base module ordering data, please refer to Section “Ordering data” on page 171.

Axioline F/ system and firmware

For system-specific information on the Axioline F system, please refer to the PLCnext Engineer online help 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/product/2404267.

MRP

The MRP Media Redundancy Protocol protocol can be used via the Ethernet interfaces of the controller. The controller supports the MRP client function, which can be enabled or disabled via an engineering tool (e.g., PLCnext Engineer). This function is disabled by default. If the function is enabled, it remains enabled after the supply voltage is switched off and on. If the controller has been reset to the delivery state, the MRP client function will also be disabled again. In a ring with Media Redundancy Protocol, maximum switch-over times of up to 200 ms can be expected.

Parameterization memory/SD card

The controller has an internal parameterization memory. This memory can be used to store programs and configurations which belong to your project, e.g., the visualization project. If the internal parameterization memory is not large enough for your application, the controller can be operated using an SD card. The SD card is optional and not required to operate the controller.

The SD card is not included in the scope of delivery of the controller.

- Only use an SD card provided by Phoenix Contact (see Section “Ordering data” on page 171).

NOTE: Damage to 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. If you format the SD card, certain information on the SD card that is required for use with Phoenix Contact devices will be lost. After formatting, you can no longer use the SD card to operate the controller.

- Ensure that the SD card is not formatted.

Visualization

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

Real-time clock

In the event of a supply voltage failure, the real-time clock integrated into the controller is buffered, see Section “Technical data” on page 173.

3.2 Type key for order designation

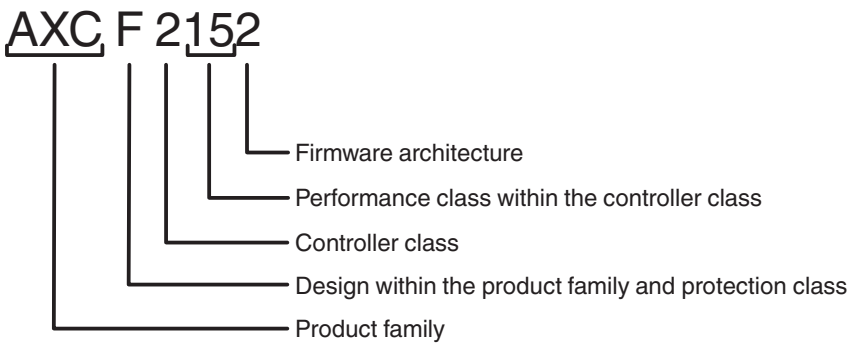


Figure 3-2 Type key for order designation

3.3 Licensing information regarding 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:

/usr/share/common-licenses

Information on the directory structure of the file system can be found in Section 3.6.

Alternatively, you can also call up the license information via the AXC F 2152 web-based management system, 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 Phoenix Contact Software License Terms (SLT) 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 on OpenSSL

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (http://www.openssl.org/).
This product includes cryptographic software written by Eric Young (eay@cryptsoft.com).

3.4 Requesting source code

The AXC F 2152 contains software components that 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. To do so, contact the Phoenix Contact After Sales Service in writing at the following address:

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

Subject: Source code for AXC F 2152

3.5 Hardware and software requirements

Hardware/software	Description
Controller	AXC F 2152
SD card	For ordering data, see Section “Ordering data” on page 171
Ethernet cable	Ethernet cable for connecting the controller to a PC
PLCnext Engineer	≥ 2019.6

3.6 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 optional SD card) and modify them as 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.

If you make changes to the directories or files, the Linux operating system generates an overlay file system. The directory structure depends on whether you operate the controller with or without an SD card:

Operation without an SD card

If you make changes to the directories or files on the internal parameterization memory, the Linux operating system generates an overlay file system here.

Operation with an SD card

If you operate the controller with an SD card, the overlay file system is generated on the SD card.
Settings that you have configured yourself (e.g., network configuration, configured bus configuration, PLCnext Engineer project, etc.) are also saved to the SD card.

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

Directory	Description
/usr/local/lib	Directory for storing additional open-source libraries that are used by customized C++ programs. Detailed information on 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 “admin” Linux user and working directory of the device firmware Files written by the application program are stored in this directory if the specified file name does not contain a storage path.
/opt/plcnext/logs	Log files of the device firmware
/opt/plcnext/projects	Directory for storing project folders and files
/opt/plcnext/projects/PCWE	Directory for storing PLCnext Engineer projects All files and subdirectories in this directory are managed exclusively by PLCnext Engineer. • Do not make any changes to this directory.

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

Directory	Description
/opt/plcnext/Security	Directory for storing certificates of the Identity Store and the Trust Store
/opt/plcnext/Security/Certificates/https	Directory for storing HTTPS certificates For additional information on the exchange of HTTPS certificates, please refer to Section “Replacing the HTTPS certificate” on page 179.
/opt/plcnext/Security/TrustStores	Directory for storing the Trust Stores configured in WBM Every subdirectory corresponds with the name of a Trust Store. A Trust Store directory contains the following subdirectories: – **trusted**: The directory contains CA certificates that can be trusted. – **issuers**: The directory contains CA certificates that cannot be trusted automatically, but that are needed for the creation of a certificate chain. – **trusted/crl**: The directory contains files with Certificate Revocation Lists (CRL) for the CA certificates. – **issuers/crl**: The directory contains files with Certificate Revocation Lists (CRL) for issuer certificates.
/opt/plcnext/Security/IdentityStores	Directory for storing the Identity Stores configured in WBM Every subdirectory corresponds with the name of an Identity Store. An Identity Store contains identities (X.509 certificates with the corresponding private key). An Identity Store directory contains the following files: – **certificate.pem**: The file in PEM format contains the X.509 certificate of the identity. The file can additionally contain several certificates of the certificate chain. – **key.pem**: The file in PEM format contains the private key for the certificate. – **tpmkey.pem**: The file contains the private key, linked to the TPM (Trusted Platform Module) of the controller.
/opt/plcnext/apps	All active apps that you downloaded from the PLCnext store to the controller are mounted in this directory. Every active app is mounted in a subdirectory with the name of the app identifier. The entire content of the app container is available in this directory (read-only). The directory is managed by the PLCnext Store. • Do not make any changes to this directory.
/opt/plcnext/installed_apps	Directory for storing all installed app containers The directory is part of the PLCnext Store.
/opt/plcnext/appshome	Directory for storing and managing app data The directory is managed by the PLCnext Store and the installed apps. • Do not make any changes to this directory.
/opt/plcnext/lttng	Directory for storing the default configuration files for tracing via LTTng

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

Directory	Description
/opt/plcnext/lttng_traces	Directory for storing the trace files The directory is created during the runtime of the trace controller at the first invocation of the trigger function for saving the trace files. At every invocation of the trigger function of the memory, a new subdirectory (trace directory) is created in the directory for saving the current trace data. The designation of a trace directory consists of the following: YYYYMMDD_hhmmss For example: /opt/plcnext/lttng_traces/20190418_190615/<trace data> The memory functions as a ring memory. If the configured maximum memory space is exceeded, the respectively oldest trace directory is deleted.
/opt/plcnext/backup	Directory for download changes operations The directory is used for creating a backup of the project folder. In the event of an error, the contents of the backup folder are restored. The backup directory is created after the first successful project download and updated after each successful project download.
/opt/plcnext/retaining	Not used
/opt/plcnext/shadowing	Directory for the internal storage of copies of C++ user libraries that have been configured in PLCnext Engineer and transferred to the controller.
/opt/plcnext/profinet	Directory for storing temporary PROFINET files

3.7 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. SFTP client software is required for this (e.g., WinSCP).

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

Please note:

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 in the web-based management system of the AXC F 2152 via the User Manager, see Section 9.5.4.1.

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

User name: admin
Password: printed on the controller (see Figure 3-3).

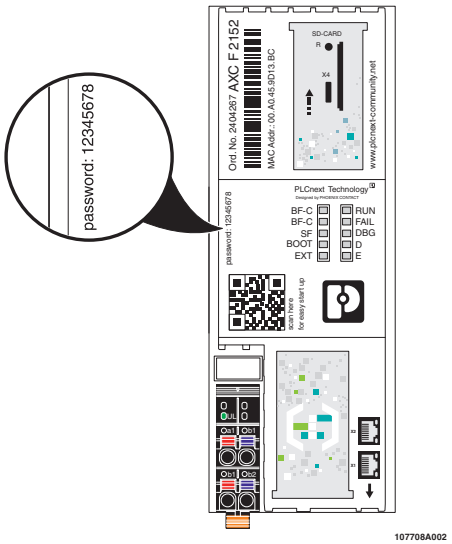


Figure 3-3 Administrator password on the controller

3.8 Firewall

The 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 via all UDP ports if the firewall is activated. Otherwise, establishing a connection to certain PROFINET devices is not possible.

You can configure the firewall via the web-based management system of the controller, see Section ""Firewall" page" on page 152.

For more detailed information on the firewall, please refer to the "PLCnext Technology" user manual.

The user manual can be downloaded at phoenixcontact.net/product/2404267.

3.9 Possible fields of application of the controller

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

The controller can be used as a distributed controller for an Axioline F station that is connected to an Ethernet system. A maximum of 63 devices (Axioline F modules) can be connected to the controller. The maximum number of alignable devices 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 ≤ 55°C).

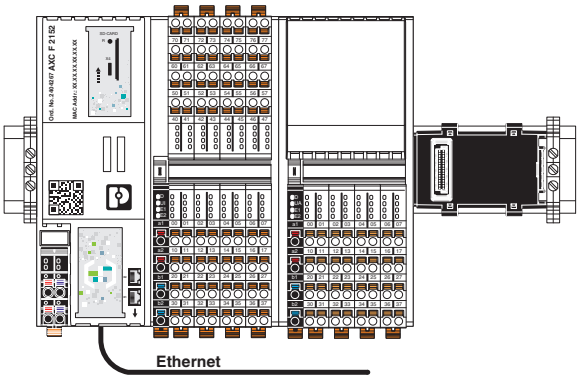


Figure 3-4 Axioline F station with AXC F 2152 controller

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

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

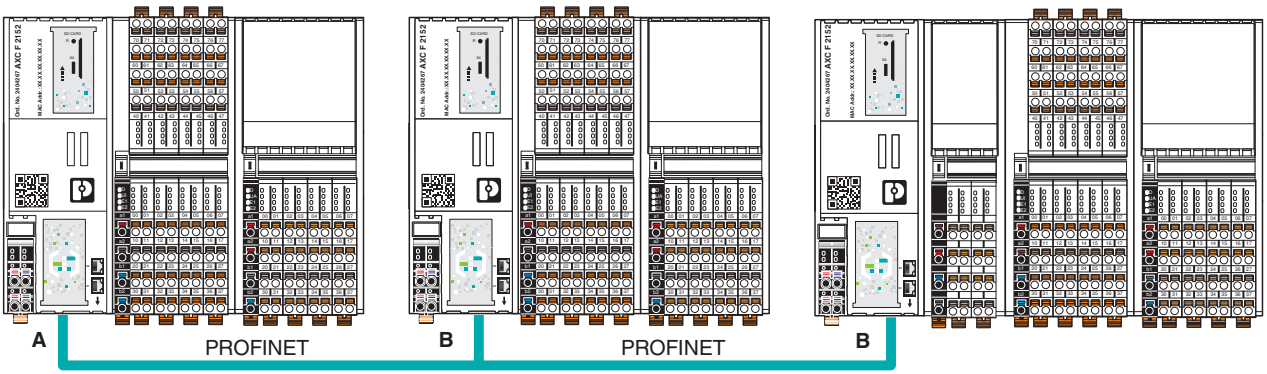


Figure 3-5 AXC F 2152 as a PROFINET controller

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 into a PROFINET network as a PROFINET controller, please refer to the PLCnext Engineer online help.

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

Figure 3-6 shows the example of the AXC F 2152 as a PROFINET device in a PROFINET network.

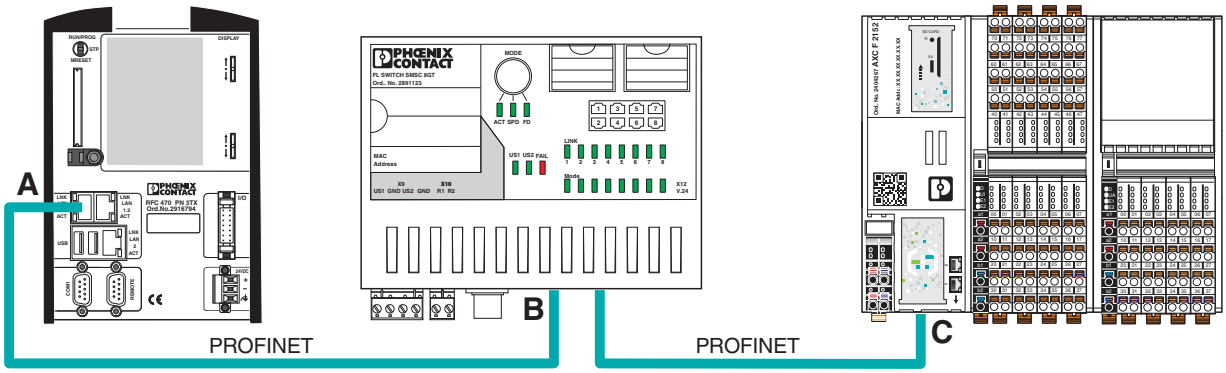


Figure 3-6 AXC F 2152 as a PROFINET device

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 into a PROFINET network as a PROFINET device, please refer to the PLCnext Engineer online help.

3.9.4 System redundancy with AXC F 2152

Figure 3-7 shows an application example of system redundancy. In the example, two RFC 460R PN 3TX controllers connected via a fiber optic synchronization connection (SYNC) form the higher-level redundant control system. The higher-level control system controls a lower-level PROFINET ring network that is configured as redundant using the MRP Media Redundancy Protocol. In the example, the AXC F 2152 controller operates as a PROFINET device with control function and is connected to the PROFINET network via a switch.

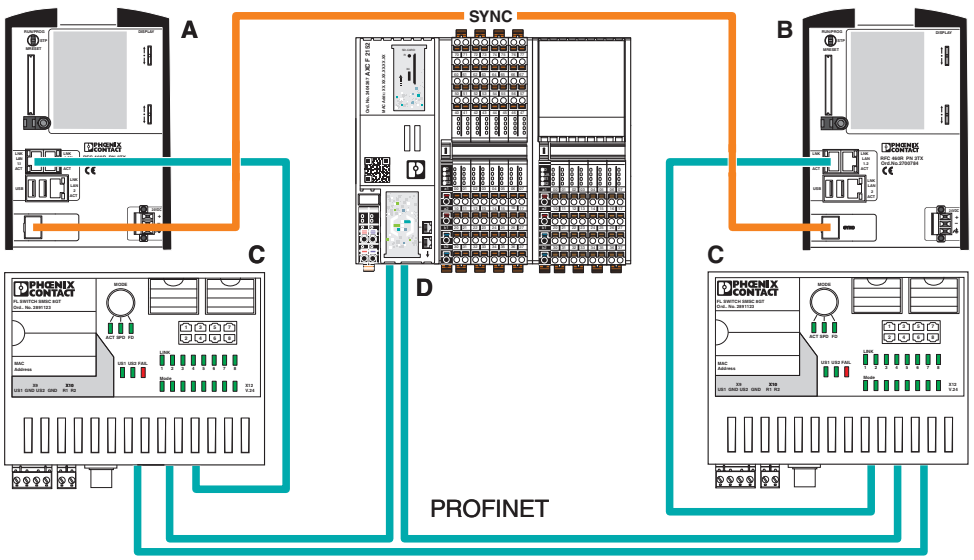
Identical application programs run on both higher-level PROFINET controllers. In the example, controller A is the FIRST PROFINET controller and controller B is the SECOND PROFINET controller. Which of the two controllers controls the process depends on the redundancy role (PRIMARY/BACKUP) of the controller, which may change depending on the redundancy status.

For additional information on redundancy, please refer to the UM EN RFC 460R PN 3TX user manual and the AH EN APPLICATIVE SYSTEM REDUNDANCY application note.

These documents can be downloaded at phoenixcontact.net/products.

Redundant control system (with RFC 460R PN 3TX)

Network redundancy with MRP Media Redundancy Protocol



PROFINET device (with Phoenix Redundancy Layer) in the redundancy ring (supports MRP)

Figure 3-7 Redundant higher-level control system and lower-level network ring redundancy using MRP

Key:

A FIRST PROFINET controller (in the example: RFC 460R PN 3TX)
The redundancy role (PRIMARY/BACKUP) may change depending on the redundancy status.

B SECOND PROFINET controller (in the example: RFC 460R PN 3TX)
The redundancy role (BACKUP/PRIMARY) may change depending on the redundancy status.

C Infrastructure components (in the example: FL SWITCH SMCS ... managed switches)

D PROFINET device with control function (in the example: AXC F 2152 with activated PROFINET device function and Phoenix Redundancy Layer)

Information for activating the MRP-Client function of the AXC F 2152 can be found in the online help of PLCnext Engineer.

3.10 Components of the controller

3.10.1 Connection and operating elements

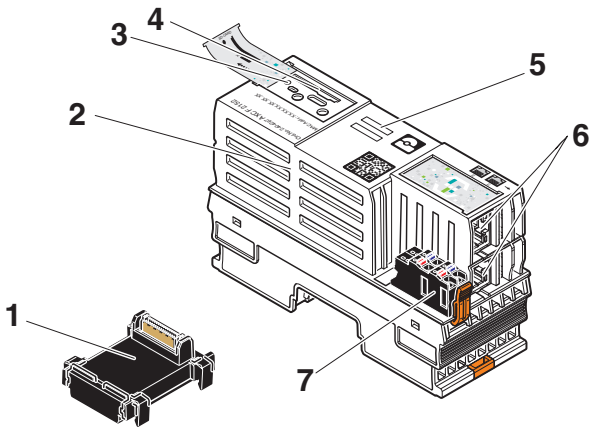


Figure 3-8 Connection and operating elements of the controller

The controller consists of the following components:

1 Bus base module

2 Electronics module

3 Reset button

4 SD card holder

The SD card is optional and not supplied as standard with the controller.
Please refer to the ordering data in Section “Ordering data” on page 171.

5 Diagnostic and status indicators

6 Ethernet interfaces (X1, X2)

7 Supply connector (connector for connecting the supply voltage (communications power U_L))

3.10.2 Printing

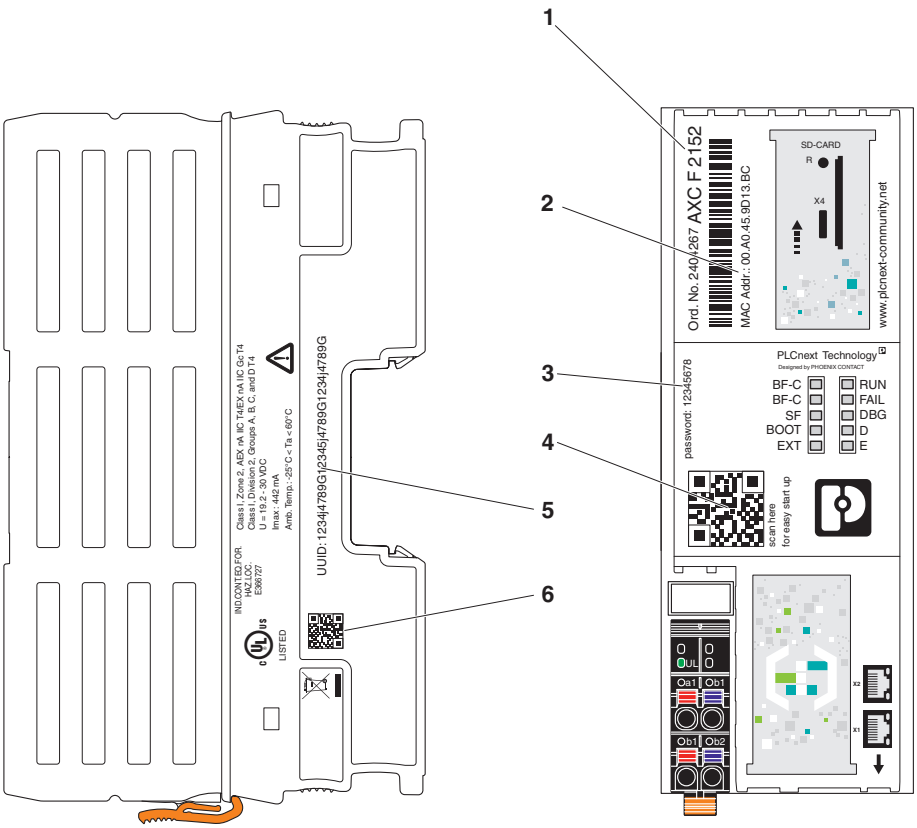


Figure 3-9 Printing

The following information is printed on the controller:

1 Order number and order designation
2 MAC address
3 Administrator password
4 QR code for connecting to the PLCnext Community
5 UUID for connecting to PROFICLOUD
6 QR code for connecting to PROFICLOUD

Administrator password

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

– The controller file system
– Certain functions in PLCnext Engineer
– The PLCnext Engineer HMI
– Web-based management (WBM)
– The AXC F 2152 OPC UA server

Recommended:

- Only use the administrator password for initial access.
- Once you have gained access successfully, change the administrator password to prevent unauthorized administrator access (see Section 9.5.4.1).

QR code for connecting to the PLCnext Community

You can access the PLCnext Community directly via the QR code.
In the PLCnext Community, you will find:

– Information on PLCnext Technology
– Information on PLCnext Engineer
– Information on programming the AXC F 2152 with C++
– Operating instructions
– Tutorials
– Example projects
– FAQs

QR code for connecting to PROFICLOUD

You can register the controller in PROFICLOUD directly via the QR code. If you are not already logged into PROFICLOUD, you must log in first. When you scan the QR code, the controller UUID is automatically applied.

3.11 Diagnostic and status indicators

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

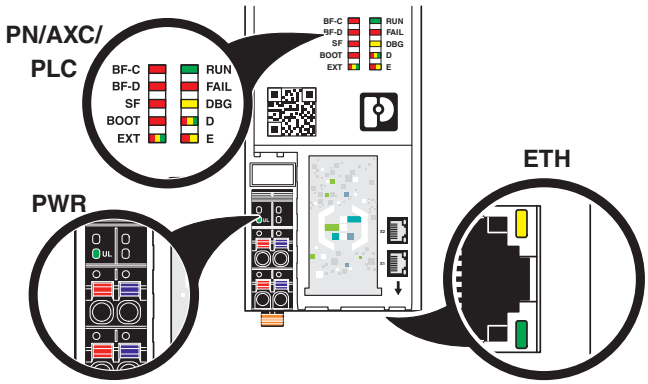


Figure 3-10 Diagnostic and status indicators

Table 3-2 Controller diagnostic and status indicators

Desig-nation	Color	Meaning	State	Description
PN: PROFINET controller/device function				
BF-C	Red	Status of PROFINET communication/ communication error	**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 does not have a communication connection.
BF-D	Red	Status of PROFINET communication/ communication error	**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 3-2 Controller diagnostic and status indicators

Desig-nation	Color	Meaning	State	Description
PLC: Controller diagnostics				
RUN	Green	Controller RUN status	Off	PLCnext runtime system is not ready for operation.
			Flashing (0.5 Hz)	PLCnext runtime system successfully initialized. The controller is in the READY/STOP state; application program is not being processed.
			Flashing (2 Hz)	Controller has been reset to the default status (see Section “Reset button (concealed)” on page 35).
			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 PLCnext Engineer (breakpoint(s) set). The status of the RUN LED is not affected.
BOOT	Red	Device firmware loading status	On	Device firmware is faulty.
			Flashing (2 Hz)	Device firmware is being loaded (boot process).
			Off	Device firmware running.

Table 3-2 Controller diagnostic and status indicators

Desig-nation	Color	Meaning	State	Description
AXC: Axioline F diagnostics				
D	Red/yel-low/green	Axioline F: Diag-nostics for local bus communica-tion	Green on	Run: The Axioline F station is ready for operation; communication within the Axioline F station is OK. All data is valid. No malfunction is present.
			Flashing green	Active: The Axioline F station is ready for operation; communication within the Axioline F station is OK. The data is **not** valid. There is no valid data available from the controller. No malfunction is present on 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: – Configuration cannot be generated, information is missing from a device – Chip version of a device is < V 1.1 – Desired configuration and actual configuration differ – Local bus device not connected – The maximum number of local bus devices has been 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: – 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	I/O error at a local bus device

Table 3-2 Controller diagnostic and status indicators

Desig-nation	Color	Meaning	State	Description
EXT	Red	Left alignment	On	Error at extension module Possible error causes: – Extension module is not supported. – Extension module is not mounted correctly or is defective. – Extension module was disconnected from power during operation or has been removed.
	Yellow		On	Extension module test during the boot process
	Green		On	Extension module operating without errors.
PWR: Supply voltage (communications power U_L)				
UL	Green	U_{Logic}	Off	24 V communications power feed-in not present or too low.
			On	24 V communications power feed-in 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 not active
			On/flashing	Data transmission active (activity): the Ethernet interface is sending or receiving data

Special case: Firmware update

During a firmware update, the RUN LED first flashes, and then stops. Upon a successful controller restart, the RUN LED lights up again permanently.

Information on firmware updates can be found in Section “Updating the firmware via the shell” on page 177.

Special case: Unauthorized removal of the SD card during operation

If the SD card is removed during operation, all LEDs except the D and E LEDs begin to flash red (1 Hz).

Information on operating the controller with an SD card can be found in Section “SD card (optional)” on page 38.

3.12 Reset button (concealed)

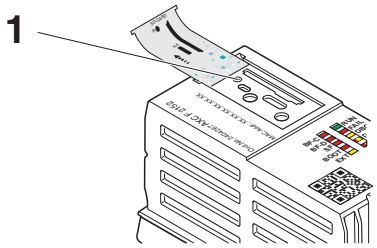


Figure 3-11 Reset button (1, concealed)

The reset button on the controller can only be operated with a pointed object, such as a pin, 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. Here, a distinction is made between two types of default settings:

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

Please note the following when using PROFICLOUD:

Upon reset to default setting type 1 or 2, the controller can no longer be reached by PROFICLOUD. To continue using the controller in PROFICLOUD, proceed as follows:

- Delete the controller from PROFICLOUD, as described in the “Startup and operation of hardware and software components of the PROFICLOUD” user manual.
- Then reregister the controller in PROFICLOUD and add it as a PROFICLOUD device, as described in Section “Configuring PROFICLOUD” on page 106.

Default setting type 1

When restoring the controller to default setting type 1, all the settings that you have configured are deleted. These include, for example:

– The PLCnext 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 configured 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 the reset button down and switch the supply voltage on.

The RUN and FAIL LEDs light up.

- Release the reset button.

The controller is reset to default setting type 1.

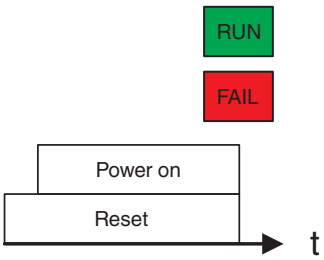


Figure 3-12 Sequence when resetting to default setting type 1 and LED indicators

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 the reset button down and switch the supply voltage on.

The RUN and FAIL LEDs light up.

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

The controller is reset to default setting type 2.

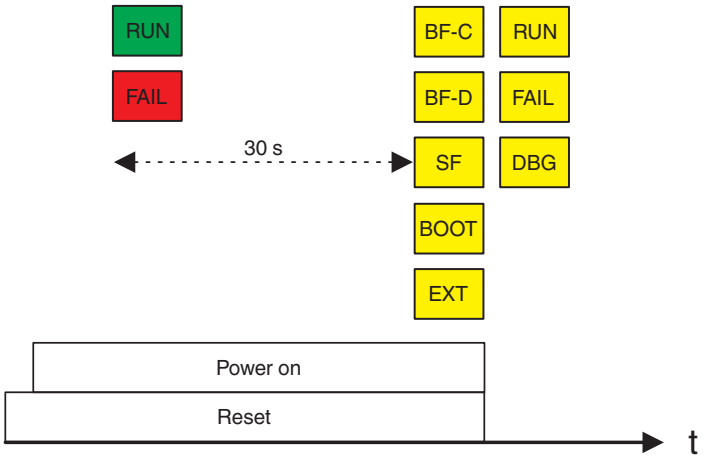


Figure 3-13 Sequence when resetting to default setting type 2 and LED indicators

3.13 Parameterization memory

The controller has an internal parameterization memory. Alternatively, a plug-in parameterization memory in the form of an SD card can be used, see Section 3.14.

The programs and configurations (e.g., controller IP address) belonging to your PLCnext Engineer project are stored in the parameterization memory. In addition, application-specific data can also be stored in the parameterization memory.

If you make changes to Linux operating system files on the internal parameterization memory, the Linux operating system generates an overlay file system from the changed files and directories.
If you operate the controller with an SD card, the overlay file system is generated on the SD card.

3.14 SD card (optional)

If the internal parameterization memory is not large enough for your application, the controller can be operated using an SD card. The SD card is optional and not required to operate the controller.

If you operate the controller with an SD card, all application-specific data (e.g., the PLCnext Engineer project) is stored there.

The SD card is recognized during the initialization phase of the controller. If you insert the SD card during operation, the SD card will not be recognized.

- Make sure that the SD card has been inserted before switching the controller on, in order to enable the controller to use it.
- Only insert and remove the SD card when the controller supply voltage is disconnected.
  Refer to Section “Diagnostic and status indicators” on page 31 for the LED blink codes in the event of unauthorized removal of the SD card during operation.
- Only use an SD card provided by Phoenix Contact, see Section “Ordering data” on page 171.

Please note:

You can activate or deactivate the support of the SD card via the WBM of the controller, refer to Section 9.5.4.4.

Recommended:

- Deactivate the support of the SD card if you run the controller without SD card.

You thereby avoid the risk of data theft and manipulation, refer to Section 9.5.4.4.

Change: Operation without SD card → Operation with SD card

When changing from operation without SD card to operation with SD card, note the following:

If there is already an overlay file system on the internal parameterization memory, this will be copied to the SD card.
If there is already an overlay file system on the SD card, the controller will access this. The overlay file system on the internal parameterization memory will be deleted.

Furthermore, all application-specific data will be deleted from the internal parameterization memory. PLCnext Engineer projects and IP configurations stored on the parameterization memory are no longer available. The controller accesses the data stored on the SD card.

NOTE: Data loss due to removing the SD card

If you remove the SD card during operation, data will be lost.

- Do not remove the SD card during operation.

NOTE: Damage to 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. If you format the SD card, certain information on the SD card that is required for use with Phoenix Contact devices will be lost. After formatting, you can no longer use the SD card to operate the controller.

- Ensure that the SD card is not formatted.
- If you would like to delete the overlay file system from the SD card:
  Reset the controller to default setting type 1.

The SD card is recognized during the initialization phase of the controller. If you insert the SD card during operation, the SD card will not be recognized.

- Make sure that the SD card has been inserted before switching the controller on, in order to enable the controller to use it.
- Only insert and remove the SD card when the controller supply voltage is disconnected.
  Refer to Section “Diagnostic and status indicators” on page 31 for the LED blink codes in the event of unauthorized removal of the SD card during operation.
- Only use an SD card provided by Phoenix Contact, see Section “Ordering data” on page 171.

Please note:

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

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

Change: Operation with SD card → Operation without SD card

If you want to switch from operation with SD card to operation without SD card, please note the following:

If there is an overlay file system on the SD card, there will be an empty overlay file system on the internal parameterization memory after removing the SD card and rebooting the controller. The contents of the overlay file system on the SD card will not be transferred over to the internal parameterization memory of the controller.

The application-specific data on the SD card will not be transferred over to the internal parameterization memory of the controller either.

3.15 Internal basic circuit diagram

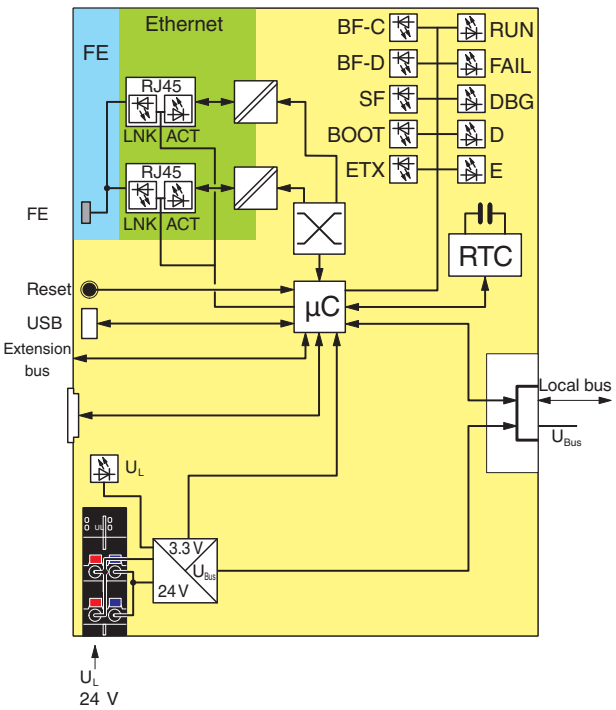


Figure 3-14 Internal basic circuit diagram

Key:

µC	Microprocessor		Transmitter
	Service interface (USB type C)		LED
	Reset button	RTC	Real-time clock
RJ45 LNK ACT	RJ45 interface	3.3 V 24 V U_{Bus}	Power supply unit
	Functional ground connection		Ethernet switch
	SD card holder	Local bus U_{Bus}	Axioline F local bus
Extension bus	Left-aligned Axioline F extension modules		

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

- Logic
- Ethernet interface
- Functional ground

3.16 Communication paths

The following communication paths are available on the controller (see Figure 3-15):

(1)	2 x Ethernet	X1/X2: 10/100 BASE-T(X) (switched internally)
(2)	Service interface (USB type C)	No function at present

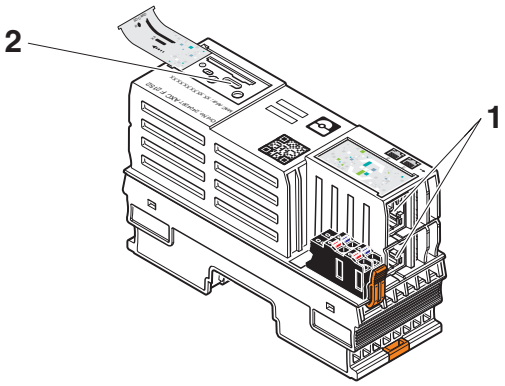


Figure 3-15 Communication paths: (1) Ethernet, (2) service interface (USB type C)

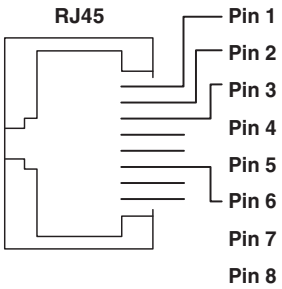
3.16.1 Ethernet

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 that at least complies with CAT5 of IEEE 802.3.
- Observe the bending radii of the Ethernet cables used.

The contact assignment of the interface is as follows:



Pin	Signal	Description
1	T+	Transmit data +
2	T-	Transmit data -
3	R+	Receive data +
4	–	–
5	–	–
6	R-	Receive data -
7	–	–
8	–	–

Figure 3-16 Ethernet interface and pin assignment

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

3.17 Supply connector

Figure 3-17 Terminal points for the supply voltage (communications power U_L)

Terminal point assignment

Table 3-3 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	Communications power feed-in (bridged internally)
GND	Supply voltage reference potential (bridged internally)

3.18 Bus base module

AXL BS BK bus base module

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

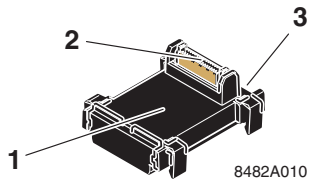


Figure 3-18 Structure of the AXL BS BK bus base module

1 Bus base module
2 Connection of the local bus to the controller
3 Connection to the following bus base module

AXC BS L 2 bus base module

For an Axioline F extension module to be aligned to the left, the controller requires the AXC BS L 2 bus base module. The bus base module is not supplied with the controller. Please refer to the ordering data in Section “Ordering data” on page 171.

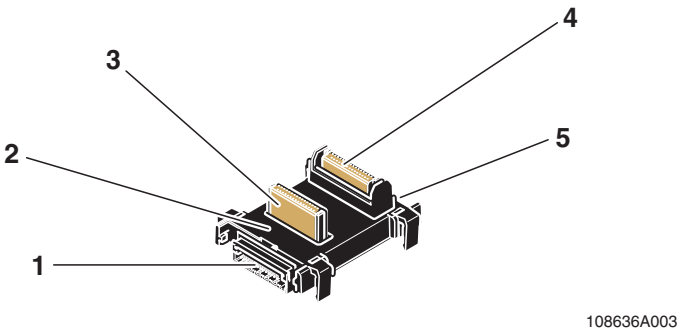


Figure 3-19 Structure of the AXC BS L 2 bus base module

1 Connection to the bus base module of a left-alignable Axioline F extension module
2 Bus base module
3 Connection of the extension bus to the controller
4 Connection of the local bus to the controller
5 Connection to the following bus base module

4 Mounting hardware

For basic information on 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: Damage to electronics due to inadequate external protection – No safe fuse tripping in the event of a fault

The electronics in the device will be damaged due to inadequate external fuse 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).
- Ensure that the external fuse trips reliably in the event of a fault.

NOTE: Damage to the contacts when tilting

Tilting the modules can damage the contacts.

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

Please note:

During any 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 reactivation.

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

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

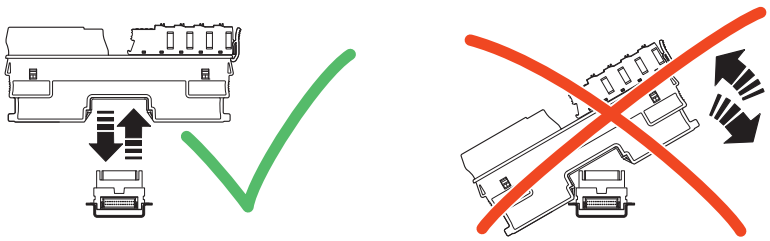


Figure 4-1 Placing the module **vertically**

4.2 Basic information

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 junction 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 as well as the notes on mounting distances in the UM EN AXL F SYS INST user manual.

Supply connector

The controller has a supply connector for connecting the power supply. The connector is fitted with spring-cage terminal blocks. When using suitable conductors, the conductors can be connected by means of direct connection technology (Push-in Technology).

For additional information, please refer to Section 5.1.2.

FE connection

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

End brackets

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

Table 4-1 Recommended end brackets

Mounting position	Ambient conditions	End bracket
Horizontal; A in Figure 4-2 on page 48:	Normal	CLIPFIX 35, CLIPFIX 35-5
	High shock and vibration load	E/AL-NS 35
Other; B in Figure 4-2 on page 48	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).

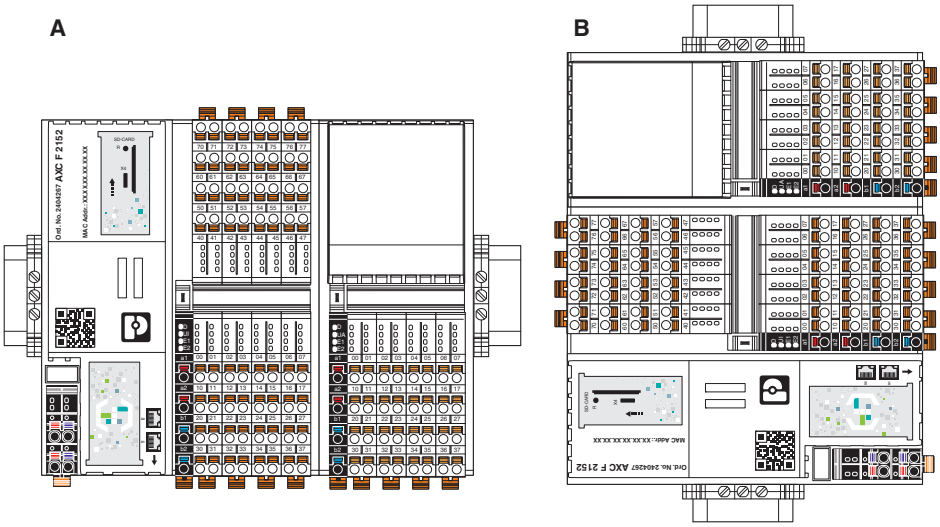


Figure 4-2 Horizontal (A) and vertical (B) mounting position

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:

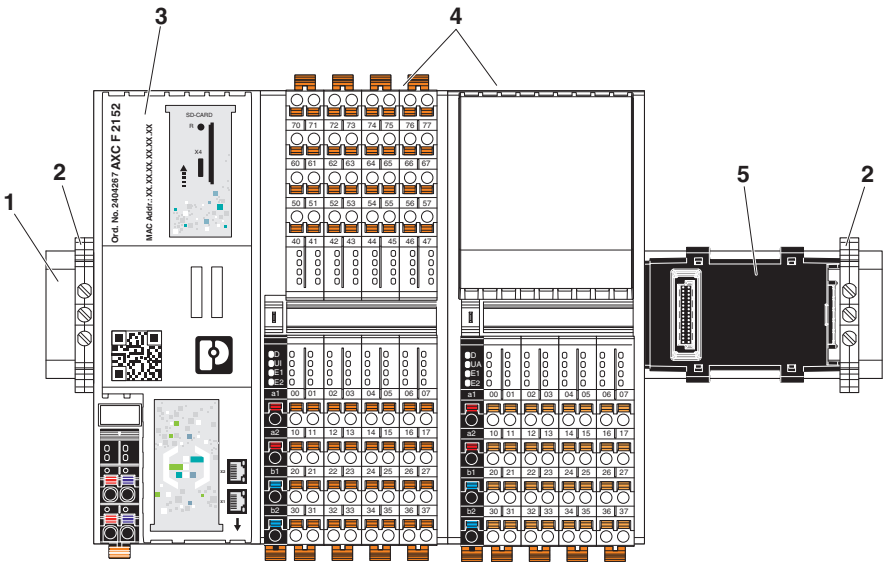


Figure 4-3 Structure of an Axioline F station

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.

Left-alignment of Axioline F extension modules

You can connect **one** Axioline F extension module to the controller using the AXC BS L 2 bus base module.

The following left-alignable Axioline F extension modules are currently available:

– AXC F XT ETH 1TX (Order No. 2403115):
  Left-alignable Ethernet interface
– AXC F XT IB (Order No. 2403018):
  Left-alignable INTERBUS master for the connection of up to 255 INTERBUS remote bus devices

Please note:
The AXC BS L 2 bus base module is not supplied with the AXC F 2152. For the bus base module ordering data, please refer to Section “Ordering data” on page 171.

Figure 4-4 shows an example structure of an Axioline F station with an AXC F XT ETH 1TX left-aligned Axioline F extension module:

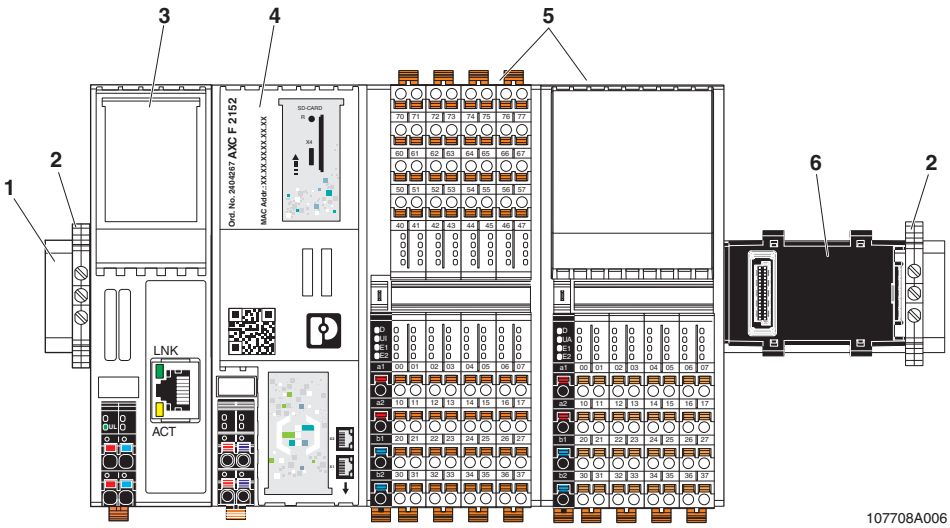


Figure 4-4 Structure of an Axioline F station with an AXC F XT ETH 1TX left-aligned Axioline F extension module

Key:

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

4.4 Structure of a PLCnext Inline station

As an alternative to an Axioline F station, you can create a PLCnext Inline station using the controller. To do so, you need the AXC F IL ADAPT Inline adapter terminal (Order No. 1020304). You can directly install the Inline modules in series on the Inline adapter terminal.

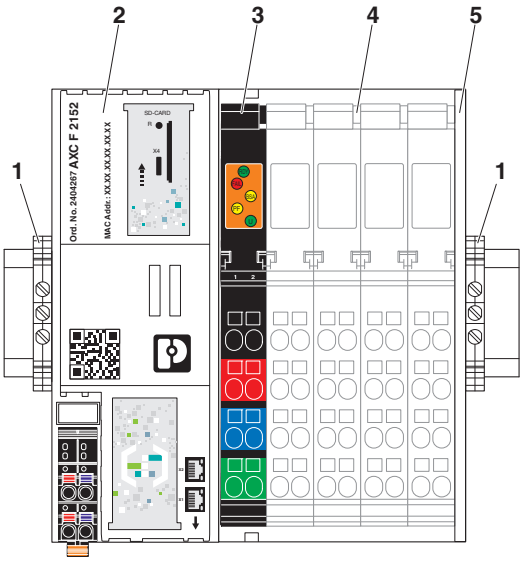


Figure 4-5 Structure of a PLCnext Inline station

1 End bracket (e.g., CLIPFIX 35-5, Order No. 3022276)
2 Controller (as of firmware version 1.2)
3 Inline adapter terminal
4 Inline terminals corresponding to the application
5 End plate (snapped onto the DIN rail as station end)

For mounting information, please refer to the packing slip and the data sheet for the Inline adapter terminal. The documents can be downloaded at phoenixcontact.net/product/1020304.

Various functions blocks are available in PLCnext Engineer for INTERBUS configuration and communication.
For more detailed information, please refer to the online help for PLCnext Engineer.

For more detailed information on PCP and INTERBUS services, please refer to the following user manuals: “Peripherals Communication Protocol (PCP)” (IBS SYS PCP G4 UM E), “Firmware Services and Error Messages” (IBS SYS FW G4 UM E), and “INTERBUS Diagnostics Guide” (IBS SYS DIAG DSC UM E).
The documents can be downloaded at phoenixcontact.net/product/1020304.

4.5 Mounting the controller

- Disconnect the Axioline F station from the power supply.
- Mount the left end bracket on the Axioline F station.

Mounting bus base modules

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

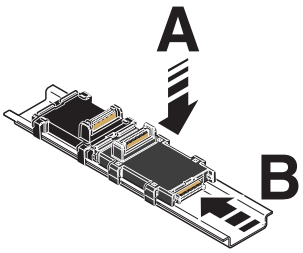


Figure 4-6 Mounting the bus base modules

Snapping the controller into place

- Push the controller vertically onto 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.

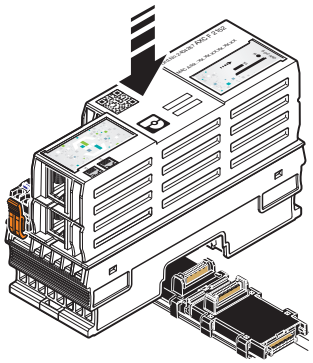


Figure 4-7 Snapping the controller into place

4.6 Inserting the SD card

NOTE: Damage to 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. If you format the SD card, certain information on the SD card that is required for use with Phoenix Contact devices will be lost. After formatting, you can no longer use the SD card to operate the controller.

- Ensure that the SD card is not formatted.
- If you would like to delete the overlay file system from the SD card: Reset the controller to default setting type 1.

The SD card is recognized during the initialization phase of the controller. If you insert the SD card during operation, the SD card will not be recognized.

- Make sure that the SD card has been inserted before switching the controller on, in order to enable the controller to use it.
- Only insert and remove the SD card when the controller supply voltage is disconnected.
  Refer to Section “Diagnostic and status indicators” on page 31 for the LED blink codes in the event of unauthorized removal of the SD card during operation.
- Only use an SD card provided by Phoenix Contact, see Section “Ordering data” on page 171.

The SD card is optional and not supplied as standard with the controller.

Please refer to the ordering data in Section “Ordering data” on page 171.

- Disconnect the Axioline F station from the power supply.

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

- Remove the upper marking field of the controller (item 1 in Figure 4-8).

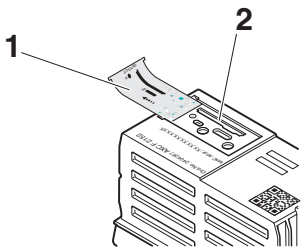


Figure 4-8 Removing the upper marking field

- Gently push the SD card into the SD card holder (item 2 in Figure 4-8) until it engages with a click in the SD card holder (see Figure 4-9, “Click”).

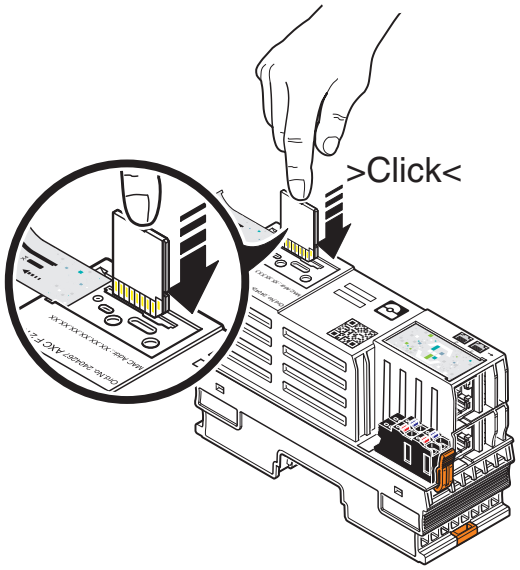


Figure 4-9 Inserting the SD card

4.7 Mounting a left-alignable Axioline F extension module

- Mount the left-alignable Axioline F extension module as described in the module-specific packing slip and module-specific data sheet.

Please note:
You can connect only one Axioline F extension module to the left of the controller. It is not possible to align more Axioline F extension modules to the left.

5 Connecting and wiring hardware

5.1 Supply voltage

5.1.1 Sizing 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 operation with protective extra-low voltage (PELV) in accordance with EN 60204-1. Only PELV in accordance with the listed standard may be used for the supply.

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

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

A **power supply without a fall-back characteristic curve** must be used for the correct operation of the controller (see Figure 5-2).
When the controller is switched on, an increased inrush current occurs briefly. When it is switched on, the controller behaves like a capacitive load.

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

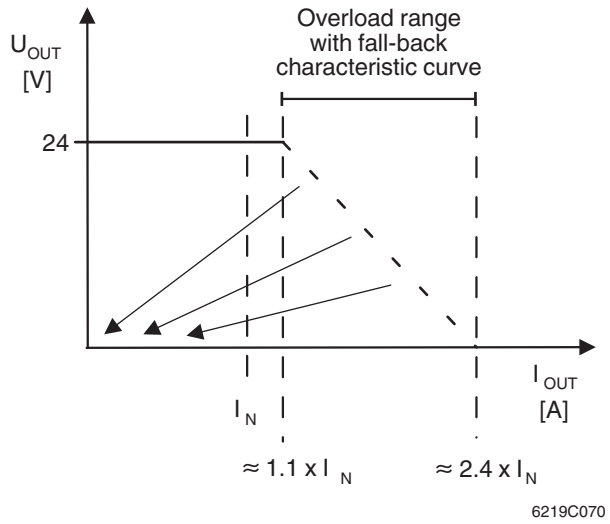


Figure 5-1 Overload range **with** fall-back characteristic curve

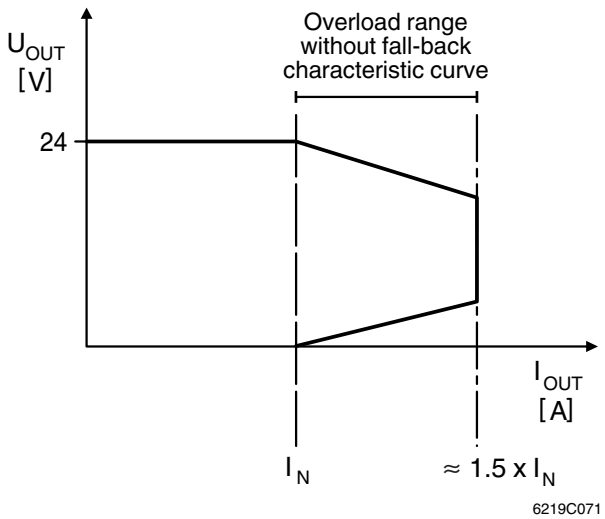


Figure 5-2 Overload range **without** fall-back characteristic curve

5.1.2 Connecting the power supply

Observe the notes in Section 3.17 when assembling the connector for the supply voltage.

- Strip 8 mm of insulation off of the end of the cable. If necessary, fit a ferrule to the cable.

When using ferrules:

- Use ferrules in accordance with the specifications in the UM EN AXL F SYS INST user manual.
- Ensure the ferrules are crimped correctly.

Rigid conductor/ferrule

- Insert the conductor into the terminal point. It is clamped into place automatically.

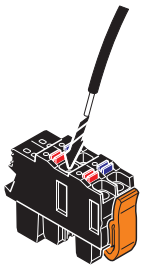


Figure 5-3 Connecting a rigid conductor

Flexible conductor

- Open the spring by pressing on the spring lever with a screwdriver (A in Figure 5-4).
- Insert the conductor into the terminal point (B in Figure 5-4).
- Remove the screwdriver to secure the conductor (recommended: bladed screwdriver, blade width: 2.5 mm (e.g., SZS 0,4x2,5 VDE, Order No. 1205037).

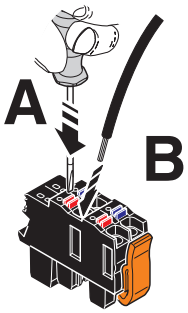


Figure 5-4 Connecting a flexible conductor

Connecting the supply connector

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

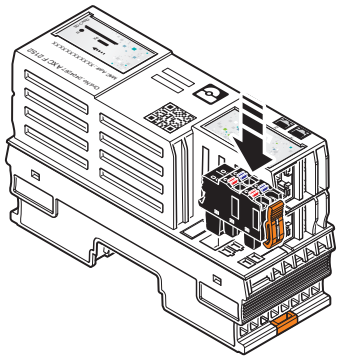


Figure 5-5 Connecting the supply connector

Supply the controller via external 24 V DC sources. The permissible voltage range is 19.2 V DC to 30 V DC (ripple included).
The power consumption of the controller at 24 V is typically 4.8 W (without 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 connector as shown in Figure 5-3 and in Figure 5-4. Note the information in Section 3.17.
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 in the controller. In this case, please contact Phoenix Contact.

Please note the following when using an AXC F XT ETH 1TX or AXC F XT IB left-alignable Axioline F extension module:

The supply voltage of the controller and the left-alignable Axioline F extension module must be fed in via **a shared** power supply unit.

- Connect the supply voltage as described in the module-specific data sheet.

5.2 Connecting Ethernet

- Connect the Ethernet network to the RJ45 socket.

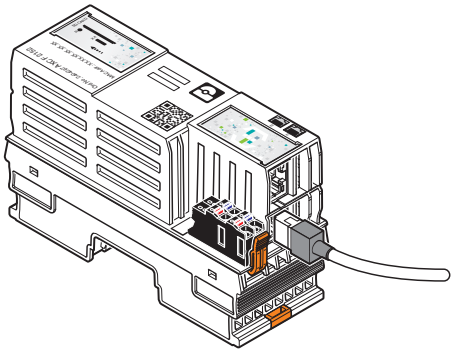


Figure 5-6 Connecting Ethernet

6 Startup

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

The PLCnext Engineer software is required for starting up the controller.

6.1 Installing PLCnext Engineer

The software can be downloaded at phoenixcontact.net/product/1046008.

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

6.2 User interface

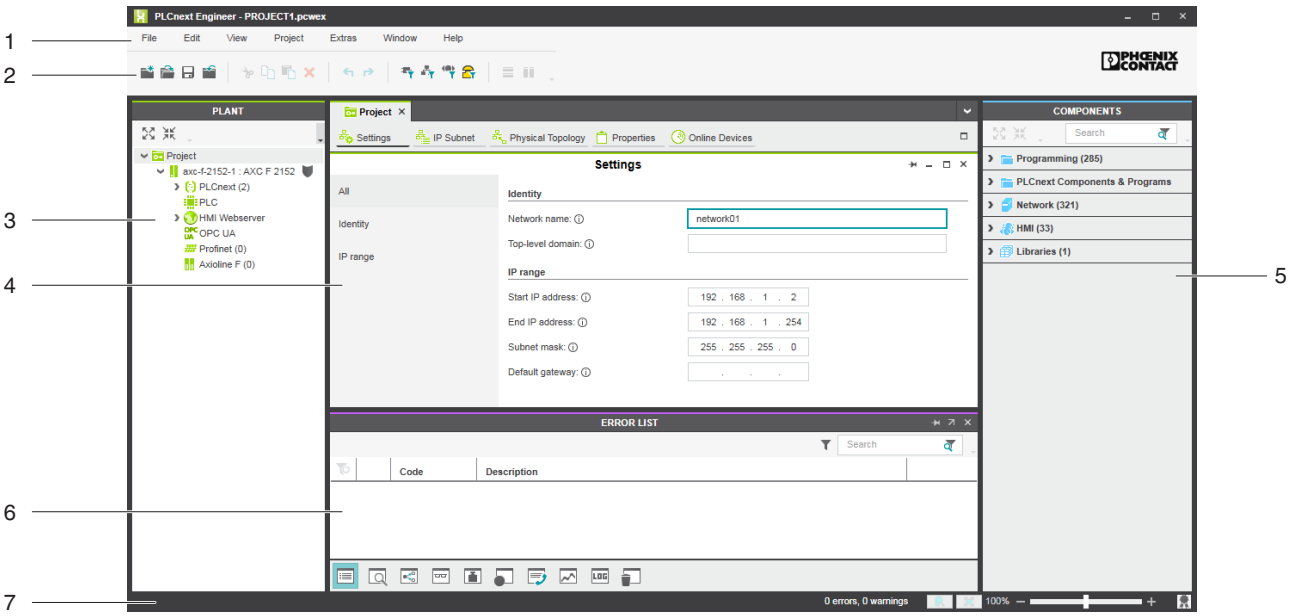


Figure 6-1 PLCnext Engineer user interface

1. Menu bar
2. Tool bar
3. “PLANT” area
4. Editors area
5. “COMPONENTS” area
6. Cross-functional area
7. Status bar

"PLANT" area

All of the physical and logical components of your application are mapped in the form of a hierarchical tree structure in the "PLANT" area.

Editors area

Double-clicking on a node in the "PLANT" area or an element in the "COMPONENTS" area opens the associated editor group in the Editors area. Editor groups are always displayed in the center of the user interface. The color of the editor group indicates whether it is an instance editor (green; opened from the "PLANT" area) or a type editor (blue; opened from the "COMPONENTS" area). Each editor group contains several editors that can be opened and closed via buttons in the editor group.

"COMPONENTS" area

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

- Developing program code ("Data Types", "Programs", and "Functions & Function Blocks")
- Displaying all devices available for the "PLANT" area and adding them via GSDML or FDCML ("Devices")
- Editing HMI pages ("HMI")
- Adding libraries such as firmware libraries, 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 for the current project.
- GLOBAL FIND AND REPLACE:

  Finds and replaces 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.
- WATCH WINDOWS:

  Debug tool; shows the current values of the added variables in online mode.
- BREAKPOINTS:

  Debug tool for setting and resetting breakpoints when debugging within the application.
- CALL STACKS:

  Debug tool that shows the order for calling up when executing the code and that contains commands for debugging with breakpoints.
- LOGIC ANALYZER:

  Records and visualizes variable values at runtime.
- LOGGING:

  Shows all errors, warnings, and messages. A distinction is made between "online" (messages regarding the runtime environment, as well as errors and warnings that concern online communication) and "engineering" (messages regarding software events, e.g., GSDML and FDCML files; not project-related).
- RECYCLE BIN:

  Elements that have recently been deleted from the "PLANT" or "COMPONENTS" areas are moved to the recycle bin. Deleted elements can be restored from here, if needed.

6.3 Creating a new project

- Open PLCnext Engineer.
- Click on the “Empty AXC F 2152 v.00 / 2019.6.0 project” project template on the start page.

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

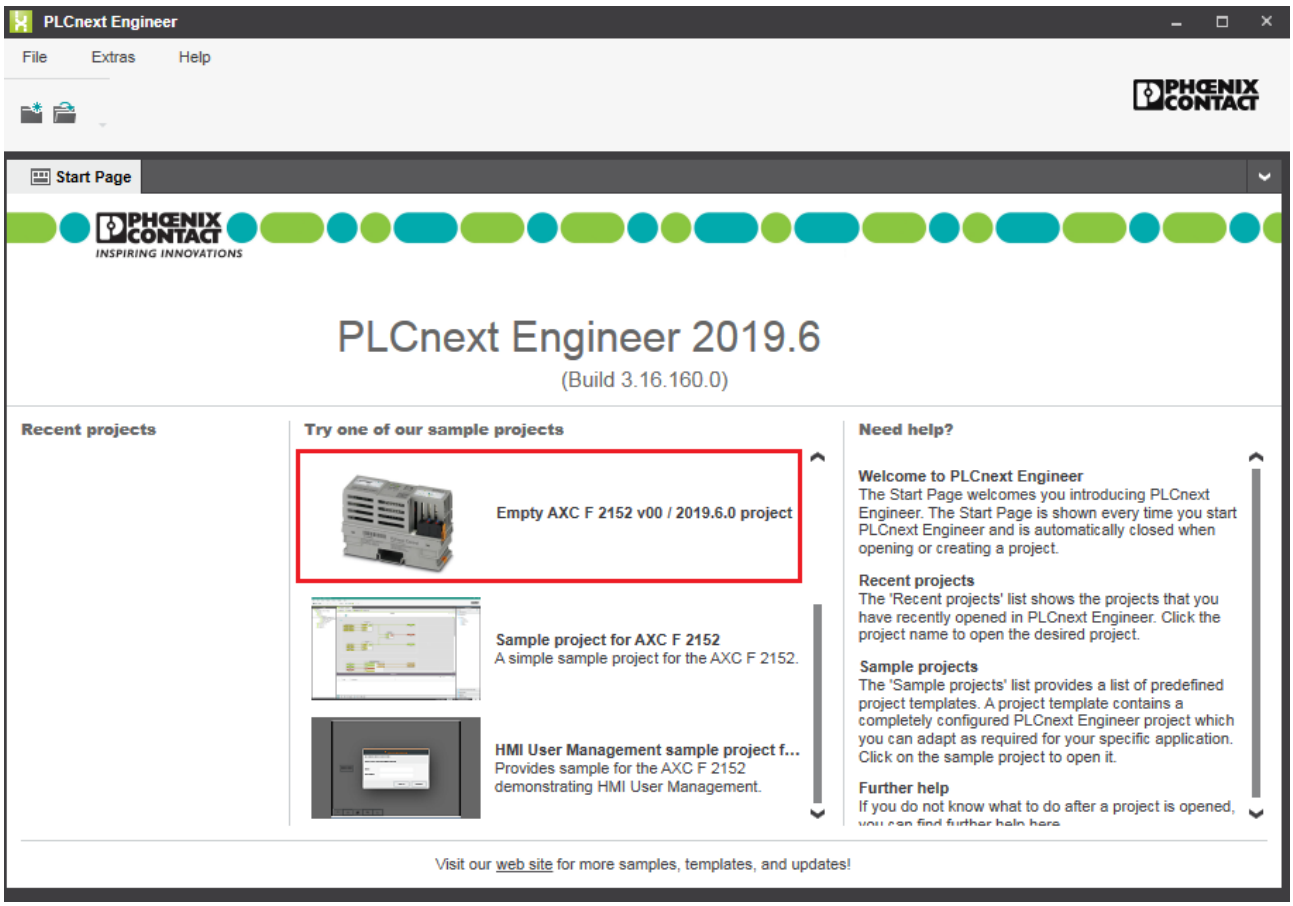


Figure 6-2 Start page, “Empty AXC F 2152 v.00 / 2019.6.0 project” project template

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

6.4 Configuring the IP settings

6.4.1 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 the project.

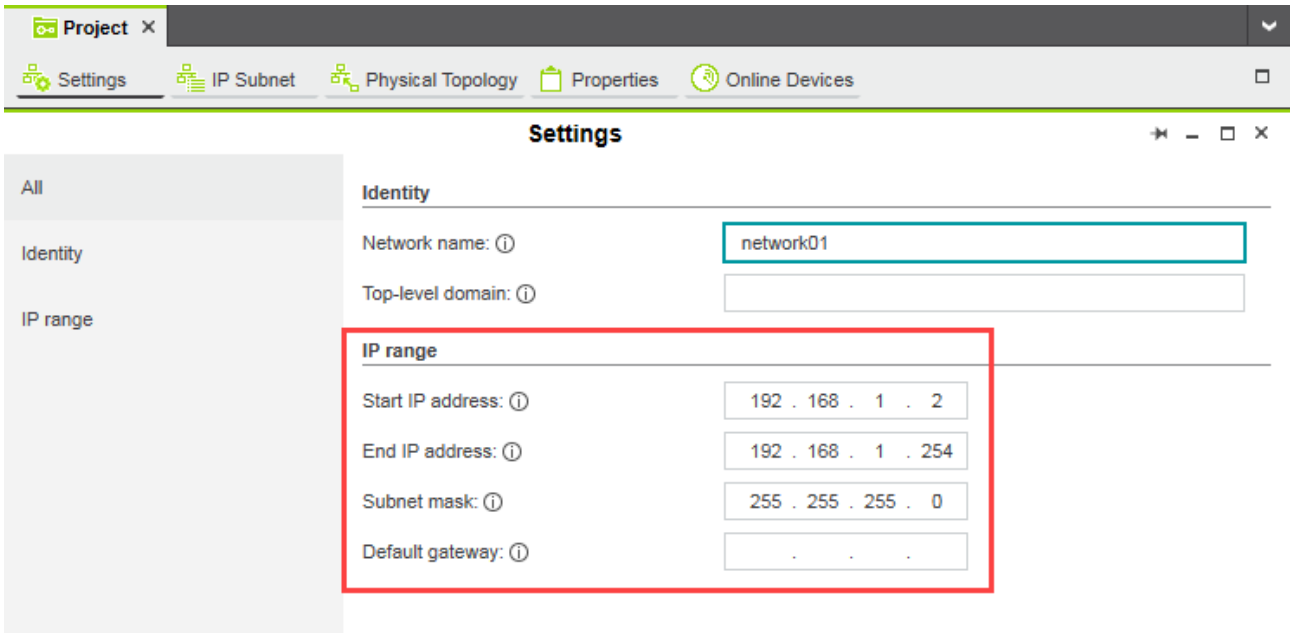


Figure 6-3 Setting the IP address range

6.4.2 Setting the IP address

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

The controller editor group opens.

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

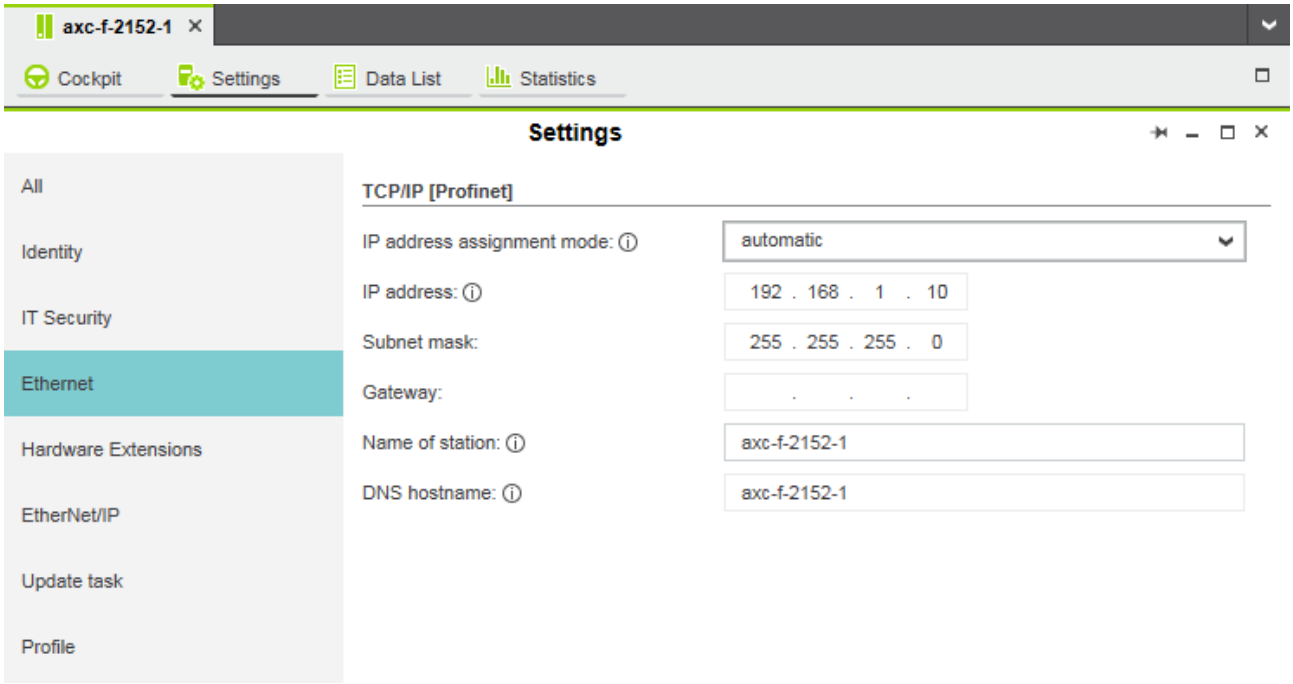


Figure 6-4 Setting the IP address

The IP address of the controller can be set automatically or manually. The IP address is assigned to the controller when you have connected PLCnext Engineer to the controller, see Section 6.5.

Setting the IP address automatically

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

PLCnext Engineer automatically assigns an IP address to the controller from the set IP address range (see Section 6.4.1, “Setting the IP address range”) as soon as a connection is established to the controller (see Section 6.5).

Setting the IP address manually

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

PLCnext Engineer assigns the manually set IP address to the controller as soon as a connection is established to the controller (see Section 6.5).

If you are using an SD card, the IP address will be stored there. In the event of a device replacement, the IP address will then be adopted by the new controller when the SD card is inserted.

6.5 Connecting to the controller

To be able to transfer a project to the controller, you must first connect PLCnext 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” editor.
- Select the appropriate network card from the drop-down list.

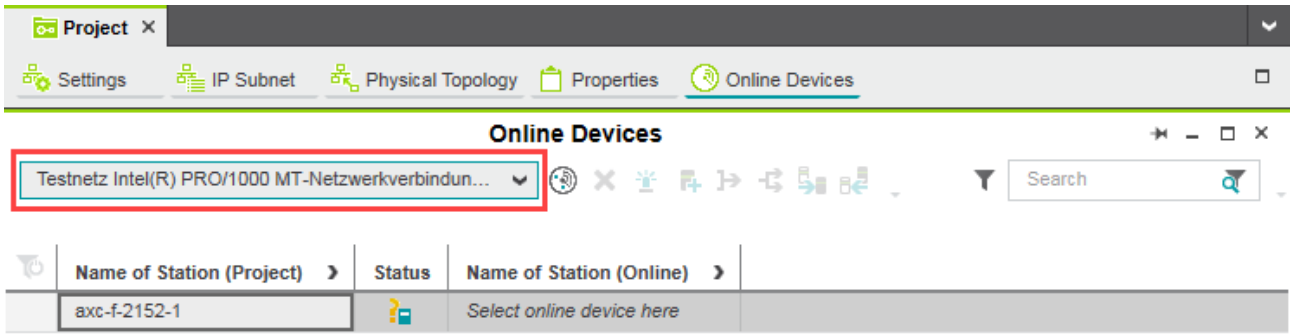


Figure 6-5 Selecting the network card

You can show and hide more detailed information by clicking on the arrows next to “Name of Station (Project)” and “Name of Station (Online)” (see Figure 6-5).

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

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

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

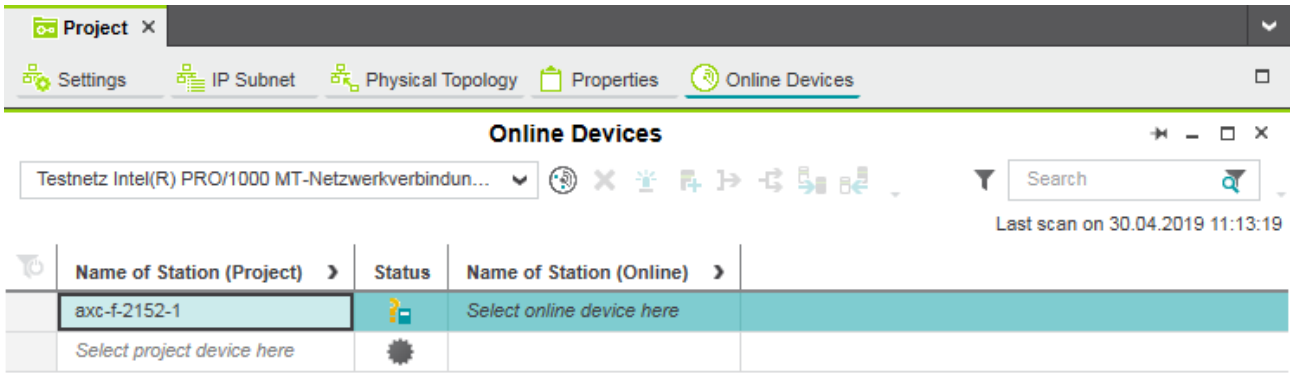


Figure 6-6 Assigning online devices

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

If you select the device (“Select project device here”) under “Name of Station (Project)”, the configured 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.

If the IP address of an online device found in the network already matches the IP address of the configured 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.

The ✔ icon in the “Status” column indicates that assignment was successful.

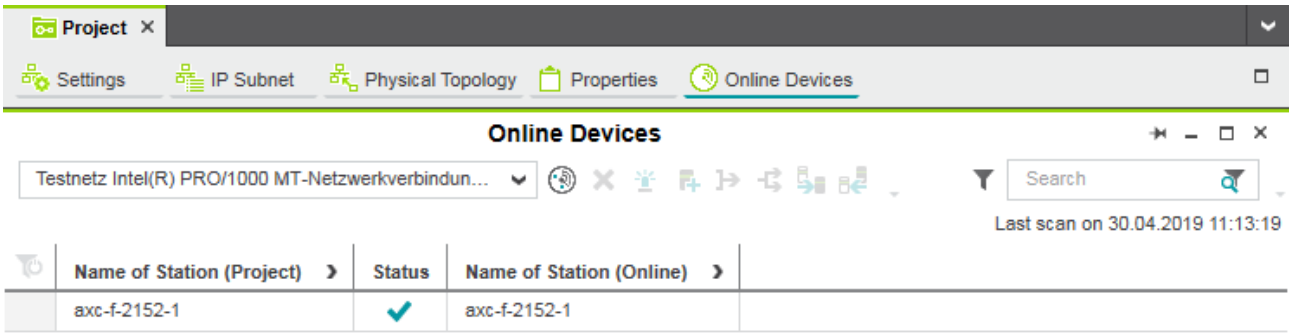


Figure 6-7 Successful assignment of the configured controller to an online device

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

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

The controller editor group opens.

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

The “SECURE DEVICE LOGIN” dialog opens.

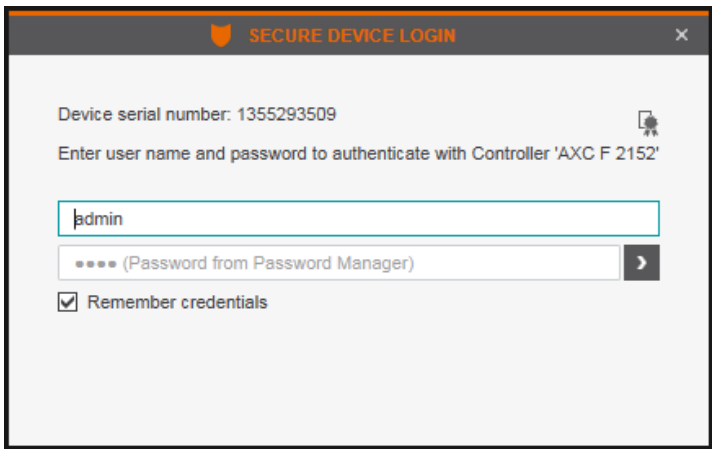


Figure 6-8 “SECURE DEVICE LOGIN” dialog

- Enter your user name and your password.

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

User name: admin
Password: printed on the controller (see **Figure 3-9**).

The icon next to the controller node in the “PLANT” area indicates that connection was successful.

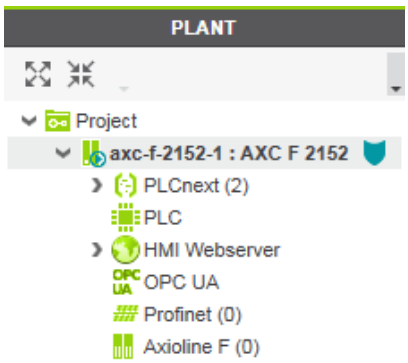


Figure 6-9 Successful connection to the controller

6.6 Configuring Axioline F modules

All of the physical and logical components of your application are mapped in the form of a hierarchical tree structure in the “PLANT” area.

Role picker: Adding Axioline F modules

To add the Axioline F modules, proceed as follows:

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

The “/ Axioline F” controller editor group opens.

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

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

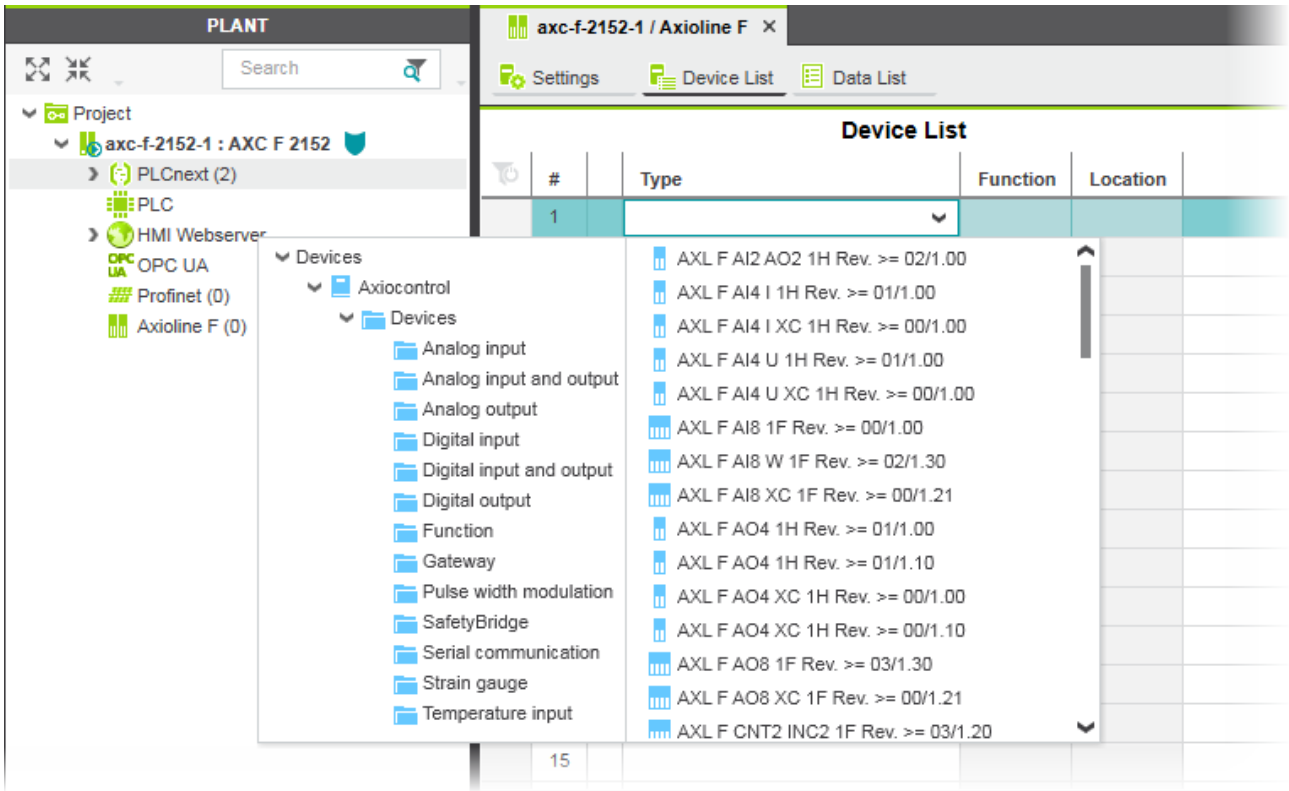


Figure 6-10 Role picker for selecting the Axioline F modules

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

The Axioline F module is added and mapped under the “Axioline F (x)” node in the “PLANT” area (see Figure 6-11).

- Proceed as described above to add more Axioline F modules.

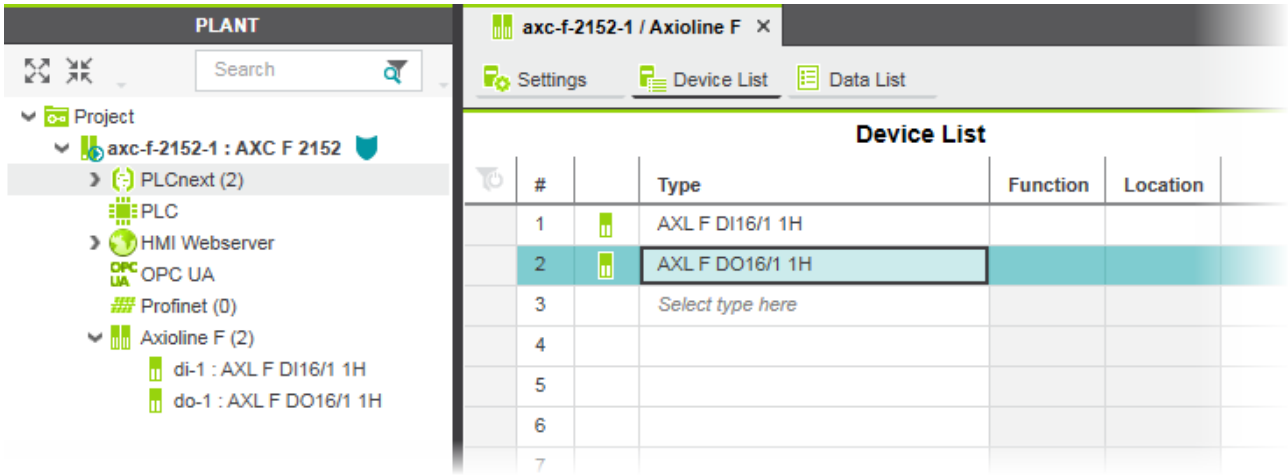


Figure 6-11 Axioline F modules in the “PLANT” area and in the Device List

The controller supports the dynamic bus configuration of the Axioline F local bus.

6.7 Configuring Inline modules

As an alternative to an Axioline F station, you can create a PLCnext Inline station using the controller. To do so, you need the AXC F IL ADAPT Inline adapter terminal (Order No. 1020304).

To configure the Inline modules, proceed as follows:

Selecting the Inline adapter terminal

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

The controller editor group opens.

- Select the “Settings” editor.
- Select the “Hardware Extensions” view.
- From the “Interbus” drop-down list, select “AXC F IL ADAPT (1020304)”.

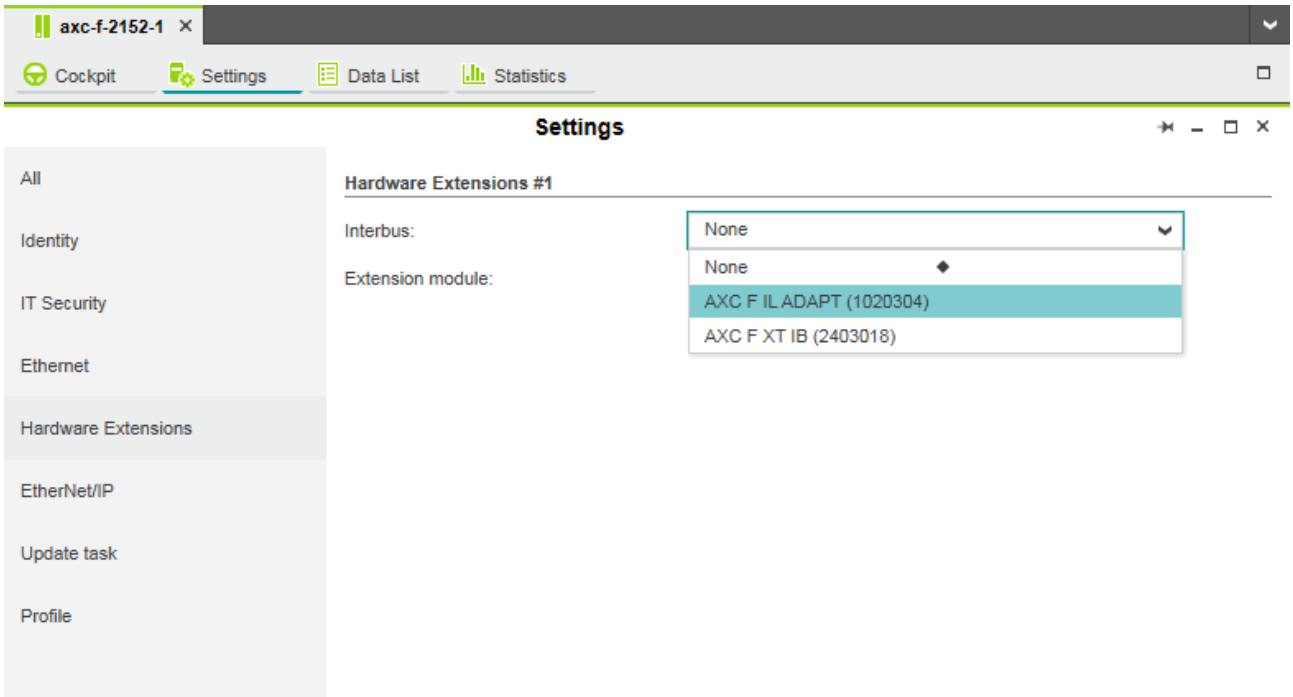


Figure 6-12 “Hardware Extensions”, “Interbus”, “AXC F IL ADAPT (1020304)” setting

The “AXC F IL ADAPT / AXC F XT IB (x)” node is now displayed in the “PLANT” area.

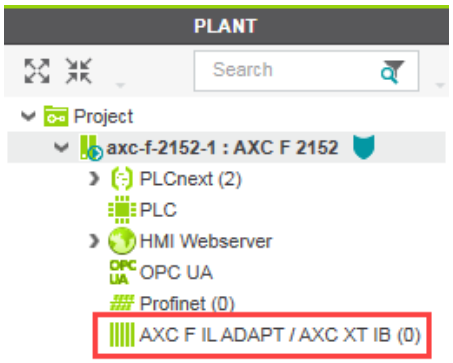


Figure 6-13 “AXC F IL ADAPT / AXC F XT IB (x)” node in the “PLANT” area

Adding the “Inline” library

All of the physical and logical components of your application are mapped in the form of a hierarchical tree structure in the “PLANT” area.

To add Inline modules, you first need to insert the “Inline” library within the “COMPONENTS” area:

- In the “COMPONENTS” area, open the “Libraries (x)” section.
- Right-click on “Libraries (x)”.
- From the context menu, select “Add Library...”.

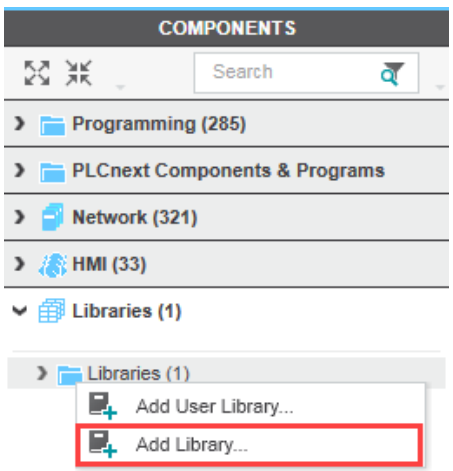


Figure 6-14 Context menu, “Add Library...”

- In the file explorer that opens, select the “Inline” library.
- Click on the “Open” button.

The “Inline” library is now displayed in the “Libraries (x)” section in the “COMPONENTS” area. You can now add the Inline modules contained in the library to your application by using the role picker.

Role picker: Adding Inline modules

To add the Inline modules, proceed as follows:

- Double-click on the “AXC F IL ADAPT / AXC F XT IB (x)” node in the “PLANT” area.

The editor group for the “AXC F IL ADAPT / AXC F XT IB (x)” Inline adapter terminal opens.

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

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

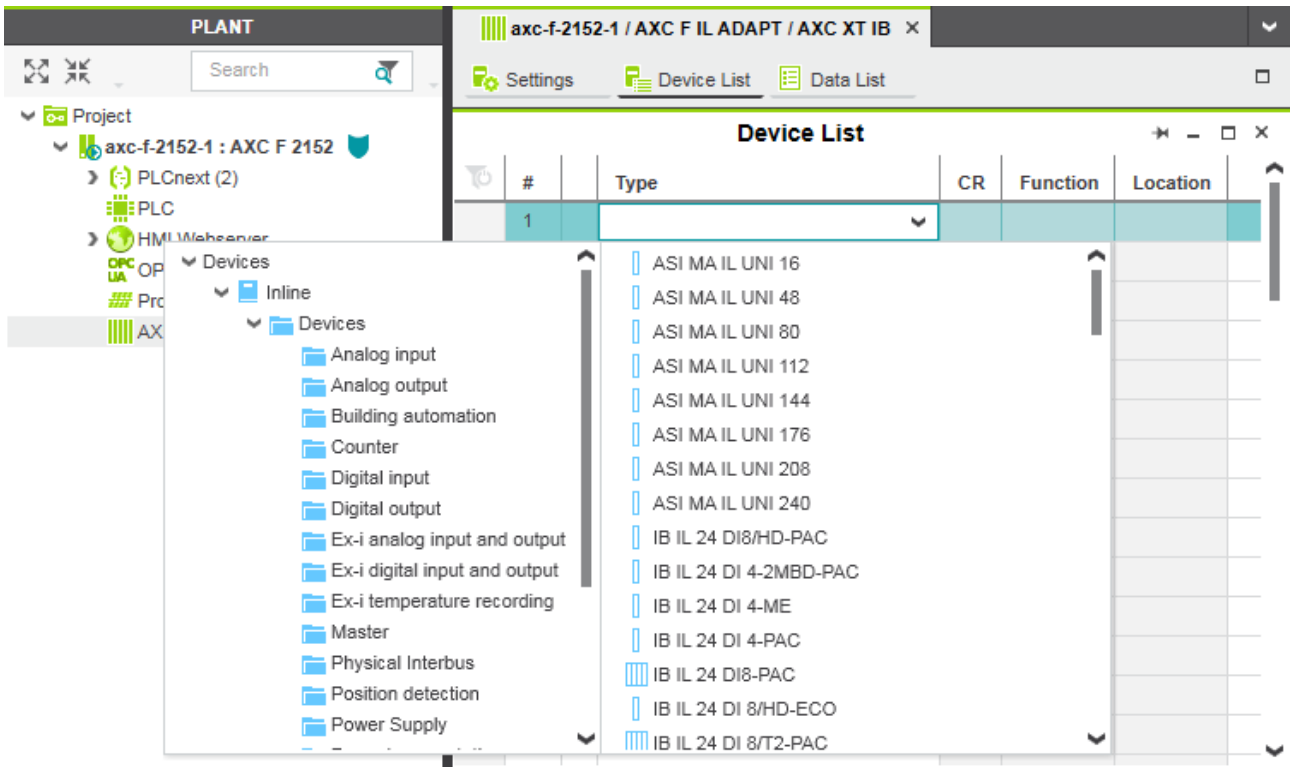


Figure 6-15 Role picker for selecting the Inline modules

- Select the relevant Inline module in the role picker.

The Inline module is added and mapped under the “AXC F IL ADAPT / AXC F XT IB (x)” node in the “PLANT” area (see Figure 6-16).

- Proceed as described above to add more Inline modules.

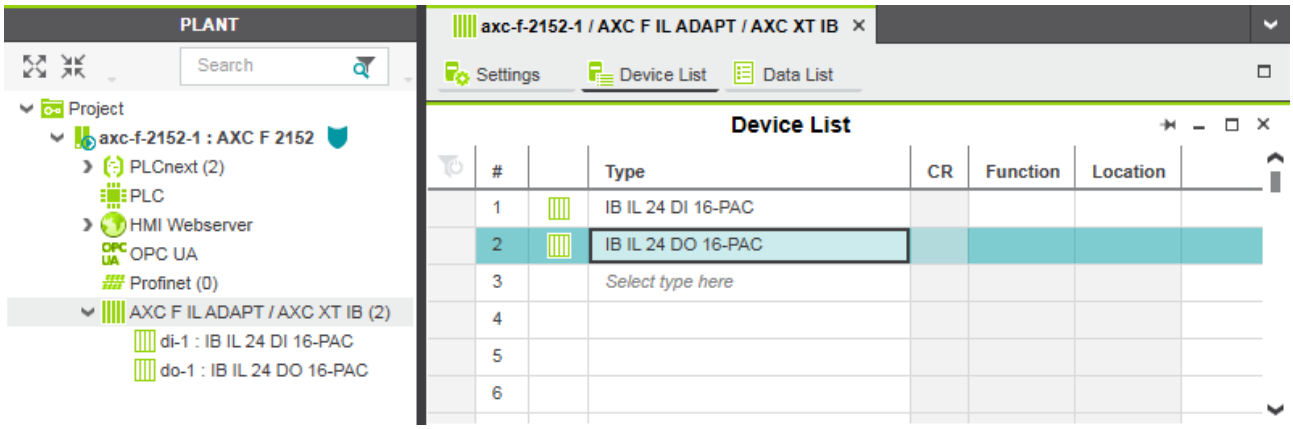


Figure 6-16 Inline modules in the “PLANT” area and in the Device List

6.8 Adding left-alignable Axioline F extension modules to the bus configuration

You can connect **one** Axioline F extension module to the controller using the AXC BS L 2 bus base module. The following left-alignable Axioline F extension modules are currently available:

– AXC F XT ETH 1TX (Order No. 2403115):
Left-alignable Ethernet interface

– AXC F XT IB (Order Number 2403018):
Left-alignable INTERBUS master for the connection of up to 255 INTERBUS remote bus devices

6.8.1 AXC F XT IB INTERBUS master

To add the AXC F XT IB INTERBUS master to your bus configuration, proceed as follows:

Selecting the AXC F XT IB INTERBUS master

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

The controller editor group opens.

- Select the “Settings” editor.
- Select the “Hardware Extensions” view.
- From the “Interbus” drop-down list, select “AXC F XT IB (2403018)”.

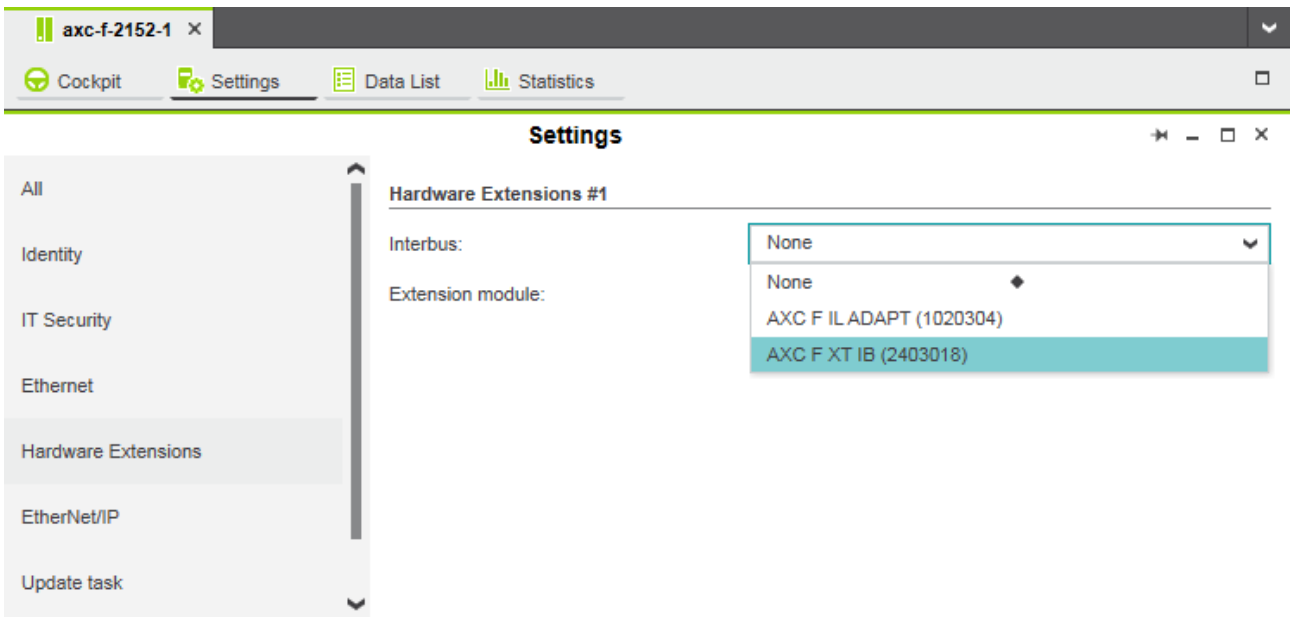


Figure 6-17 “Hardware Extensions”, “Interbus”, “AXC F XT IB (2403018)” setting

The “AXC F IL ADAPT / AXC F XT IB (x)” node is now displayed in the “PLANT” area.

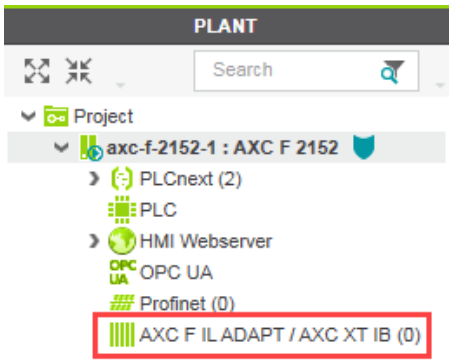


Figure 6-18 “AXC F IL ADAPT / AXC F XT IB (x)” node in the “PLANT” area

Adding the “Interbus physical” library

To use the INTERBUS master, you need to insert the “Interbus physical” library within the “COMPONENTS” area:

- In the “COMPONENTS” area, open the “Libraries (x)” section.
- Right-click on “Libraries (x)”.
- From the context menu, select “Add Library...”.

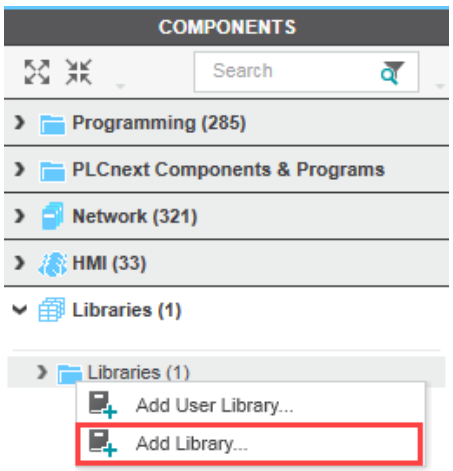


Figure 6-19 Context menu, “Add Library...”

- In the file explorer that opens, select the “Interbus physical” library.
- Click on the “Open” button.

The “Interbus physical” library is now displayed in the “Libraries (x)” section in the “COMPONENTS” area.

Adding the “IB 256” module

Once you have inserted the “Interbus physical” library, you need to add the “IB 256” module to the bus configuration. The “IB 256” module is required for INTERBUS startup.

To add the “IB 256” module, proceed as follows:

- Double-click on the “AXC F IL ADAPT / AXC F XT IB (x)” node in the “PLANT” area.

The “/ AXC F IL ADAPT / AXC F XT IB” controller editor group opens.

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

The role picker opens.

- Select the “IB 256” module in the role picker.

The “IB 256” module is added and mapped under the “AXC F IL ADAPT / AXC F XT IB (x)” node in the “PLANT” area.

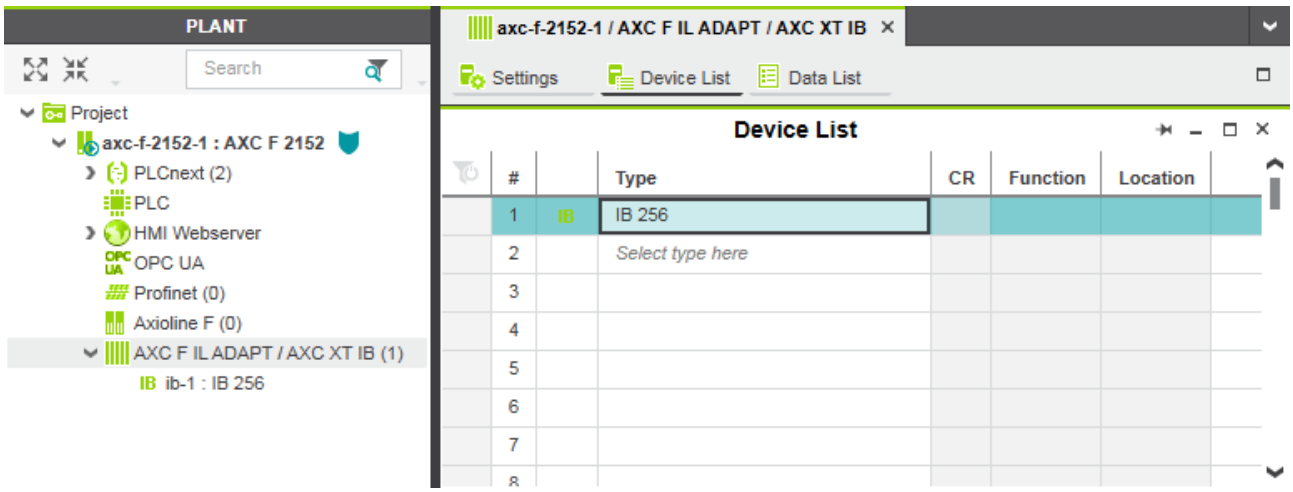


Figure 6-20 ”IB 256” module in the “PLANT” area and in the Device List

Once you have added the “IB 256” module to the bus configuration, you can start up INTERBUS. INTERBUS startup is performed using the IB_CONTROL_NEXT function block and structured text (ST) programming language.

Information on INTERBUS startup can be found in the “INTERBUS startup with the AXC F XT IB left-alignable Axioline F extension module in PLCnext Engineer” application note.
The application note can be downloaded at phoenixcontact.net/product/2404267.

6.8.2 AXC F XT ETH 1TX Ethernet interface

The controller can be extended with an additional Ethernet interface using the AXC F XT ETH 1TX left-alignable Axioline F extension module.

To extend the controller with the AXC F XT ETH 1TX Ethernet interface, proceed as follows:

Selecting the AXC F XT ETH 1TX Ethernet interface

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

The controller editor group opens.

- Select the “Settings” editor.
- Select the “Hardware Extensions” view.
- From the “Extension module” drop-down list, select “AXC F XT ETH 1TX (2403115)”.

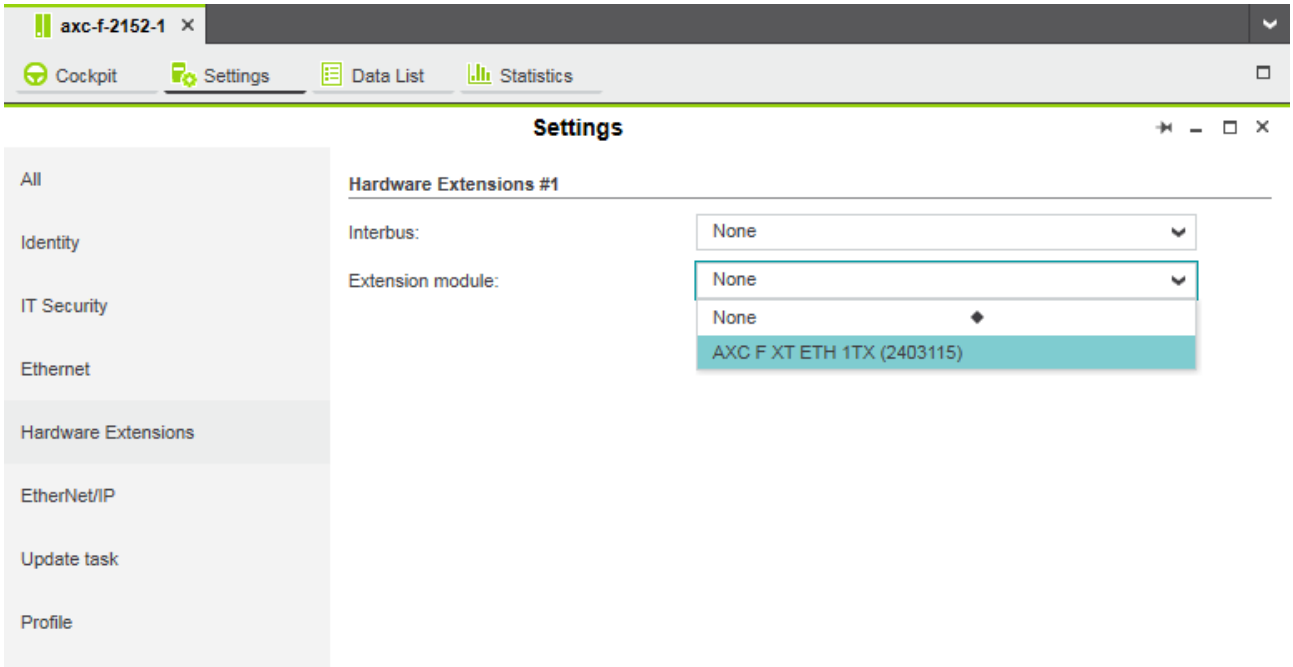


Figure 6-21 “Hardware Extensions”, “Extension module”, “AXC F XT ETH 1TX (2403115)” setting

Please note:
When you use the AXC F XT ETH 1TX left-alignable Ethernet interface, the AXC F XT ETH 1TX Ethernet interface automatically takes over the PROFINET controller functionality. The AXC F 2152 is always a PROFINET device in this case.

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 the project.

Please note:
The IP address range must differ from the IP address range that was originally set (see Section 6.4.1).

Setting the IP address

Once you have selected the AXC F XT ETH 1TX Ethernet interface as a hardware extension, you need to set the IP address of the Ethernet interface.

- Select the “Ethernet” view.

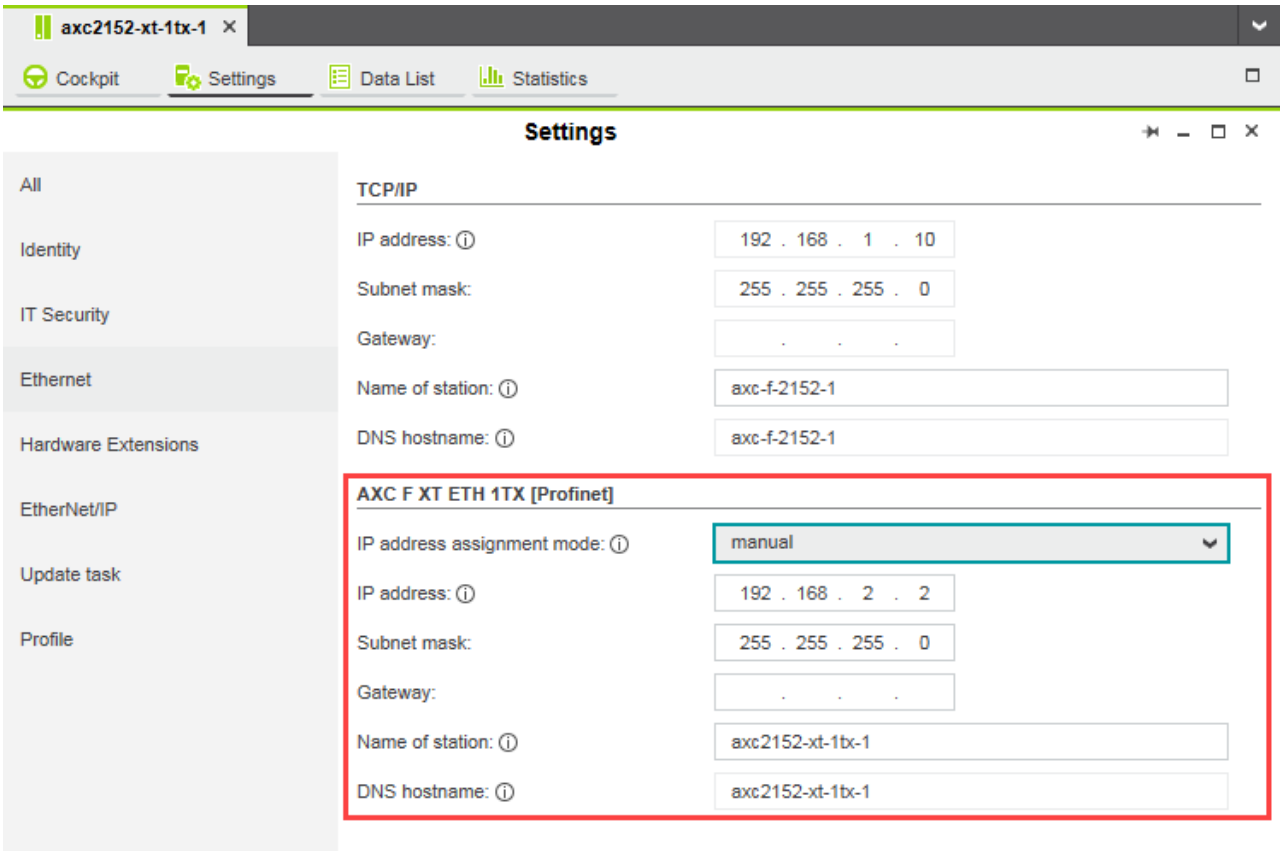


Figure 6-22 Setting the IP address of the AXC F XT ETH 1TX Ethernet interface

The IP address of the AXC F XT ETH 1TX Ethernet interface can be set automatically or manually.
The IP address is assigned to the Ethernet interface when you have connected PLCnext Engineer to the controller, see Section 6.5.

Setting the IP address automatically

- In the “AXC F XT ETH 1TX [Profinet]” area, select “automatic” from the “IP address assignment mode” drop-down list.

PLCnext Engineer automatically assigns an IP address to the Ethernet interface from the set IP address range (see Section 6.4.1, “Setting the IP address range”) as soon as a connection is established to the controller (see Section 6.5).

Setting the IP address manually

- In the “AXC F XT ETH 1TX [Profinet]” area, select “manual” from the “IP address assignment mode” drop-down list.
- Enter the IP address, subnet mask, and gateway in the respective input fields.

PLCnext Engineer assigns the manually set IP address to the Ethernet interface as soon as a connection is established to the controller (see Section 6.5).

6.9 Configuring PROFINET devices

6.9.1 Adding PROFINET devices

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

The “/ Profinet” controller editor group opens.

- Select the “Device List” editor.

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

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

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

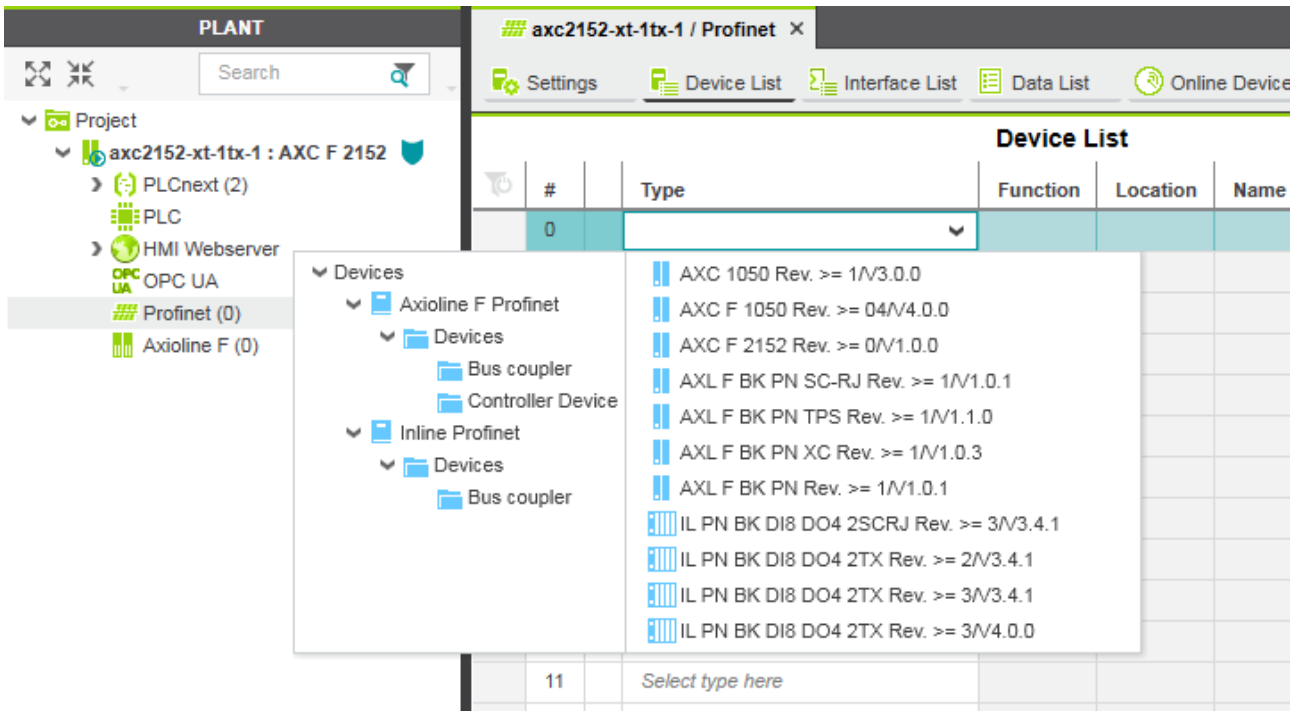


Figure 6-23 Role picker for selecting the PROFINET devices

- Select the relevant PROFINET device in the role picker.

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

- Proceed as described above to add more PROFINET devices.

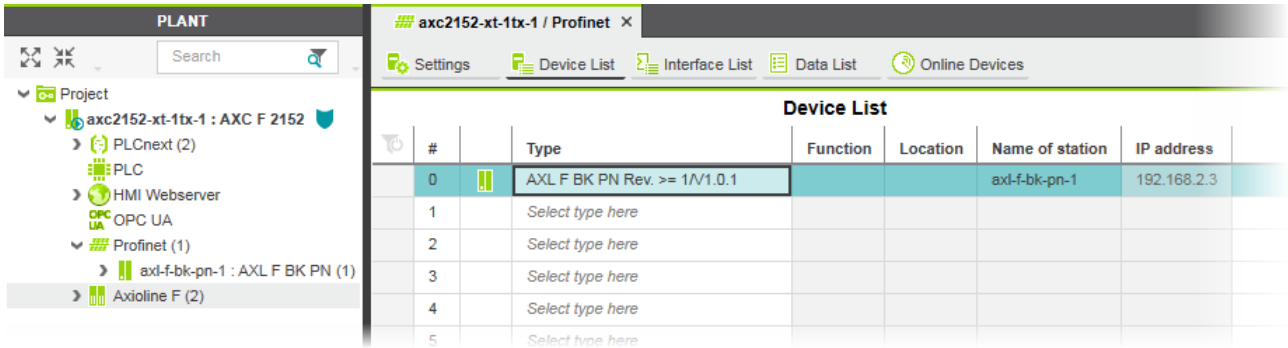


Figure 6-24 PROFINET devices in the “PLANT” area and in the Device List

6.9.2 Assigning online devices

After you add PROFINET devices to the project, you must assign each configured PROFINET device to the corresponding PROFINET device of your actual bus configuration (online device). By performing this assignment, you are giving the PROFINET devices their IP settings and their PROFINET device names. To do this, proceed as follows:

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

The “/ Profinet” controller editor group opens.

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

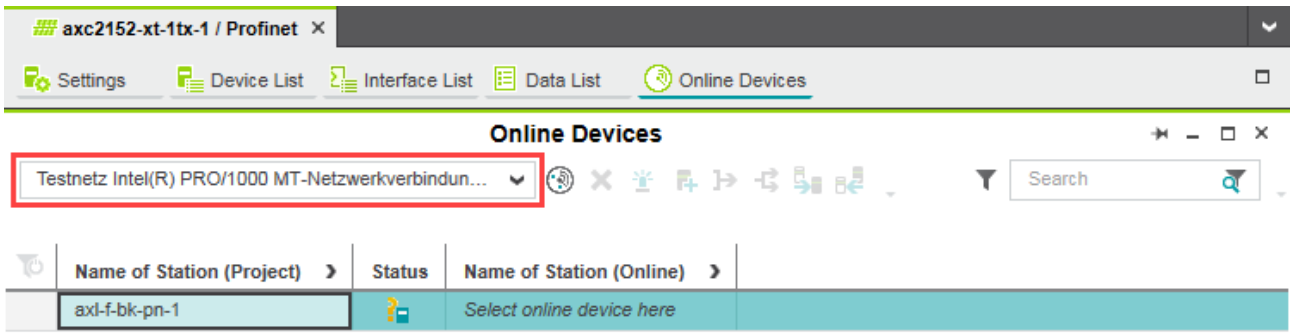


Figure 6-25 Selecting the network card

- 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 (online devices) under “Name of Station (Online)”.

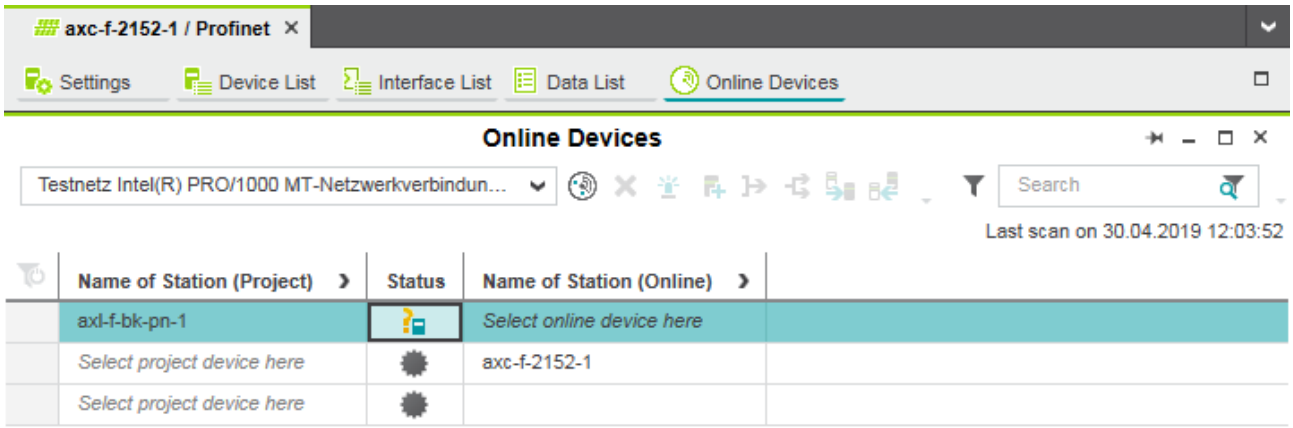


Figure 6-26 Assigning online devices

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

Please note:

The PROFINET device does not have an IP address in the delivery state.

- When starting up the PROFINET device for the first time, choose the device under “Name of Station (Online)”.

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

If you select the device (“Select project device here”) under “Name of Station (Project)”, 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. The ✔ icon in the “Status” column indicates that assignment was successful.

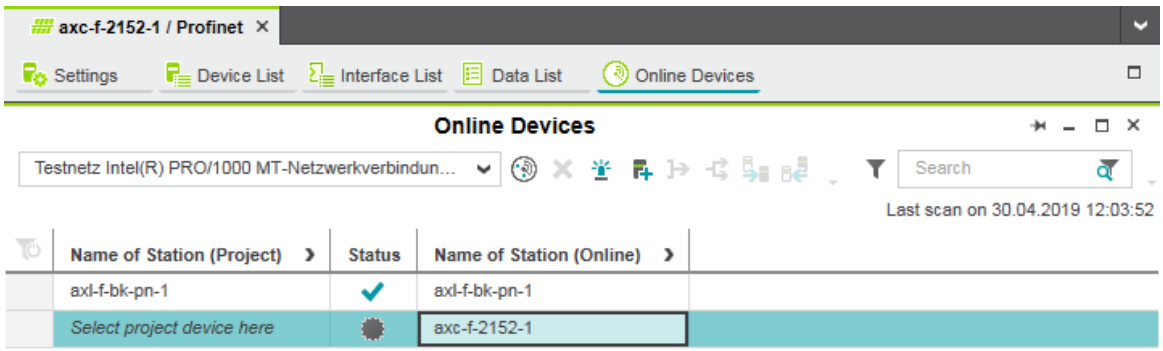


Figure 6-27 Successful assignment of the configured PROFINET device to an online device

6.9.3 Adding I/O modules

Once you have added all the PROFINET devices from your bus configuration to the project, you can add the I/O modules connected to the PROFINET device. There are two ways to add I/O modules. You can add I/O modules manually or have them read in automatically.

Adding I/O modules manually

To add I/O modules manually, proceed as follows:

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

The editor group for 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 of the “Module List” editor.

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

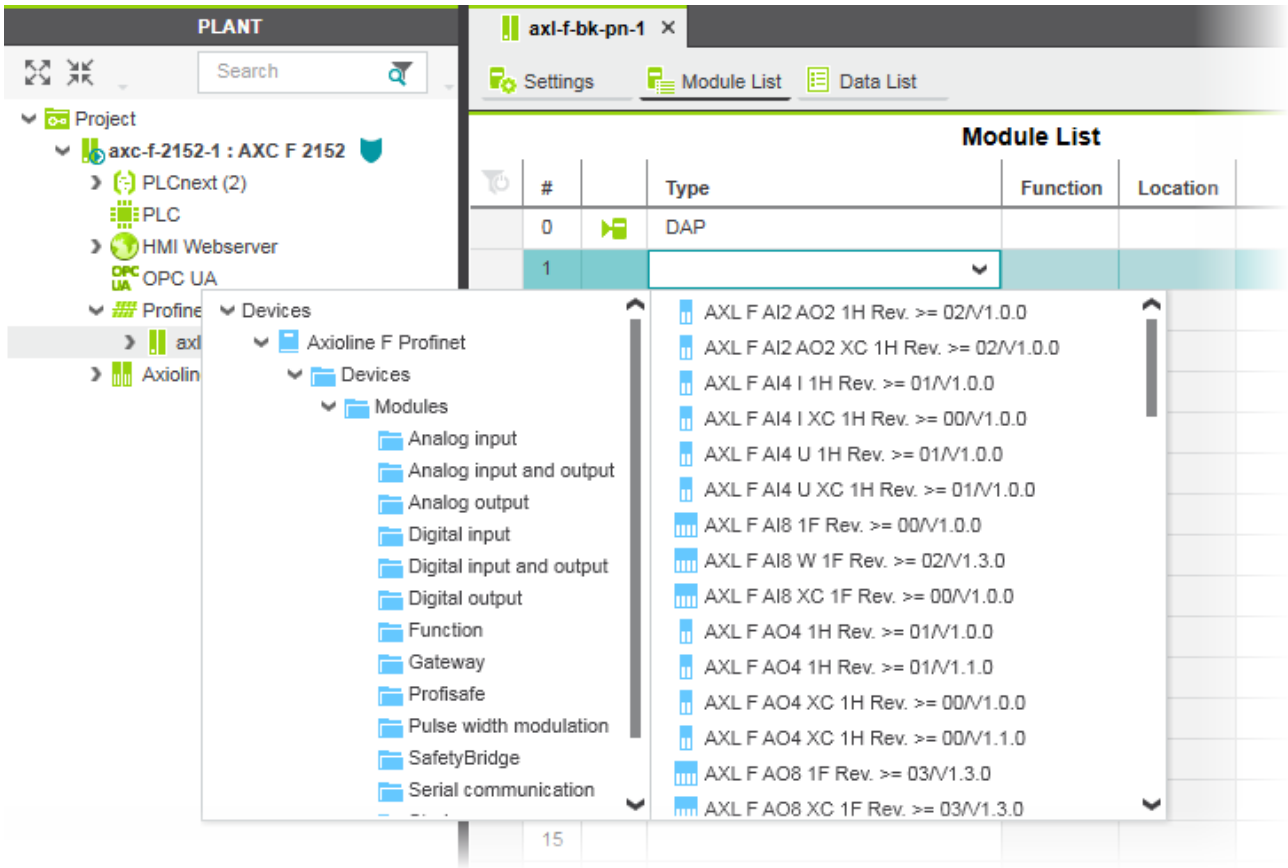


Figure 6-28 Role picker for selecting the I/O modules

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

The I/O module is added and shown in the “PLANT” area under the “Profinet (x)” node for the respective PROFINET device (see Figure 6-29).

- Proceed as described above to add more I/O modules.

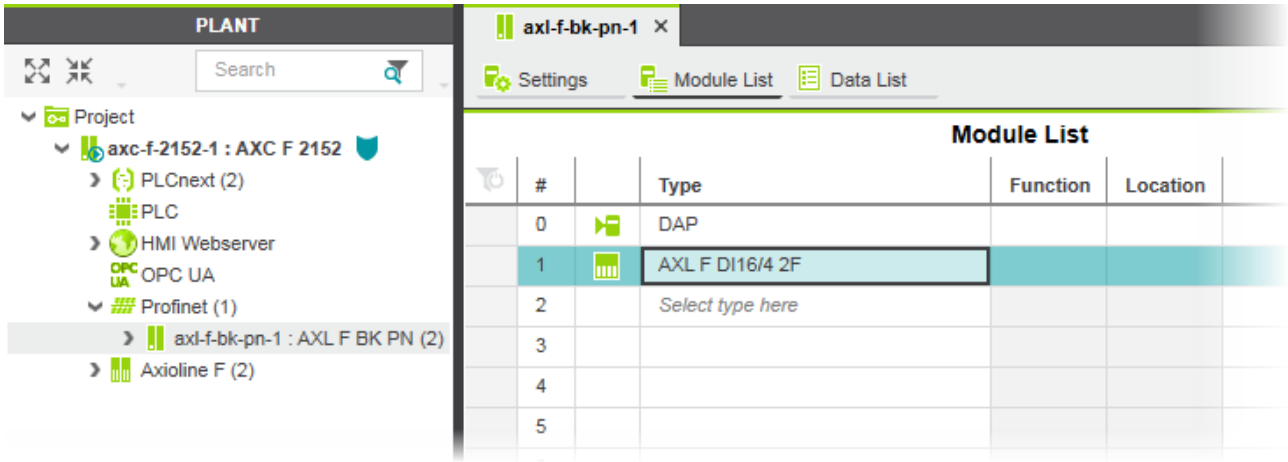


Figure 6-29 I/O modules of a PROFINET device in the “PLANT” area and in the module list

Reading in I/O modules automatically

The following requirements must be satisfied before you can read in the I/O modules of a PROFINET device automatically:

– The controller has valid IP settings (see Section 6.4).
– The PROFINET device has valid IP settings and is connected to PLCnext Engineer (see Section 6.9.2).

To read in the I/O modules of a PROFINET device automatically, proceed as follows:

- Under the “Profinet” node in the “PLANT” area, right-click on the PROFINET device whose I/O modules you wish to read in.
- Select “Read Profinet modules” in the context menu.

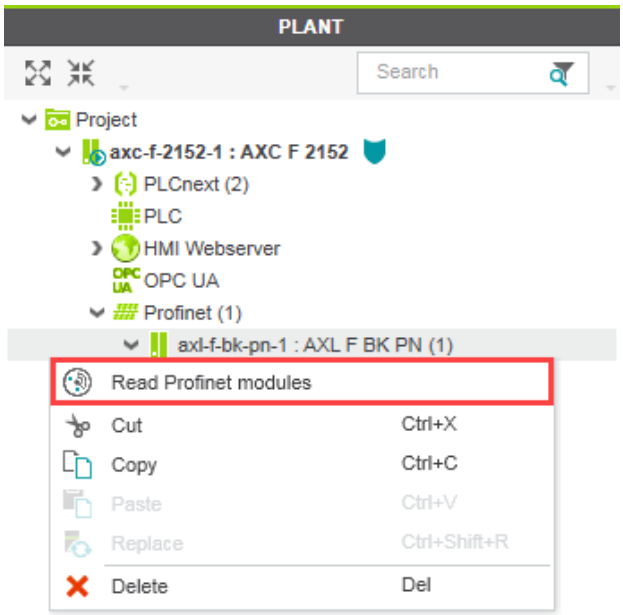


Figure 6-30 Reading in I/O modules of a PROFINET device automatically

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

6.10 Programming in accordance with IEC 61131-3

Please note:
Programming with C++ or MATLAB® Simulink® is not described in this user manual.
Detailed information on programming 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.

6.10.1 Opening and creating the POU, creating variables

If you have created the project with the project template for an empty AXC F 2152 project, a Program Organization Unit (POU) with the name “Main” is created automatically in the “COMPONENTS” area under “Programming (x), Local (x), Programs (x)”.

Opening the POU

To open a POU, proceed as follows:

- In the “COMPONENTS” area, open the “Programming (x), Local (x), Programs (x)” section.
- Double-click on the desired POU, for example “Moving_Light_Prog”.

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

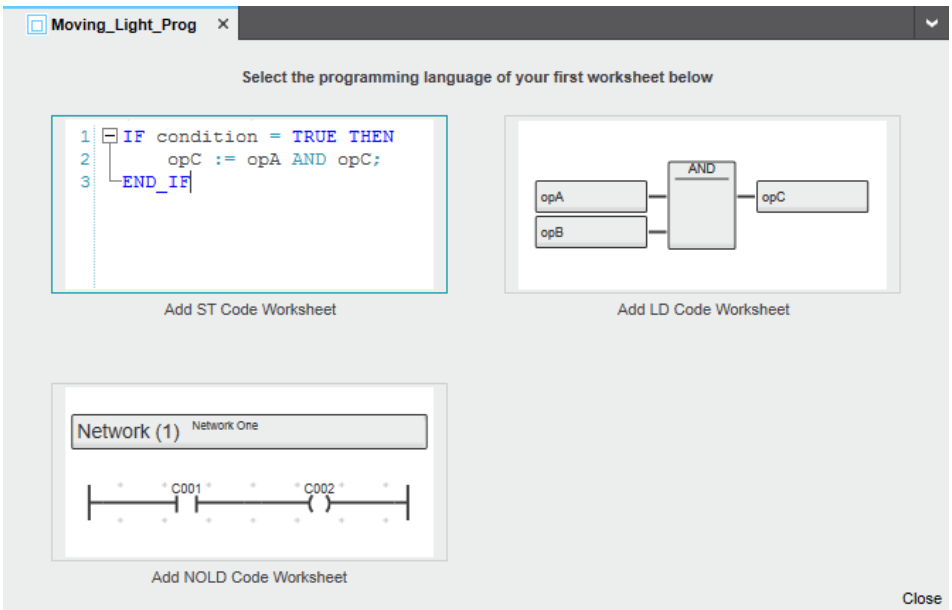


Figure 6-31 Selecting the programming language for the first worksheet

- Click on the desired programming language.

Creating a new POU

To create a new POU, proceed as follows:

- In the “COMPONENTS” area, open the “Programming (x), Local (x), Programs (x)” section.
- Right-click on “Programs (x)”.
- In the context menu, select “Add Program”.

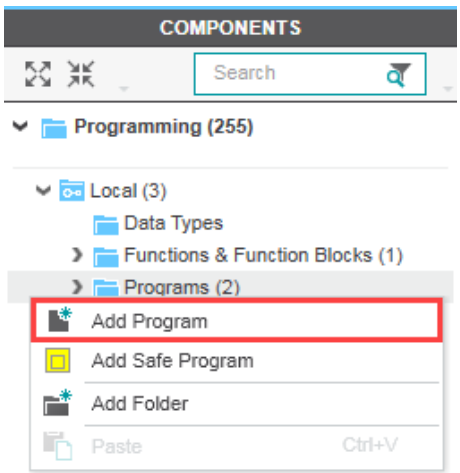


Figure 6-32 “Add Program” in the context menu

The newly created POU is inserted in the “Programming (x), Local (x), Programs (x)” section in the “COMPONENTS” area.

- Right-click to open the context menu for the newly created POU.
- Select “Rename”.
- Enter a unique and meaningful name.

The name must not contain any spaces.

- Press the “Enter” key to apply the entry.
- Double-click on the desired POU to open the editor group for the POU.

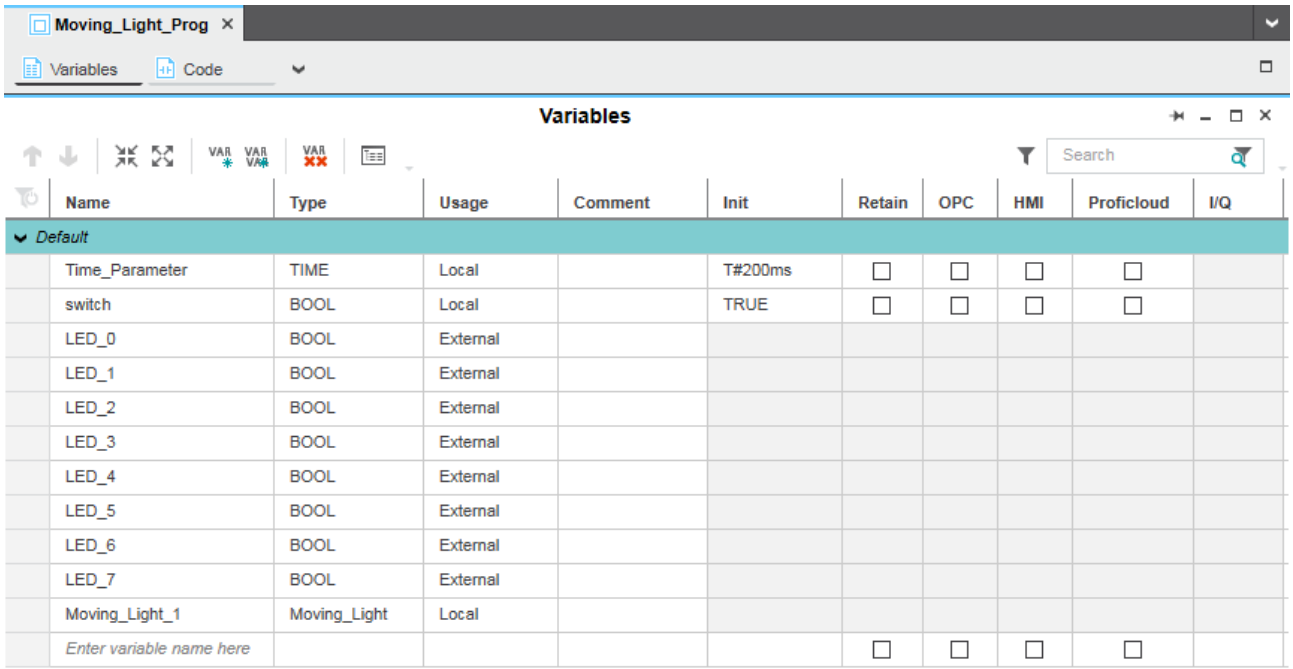
You are prompted to select the programming language for the first worksheet of the POU.

- Click on the desired programming language.

The editor group for the POU opens. You can now create the necessary variables.

Creating variables

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



Name	Type	Usage	Comment	Init	Retain	OPC	HMI	Proficloud	I/Q
Default									
Time_Parameter	TIME	Local		T#200ms	☐	☐	☐	☐	
switch	BOOL	Local		TRUE	☐	☐	☐	☐	
LED_0	BOOL	External							
LED_1	BOOL	External							
LED_2	BOOL	External							
LED_3	BOOL	External							
LED_4	BOOL	External							
LED_5	BOOL	External							
LED_6	BOOL	External							
LED_7	BOOL	External							
Moving_Light_1	Moving_Light	Local							
Enter variable name here					☐	☐	☐	☐	

Figure 6-33 Creating variables for a POU (“Moving_Light_Prog” in the example for the POU)

Once you have created all of the necessary variables, create the program for the selected POU, see Section 6.10.2.

6.10.2 Creating a program

Creating a program

To create a program, proceed as follows:

- Select the program editor.

The program editor is referred to as “Code” by default. You can change the designation of the program editor as desired.

- Create the program.

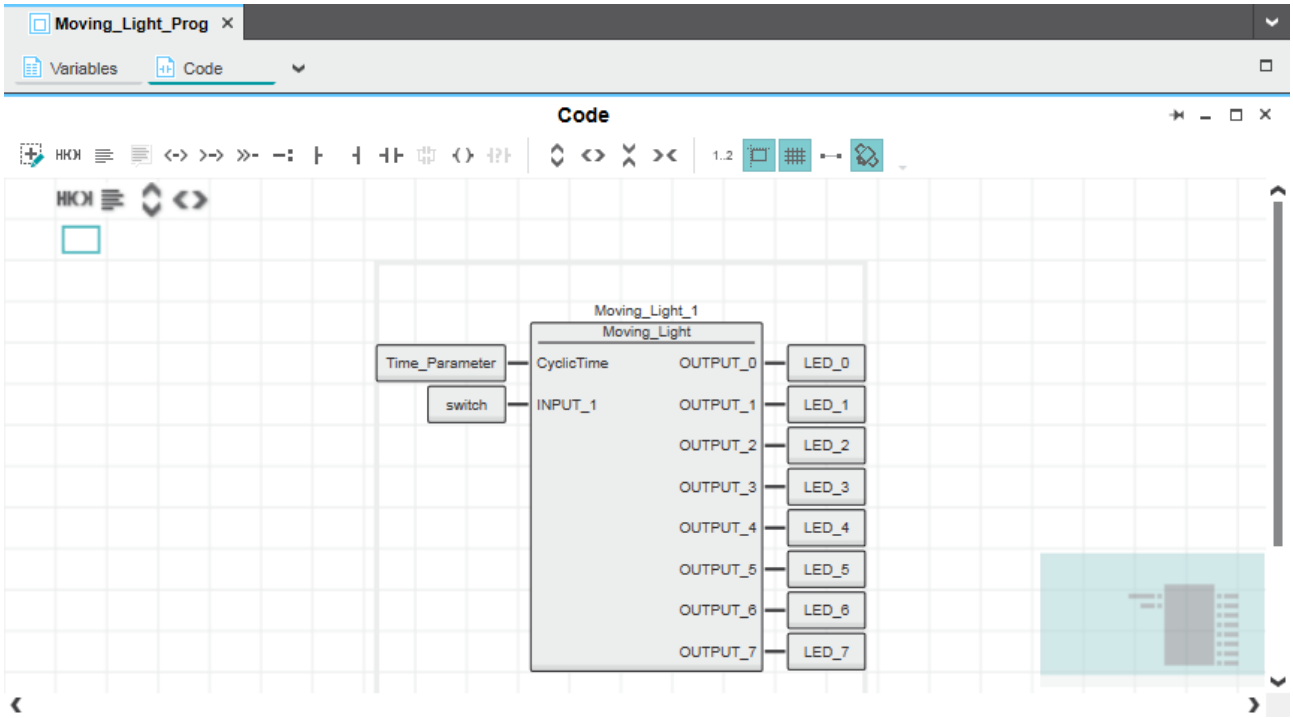


Figure 6-34 Example program in FBD

Adding worksheets

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

To add additional worksheets to a POU, proceed as follows:

- Select a worksheet in the program editor (in Figure 6-35: “Code” editor).
- Click on the arrow on the right next to the designation of the program editor.
- From the drop-down list that opens, select the desired code worksheet.

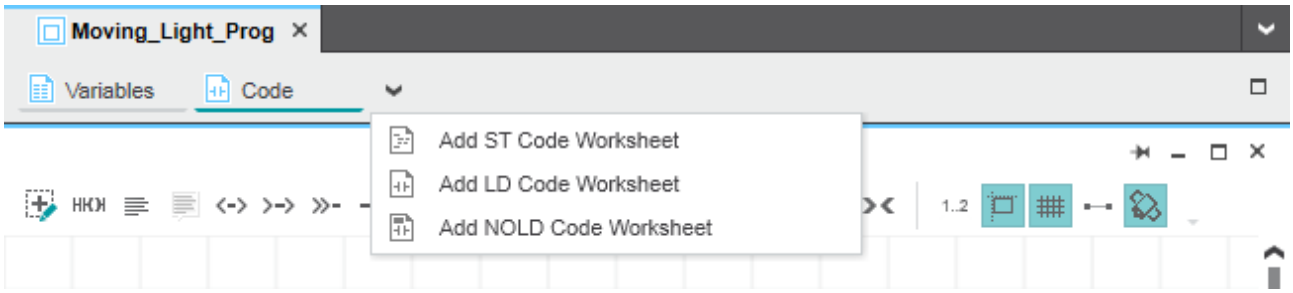


Figure 6-35 Adding a code worksheet to a POU

6.10.3 Creating functions and function blocks

Creating a function or function block

To create your own functions and function blocks, proceed as follows:

- In the “COMPONENTS” area, open the “Programming (x), Local (x), Functions & Function Blocks (x)” section.
- Right-click on “Functions & Function Blocks (x)”.
- In the context menu, select the appropriate entry for the new function or function block to be created.

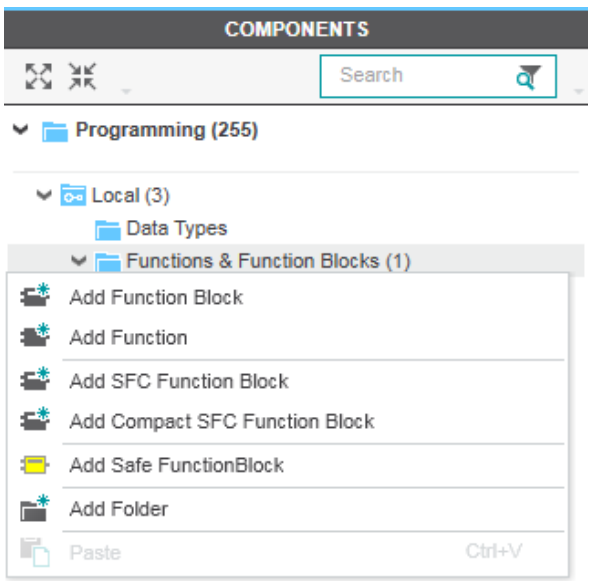


Figure 6-36 Context menu for adding a function or function block

The newly created function or function block is inserted in the “Programming (x), Local (x), Functions & Function Blocks (x)” section in the “COMPONENTS” area.

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

The name must not contain any spaces.

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

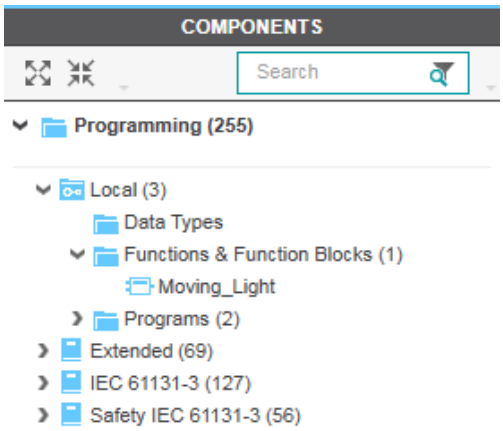


Figure 6-37 Newly created function block in the “COMPONENTS” area

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

Selecting the programming language for the first worksheet

- In the “COMPONENTS” area, open the “Programming (x), Local (x), Functions & Function Blocks (x)” section.
- Double-click on the function or function block.

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

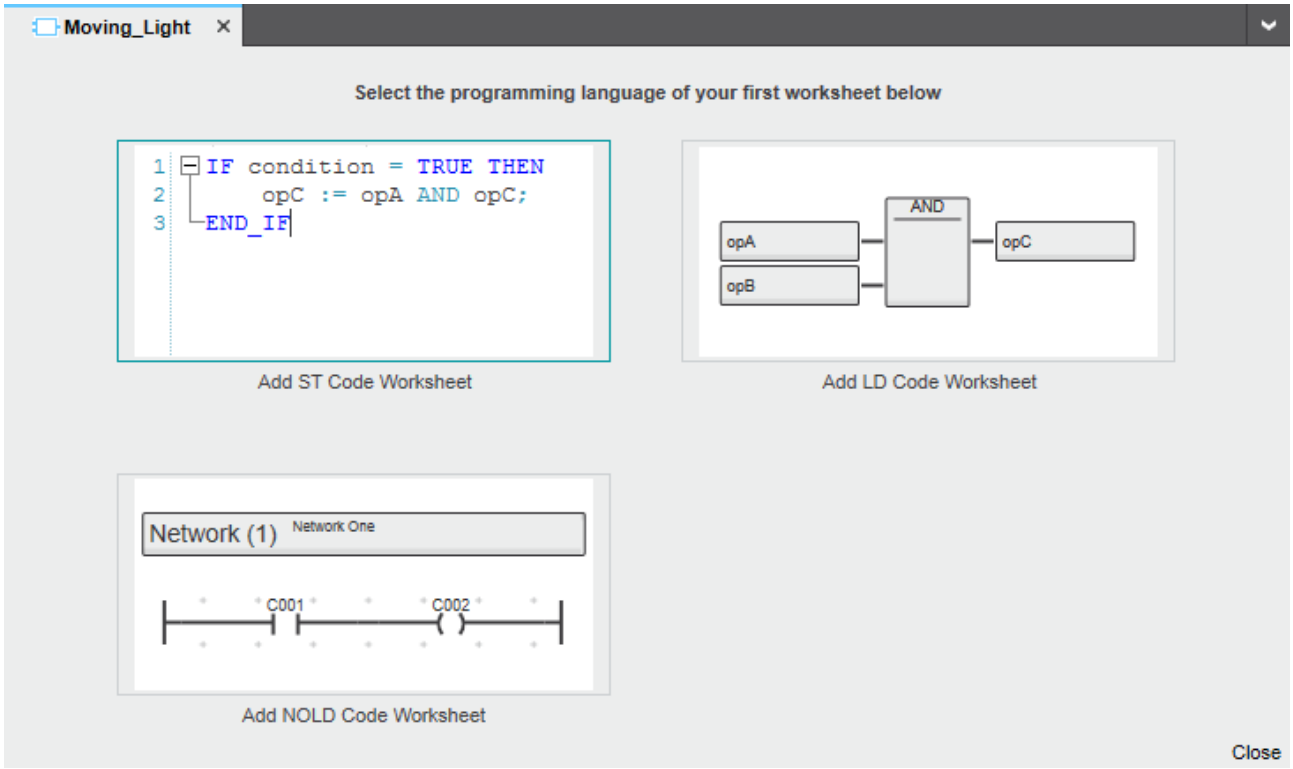


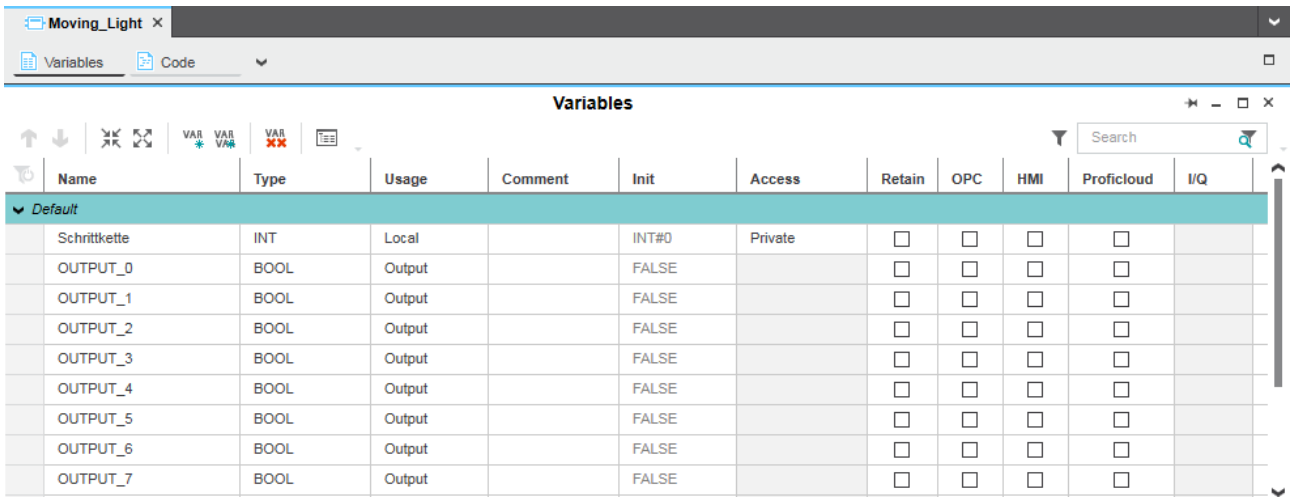
Figure 6-38 Selecting the programming language for the first worksheet

- 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 “Variables” editor.
- Create the variables that you need to program the function or function block.



Name	Type	Usage	Comment	Init	Access	Retain	OPC	HMI	Proficloud	I/Q
Default										
Schrittkette	INT	Local		INT#0	Private	☐	☐	☐	☐	
OUTPUT_0	BOOL	Output		FALSE		☐	☐	☐	☐	
OUTPUT_1	BOOL	Output		FALSE		☐	☐	☐	☐	
OUTPUT_2	BOOL	Output		FALSE		☐	☐	☐	☐	
OUTPUT_3	BOOL	Output		FALSE		☐	☐	☐	☐	
OUTPUT_4	BOOL	Output		FALSE		☐	☐	☐	☐	
OUTPUT_5	BOOL	Output		FALSE		☐	☐	☐	☐	
OUTPUT_6	BOOL	Output		FALSE		☐	☐	☐	☐	
OUTPUT_7	BOOL	Output		FALSE		☐	☐	☐	☐	

Figure 6-39 Creating variables for a function block (“Moving_Light” in the example for the function block)

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

Programming logic

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

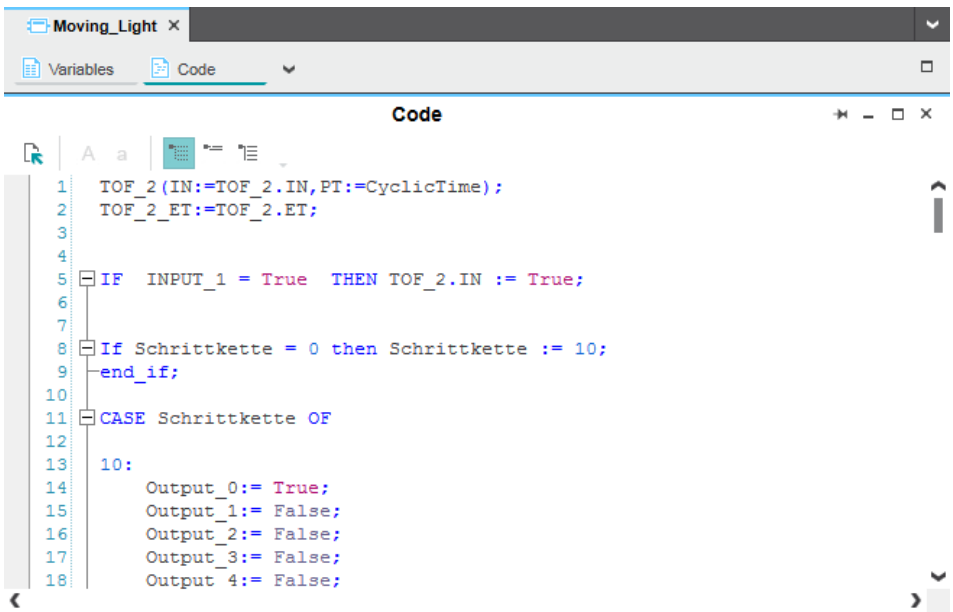


Figure 6-40 Example code for a function block

Adding worksheets

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

To add additional worksheets to a function or function block, proceed as follows:

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

6.11 Instantiating a program

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

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 a task

To create a new task, proceed as follows:

- In the “Name” column, enter a name for the new task in the “Enter task name here” input field.

The name must not contain any spaces.

- In the “Task Type” column, click in the input field.
- Select the “Task Type” from the drop-down list.
- Make all of the required settings for the task in the remaining columns.

Instantiating a program

To instantiate a program, proceed as follows:

- In the “Name” column, enter a name for the program instance under a task in the “Enter program instance name here” input field (“Program1_Moving_Light” in the example in Figure 6-41).

The name must not contain any spaces.

- Click on “Select program type here” in the “Program Type” column.
- Select the program to be instantiated from the drop-down list (“Moving_Light_Prog” in the example in Figure 6-41).

The selected program is instantiated and assigned to a task.

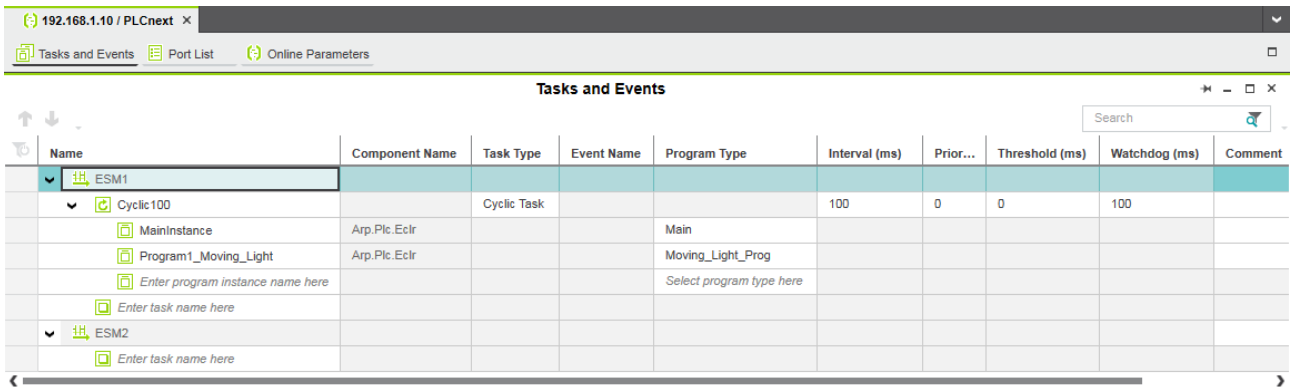


Figure 6-41 Tasks and program instances in the “Tasks and Events” editor

6.12 Assigning process data

6.12.1 For programs in accordance with IEC 61131-3 without IN and OUT ports

There are two ways to assign process data:

– You can assign a process data item to a variable.
– You can assign a variable to a process data item.

Process data is assigned in the “Data List” editor.

Assigning a process data item to a variable

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

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

The “/ PLC” controller editor group opens.

- Select the “Data List” editor.

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

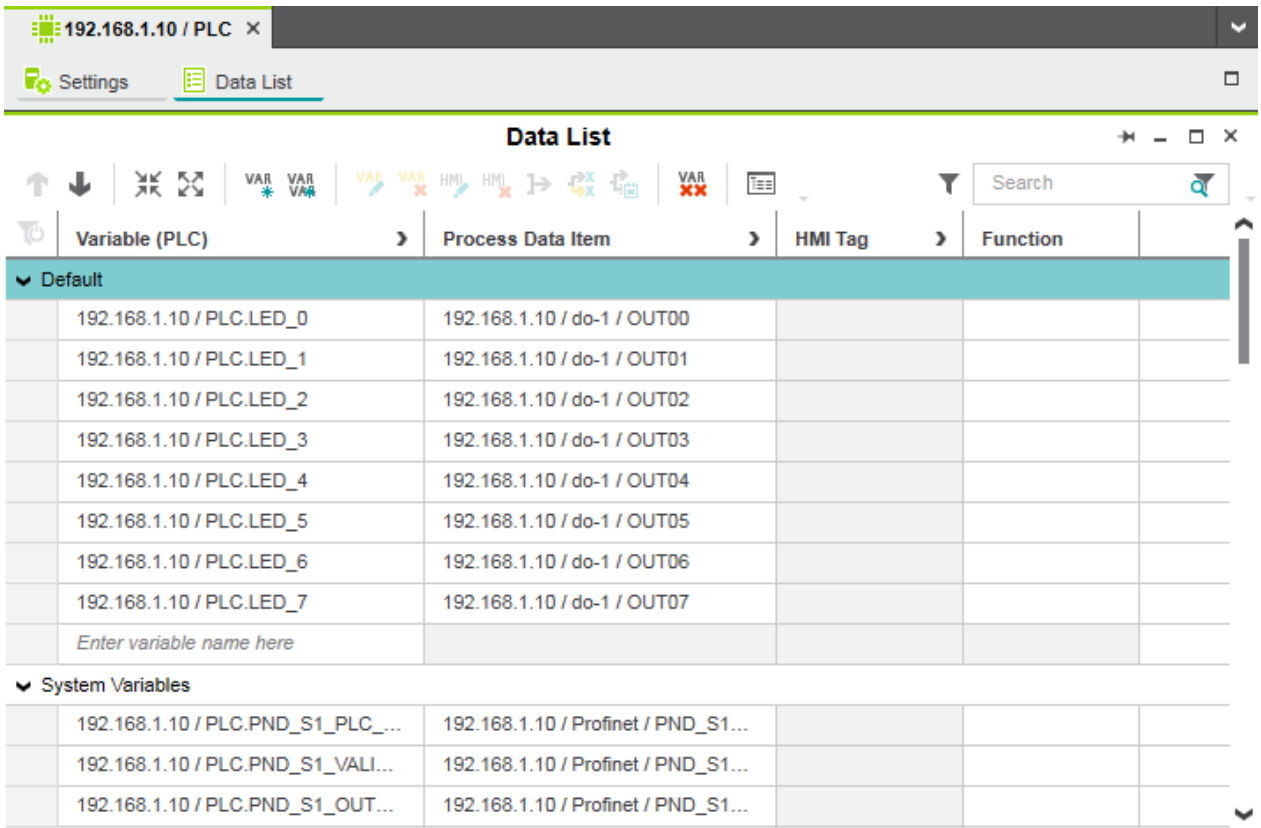


Figure 6-42 Example: overview of all available variables

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

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

The role picker opens. Only the process data items that you can actually assign to the respective variable are displayed in the role picker.

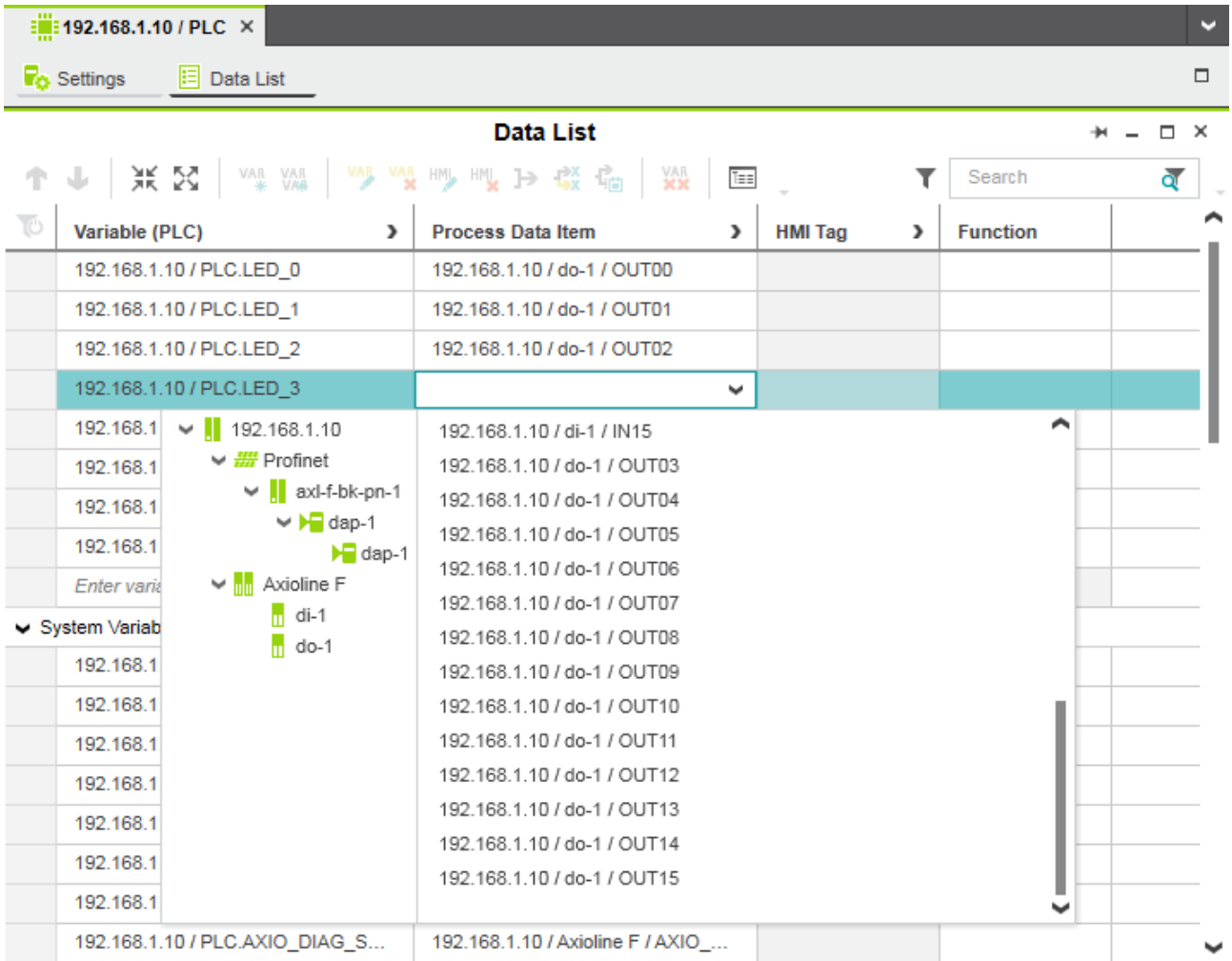


Figure 6-43 Role picker for selecting the process data items

- In the role picker, select the process data item that you want to assign to the respective variable.

The process data item is assigned to the variable.

- Proceed as described above to add more variables.

Assigning a variable to a process data item

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

- Select the “Data List” editor.

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

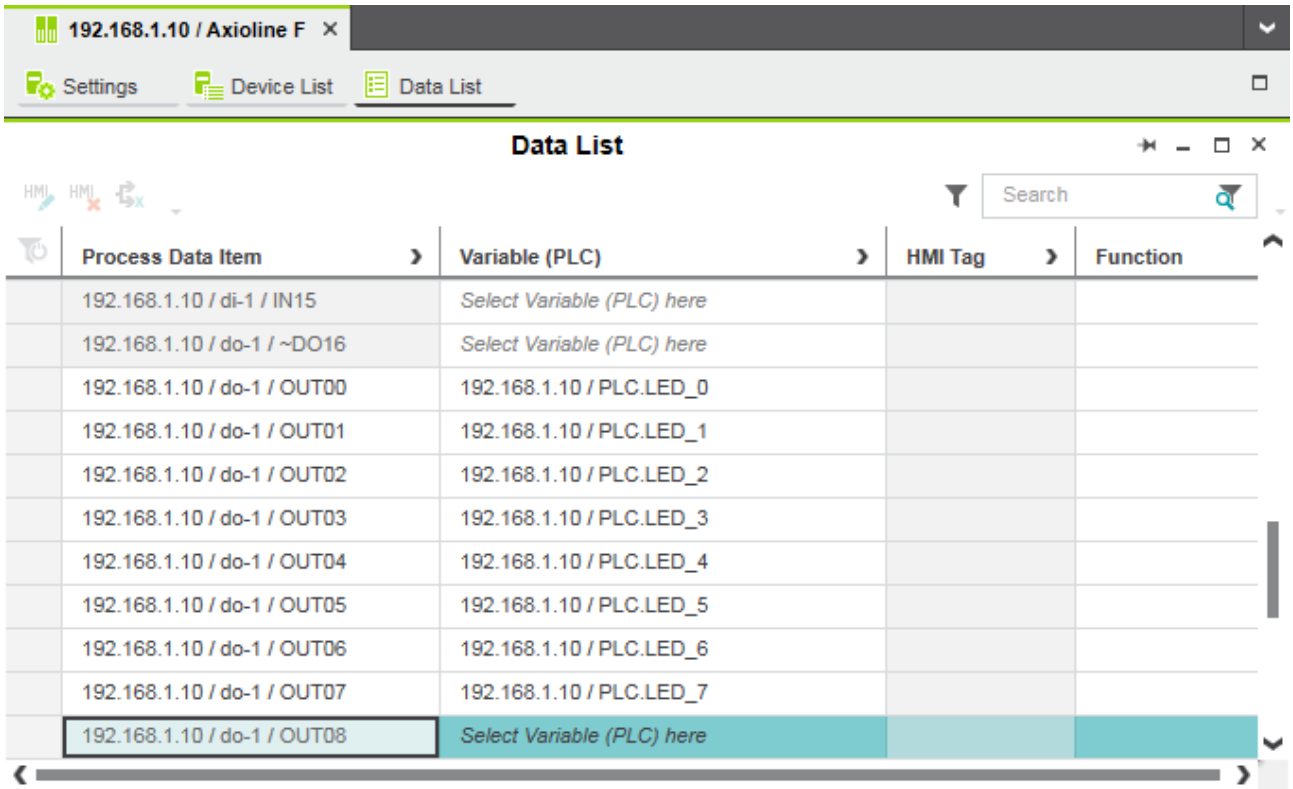


Figure 6-44 Example: overview of all available process data items

- 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 variables that you can actually assign to the respective process data item are displayed in the role picker.

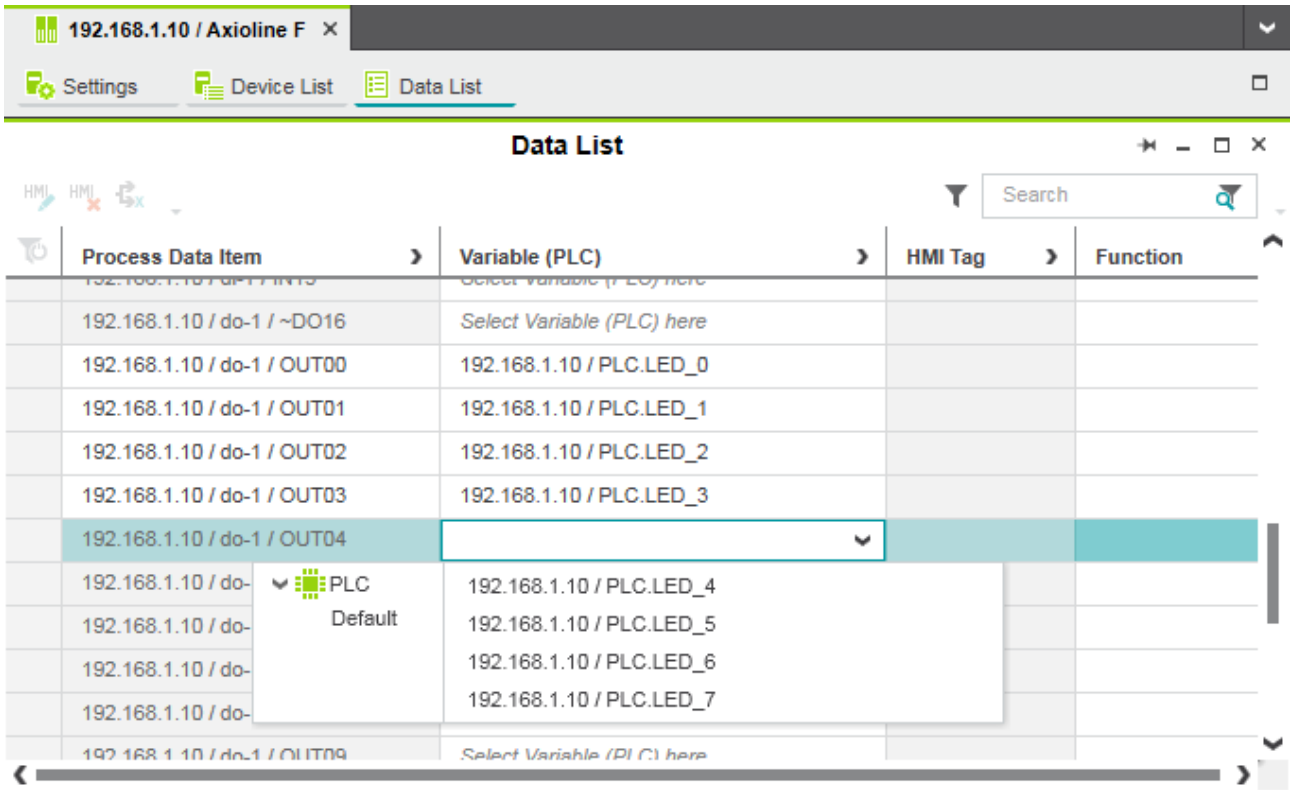


Figure 6-45 Role picker for selecting the variables

- In the role picker, select the variable that you want to assign to the respective process data item.

The variable is assigned to the process data item.

- Proceed as described above to add more process data items.

6.12.2 For programs in accordance with 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 “Port List” editor of the “PLCnext” node.

There are two ways to assign process data:

– You can assign an IN port to an OUT port.
– You can assign an OUT port to an IN port.

Opening the “Port List” editor

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

The “/ PLCnext” editor group opens.

- Select the “Port List” editor.

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

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

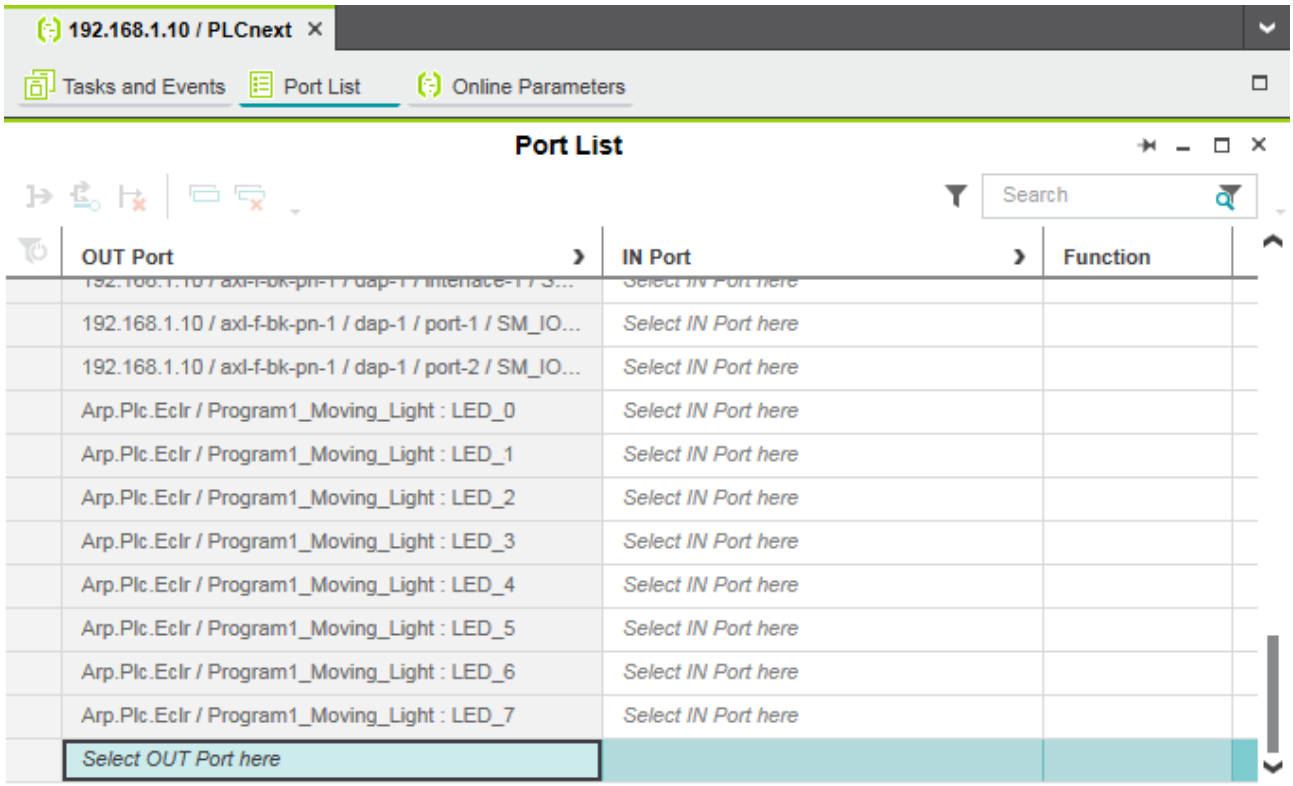


Figure 6-46 Example: overview of all available IN and OUT ports

Assigning an IN port to an OUT port

- To assign an IN port to an OUT port, click on “Select IN Port here” in the “IN Port” column.

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

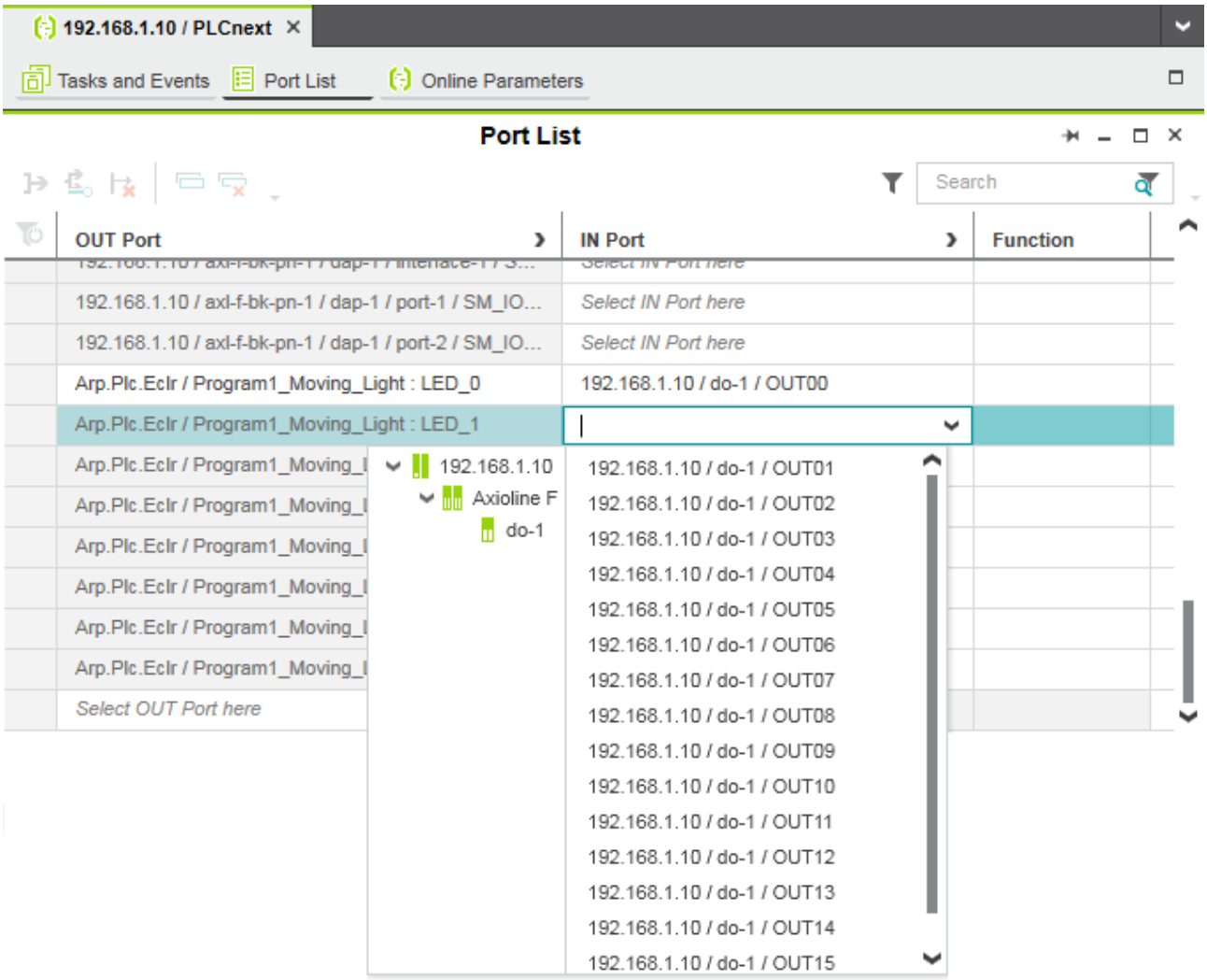


Figure 6-47 Role picker for selecting the IN ports

- Select the IN port that you want to assign to the relevant OUT port in the role picker.

The IN port is assigned to the OUT port.

- Proceed as described above to add more IN ports.

Assigning an OUT port to an IN port

- To assign an OUT port to an IN port, click on “Select OUT Port here” in the “OUT Port” column.

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

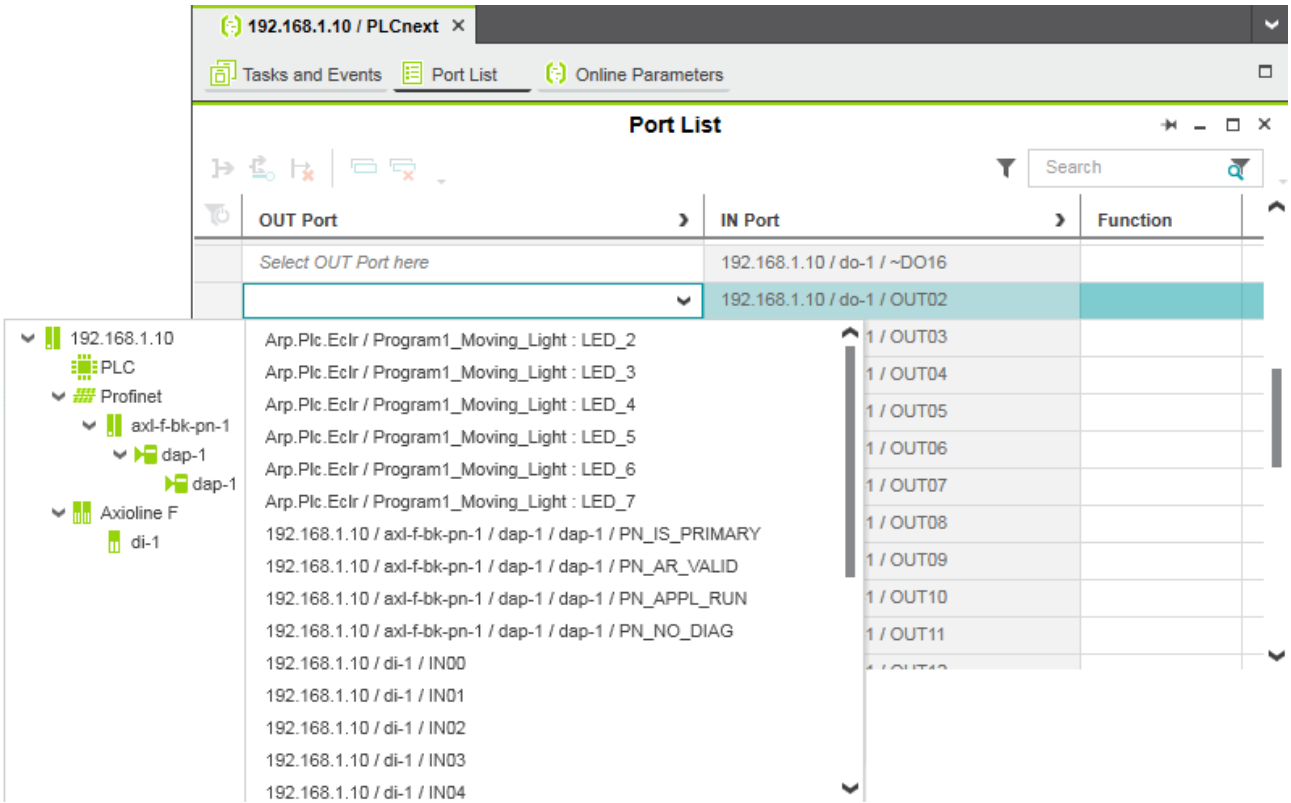


Figure 6-48 Role picker for selecting the OUT ports

- Select the OUT port that you want to assign to the relevant IN port in the role picker.

The OUT port is assigned to the IN port.

- Proceed as described above to add more OUT ports.

6.13 Specifying the refresh interval for Axioline F I/O data

You can specify a trigger task for the updating of the Axioline F I/O data. To do this, proceed as follows:

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

The “/ Axioline F” controller editor group opens.

- Select the “Settings” editor.
- Select the “Trigger task” view.
- In the drop-down list, select the task that is to trigger the Axioline F I/O data update.

Please note:

Only tasks that you previously created in the “Tasks and Events” editor are displayed in the drop-down list.

For information on creating tasks, please refer to Section 6.11.

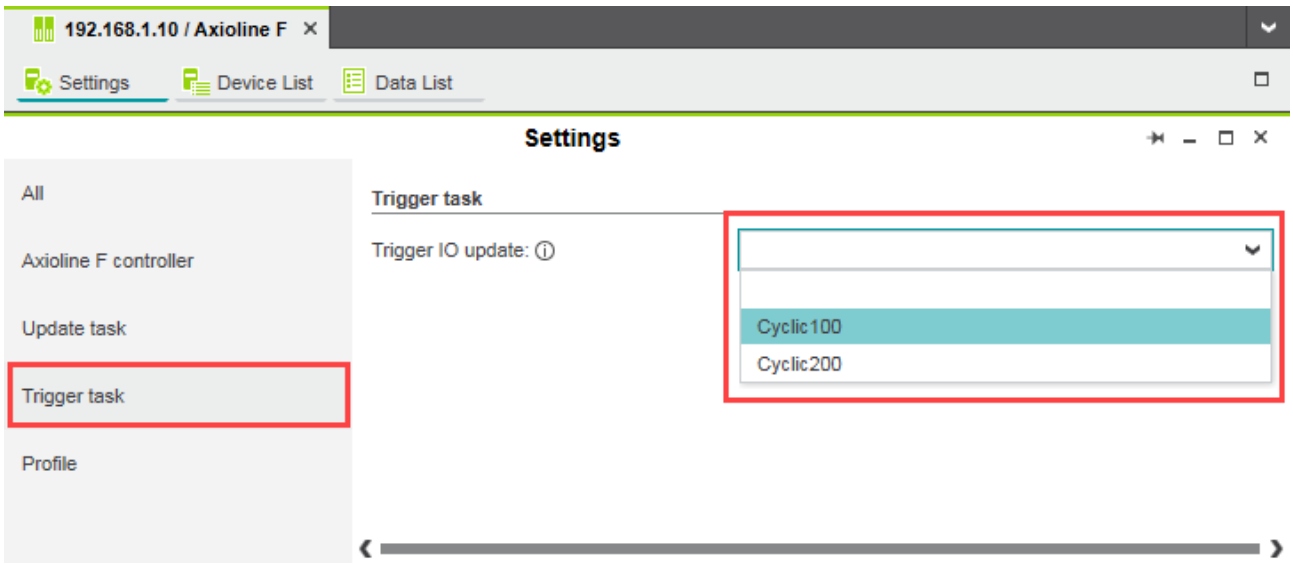


Figure 6-49 Selecting the trigger task to update the Axioline F I/O data

Please note:

If you do not select a task, the firmware automatically calculates an interval for updating the Axioline F I/O data from the interval times of all available cyclic tasks. Event or idle tasks are not taken into account for the calculation. If no cyclic task is available, the data of the Axioline F modules are updated every 500 µs.

As an alternative to a cyclic task, you can select an idle task for the updating of the Axioline F I/O data.

6.14 Transferring a 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 controller editor group 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 in order to execute 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 have the necessary authorization.

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

If you do not have the necessary authorization to execute the function, PLCnext Engineer informs you of this in a message.

For information on the User Manager and the user roles, please refer to Section 9.5.4.1.

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

Download Changes

The controller supports the “Download Changes” function. With the “Download Changes” function, program changes can be transferred to the controller during operation without interruption.
This is subject to the following conditions:

- You have not made any changes to the bus configuration.
- You have not changed the process data assignment.
- You have not changed the properties of the existing tasks (e.g., task type, interval, watchdog).
- You have not deleted any tasks or added any new tasks.
- You have not made any changes to a high-level language program.

6.15 Creating a PLCnext Engineer HMI application

In PLCnext Engineer, you can create a PLCnext Engineer HMI application, which can be used to visualize, monitor, and control the application on your controller.

For information on creating a PLCnext Engineer HMI application, refer to the “Installing and operating the PLCnext Engineer software” quick start guide and the online help for PLCnext Engineer.

7 Transferring variable values to PROFICLOUD

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

7.1 Creating variables in PLCnext Engineer as OUT ports

Variables that are to be transferred from a PLCnext Engineer project to PROFICLOUD have to be created as OUT ports in PLCnext Engineer.

To create a variable in PLCnext Engineer as an OUT port, proceed as follows:

- In the “COMPONENTS” area, open the “Programming (x), Local (x), Programs (x)” section.
- Double-click on the desired POU from which variables are to be transferred to PROFICLOUD.
- Select the “Variables” editor.
- Enter the variable name and data type.
- Select “OUT Port” in the “Usage” column.
- Enable the check box in the “Proficloud” column.

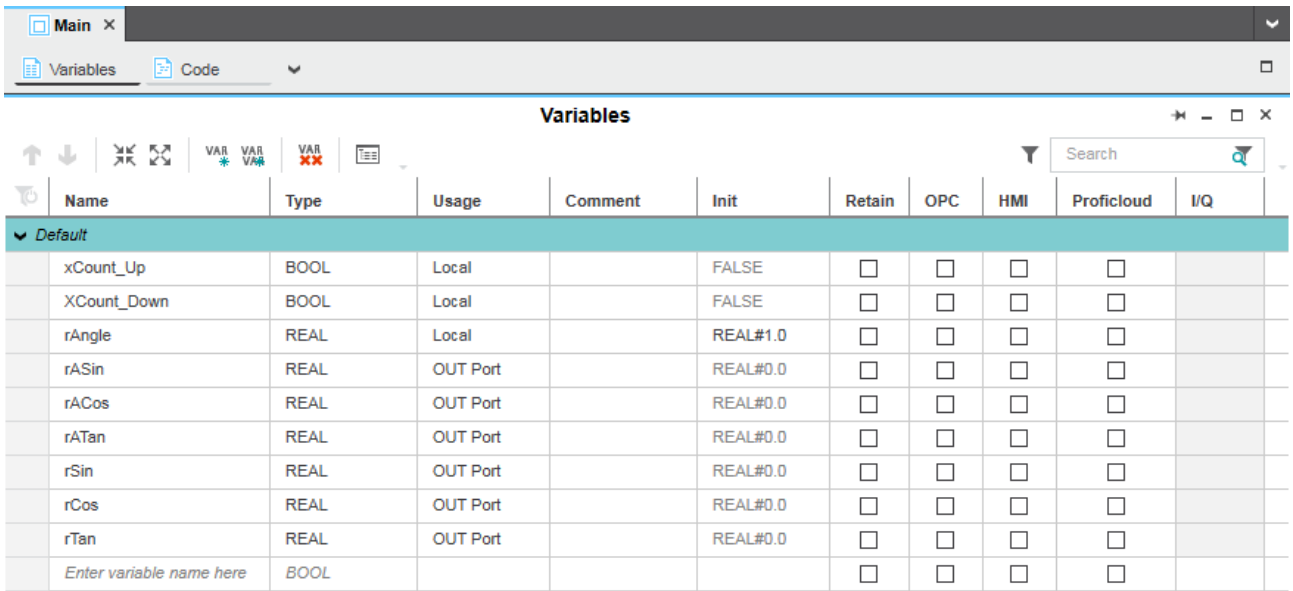


Figure 7-1 Creating variables as OUT ports

Transferring variable values from C++ programs:

If you program your C++ program using the PLCnext Technology Command Line Interface, you have to define the variables declared as OUT ports, whose values are to be transferred to PROFICLOUD, using the attributes `Output` and `Proficloud` (`//#attributes (Output|Proficloud)`).

For more detailed information on this, please refer to the “PLCnext Technology” user manual.

The user manual can be downloaded at phoenixcontact.net/product/2404267.

7.2 Configuring PROFICLOUD

Before you can transfer the metrics to PROFICLOUD, you must register the AXC F 2152 in 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 password.
- Click on the “Sign In” button to sign into PROFICLOUD.

Adding the AXC F 2152

- To add the AXC F 2152 as a PROFICLOUD device, select the “TSD Device Manager” PROFICLOUD solution.

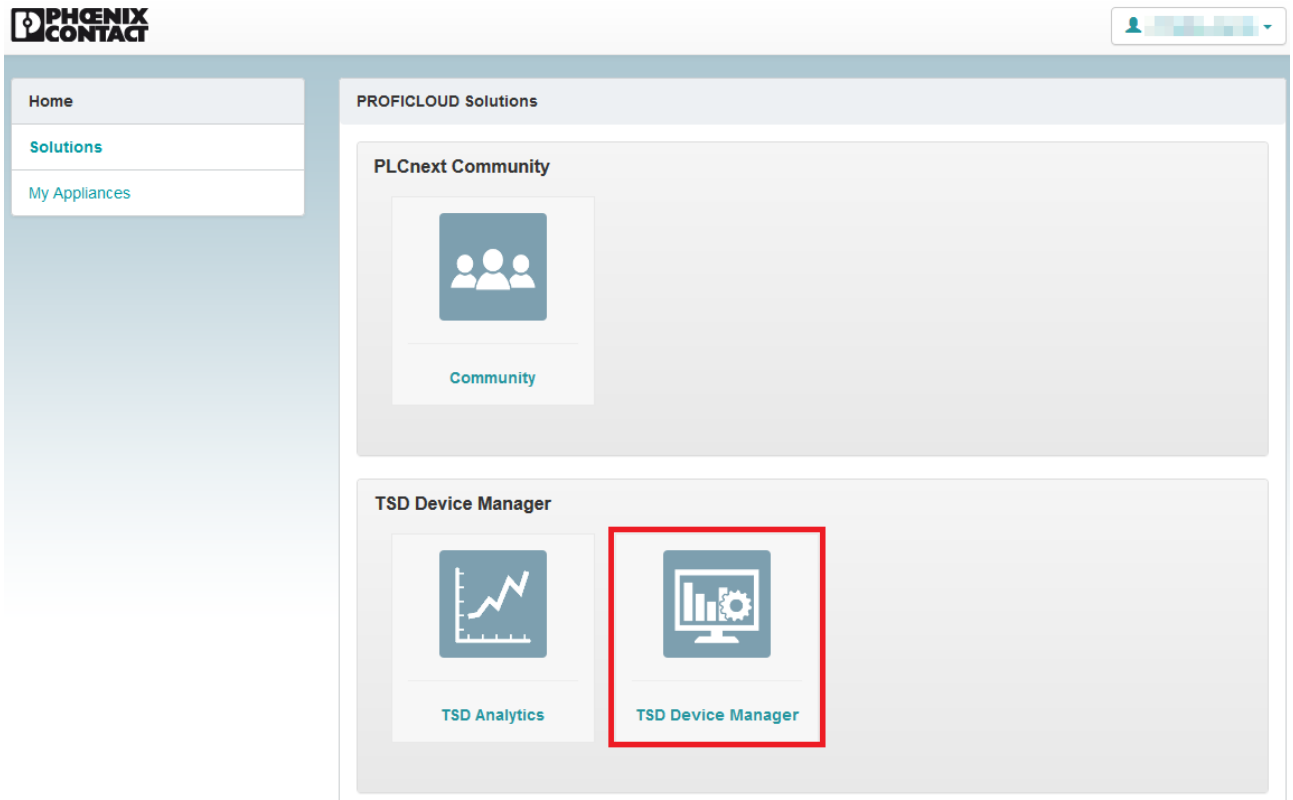


Figure 7-2 Selecting the “TSD Device Manager” PROFICLOUD solution

The “Appliances” page opens.

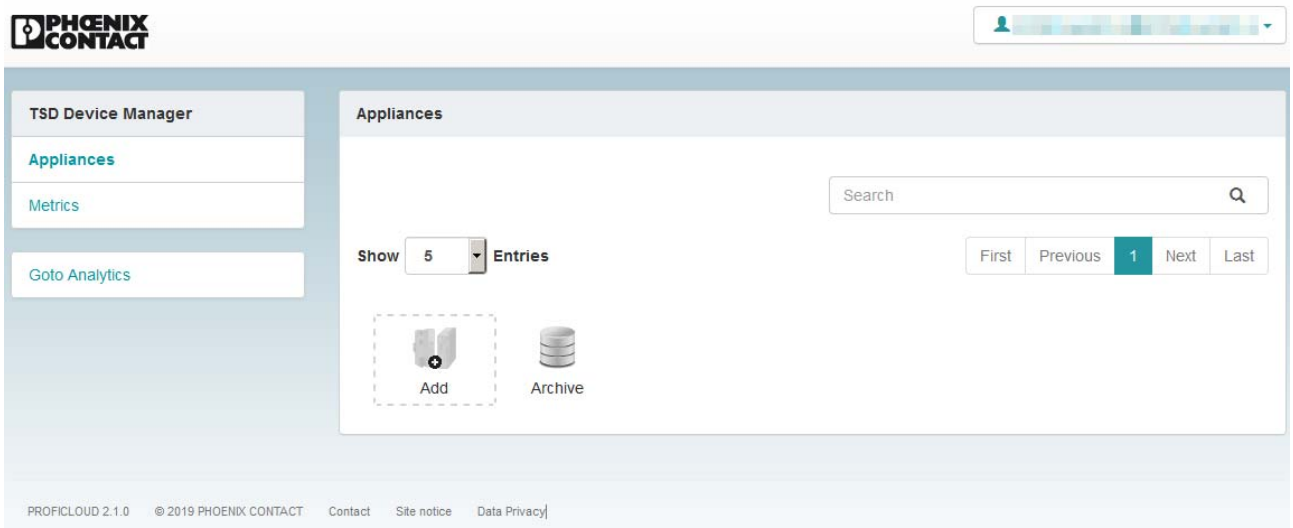


Figure 7-3 “Appliances” page

Registering the AXC F 2152

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

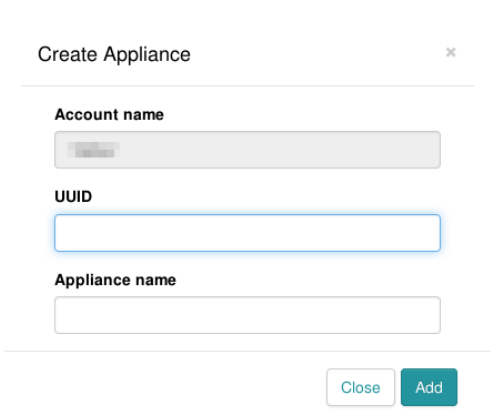


Figure 7-4 “Create Appliance” dialog

- In the “UUID” input field, enter the UUID of the AXC F 2152.

The AXC F 2152 UUID is printed on the side of the device. You will also find the UUID in WBM in the “Configuration” area on the “PROFICLOUD” page (see Section 9.5.3.1).

Alternatively, you can scan the QR code for the connection to PROFICLOUD (see **Figure 3-9**). When you do this, the controller UUID is automatically applied in the “Create Appliance” dialog.

- Enter a unique name for the AXC F 2152 in the “Appliance name” input field.
- Click on the “Add” button to save your entries.

7.3 Enabling the PROFICLOUD connection of the controller

You can enable or disable the PROFICLOUD connection of the controller as well as various PROFICLOUD services via the web-based management system of the controller.

In order to transfer variable values as metrics to PROFICLOUD, the PROFICLOUD connection of the controller and the TSD PROFICLOUD service must be enabled.

Enable the PROFICLOUD connection and the TSD PROFICLOUD service as described in Section ""PROFICLOUD" page" on page 140.

7.4 Displaying an overview of the PROFICLOUD device metrics

When the AXC F 2152 is switched on, the metrics are automatically transferred to PROFICLOUD.
To display an overview of all of the metrics of a PROFICLOUD device, proceed as follows:

- Select the “TSD Device Manager” PROFICLOUD solution.

The “Appliances” page opens.

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

The “Appliances / Device name” page opens.

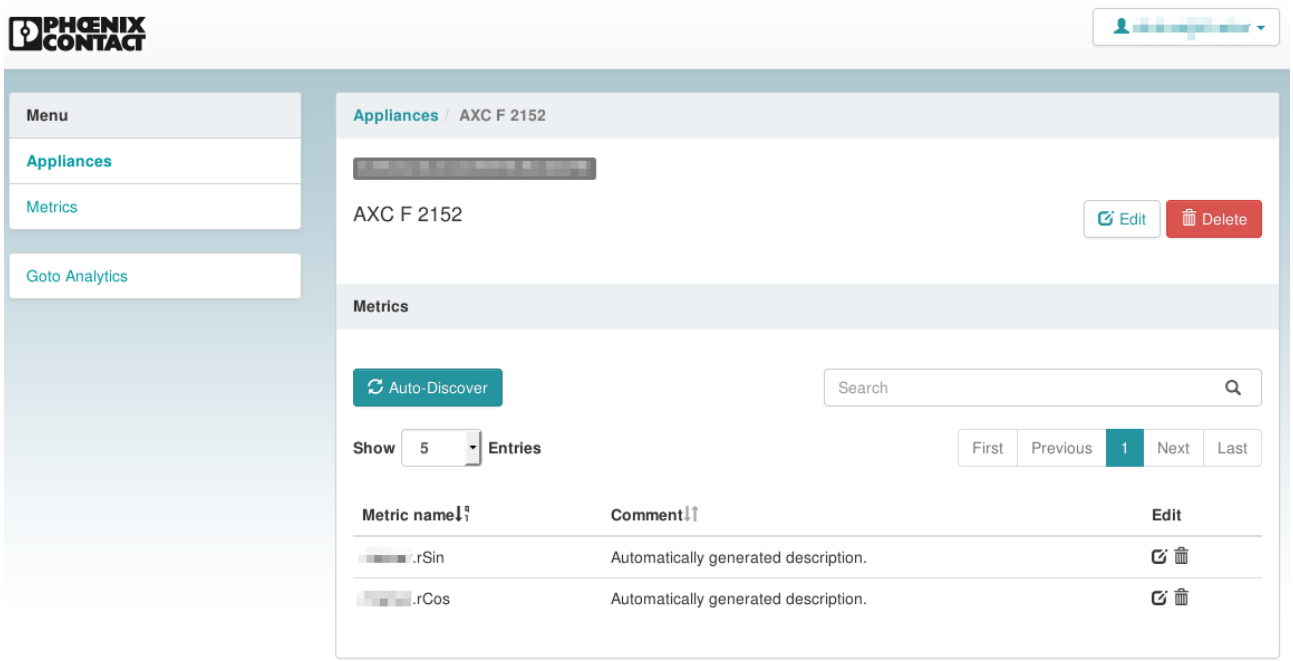


Figure 7-5 “Appliances / Device name” page

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

7.5 Displaying the metrics graphically in Grafana

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

To display a metric graphically in Grafana, proceed as follows:

Establishing a connection to Grafana

- Select the “TSD Device Manager” PROFICLOUD solution.
- Select the “Go to Analytics” entry in the menu.

The Grafana homepage opens.

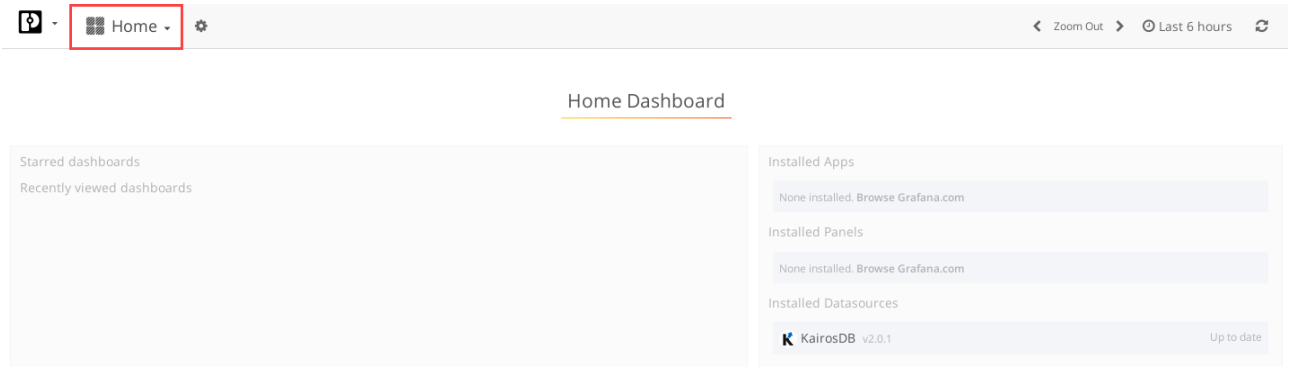


Figure 7-6 Grafana: Homepage

Creating a new dashboard

- Click on the “Home” button.

The “Home” page opens.

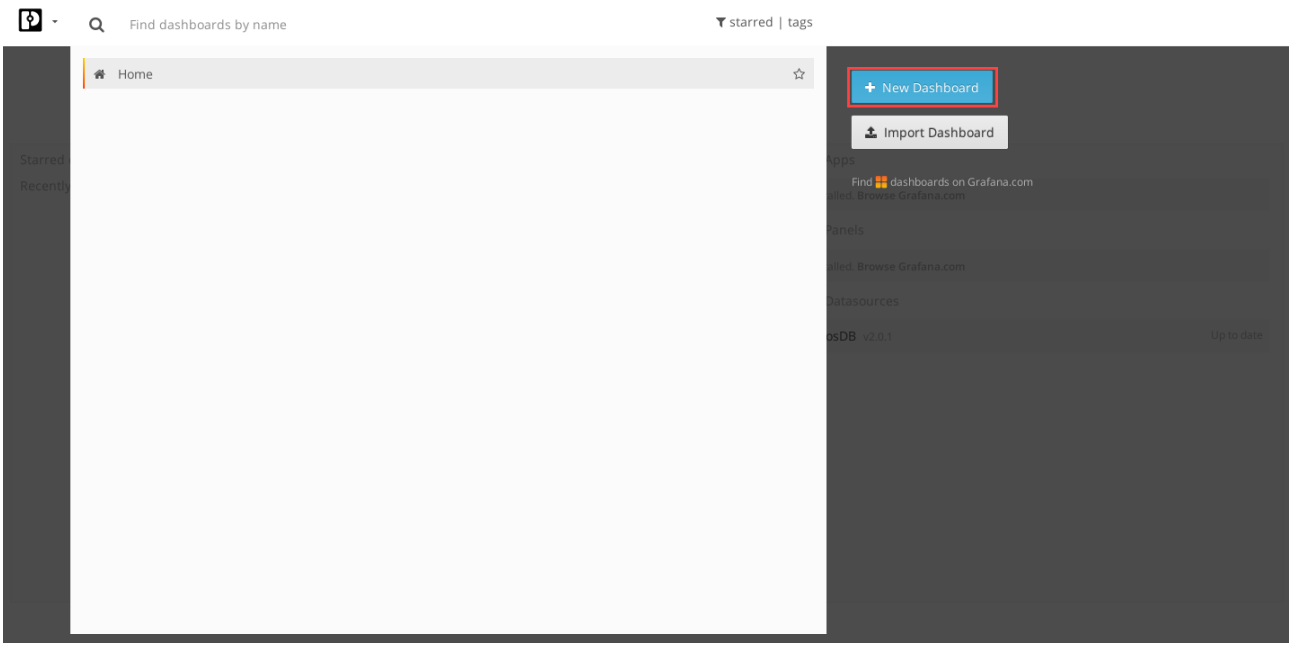


Figure 7-7 Grafana: “Home” page

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

The “New dashboard” page opens.

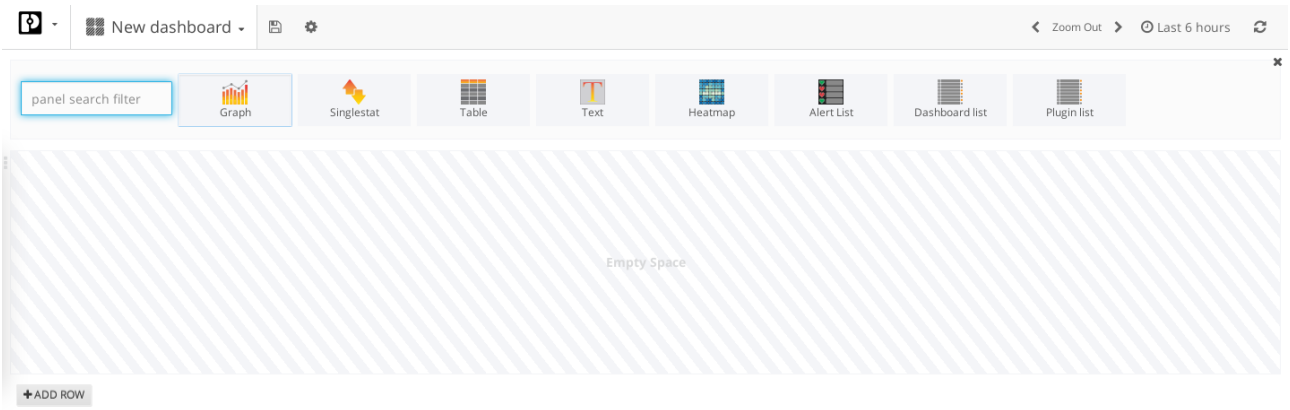


Figure 7-8 Grafana: “New dashboard” page

Selecting the display type

- Click on one of the buttons to select a display type (e.g., graph, etc.).

An example display opens for the type of graphical display selected (see Figure 7-9).

Selecting a metric

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

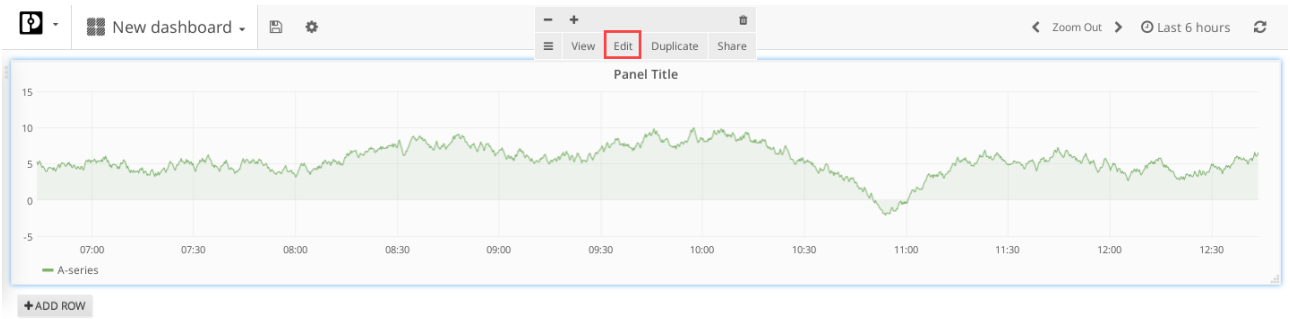


Figure 7-9 Grafana: Example graph; Edit Panel Title

An area in which you are able to edit the details of the selected graphical display opens below the example display.

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

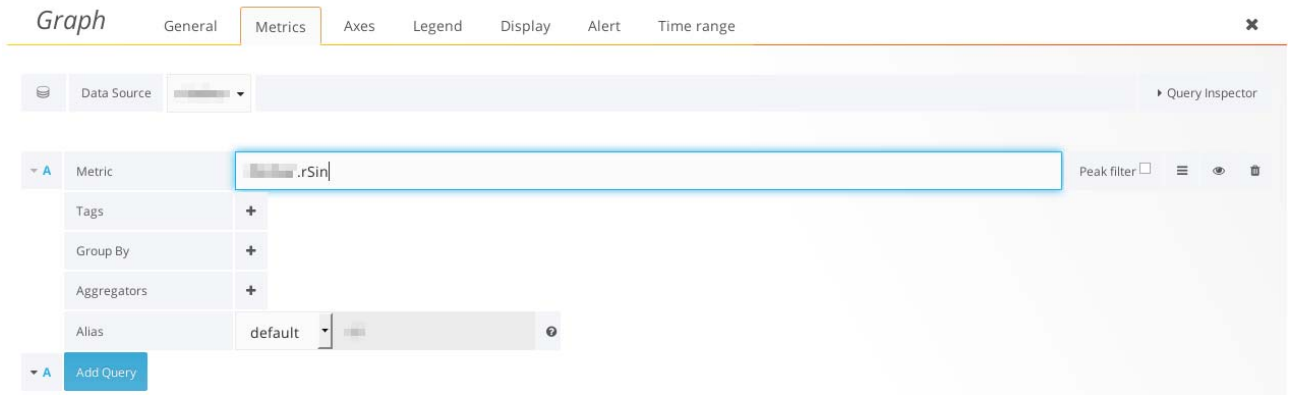


Figure 7-10 Grafana: Selecting the metric to be displayed

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

The selected metric is now displayed graphically.

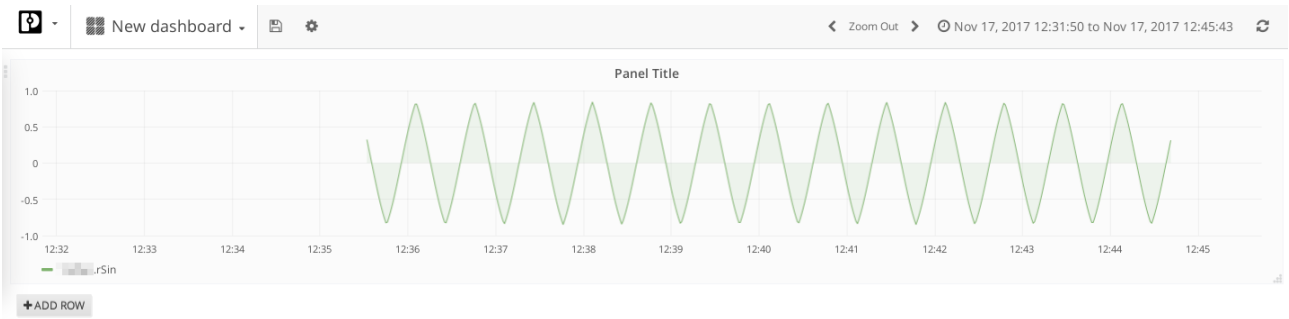


Figure 7-11 Grafana: Graphical display of the selected metric

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 that is used for diagnostics and easy control of the controller and the 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 Data structures

Some system variables of the controller are organized as data structures. The data structure for this type of system variable contains further system variables.
In the Init Value Configuration of PLCnext Engineer, you can see which specific system variables belong to a system variable that is organized as a data structure.

To open the Init Value Configuration for a system variable organized as a data structure, proceed as follows:

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

The “/ PLC” controller editor group opens.

- Select the “Data List” editor.

Alternatively, you can open the “Data List” editor via the controller node in the “PLANT” area.

- Open the “System Variables” section.
- In the “Variable (PLC)” column, click on the arrow to display additional information.

The data type of the system variable is displayed in the “Type” column of the additional information.

- Select the row for the system variable organized as a data structure whose associated system variables you would like to view.
  To do this, click on the first column in the row for the system variable organized as a data structure.
- Click on the button to open the Init Value Configuration for the system variable organized as a data structure.

The Init Value Configuration for the selected system variable organized as a data structure opens below the “Data List” editor.

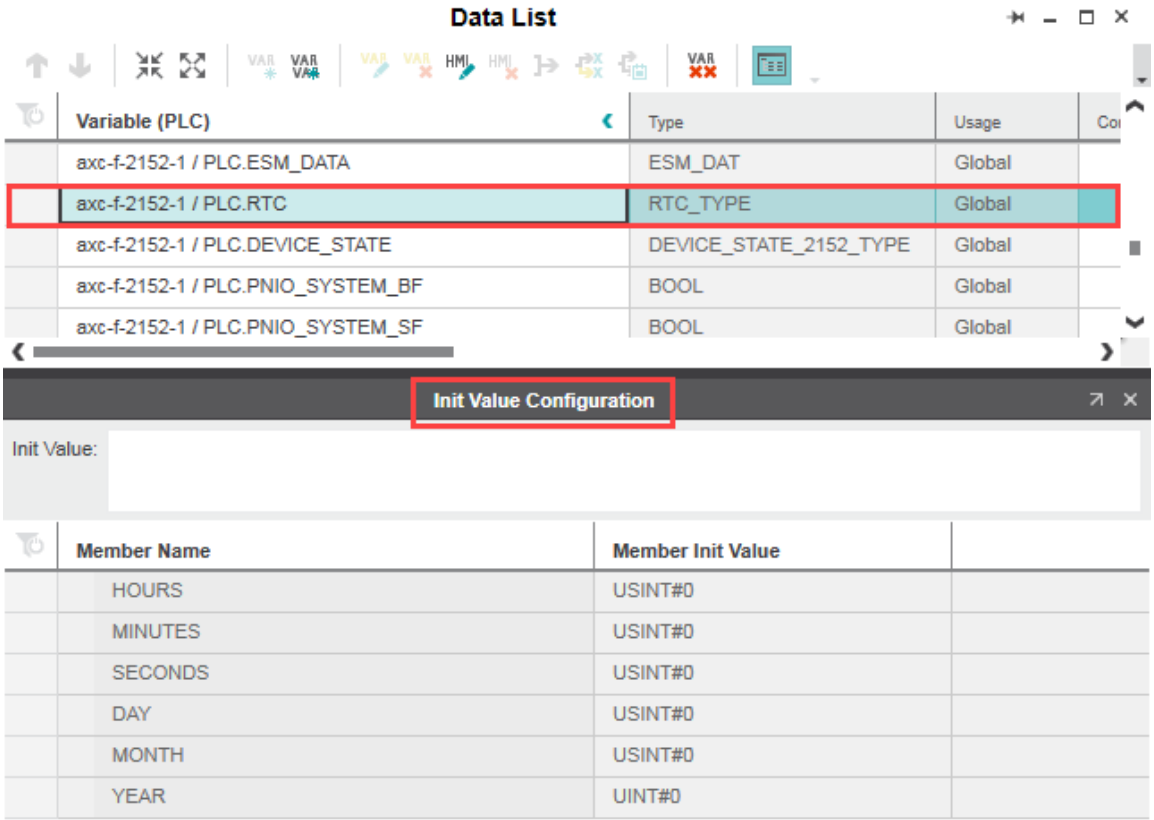


Figure 8-1 Example: Init Value Configuration for the RTC system variable organized as a data structure (RTC_TYPE data type)

The “Member Name” column in the Init Value Configuration displays all the system variables contained in the system variable organized as a data structure.

8.3 System time

The RTC system variable is a system variable organized as a data structure. The RTC system variable can be used to retrieve information on the system time of the device's internal real-time clock.

Table 8-1 RTC system variable (RTC_TYPE data structure) and the system variables it contains

System variable	Type	Description
RTC	RTC_TYPE	Data structure
HOURS	USINT	System time (hours)
MINUTES	USINT	System time (minutes)
SECONDS	USINT	System time (seconds)
DAY	USINT	System time (day)
MONTH	USINT	System time (month)
YEAR	UINT	System time (year)

8.4 TCP_SOCKET, UDP_SOCKET, and TLS_SOCKET function blocks

The TCP_SOCKET and UDP_SOCKET function blocks are used to 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 use the TLS_SOCKET function block to open and close IP sockets that are used for secure IP communication via TLS (Transport Layer Security).

You can retrieve the number of opened IP sockets using the following system variables:

Table 8-2 System variables for the TCP_SOCKET, UDP_SOCKET, and TLS_SOCKET function blocks

System variable	Type	Description
IP_ACTIVE_SOCKETS	UINT	Number of IP sockets opened using the TCP_SOCKET and UDP_SOCKET function blocks
TLS_ACTIVE_SOCKETS	UINT	Number of IP sockets opened using the TLS_SOCKET function block

8.5 Device status

The DEVICE_STATE system variable is a system variable organized as a data structure. The DEVICE_STATE system variable can be used to retrieve various information on the device status of the controller.

Table 8-3 DEVICE_STATE system variable (DEVICE_STATE_2152_TYPE data structure) and the system variables it contains

System variable	Type	Description
DEVICE_STATE	DEVICE_STATE_2152_TYPE	Data structure
BOARD_TEMPERATURE	SINT	Temperature inside the housing (in °C)
reserved1	BOOL	Reserved
reserved2	USINT	Reserved
CPU_LOAD_ALL_CORES	USINT	Average current utilization of all processor cores (in %)
CPU_LOAD_PER_CORE	CPU_LOAD_PER_CORE_ ARRAY	Information on the utilization per processor core
[1]	USINT	Current utilization of processor core 1 (in %)
[2]	USINT	Current utilization of processor core 2 (in %)

8.6 Task handling

Programs and program parts are treated as tasks in PLCnext Engineer. Individual tasks are coordinated and processed in the Execution and Synchronization Manager (ESM).
The ESM_DATA system variable can be used to retrieve information on the task handling of the ESM. The ESM_DATA system variable is a system variable organized as a data structure.

Table 8-4 ESM_DATA system variable (ESM_DAT data structure) and the system variables it contains

System variable	Type	Description
ESM_DATA	ESM_DAT	Data structure
ESM_COUNT	USINT	Number of ESMs (one ESM per processor core)
ESM_INFOS	ESM_INFO_ARRAY	Information on ESMs [1 ... 2]
[1] ... [2]	ESM_INFO	
TASK_COUNT	UINT	Number of tasks that have been configured for the ESM
TICK_COUNT	UDINT	Always 0
TICK_INTERVAL	UDINT	Always 0
TASK_INFOS	TASK_INFO_ARRAY	Information on tasks [1 ... 16]
[1] ... [16]	TASK_INFO	
INTERVAL	LINT	For cyclic tasks: time interval in µs For acyclic tasks: 0
PRIORITY	INT	Priority of the task
WATCHDOG	LINT	Watchdog time in µs (0 = no watchdog) Watchdog time that you define for the sum of execution duration and delay time. If the watchdog time is exceeded, the watchdog will trigger.
LAST_EXEC_DURATION	LINT	Execution duration of the task in the previous cycle in µs (including interruptions by higher priority tasks)
MIN_EXEC_DURATION	LINT	Minimum execution duration of the task in µs (including interruptions by higher priority tasks)
MAX_EXEC_DURATION	LINT	Maximum execution duration of the task in µs (including interruptions by higher priority tasks)
LAST_ACTIVATION_DELAY	LINT	Delay time of the task in the previous cycle in µs (delay occurs if higher priority tasks are pending at the time of task activation)
MIN_ACTIVATION_DELAY	LINT	Minimum delay time of the task in µs (delay occurs if higher priority tasks are pending at the time of task activation)

Table 8-4 ESM_DATA system variable (ESM_DAT data structure) and the system variables it contains

System variable	Type	Description
MAX_ACTIVATION_DELAY	LINT	Maximum delay time of the task in µs (delay occurs if higher priority tasks are pending at the time of task activation)
EXEC_TIME_THRESHOLD	LINT	Threshold value that you can define for the sum of execution duration and delay time.
EXEC_TIME_THRESHOLD_CNT	UDINT	If the defined threshold value EXEC_TIME_THRESHOLD is exceeded, the value of the EXEC_TIME_THRESHOLD_CNT variable is incremented.
NAME	STRING	Name of the task
EXCEPTION_COUNT	USINT	Number of exceptions
EXCEPTION_INFOS	ESM_EXCEPTION_INFO_ARRAY	Information on exceptions [1 ... 2]
[1] ... [2]	ESM_EXCEPTION_INFO	
TYPE_ID	UDINT	ID of the exception
SUB_TYPE	STRING512	Type of exception
SUB_TYPE_ID	UDINT	ID of the task in which the exception occurred
TASK_NAME	STRING	Name of the task in which the exception occurred
PROGRAM_NAME	STRING512	Name of the program instance in which the exception occurred
INFORMATION	STRING512	Information on the exception that occurred

8.7 Client connections to a PLCnext Engineer HMI web server

A PLCnext Engineer HMI application is executed on a PLCnext Engineer HMI server. There are two system variables for handling client connections to a PLCnext Engineer HMI web server:

– HMI_STATUS
– HMI_CONTROL

8.7.1 HMI_STATUS system variable

The HMI_STATUS system variable can be used to retrieve information on the client connections to a PLCnext Engineer HMI web server.
The HMI_STATUS system variable is a system variable organized as a data structure.

Table 8-5 HMI_STATUS system variable (HMI_STATUS_TYPE data structure) and the system variables it contains

System variable	Type	Description
HMI_STATUS	HMI_STATUS_TYPE	Data structure
CLIENT_COUNT	UINT	Number of existing client connections to the HMI web server at runtime
CLIENTS	HMI_STATUS_ARRAY	Information on existing client connections
[1] ... [256]	HMI_STATUS_STRUCT	Client connections 1 ... 256
SESSION_ID	STRING	Session ID of the client connection
STATION_ID	STRING	Station ID of the client
LAST_REQ	LINT	Time of the last request from the client to the controller
IP_ADDRESS	IP_ADDRESS_ARRAY	IP address of the client
[0] ... [3]	BYTE	IP address in hexadecimal format (Example: [C0].[A8].[01].[64] ⇒ 192.168.1.100)

8.7.2 HMI_CONTROL system variable

The HMI_CONTROL system variable can be used to disconnect a client from a PLCnext Engineer HMI web server.
The HMI_CONTROL system variable is a system variable organized as a data structure.

Table 8-6 HMI_CONTROL system variable (HMI_CONTROL_TYPE data structure) and the system variables it contains

System variable	Type	Description
HMI_CONTROL	HMI_CONTROL_TYPE	Data structure
CLIENTS	HMI_CONTROL_ARRAY	Information on existing client connections
[1] ... [256]	HMI_CONTROL_STRUCT	Client connections 1 ... 256
DISABLE	BOOL	• Set this bit to 1 to disconnect the selected client from the PLCnext Engineer HMI web server.

8.8 Axioline F: 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 8-7 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	I/O error
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 for operation
AXIO_DIAG_STATUS_REG_RDY	BOOL	The Axioline F local bus is ready for operation
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.

8.9 Axioline F: 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.

Special case: 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 a malfunction occurs. If a malfunction has not been detected, the diagnostic parameter register contains the value 0.

Table 8-8 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)

8.10 PROFINET system variables

Table 8-9 lists the PROFINET system variables of the integrated PROFINET controller functionality.

Table 8-9 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 demand At least one PROFINET device is indicating the “maintenance demand” alarm (high-priority maintenance alarm) with an 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 requirement” alarm (low-priority maintenance alarm) with an 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 PLCnext 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 8-10 lists the PROFINET system variables for the integrated PROFINET device functionality.

Table 8-10 PROFINET system variables (PROFINET device functionality)

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 contained 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	Input process data Memory area for input process data that the PROFINET device receives from the higher-level PROFINET controller

8.11 INTERBUS: Master diagnostic status register

You can connect the AXC F XT IB Axioline F extension module (INTERBUS master) to the left of the controller using the AXC BS L 2 bus base module. Up to 255 INTERBUS remote bus devices can be connected to the INTERBUS master.

Information on the operating state of the INTERBUS master is stored in the diagnostic status register. A specific INTERBUS master 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 8-11 System variables of the master diagnostic status register

System variable	Type	Description
IB_DIAG_STATUS_REG_HI	BYTE	Master diagnostic status register, high byte
IB_DIAG_STATUS_REG_LOW	BYTE	Master diagnostic status register, low byte
IB_DIAG_STATUS_REG_SYSFAIL	BOOL	“System failure” error message
IB_DIAG_STATUS_REG_WARN	BOOL	Defined warning time exceeded
IB_DIAG_STATUS_REG_QUAL	BOOL	Defined error density exceeded
IB_DIAG_STATUS_REG_USER	BOOL	User error/parameterization error
IB_DIAG_STATUS_REG_PF	BOOL	I/O error
IB_DIAG_STATUS_REG_BUS	BOOL	Bus error
IB_DIAG_STATUS_REG_CTRL	BOOL	INTERBUS master/hardware fault
IB_DIAG_STATUS_REG_DTC	BOOL	Diagnostic routine is active
IB_DIAG_STATUS_REG_RUN	BOOL	Data transmission is active
IB_DIAG_STATUS_REG_ACT	BOOL	Selected configuration is ready for operation
IB_DIAG_STATUS_REG_RDY	BOOL	The INTERBUS master is ready for operation

8.12 INTERBUS: Master diagnostic parameter register

The diagnostic parameter register provides additional information on an error indicated in the master diagnostic status register (see Section 8.11).

The following information is stored in the master diagnostic parameter register:

– Error location
– Error code

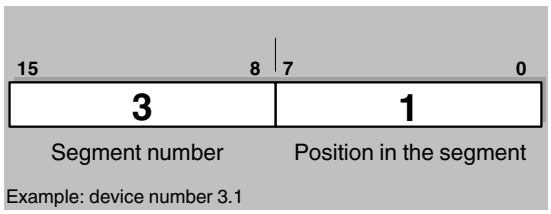


Figure 8-2 Error location in the master diagnostic parameter register

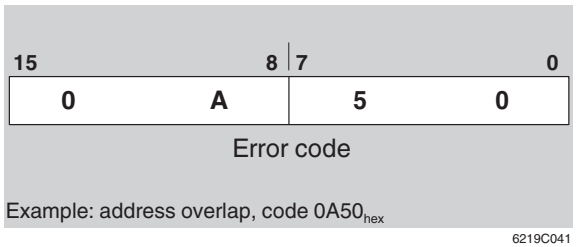


Figure 8-3 Error code in the master diagnostic parameter register

Special case:
If an INTERBUS local bus error cannot be located, the value 128 is indicated in the master diagnostic parameter register (i.e., bit 7 is set).

Table 8-12 Example for error code $0A050_{hex}$

Error code	Type	Description and remedy
$0A50_{hex}$	USER	Error when assigning a process data item. Input or output address assigned more than once. **Remedy:** • Always assign just one process data item to each input/output address. **Add_Error_Info:** PDRL index of the incorrect PDRL entry

The master diagnostic parameter register is rewritten whenever a malfunction occurs. If a malfunction has not been detected, the master diagnostic parameter register contains the value 0.

Table 8-13 System variables of the master diagnostic parameter register

System variable	Type	Description
IB_DIAG_PARAM_REG_HI	BYTE	Master diagnostic parameter register, high byte
IB_DIAG_PARAM_REG_LOW	BYTE	Master diagnostic parameter register, low byte
IB_DIAG_PARAM_2_REG_HI	BYTE	Extended master diagnostic parameter register, high byte
IB_DIAG_PARAM_2_REG_LOW	BYTE	Extended master diagnostic parameter register, low byte

9 Web-based management (WBM)

Using the web-based management (WBM) system, you can access static and dynamic controller information and modify certain controller settings. WBM can be called up via any of the controller's Ethernet interfaces.

9.1 Establishing a connection to WBM

To establish a connection to WBM, proceed as follows:

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

Please note:
WBM can only be called up if the controller has a valid IP address. Upon delivery, the controller IP address is 192.168.1.10.

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

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

Initial access: TLS certificate

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

Please note:

- The controller generates the TLS certificate during the boot phase.
- The certificate uses the IP address of the PROFINET controller.
  By default, this is the IP address of the AXC F 2152 controller.
  When you use the AXC F XT ETH 1TX left-alignable Ethernet interface, the AXC F XT ETH 1TX Ethernet interface automatically takes over the PROFINET controller functionality. In this case, the certificate uses the IP address of the AXC F XT ETH 1TX Ethernet interface.
- The certificate is used for all Ethernet interfaces of the controller.
- Each IP address of the controller must be authorized in the web browser before a PLCnext Engineer HMI application can be accessed via this address and thereby via the corresponding Ethernet interface.
- The TLS certificate is regenerated after resetting the controller to default setting type 1 or 2.
- The TLS certificate and the corresponding private key are located in the following directories of the controller file system:
  - /opt/plcnext/Security/Certificates/https/https_cert.pem
  - /opt/plcnext/Security/Certificates/https/https_key.pem

Initial access: Welcome page

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

Figure 9-1 AXC F 2152 welcome page

The welcome page contains links to the following web content:

– WBM
– PLCnext Community
– PLCnext website

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

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

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

Alternatively, you can enter the URL “https://IP address of the controller/wbm” (example: “https://192.168.1.10/wbm”) in your browser address field.
In this case, WBM is displayed immediately.

The welcome page remains accessible via the URL “https://IP address of the controller/welcome”.

9.2 Licensing information regarding open-source software

The AXC F 2152 controller works with a Linux operating system.
All license information can be called up via the “Legal Information” link on every page of WBM:

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

Licenses for all of the open-source software used are shown.

9.3 Changing the language

WBM is available in German and English.

Figure 9-2 WBM: Changing the language

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

WBM then immediately switches to the desired language.

9.4 Login

The WBM login page is displayed when:

– You access WBM for the first time

– You have enabled the WBM user authentication function, see Section 9.5.4.1.

If you disable user authentication, login is not necessary to access WBM. In this case, the WBM start page is displayed when WBM is accessed, see Section 9.5.

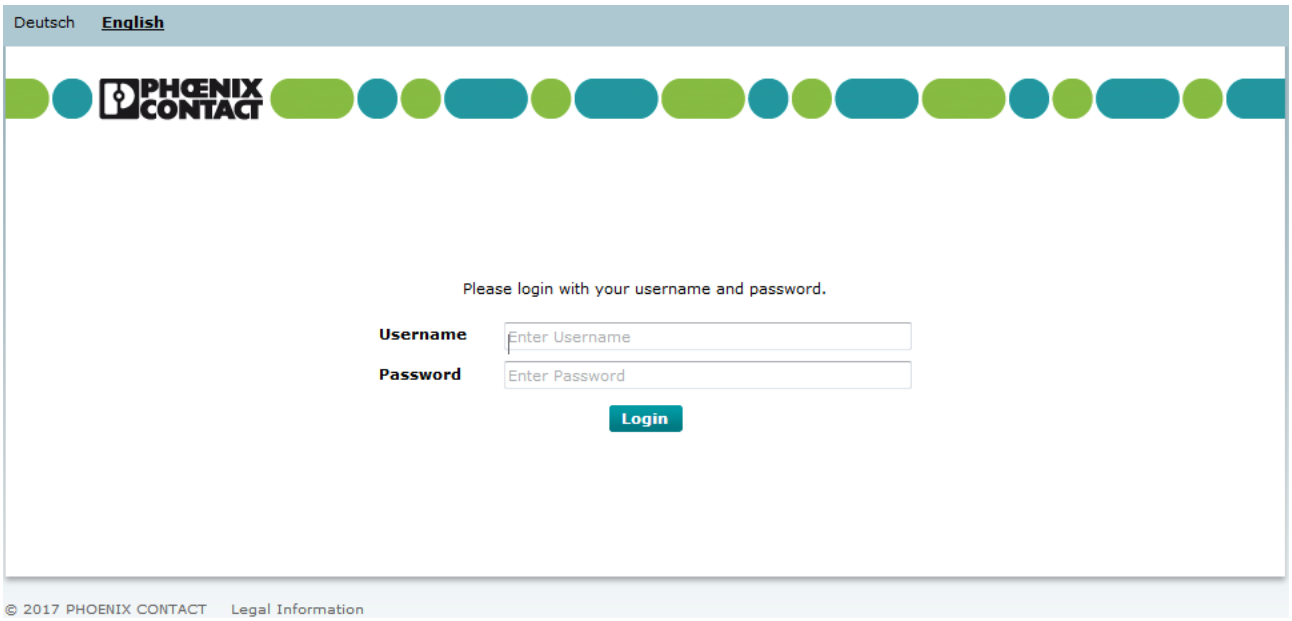


Figure 9-3 WBM: Login page

Initial access as an administrator

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

- Enter the user name “admin” in the “Username” input field.
- Enter the administrator password in the “Password” input field.
  The administrator password is printed on the controller (see Figure 9-4 on page 132).
- To open WBM, click on the “Login” button.

The WBM start page opens (see Section 9.5).

Recommended:

- Only use the administrator password for initial login.
- Once you have logged in successfully, change the administrator password to prevent unauthorized administrator access (see Section 9.5.4.1).

Please note:

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

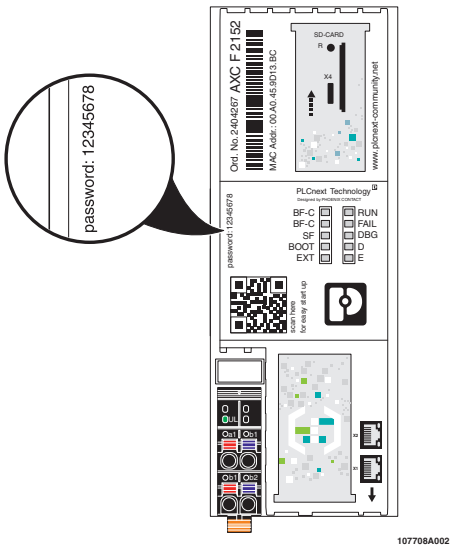


Figure 9-4 Administrator password on the controller

Logging in as a user

If WBM user authentication is enabled, log in using your user details.

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

The WBM start page opens (see Section 9.5).

9.5 Start page – Areas and functions

Figure 9-5 WBM: Start page

WBM is split into the following areas:

- Information
- Diagnostics
- Configuration
- Security
- Administration

9.5.1 “Information” area

9.5.1.1 “General Data” page

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

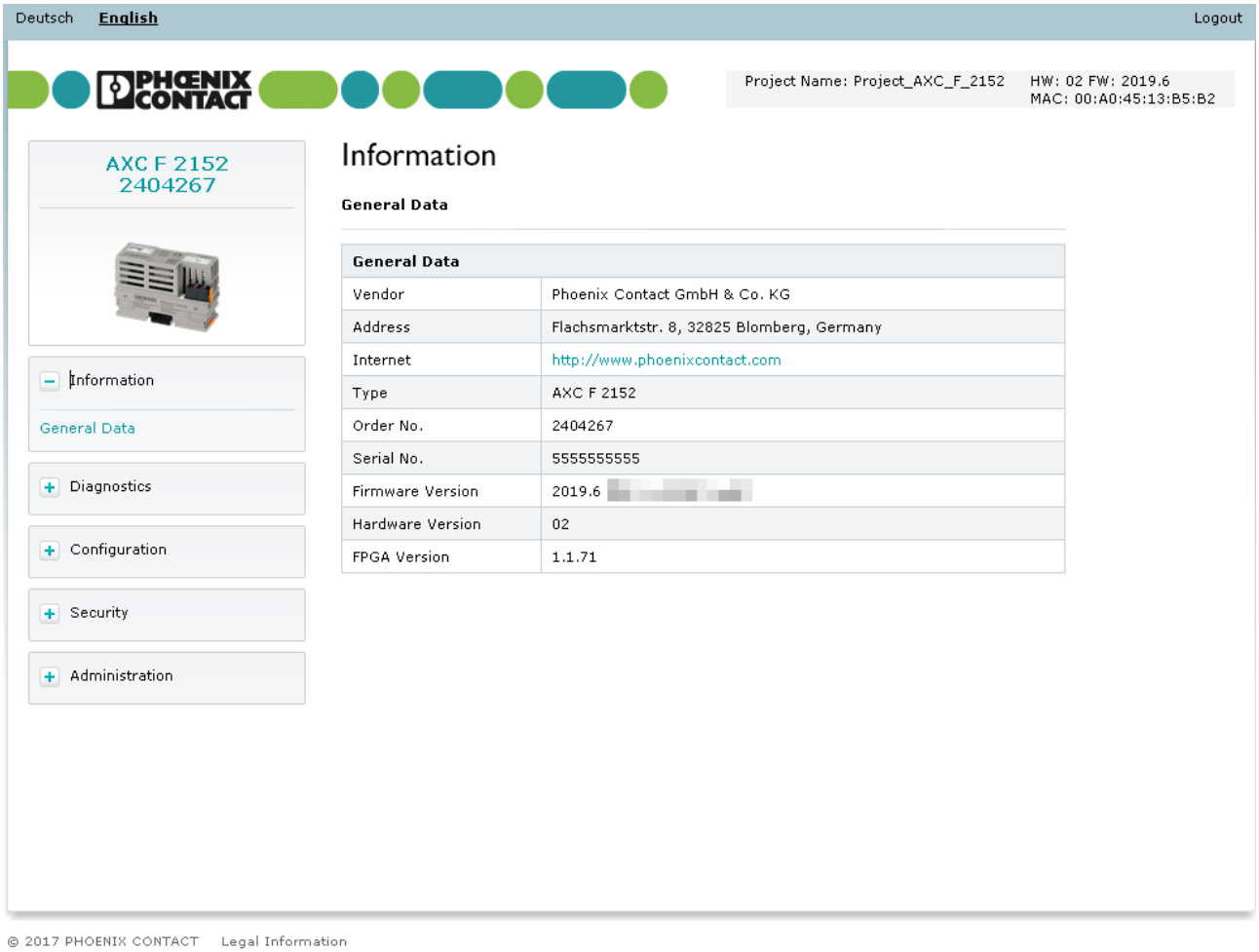


Figure 9-6 WBM: “General Data” page

9.5.2 “Diagnostics” area

9.5.2.1 “PROFINET” page

On the “PROFINET” page, you can view information on the controller and the connected PROFINET devices, as well as their Axioline F local bus devices.

On the “Overview” tab, you will find information on the current PROFINET function of the controller and its IP settings (Figure 9-7).

“Overview” tab

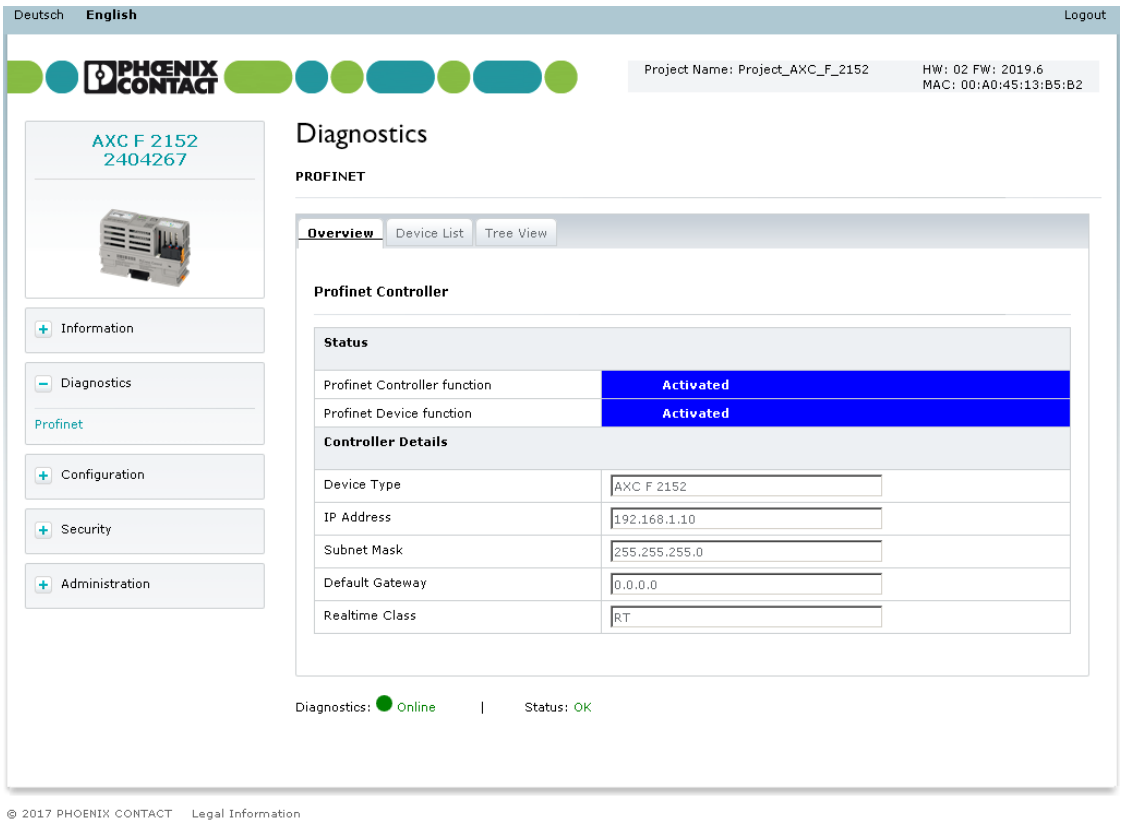


Figure 9-7 WBM: “PROFINET” page, “Overview” tab

“Status” area

In the “Status” area, you can see whether the controller is currently being used as a PROFINET controller and/or a PROFINET device.

“Controller details” area

The current IP settings of the controller are displayed in the “Controller details” area.

Please note:

The IP settings shown here relate to the Ethernet interface with PROFINET controller function.
When you use the AXC F XT ETH 1TX left-alignable Ethernet interface, the AXC F XT ETH 1TX Ethernet interface automatically takes over the PROFINET controller function. In this case, the IP settings for the AXC F XT ETH 1TX Ethernet interface are displayed.

“Device List” tab

The “Device List” tab (Figure 9-8) provides an overview of the configured PROFINET devices. The overview contains the device names of the PROFINET devices, the current IP settings, the activation status (TRUE = active, FALSE = inactive) as well as the diagnostic state and code.

Table 9-1 Possible diagnostic states of PROFINET diagnostics

Diagnostic state	Description
OK	No error
Warning	A warning occurred, e.g., “Maintenance Required”, “Maintenance Demanded”, and “Diagnosis available”.
Error	A PROFINET bus error has occurred.

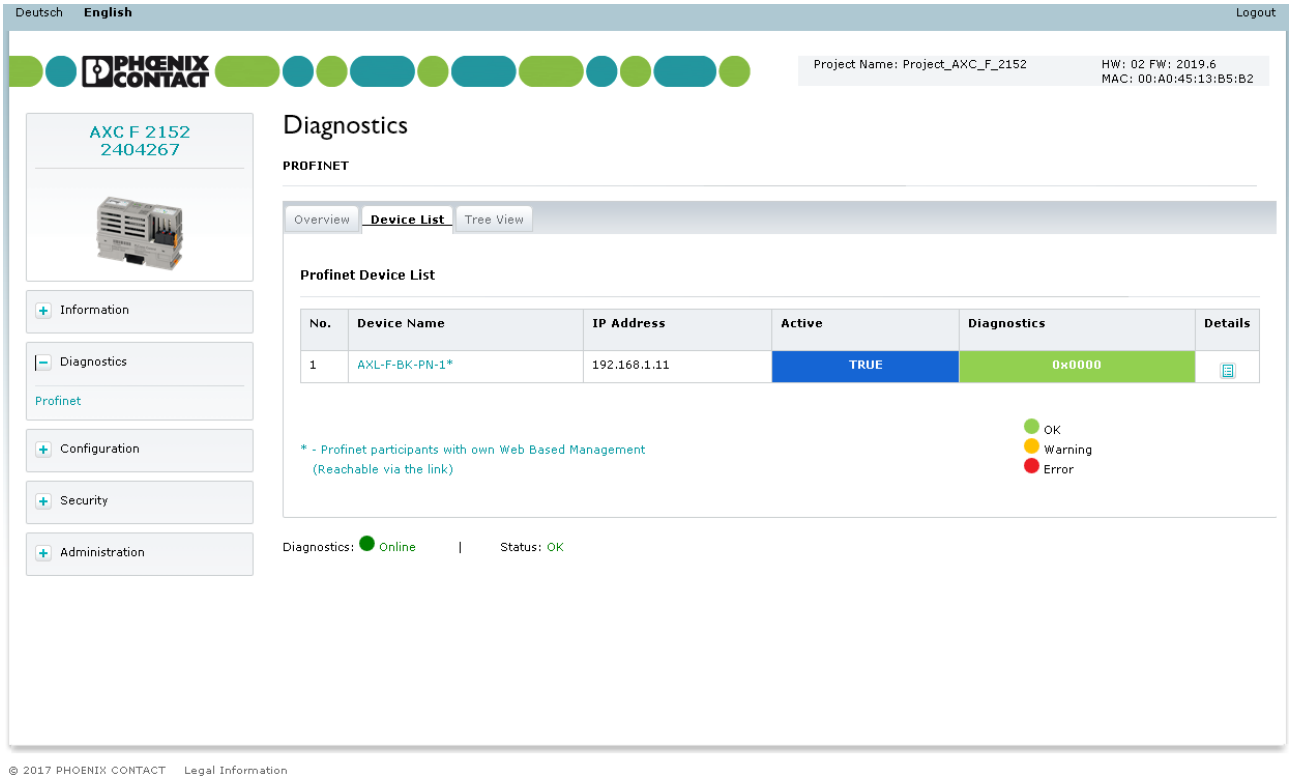


Figure 9-8 WBM: “PROFINET” page, “Device List” tab

Opening the “Device Information” view

In the “Device Information” view, you will find certain general information, the current IP settings as well as diagnostic information for each connected PROFINET device.

- In the “Details” column, click on the button.

The “Device Information” view opens (see Figure 9-9).

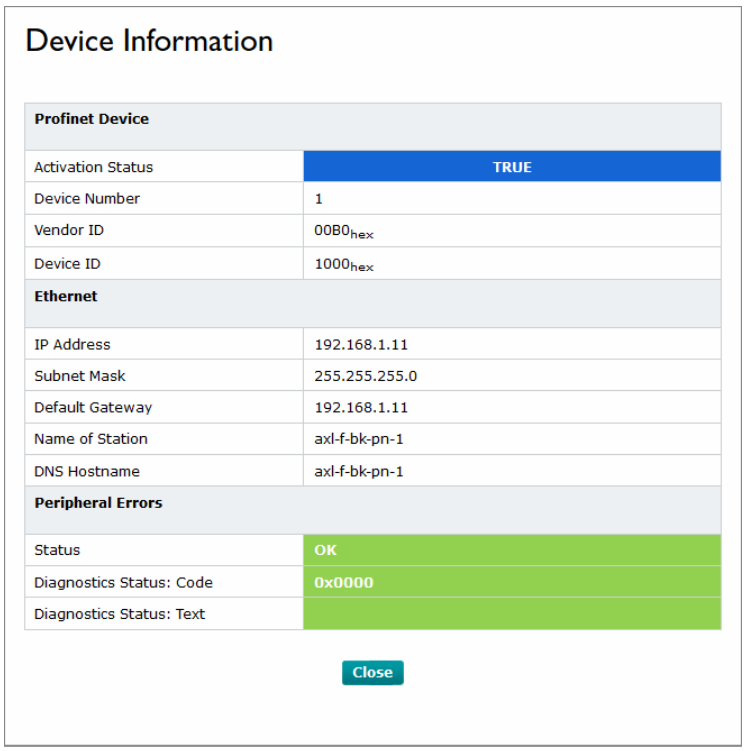


Figure 9-9 WBM: “PROFINET” page, “Device List” tab, “Device Information” view

Figure 9-10 shows the “Device Information” view in the event of an I/O error.

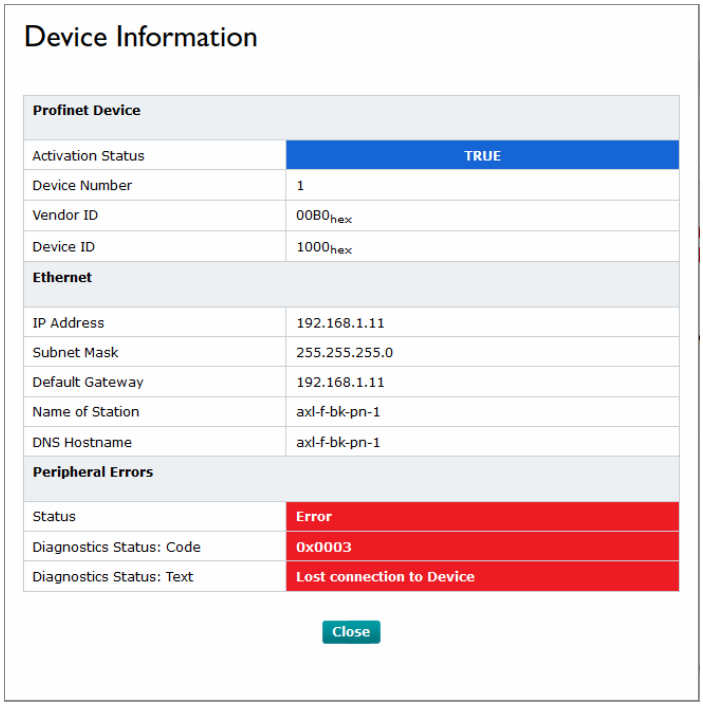


Figure 9-10 WBM: “PROFINET” page, “Device List” tab, “Device Information” view (an I/O error has occurred in the example)

- Click on the “Close” button to close the “Device Information” view.

Update frequency for diagnostic data

Diagnostic data is updated with an update frequency of 1/s. The following information is updated:

– Device List: The Device List can be recomposed, e.g., after changing and updating the PLCnext Engineer project.
– Diagnostic data:
  – Change of connection status of the PROFINET devices
  – Diagnostic state of the PROFINET devices

For more detailed information on the diagnostic code, please refer to the “PLCnext Technology” user manual.

The user manual can be downloaded at phoenixcontact.net/product/2404267.

Opening the WBM of a PROFINET device

Some PROFINET devices feature their own web-based management (WBM). You can open the WBM of a connected PROFINET device via a link on the “Device List” tab.

- In the “Device Name” column, click on the PROFINET device whose WBM you want to open.

The WBM of the PROFINET device is opened in the web browser in a new tab.

“Tree View” tab

The “Tree View“ tab provides an overview of the projected PROFINET devices. The overview contains the device names of the PROFINET devices, their current IP settings, as well as the diagnostic state of the devices and modules.

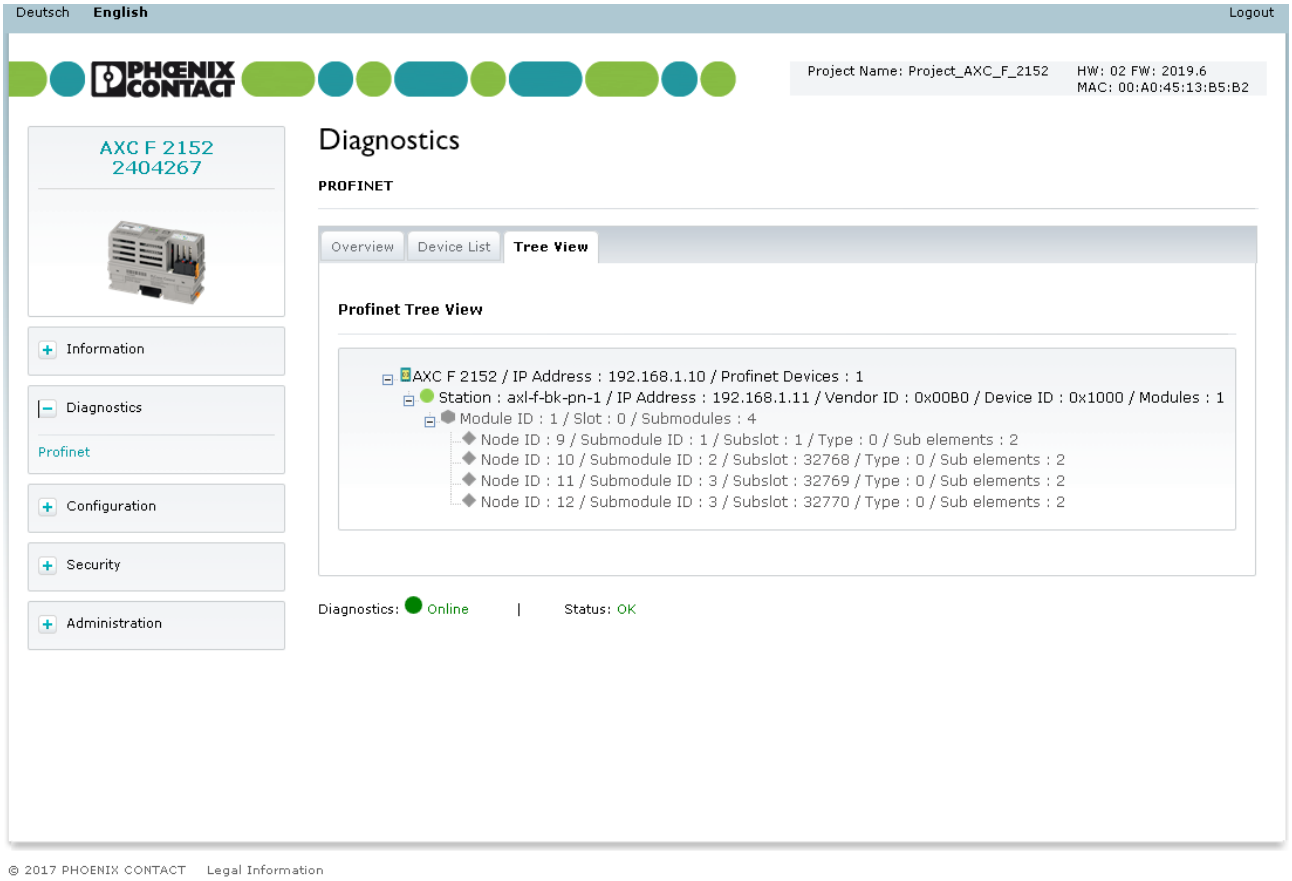


Figure 9-11 WBM: “PROFINET” page, “Tree View” tab

For more detailed information on the “Tree View“ tab, please refer to the “PLCnext Technology” user manual.

The user manual can be downloaded at phoenixcontact.net/product/2404267.

9.5.3 “Configuration” area

9.5.3.1 “PROFICLOUD” page

The “PROFICLOUD” page provides status information regarding the connection between the controller and PROFICLOUD.
You can also specify whether you are operating the controller with or without PROFICLOUD connection and which PROFICLOUD services you want to use.

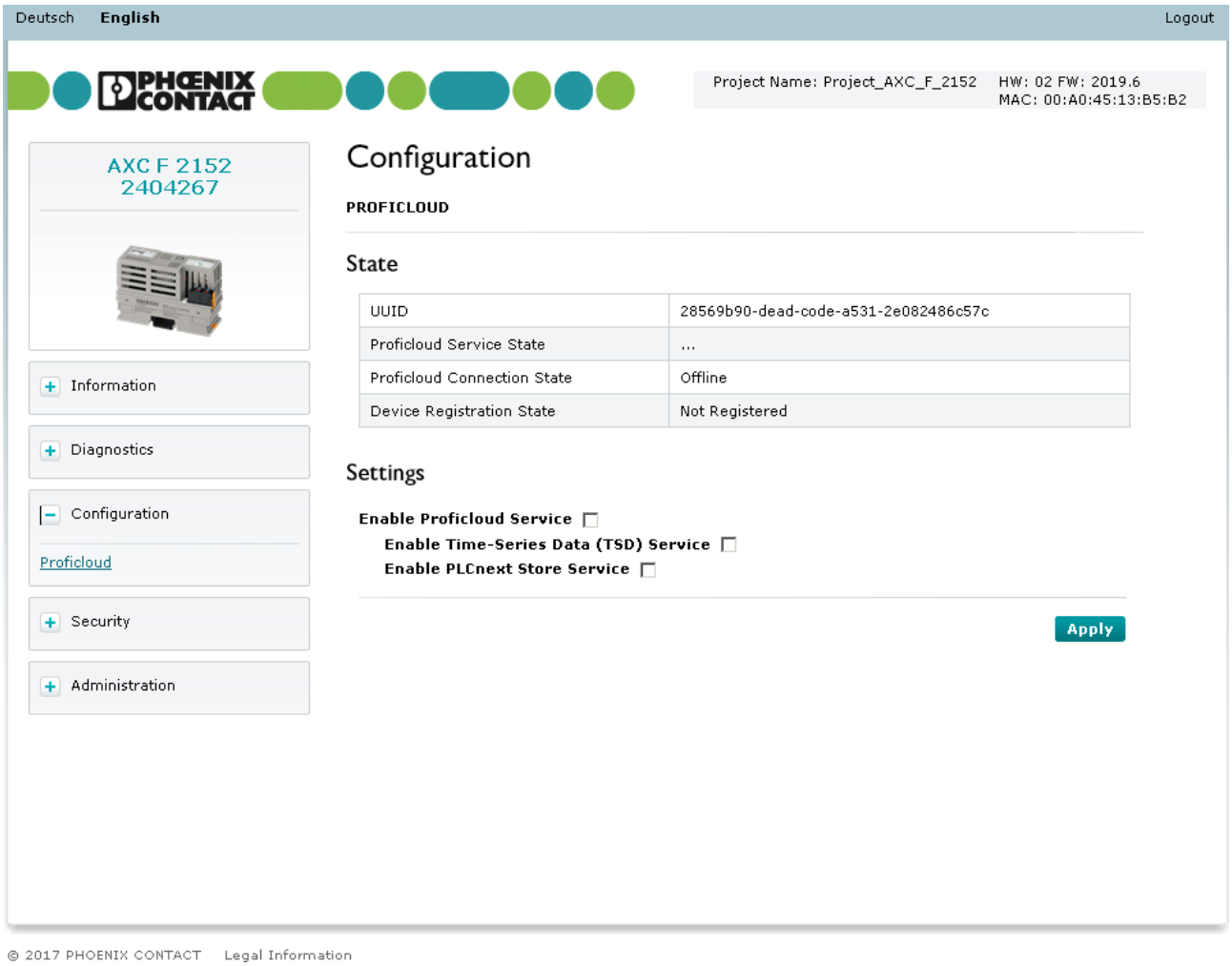


Figure 9-12 WBM: “PROFICLOUD” page

Enabling the PROFICLOUD connection

If you want to operate the controller with PROFICLOUD connection, you have to enable the Proficloud Service of the controller. When the Proficloud Service of the controller is enabled, the controller tries to establish a connection to PROFICLOUD.

- Enable the “Enable Proficloud Service” check box.
- Click on the “Apply” button.

The PROFICLOUD connection of the controller is enabled.

When the PROFICLOUD connection is enabled, you can specify which service you want to use.

Enabling the TSD PROFICLOUD service

- To transfer process data from a PLCnext Engineer project to the TSD PROFICLOUD service, enable the “Enable Time-Series Data (TSD) Service” check box.

Enabling the PLCnext Store service

To download apps from the PLCnext Store to the controller, the PLCnext Store service must be enabled on the device.

- To enable the PLCnext Store service on the device, enable the “Enable PLCnext Store Service” check box.

Disabling the PROFICLOUD connection

If you want to operate the controller without PROFICLOUD connection, you have to disable the Proficloud Service of the controller. In this case, it is not possible to establish a connection between the controller and PROFICLOUD.

- Disable the “Enable Proficloud Service” check box.
- Click on the “Apply” button.

The PROFICLOUD connection of the controller is disabled.

9.5.4 “Security” area

The security-related settings for the controller are configured in the “Security” area.

9.5.4.1 “User Authentication” page

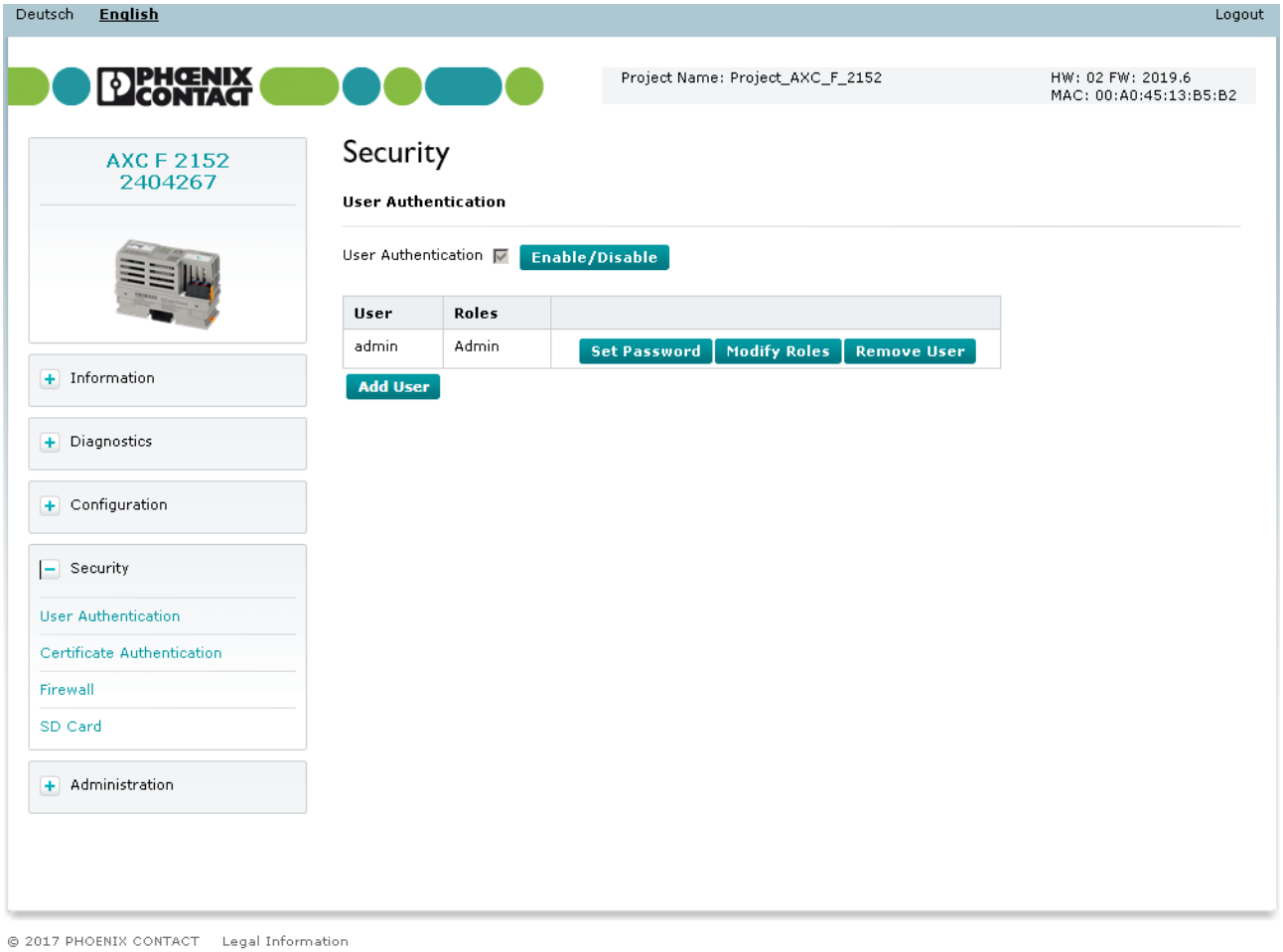


Figure 9-13 WBM: “User Authentication” page

User authentication

Enable or disable user authentication on the “User Authentication” 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 PLCnext Engineer. When user authentication is disabled, authentication is not necessary to access WBM, the AXC F 2152 OPC UA server or to the controller via PLCnext 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. In the delivery state, the “admin” user is already created with administrator rights.

Recommended:

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

The modified administrator access data is stored in the overlay file system on the internal parameterization memory. If you operate the controller with an SD card, the overlay file system is saved to the SD card.

See Section 3.6 for the directory structure of the file system.

Please note:

Enabled user authentication only provides a limited degree of protection against unauthorized network access.
Due to its communication interfaces, the controller should not be used in safety-critical applications unless additional security appliances are used.

- Make sure you always operate the controller with the latest firmware version.
- Follow the safety note on unauthorized network access in Section 1.5.

Enabling/disabling user authentication

To enable/disable user authentication, proceed as follows:

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

The “Enable/Disable User Authentication” dialog opens.

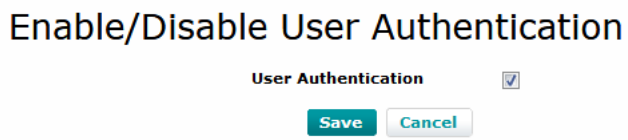


Figure 9-14 WBM: “User Authentication” page, “Enable/Disable User Authentication” dialog

- 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 apply the setting.

User management

Via user authentication, the access data of all users who are authorized to access the AXC F 2152 is managed and the required access permissions are assigned to each user (see Table 9-2).

The access data of all newly created users is stored on the internal parameterization memory. If you operate the controller with an SD card, the access data is saved to the SD card. If the SD card is inserted into 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 administrator access data after logging into WBM for the first time, the modified access data stored on the SD card will be used for access to the controller. In this case, it is no longer possible to log in with the “admin” user name and the administrator password printed on the device.

Adding a user

Proceed as follows to add a user:

- Click on the “Add User” button on the “User Authentication” page.

The “Add User” dialog opens.

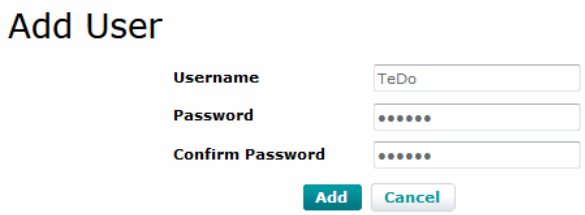


Figure 9-15 WBM: “User Authentication” page, “Add User” dialog

- Enter the desired user name in the “Username” 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 a user password:

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

The “Set User Password” dialog opens.

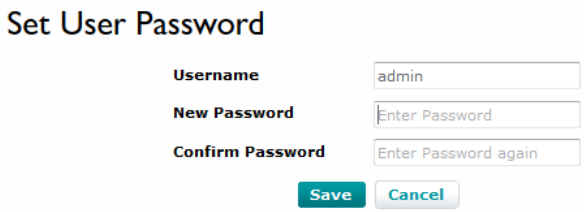


Figure 9-16 WBM: “User Authentication” page, “Set User Password” dialog

- 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 user roles

You can select one or more user roles with different permissions for each user.
These permissions control access to:

– The controller file system
– The controller via PLCnext Engineer
– The PLCnext Engineer HMI
– WBM
– The AXC F 2152 OPC UA server

To assign one or more user roles to a user, proceed as follows:

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

The “Modify Roles” dialog opens.

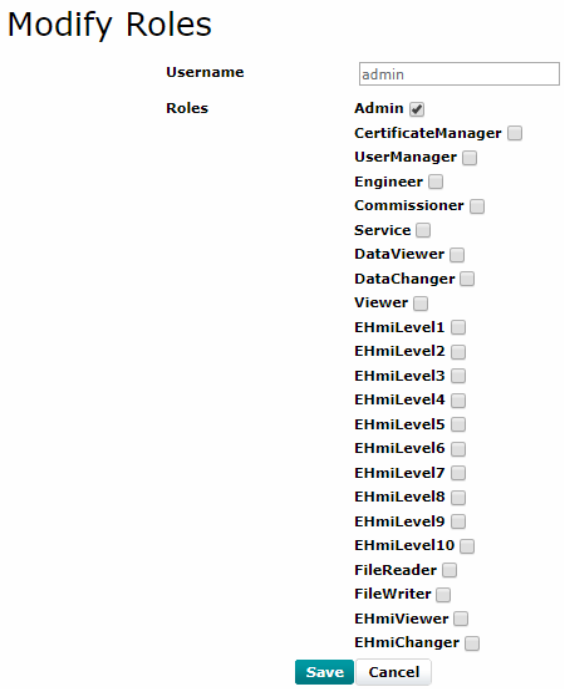


Figure 9-17 WBM: “User Authentication” page, “Modify Roles” dialog

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

You can manage the access permission to the PLCnext Engineer HMI application via the user roles EHmiLevel1...10, EHmiViewer, and EHmiChanger. The assigned user roles specify whether and to what extent a user has read and write access to the PLCnext Engineer HMI application.

For detailed information on the security functions in a PLCnext Engineer HMI application and on handling HMI user roles, refer to the PLCnext Engineer online help.

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

Table 9-2 User roles and their assigned access permissions in the various applications

Application or component of the AXC F 2152	Access permission	User role													
		Admin	Certificate Manager	UserManager	Engineer	Commissioner	Service	DataViewer	DataChanger	Viewer	EHmiLevelX	FileReader	FileWriter	EHmiViewer	EHMIChanger
SD card/parameterization memory	SFTP access to the file system with an SFTP client **Please note:** Authentication with a user name and password is **always** required for SFTP access, even when user authentication is disabled.	x	–	–	–	–	–	–	–	–	–	–	–	–	–
Shell	SSH access to the shell **Please note:** Authentication with a user name and password is **always** required for SSH access, even when user authentication is disabled.	x	–	–	–	–	–	–	–	–	–	–	–	–	–
PLCnext Engineer	View values in the cockpit (e.g., utilization, etc.)	x	–	x	x	x	x	x	x	x	x	–	–	–	–
PLCnext Engineer	Transfer a project to the controller	x	–	–	x	–	–	–	–	–	–	–	–	–	–
PLCnext Engineer	Start (cold/warm start) or stop the controller	x	–	–	x	x	x	–	–	–	–	–	–	–	–
PLCnext Engineer	Restart the controller (reboot)	x	–	–	–	–	–	–	–	–	–	–	–	–	–
PLCnext Engineer	Reset the controller to default setting type 1	x	–	–	–	–	–	–	–	–	–	–	–	–	–
PLCnext Engineer	View online variable values	x	–	–	x	–	x	x	x	x	–	–	–	–	–
PLCnext Engineer	Overwrite variables	x	–	–	x	–	x		x	–	–	–	–	–	–
PLCnext Engineer	Set and delete breakpoints	x	–	–	x	–	x			–	–	–	–	–	–
WBM	View “General Data” page	x	x	x	x	–	–	–	–	–	–	–	–	–	–
WBM	Manage users	x	–	x	–	–	–	–	–	–	–	–	–	–	–
WBM	Edit Trust Stores and Identity Stores	x	x	–	–	–	–	–	–	–	–	–	–	–	–
WBM	Configure the firewall	x	–	–	–	–	–	–	–	–	–	–	–	–	–
WBM	Update the firmware	x	–	–	–	–	–	–	–	–	–	–	–	–	–
WBM	PROFICLOUD status	x	–	–	–	–	–	–	–	–	–	–	–	–	–
WBM	Configuring SD card use	x	–	–	–	–	–	–	–	–	–	–	–	–	–

Table 9-2 User roles and their assigned access permissions in the various applications

Application or component of the AXC F 2152	Access permission	User role												
		Admin	Certificate Manager	UserManager	Engineer	Commissioner	Service	DataViewer	DataChanger	Viewer	EHmiLevelX	FileReader	FileWriter	EHmiViewer	EHMIChanger
WBM	Overview of app licenses used	x	–	–	–	–	–	–	–	–	–	–	–	–	–
WBM	PROFINET diagnostics	x	x	x	x	x	x	x	x	x	x	x	x	x	x
OPC UA client	View online variable values	x	–	–	x	–	x	x	x	x	–	–	–	–	–
OPC UA client	Overwrite variables	x	–	–	x	–	x	–	x	–	–	–	–	–	–
OPC UA client	Read files	x	–	–	–	–	–	–	–	–	–	x[1]	–	–	–
OPC UA client	Write files	x	–	–	–	–	–	–	–	–	–	–	x[2]	–	–
PLCnext Engineer HMI application	View online variable values	x	–	–	–	–	–	–	–	–	–	–	–	x	–
PLCnext Engineer HMI application	Overwrite variables	x	–	–	–	–	–	–	–	–	–	–	–	–	x

1 FileReaders can only read files via an OPC UA client if OPC UA file transfer is enabled in PLCnext Engineer (see Figure 9-18).

2 FileWriters can only write files via an OPC UA client if OPC UA file transfer is enabled in PLCnext Engineer (see Figure 9-18).

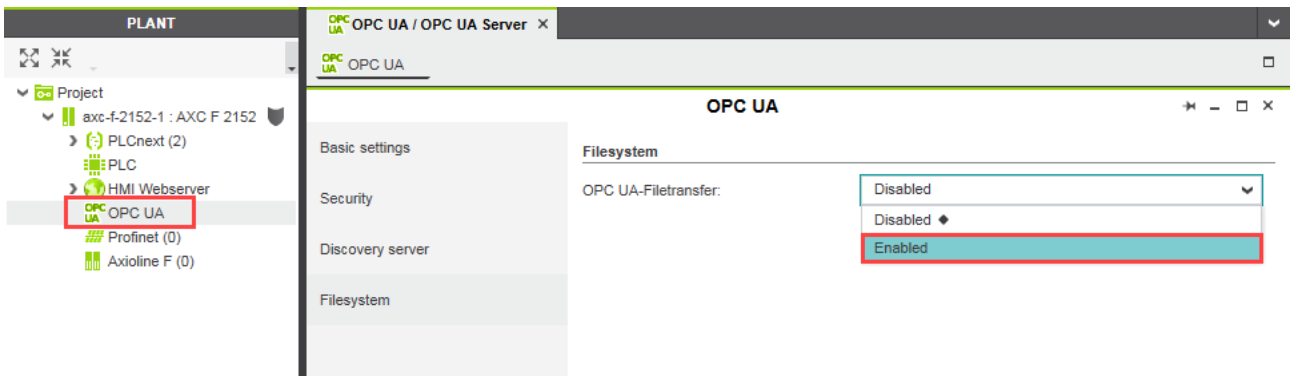


Figure 9-18 Enabling OPC UA file transfer

Removing a user

Proceed as follows to remove a user:

- On the “User Authentication” page, click on the “Remove User” button in the row of the user you want to remove.

The “Remove User” dialog opens.

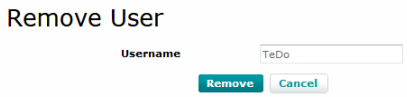


Figure 9-19 WBM: “User Authentication” page, “Remove User” dialog

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

9.5.4.2 “Certificate Authentication” page

The “Certificate Authentication” page is used to manage certificates for secure controller communication. The “Trust Stores” and “Identity Stores” tabs are used for this.
Trusted certificates and revocation lists of possible communication partners are stored on the “Trust Stores” tab.
Your own certificates are stored on the “Identity Stores” tab.

For more detailed information regarding the “Certificate Authentication” page, please refer to the “PLCnext Technology” user manual.

The user manual can be downloaded at phoenixcontact.net/product/2404267.

“Trust Stores” tab

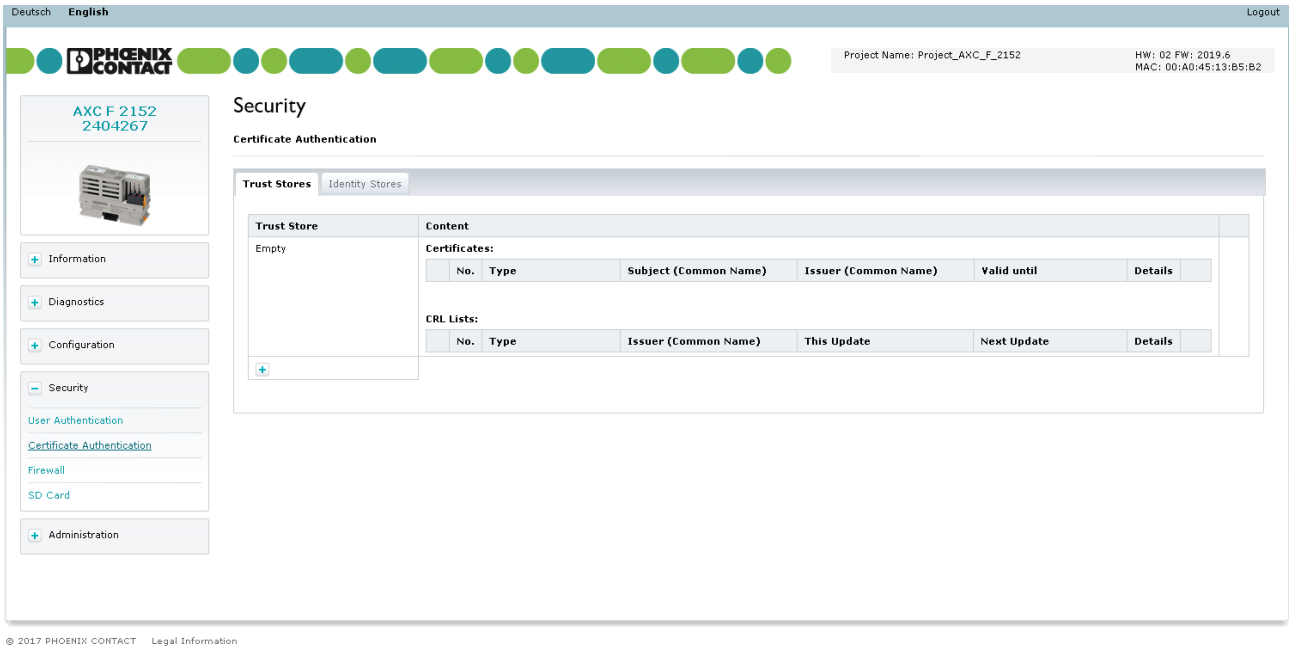


Figure 9-20 WBM: “Certificate Authentication” page, “Trust Stores” tab

“Identity Stores” tab

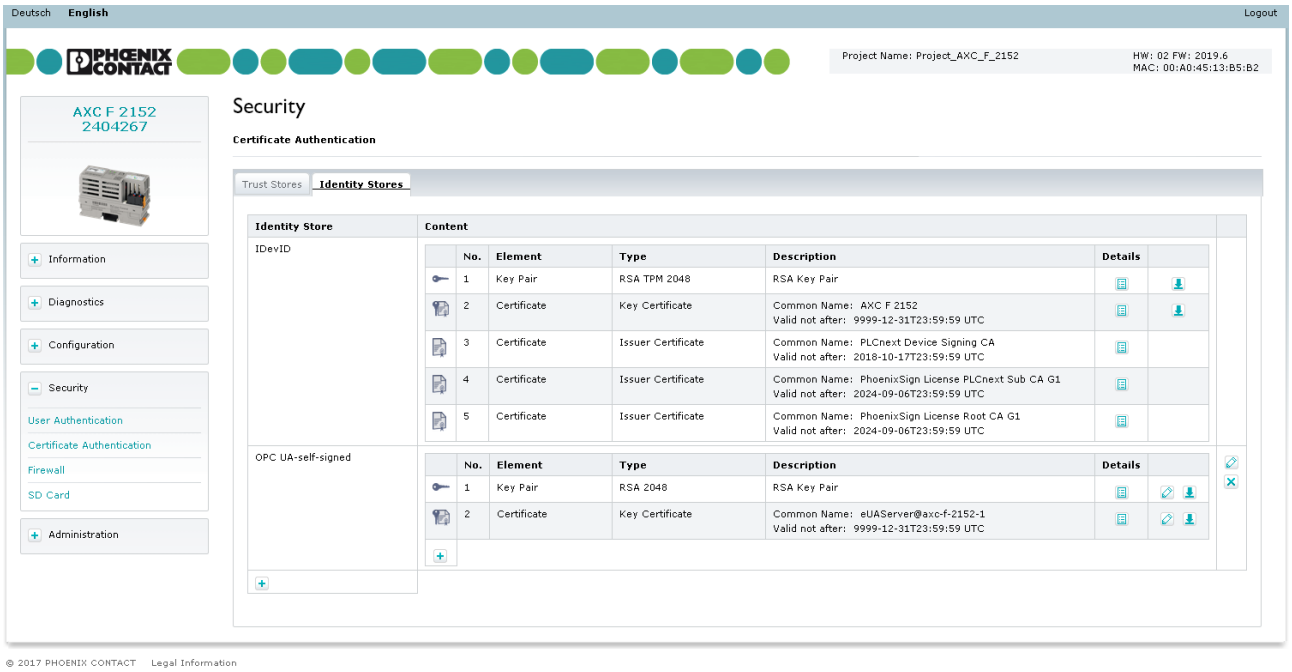


Figure 9-21 WBM: “Certificate Authentication” page, “Identity Stores” tab

9.5.4.3 “Firewall” page

The controller firewall is configured on the “Firewall” page.

You can only open the “Firewall” page if you are logged into WBM as an administrator.

For more detailed information regarding the “Firewall” page, please refer to the “PLCnext Technology” user manual.

The user manual can be downloaded at phoenixcontact.net/product/2404267.

“Basic Configuration” tab

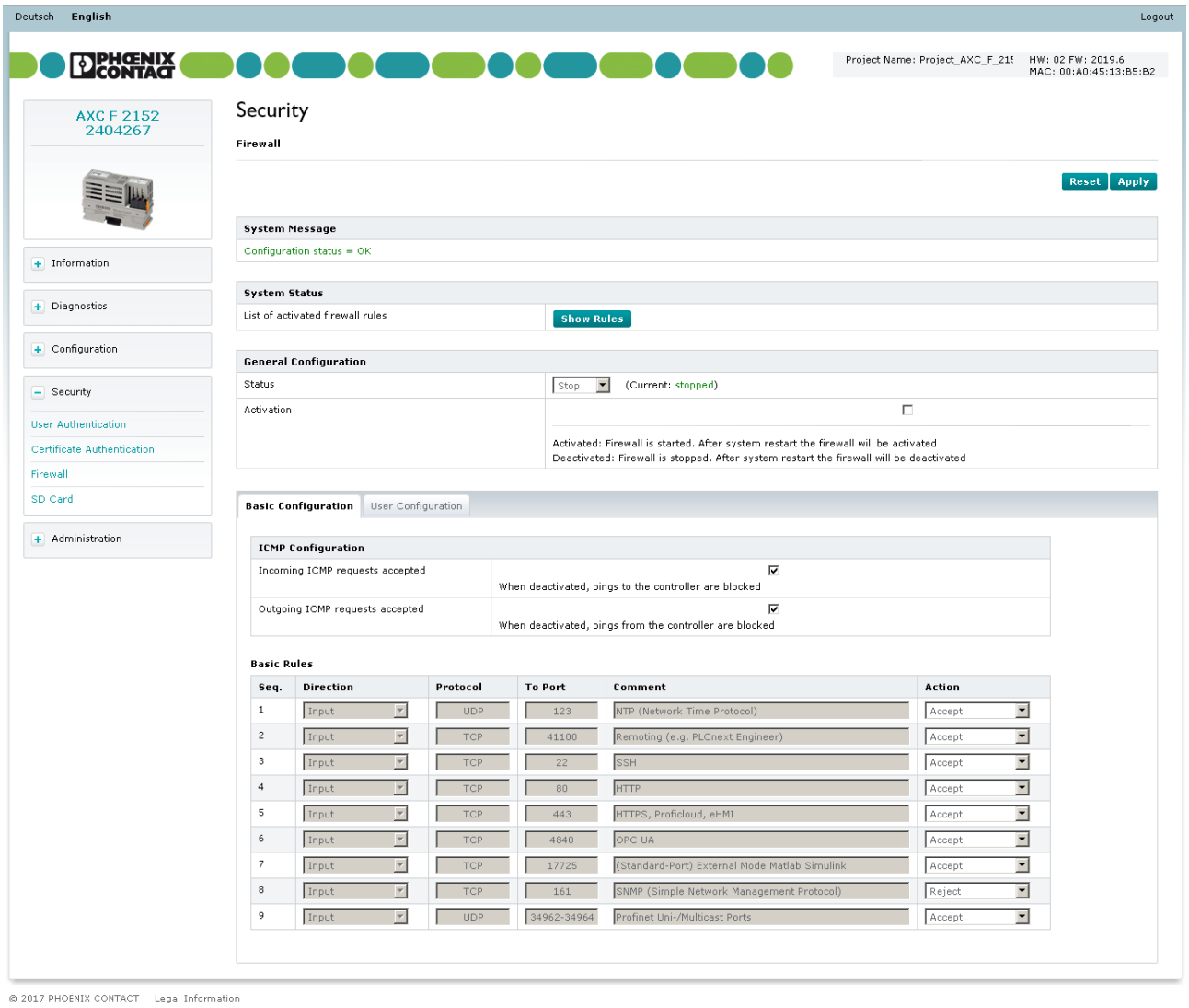


Figure 9-22 WBM: “Firewall” page, “Basic Configuration” tab

“User Configuration, Input Rules” tab

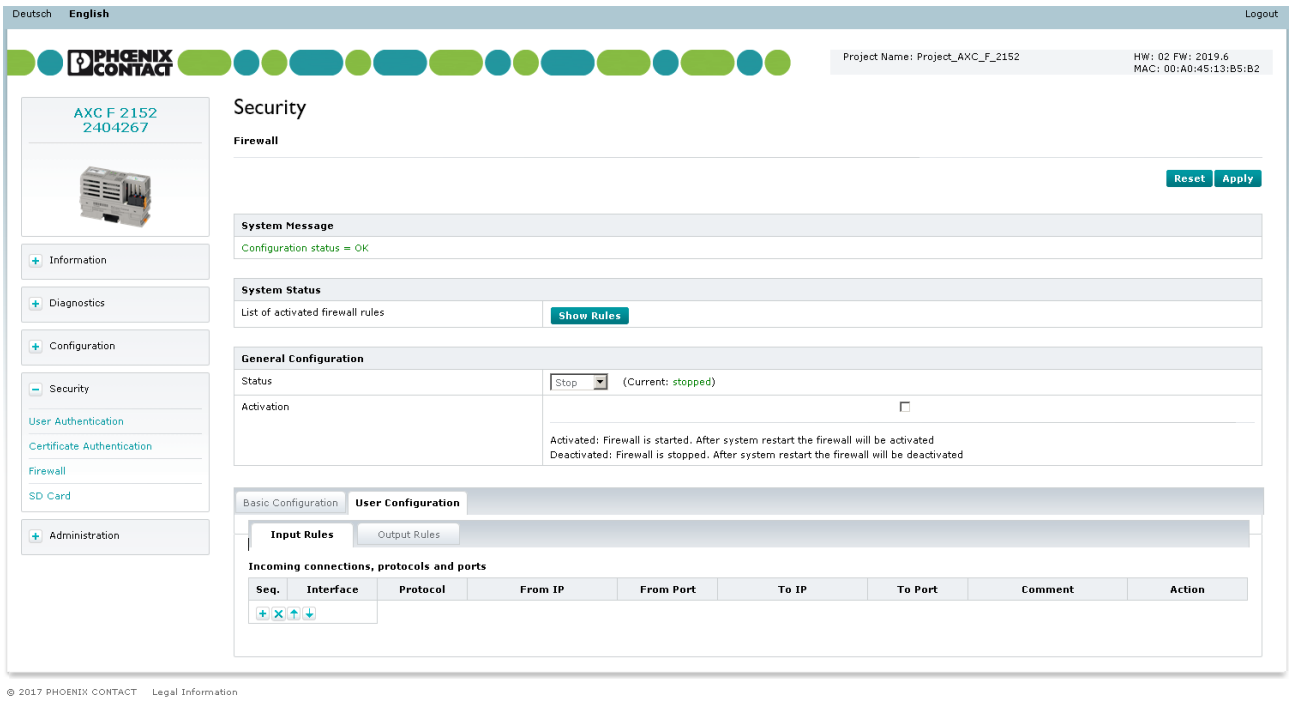


Figure 9-23 WBM: “Firewall” page, “User Configuration, Input Rules” tab

“User Configuration, Output Rules” tab

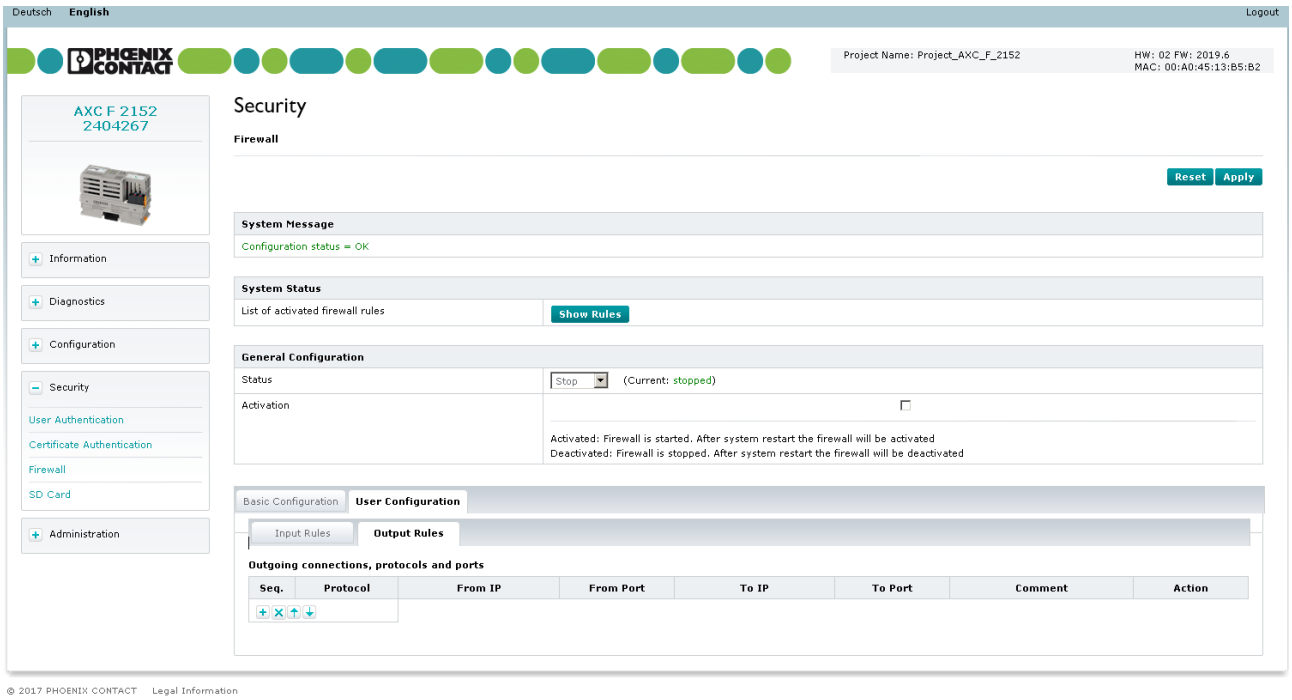


Figure 9-24 WBM: “Firewall” page, “User Configuration, Output Rules” tab

9.5.4.4 “SD Card” page

If the internal parameterization memory is not large enough for your application, the controller can be operated using an SD card, refer to Section “SD card (optional)” on page 38.

Please note the following when operating the controller with an SD card:

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

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

You can activate or deactivate the support of the SD card on the “SD Card“ page.
If you activate the support of the SD card, the SD card is recognized during the initialization phase of the controller.
If you deactivate the support of the SD card, the SD card will not be recognized by the controller.

Please note the following when operating the controller without an SD card:

If you operate the controller with **activated** SD card support **without SD card**, the possibility for data theft or manipulation is given.
Unauthorized persons could insert an SD card and reboot the controller. In this case the SD card is recognized during the initialization phase of the controller. If there is an overlay file system on the internal parameterization memory, this will be copied to the SD card. The overlay file system on the internal parameterization memory will be deleted.

Furthermore, all application-specific data will be deleted from the internal parameterization memory. PLCnext Engineer projects and IP configurations stored on the parameterization memory are no longer available. The controller accesses the data stored on the SD card.

Recommended:

- Deactivate the support of the SD card if you want to run the controller without SD card.
- Ensure that unauthorized persons do not have access to the controller.

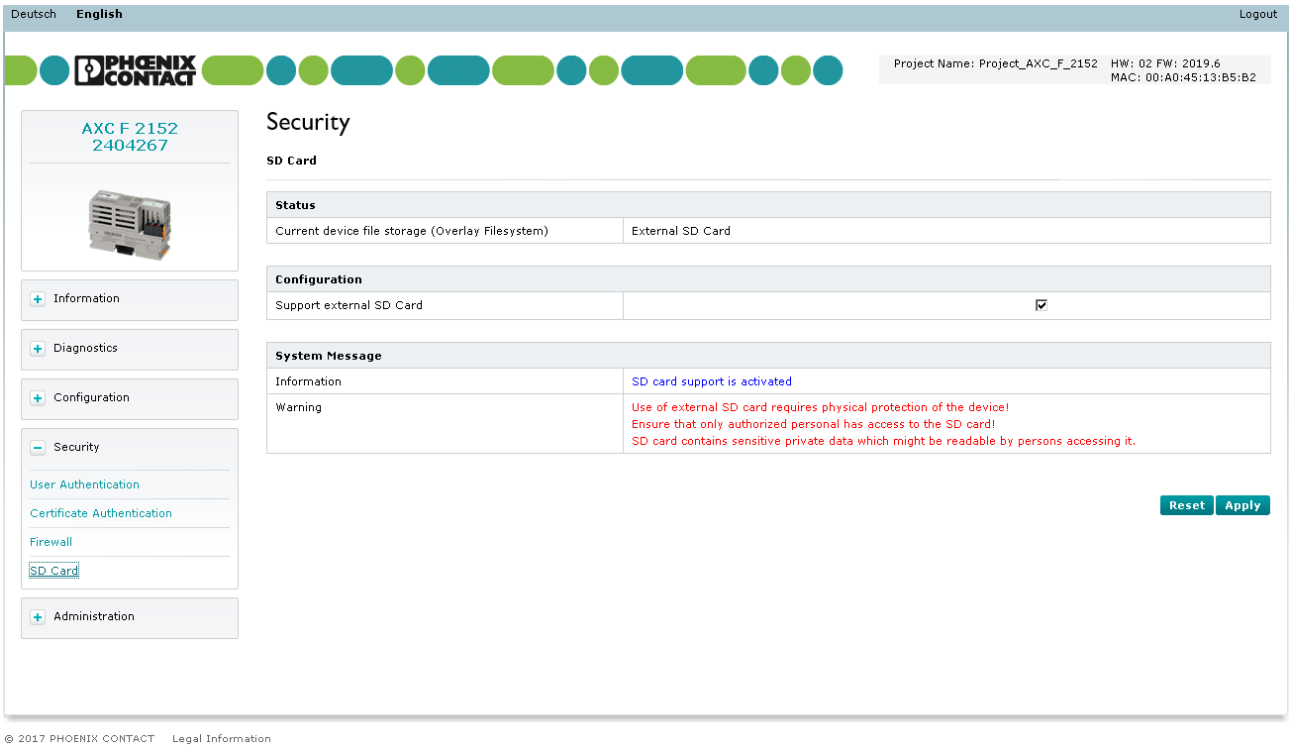


Figure 9-25 WBM: “SD Card” page

“Status” area

In the “Status“ area, you can see whether the controller is currently being used with or without an SD card.

Operation with SD card:

If you operate the controller with an SD card (display in the “Status“ area: “External SD Card“), all application-specific data is saved to the SD card. The overlay file system is generated on the SD card.

Operation without SD card:

If you operate the controller without an SD card (display in the “Status“ area: “Internal SD Card“), all application-specific data is saved to the internal parameterization memory of the controller. The overlay file system is generated on the internal parameterization memory.

“Configuration” area

You can activate or deactivate the support of the SD card in the “Configuration“ area (default setting: “Support external SD Card“ is activated).

- Activate or deactivate the check box “Support external SD Card“.
- To apply the setting, click the “Apply” button.

The setting will not take effect until the controller has been restarted.

- To discard the setting, click the “Reset” button.

Please note:

– If you deactivate the support of the SD card even though you are operating the controller with an SD card, the controller can no longer access the SD card after a restart.
– If you activate the support of the SD card even though you run the controller without an SD card, the controller boots without a fault. The possibility exists though for data theft or manipulation.
  • Deactivate the support of the SD card if you want to run the controller without SD card.

  In this case, the controller cannot access the SD card. This rules out the possibility that data from the internal parameterization memory is copied to the SD card (data theft) in case of an unauthorized plugging of an SD card. Additionally it is ruled out that data or configurations already on the SD card are transferred to the controller (data manipulation).
  • Ensure that unauthorized persons do not have access to the controller.

“System Message” area

In the “System Message“ area, information on the current configuration status or changes of the configuration are displayed (“Information“). Potential security risks are displayed as well (“Warning“).

9.5.5 “Administration” area

You can update the controller firmware via this area.
Alternatively, you can update the firmware via the shell, see Section A 1 on page 177.

9.5.5.1 “Firmware Update” page

You can only open the “Firmware Update” page if you are logged into WBM as an administrator.

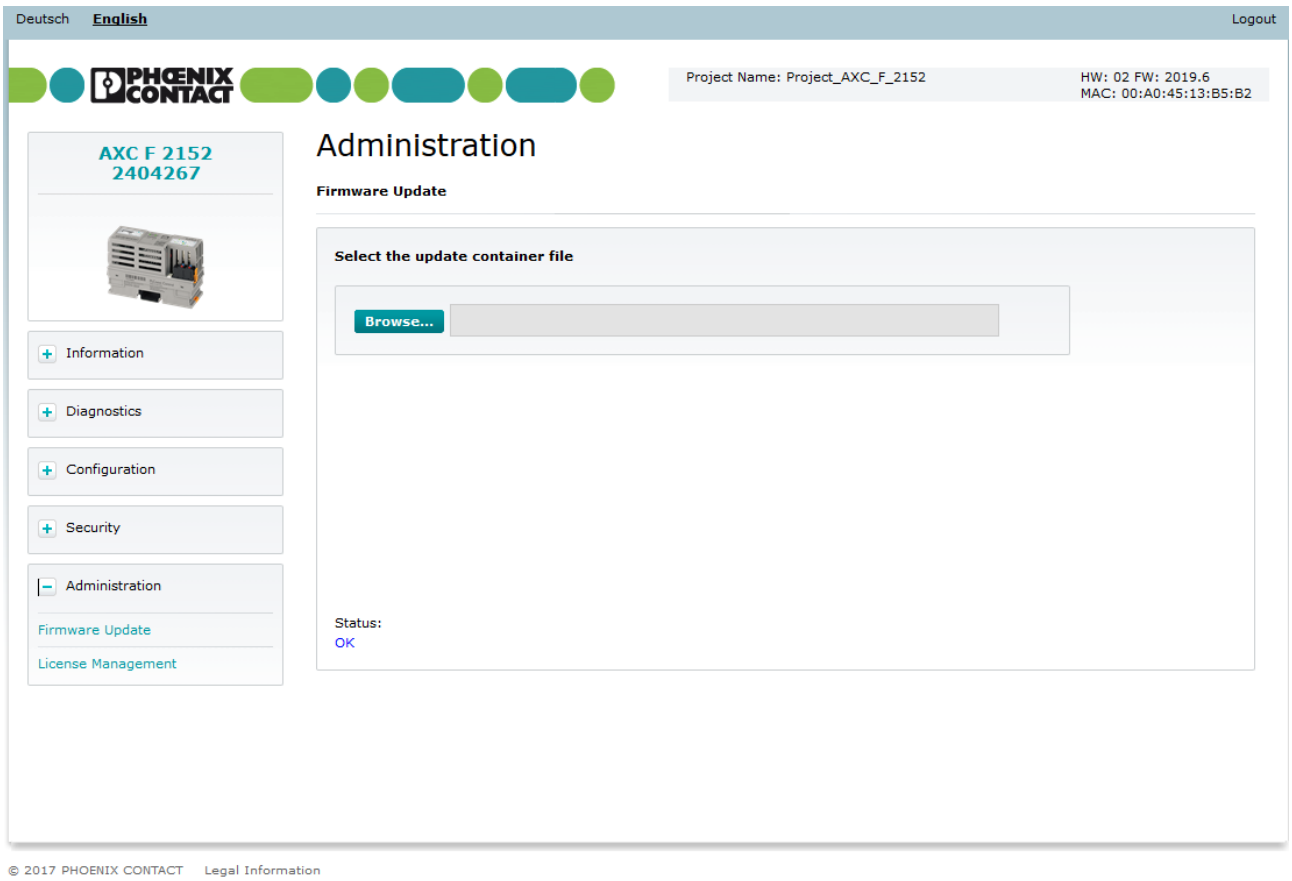


Figure 9-26 WBM: “Firmware Update” page

To update the controller firmware, proceed as follows:

Downloading the firmware file

- Download the firmware *.zip file at phoenixcontact.net/product/2404267.
- Unzip the firmware *.zip file.
- Run the *.exe setup file.
- Follow the instructions in the installation wizard.

During installation, the update file (*.raucb) and PDF files containing device-specific information are copied to the selected destination directory.

Noting down the installed firmware version

The firmware version currently installed on the controller is displayed on the “General Data” page (see Figure 9-6).

- Before updating the firmware, note down the installed firmware version so that you can then check that the firmware update was successful.

Selecting the firmware file

- Click on the “Browse...” button.
- In the file explorer that opens, select the *.raucb firmware file you want to install.
- Click on the “Open” button.

The firmware file to be installed is now displayed in WBM (see Figure 9-27).

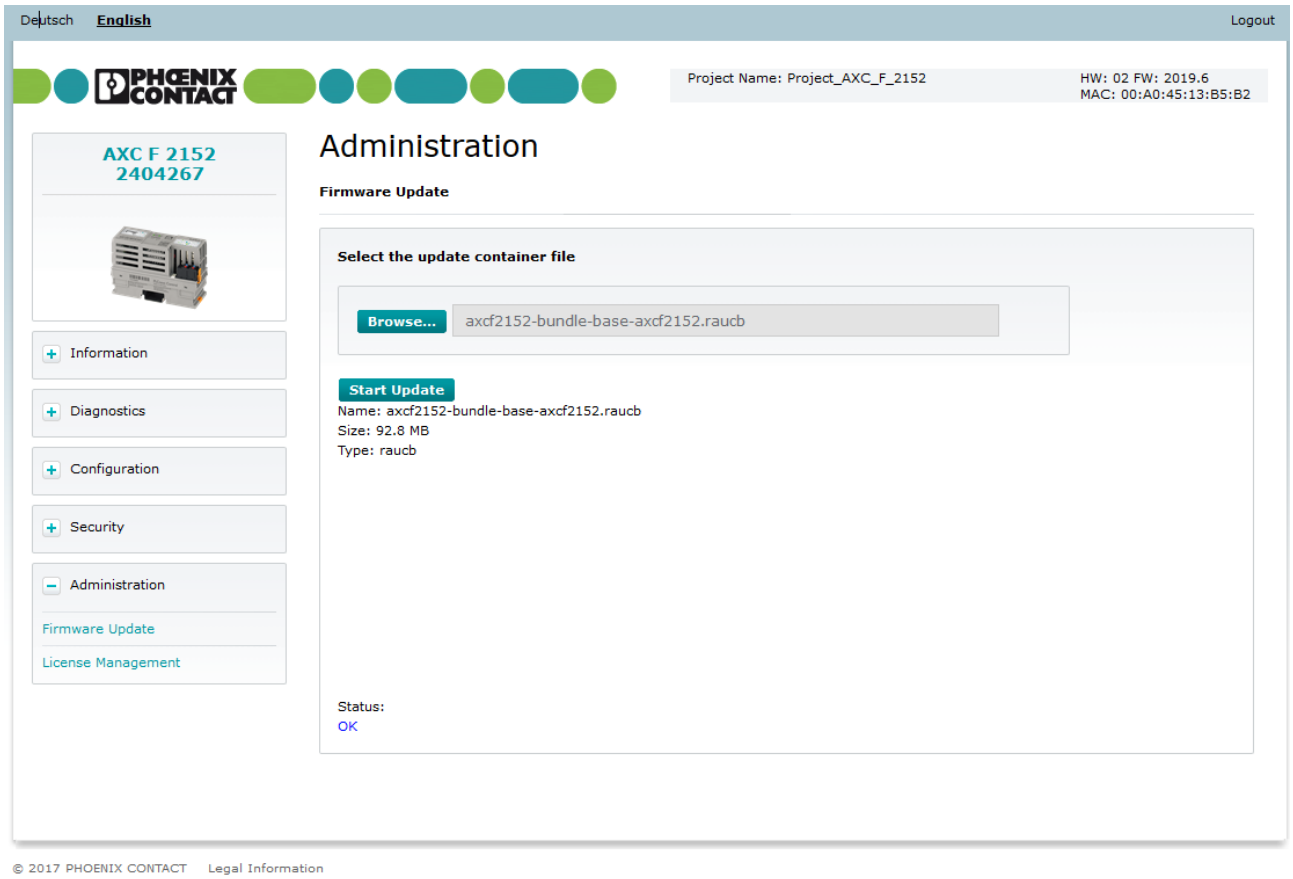


Figure 9-27 WBM: Firmware file to be installed in WBM

Starting the firmware update

- To start the firmware update, click on the “Start Update” button.

The update file is transferred to the controller.

Once the file has been successfully transferred, the firmware update is started.

The status of the file transfer and the update process are indicated respectively in WBM by progress bars (see Figure 9-28).

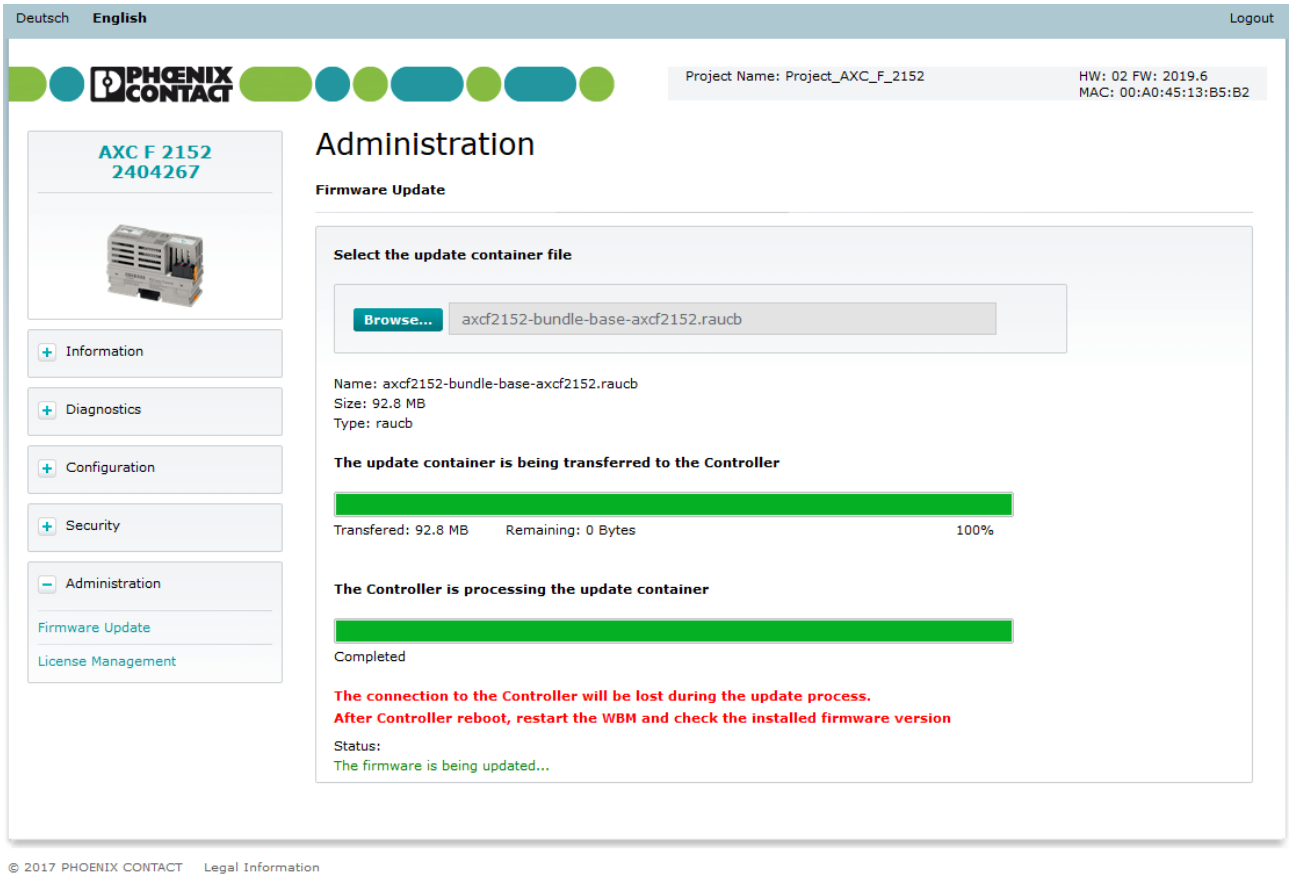


Figure 9-28 WBM: Status of the file transfer and the update process

After the firmware update, the controller is restarted automatically.

Please note:
The connection to the controller is interrupted during the firmware update. The WBM pages opened in the browser are no longer current after the firmware update.
Once the controller is fully initialized after the restart, you need to log back into WBM to update the WBM pages.
The updated firmware version is displayed in the top-right corner of every WBM page.

Checking the firmware version

- Once the controller has successfully restarted, log back into WBM.
- Open the “General Data” page.
- Check whether the correct firmware version is displayed.

If the previously installed firmware version is still displayed after the firmware update (see “Noting down the installed firmware version”), an error occurred during the firmware update.

- In this case, repeat the firmware update.

9.5.5.2 “License Management” page

On the “License Management“ page, you can view the licenses of the apps from the PLCnext Store that are installed on the controller.

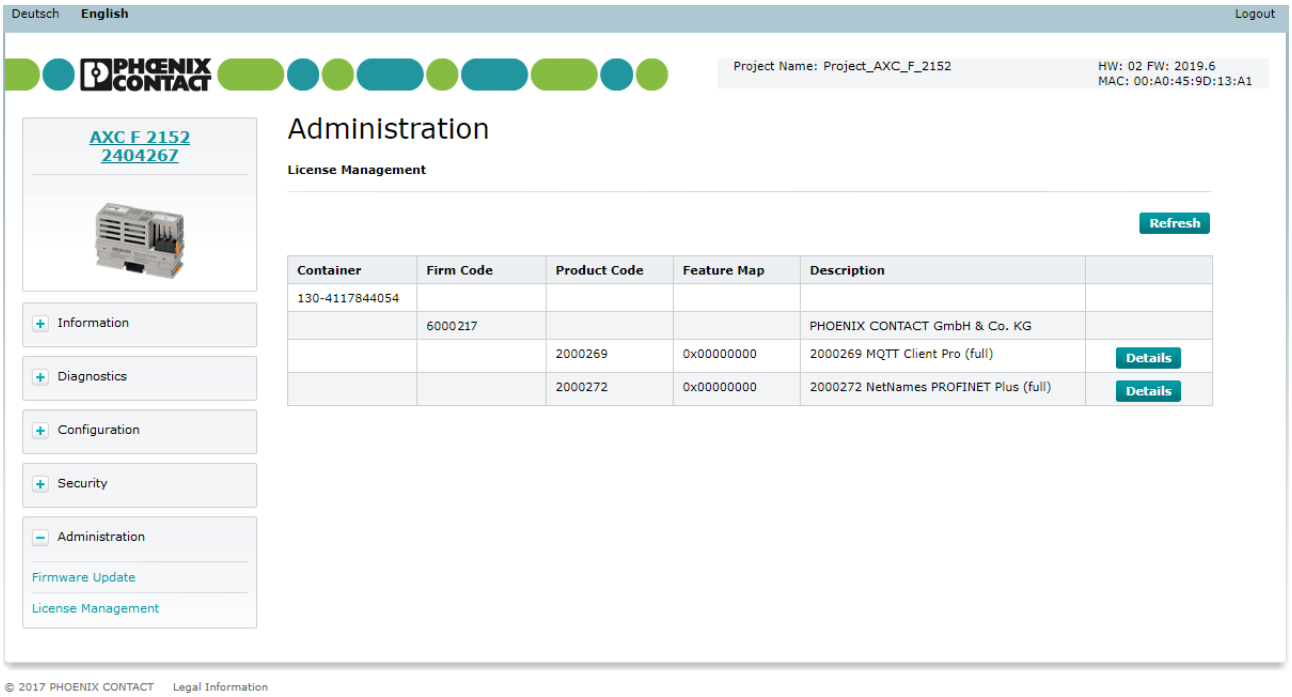


Figure 9-29 WBM: “License Management” page

Table 9-3 License Management

Column	Description
Container	Serial number of the container Licenses are managed in a container.
Firm Code	Firm Code and Product Code are issued by Phoenix Contact and together create a unique identification number for the license.
Product Code	
Feature Map	The Feature Map specifies with which scope of functions the app is installed.
Beschreibung	Name of the license component (container, licenser or app)

- To update the overview of the app licenses, click on the “Refresh“ button.

“Details view”

- To call up more information on an app license, click on the “Details“ button.

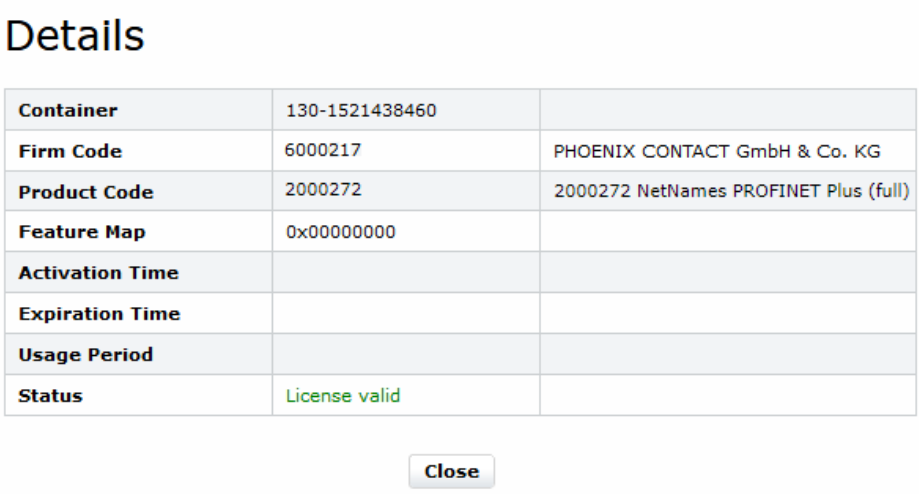


Figure 9-30 WBM: “License Management” page, “Details” view

Table 9-4 Details

Column	Description
Activation Time	Date as of when the license is valid.
Expiration Time	Date as of when the license is invalid.
Usage Period	Use duration in days
Status	Current status of the license

10 Removing hardware

For basic information on 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: Damage to electronics due to inadequate external protection – No safe fuse tripping in the event of a fault

The electronics in the device will be damaged due to inadequate external fuse 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).
- Ensure that the external fuse trips reliably in the event of a fault.

NOTE: Damage to the contacts when tilting

Tilting the modules can damage the contacts.

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

Please note:

- During any 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 reactivation.

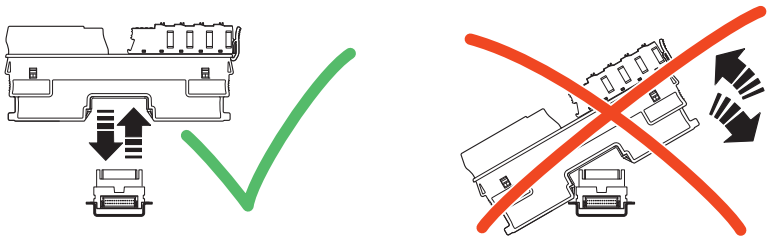


Figure 10-1 Removing the module keeping it **perpendicular** to the DIN rail

10.2 Removing cables

- Disconnect the Axioline F station from the power supply.

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).

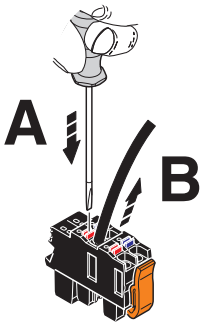


Figure 10-2 Removing the cable

10.3 Removing the connector

Removing the supply connector

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

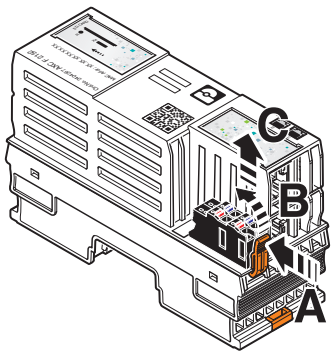


Figure 10-3 Removing the supply connector

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-in mechanism releases the SD card and partially ejects the SD card from the SD card holder.
- Remove the SD card.

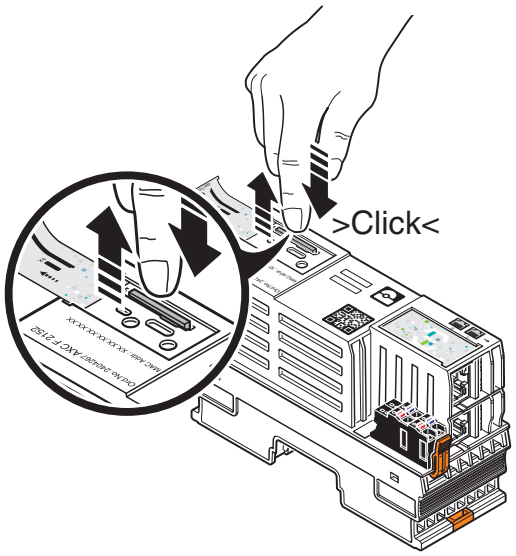


Figure 10-4 Removing the SD card

10.5 Removing the controller

- Insert a suitable tool (e.g., bladed screwdriver) into the upper and lower snap-in 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 keeping it perpendicular to the DIN rail (B in Figure 10-5).

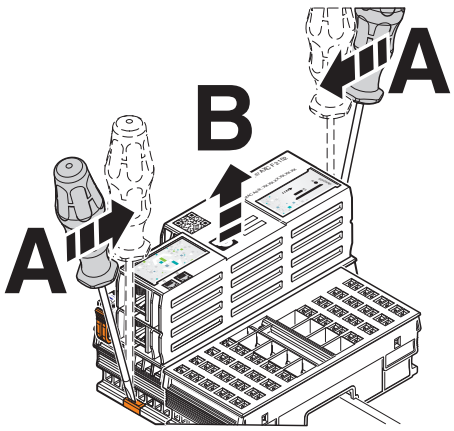


Figure 10-5 Removing the controller

10.6 Removing a left-alignable Axioline F extension module

- Remove the left-alignable Axioline F extension module as described in the module-specific packing slip.

10.7 Removing the AXC F IL ADAPT Inline adapter terminal

- Remove the Inline adapter terminal as described in the module-specific packing slip.

11 Device replacement, device defects and repair

11.1 Device replacement

The controller can be replaced as required.

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

- Disconnect the Axioline F station from the power supply.
- Remove the SD card of the controller to be replaced.
- Replace the controller in your application with an identical controller (same order number).

Please note:
If the new controller firmware is of a later version than the firmware of the controller to be replaced, you may have to recompile the project in the PLCnext Engineer software and in the integrated development environment. This procedure is only necessary for certain firmware versions. For additional information, please refer to the “Change notes for the AXC F 2152 controller” application note.
The application note can be downloaded at phoenixcontact.net/product/2404267.

- To adopt the settings stored on the SD card, insert the SD card in the new controller.
- Once replaced, restore all of the necessary connections.
- In case you operate the controller with PROFICLOUD connection:
- Delete the controller from PROFICLOUD, as described in the “Startup and operation of hardware and software components of the PROFICLOUD” user manual.
- Then reregister the controller in PROFICLOUD and add it as a PROFICLOUD device, as described in Section “Configuring PROFICLOUD” on page 106.

11.2 Device defects and repair

Repairs may only be carried out by Phoenix Contact.

- Send faulty devices back to Phoenix Contact for repair or to receive a replacement device.
- We strongly recommend using the original packaging to return the product.
- Include a note in 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 14.2).
  - Use dehumidifying agents if necessary.
  - Use suitable 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 wadding.
  - Attach warnings to the transport packaging so that they are clearly visible.
  - Please ensure that the delivery note is placed inside the package if the package is to be shipped domestically. However, if the package is being shipped internationally, the delivery note must be placed inside a delivery note pocket and attached to the outside so that it is clearly visible.

12 Maintenance, decommissioning and disposal

12.1 Maintenance

The controller is maintenance-free.

12.2 Decommissioning and 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 reformatting 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.

13 Troubleshooting and frequently asked questions (FAQs)

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

14 Ordering data and technical data

14.1 Ordering data

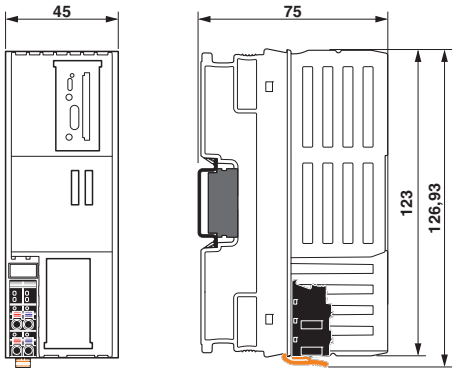
Description	Type	Order No.	Pcs./Pkt.
PLCnext Control for the direct control of Axioline F I/Os. With two Ethernet interfaces. Complete with connector and bus base module.	AXC F 2152	2404267	1

Accessories	Type	Order No.	Pcs./Pkt.
Engineering software platform for Phoenix Contact automation controllers. PLCnext Engineer is IEC 61131-3-compliant and its functionality can be expanded using add-ins. (Software)	PLCNEXT ENGINEER	1046008	1
Program and configuration memory for storing the application programs and other files in the file system of the PLC, pluggable, 8 GB. (Memory)	SD FLASH 8GB PLCNEXT MEMORY	1061701	1
Program and configuration memory for storing the application programs and other files in the file system of the PLC, pluggable, 2 GB. (Memory)	SD FLASH 2GB PLCNEXT MEMORY	1043501	1
Right-alignable Inline adapter terminal (INTERBUS master) for one PLCnext Control device for setting up a PLCnext Technology Inline station	AXC F IL ADAPT	1020304	1
Left-alignable Ethernet interface, for connection to a compatible modular controller from the PLCnext Control range.	AXC F XT ETH 1TX	2403115	1
Left-alignable INTERBUS master, for the connection of INTERBUS remote bus components to a compatible modular controller from the PLCnext Control range.	AXC F XT IB	2403018	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
Bus base module for left-aligning the AXC F 2xxx controllers	AXC BS L 2	1064312	1
Connecting cable, for connecting the controller to a PC from USB C to USB C (Cable/conductor)	CAB-USB C/ USB C/1,8M	1021809	1
Connecting cable, for connecting the controller to a PC from USB A to USB C (Cable/conductor)	CAB-USB A/ USB C/1,8M	2404677	1

	Type	Order No.	Pcs./Pkt.
Axioline F bus base module for housing type BK (Replacement item)	AXL BS BK	2701422	5

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	-	-
Data sheet, English, PLCnext Technology, Inline adapter terminal (INTERBUS master), right-alignable	DB EN AXC F IL ADAPT	-	-
Data sheet, English, Axioline F, left-alignable INTERBUS master	DB EN AXC F XT IB	-	-
Data sheet, English, Axioline F, left-alignable Ethernet interface	DB EN AXC F XT ETH 1TX	-	-
Application note, English, Measures to protect network-capable devices with Ethernet connection against unauthorized access	AH EN INDUSTRIAL SECURITY	-	-
User Manual, English, for diagnosis in Generation 4 controller boards	IBS SYS DIAG DSC UM E	2747293	1
User manual, English, for firmware messages of Generation 4 controller boards, only available as a download.	IBS SYS FW G4 UM E	2745185	1
User manual, English, for the Peripherals Communication Protocol (PCP), only available as a download.	IBS SYS PCP G4 UM E	2745169	1

14.2 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
Operating system	Linux
	512 Mbyte DDR3 SDRAM
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 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

Ambient conditions	
Vibration (operation)	5g
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 DIN EN 60068-2-27)
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 mm² ... 1.5 mm²
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)
Number of local bus devices that can be connected	max. 63 (observe current consumption)

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 consumption	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. If you are using an external fuse, the power supply unit must be able to supply four times the nominal current of the fuse. This ensures that it trips in the event of an error.

Axioline F local bus supply (U_{Bus})	
Supply voltage	5 V DC (via bus base module)
Power supply unit	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

Programming tool	PLCnext Engineer Eclipse
Programming languages supported	Programming in acc. with IEC 61131-3 C++ C# Java Manufacturer-specific

IEC 61131 runtime system	
Module classification	PLCnext Control for direct control of Axioline F I/Os.
Application type	Distributed control technology
Application interface	OPC UA
Number of data blocks	depends on mass storage
Number of control tasks	32 (16 per processor core)
Cycle Time	1 ms (for cyclical task)
Program memory	8 Mbyte
Retentive mass storage	48 kByte (NVRAM)
Mass storage	16 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	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.

UL: Additional information	
Overvoltage category	2
Pollution degree	2
Operating mode	Indoor use
Minimum temperature rating and size of the cables to be connected to the field wiring terminals	min. 75 °C and 24 ... 16 AWG

- All types are intended to be used in final safety enclosure, which shall conform with requirements for protection against the spread of fire and shall have adequate rigidity acc. to UL 61010–1 & UL 61010–2–201.
- If the device is used in not specified manner, the protection provided by the device may be impaired.
- The supply source and ext. circuits intended to be connected to this device shall be galv. separated from mains supply or hazardous live voltage by reinforced or double insulation and meet the requirements of SELV circuit of UL/IEC 61010–2–201 and clause 9.4 Limited energy circuit of UL/IEC 61010–1 or NEC Class 2.

A Appendix

A 1 Updating the firmware via the shell

To update the controller firmware, proceed as follows:

- Download the firmware *.zip file at phoenixcontact.net/product/2404267.
- Unzip the firmware *.zip file.
- Run the *.exe setup file.
- Follow the instructions in the installation wizard.

During installation, the update file (*.raucb) and PDF files containing device-specific information are copied to the selected destination directory.

- Open the SFTP client software (e.g., WinSCP).
- If necessary:
  Enter the IP address of the controller in the “Host name” input field.
- Log in as an administrator.

The following access data is set by default:
User name: admin
Password: printed on the controller (see Figure 3-3)

- Copy the *.raucb update file to the /opt/plcnext directory (home directory of the Linux user “admin”).
- Open the shell using a command line tool (e.g., PuTTY or Tera Term).
- Log in as an administrator.

The following access data is set by default:
User name: admin
Password: printed on the controller (see Figure 3-3)

- Switch to the /opt/plcnext directory (command: `cd /opt/plcnext`).
- To start the firmware update, enter the command
  `sudo update-axcf2152`.

You will be asked to enter the administrator password.

- Enter the administrator password.

The firmware is updated. During the firmware update, the RUN LED first flashes, and then stops.
Following this, the controller is restarted. Once the controller has been fully initialized, the RUN LED lights up permanently.
The update file is deleted automatically from the /opt/plcnext directory.

Alternatively, you can update the firmware via the controller WBM, see Section 9.5.5.1.

A 2 Shell commands for controlling the firmware

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

You can control the firmware with the following shell commands:

Table A-1 Shell commands for controlling the firmware

Shell command	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 PLCnext Engineer.
`sudo /etc/init.d/plcnext start`	Starts all PLCnext firmware processes
`sudo /etc/init.d/plcnext restart`	Restarts all PLCnext firmware processes

A 3 Replacing the HTTPS certificate

You have the option of replacing the HTTPS certificate used by the controller with a third-party certificate. The HTTPS certificate comprises two files: https_cert.pem and https_key.pem.

To replace the files on the controller, proceed as follows:

- Open the SFTP client software (e.g., WinSCP).
- If necessary:
  Enter the IP address of the controller in the “Host name” input field.
- Log in as an administrator.

The following access data is set by default:
User name: admin
Password: printed on the controller (see Figure 3-3).

- Open the /opt/plcnext/Security/Certificates/https directory.

The two files, https_cert.pem and https_key.pem, are located in this directory.

- Replace the two files with the third-party certificate files.

Please note:

The third-party certificate files must have the same designation as the original files.

- If necessary, rename the third-party certificate files to https_cert.pem and https_key.pem.

B Appendix for document lists

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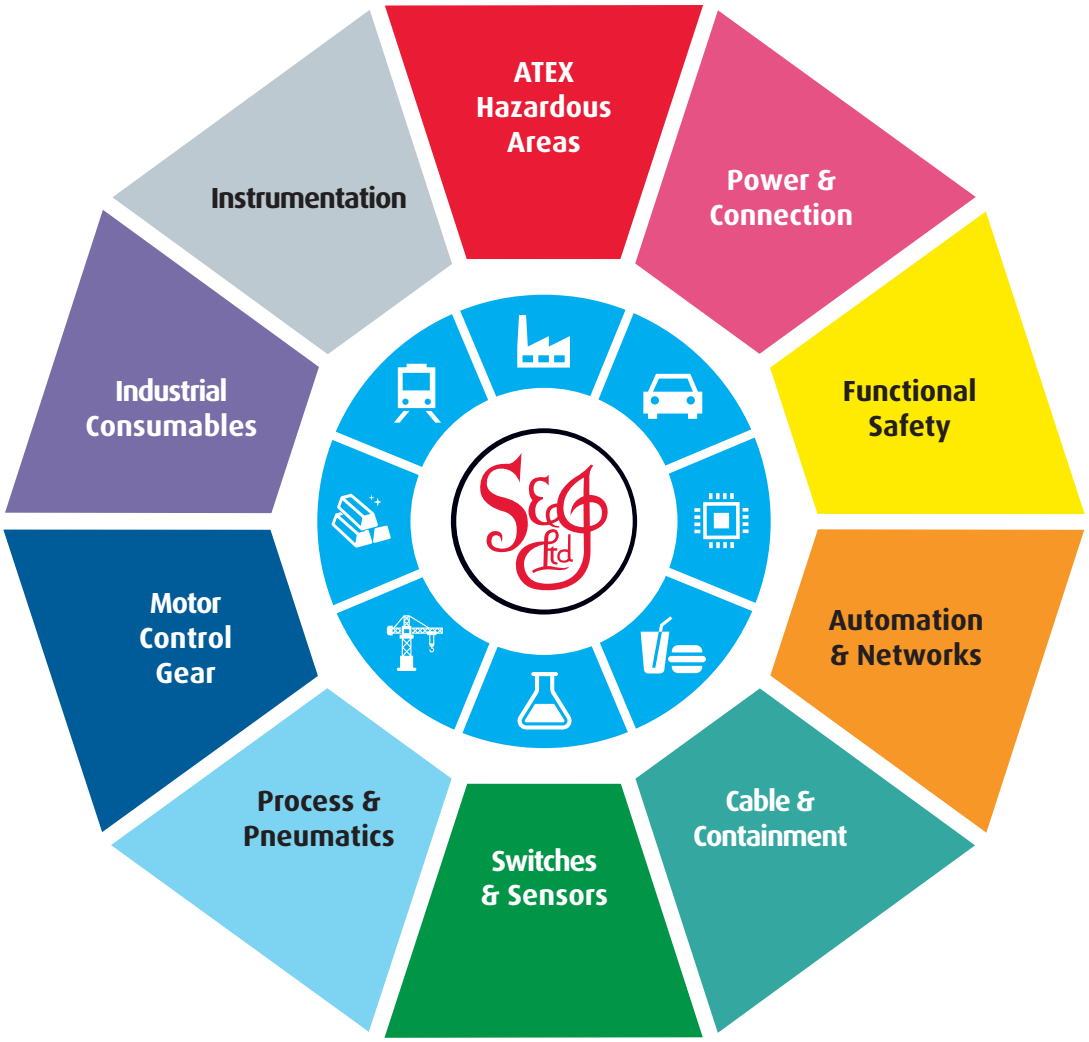

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