



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

User manual

User manual

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

UM EN AXC F 2152, Revision 02

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1 For your safety

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

1.1 Identification of warning notes



This symbol indicates hazards that could lead to personal injury. There are three signal words indicating the severity of a potential injury.

DANGER

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

WARNING

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

CAUTION

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



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



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

1.2 Qualification of users

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

- Electrically skilled persons or persons instructed by them. The users must be familiar with the relevant safety concepts of automation technology as well as applicable standards and other regulations.
- 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.

1.3.2 Modifications

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.

1.4 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
- Secure against reconnection
- Verify safe isolation from the supply
- Ground and short circuit
- Cover or safeguard adjacent live parts

Once the work is complete, perform above steps 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 or thermal stress that exceeds the specified thresholds.

**NOTE: Risk of unauthorized network access**

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

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 the communication interfaces of the controller, 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 in accordance with §§ 15 ff. AktG or German Stock Corporation Act (hereinafter collectively referred to as "Phoenix Contact") from all third-party claims that are made due to improper use.

For the protection of networks for remote maintenance via VPN, Phoenix Contact offers the mGuard product range as 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 to be found in the AH EN INDUSTRIAL SECURITY application note. The application note is available for downloading at phoenixcontact.net/product/2404267.

**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. into the cooling openings).

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

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

- Ensure that the device is operated within the permitted ambient temperature range, see [Section 13.2](#).

**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 13.2](#).



NOTE: Device damage 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.

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

2 Transport and unpacking

2.1 Transport

The device is delivered in cardboard packaging.

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

2.2 Storage

The storage location must meet the following requirements:

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

2.3 Checking the delivery

- Check the delivery for transport damage.

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

- Submit claims for any transport damage immediately, and inform Phoenix Contact or your supplier as well as the shipping company without delay.
- Enclose photos which clearly document the damage to the packaging/delivery together with your claim.
- Immediately upon delivery, refer to the delivery note to ensure that the content of the packaging is complete.
- Keep the box and packaging material in case it is necessary 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 13.2](#)).
 - If necessary, use dehumidifying agents.
 - Use appropriate ESD packaging to protect components that are sensitive to electrostatic discharge.

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

Scope of supply

- AXC F 2152 controller
- AXL F BS BK bus base module
- AXL CN S/UL supply plug

2.4 Unpacking

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

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

**NOTE: Electrostatic discharge**

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

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

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

- Observe the ESD notes during unpacking and packaging.

3 Description of the AXC F 2152

3.1 General description of the controller

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

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

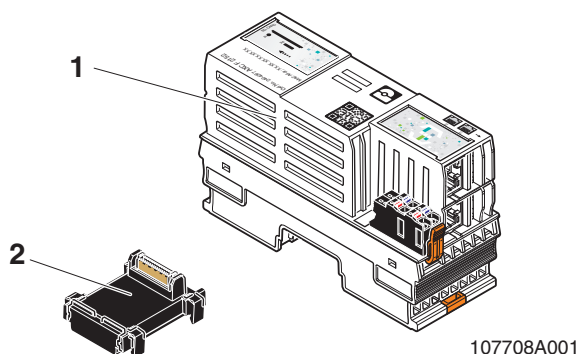


Figure 3-1 Components of the controller

Axioline F station

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

Programming

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

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

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



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

Axioline F local bus

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

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



NOTE: Electronics may be damaged if overloaded

Observe the current consumption of each device when configuring an Axioline F station. The current consumption is specified in 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.

Axioline F/ System and firmware

For system-specific information on the Axioline F system, please refer to the PC Worx 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 are available for downloading at phoenixcontact.net/product/2404267.

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 supplied as standard with the controller.

- Only use an SD card provided by Phoenix Contact (see [Section “Ordering data” on page 120](#)).



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 PC Worx 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 121](#).

3.2 Licensing information on open source software

The AXC F 2152 controller works with a Linux operating system.

License information on the individual Linux packages are to be found in the file system of the AXC F 2152 under the path

/usr/share/common-licenses



Information on the directory structure of the file system is to be found in [Section 3.5](#).

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).

3.3 Requesting source code

This 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 within three years after delivery of the AXC F 2152.

To do so, contact the Phoenix Contact After Sales Service in writing at the address

PHOENIX CONTACT GmbH & Co. KG

After Sales Service

Flachsmarktstraße 8

32825 Blomberg

GERMANY

Subject: Source code AXC F 2152

3.4 Hardware and software requirements

Hardware/software	Description
Controller	AXC F 2152
SD card	For ordering data, see Section "Ordering data" on page 120
Ethernet cable	Ethernet cable for connecting the controller to a PC
PC Worx Engineer	≥7.2

3.5 Directory structure of the file system

The AXC F 2152 controller works with a Linux operating system. You can access the controller via SFTP or via SSH and view the directories and files on the file system (on the internal parameterization memory and on the 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 filesystem. 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 filesystem here.

Operation with an SD card

If you operate the controller with an SD card, the overlay filesystem is generated on the SD card.

Settings that you have configured yourself (e.g. network configuration, project bus configuration, PC Worx 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 customer-specific C++ programs. Detailed information on programming the AXC F 2152 using C++ is to be found in the PLCnext community at plcnext-community.net .
/usr/share/common-licenses	License information on the individual Linux packages of the AXC F 2152

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

Directory	Description
/opt/plcnext	Home directory of the Linux user “admin” 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 memory path.
/opt/plcnext/logs	Log files of the device firmware
/opt/plcnext/projects/PCWE	Directory for storing PC Worx Engineer projects All files and subdirectories in this directory are managed exclusively by PC Worx Engineer. <ul style="list-style-type: none"> Do not make any changes to this directory.
/opt/plcnext/certificates/https	Directory for storing HTTPS certificates For detailed information on the exchange of HTTPS certificates, please refer to Section “Replacing HTTPS certificate” on page 127 .

3.6 Using SFTP to access the file system

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

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



Please note:

Authentication via 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 of the AXC F 2152 via the User Manager, see [Section 9.5.2.1](#).

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

User name: admin

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

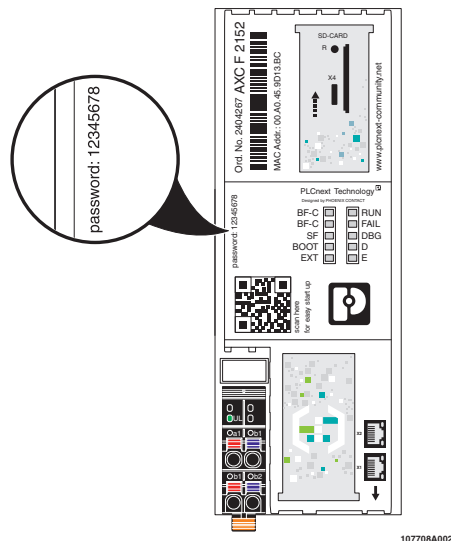


Figure 3-2 Administrator password on the controller

3.7 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.

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

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



Please note:

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

Administrator rights are required for SSH access.

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

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

User name: admin

Password: Printed on the controller (see position 1 in the [Figure 3-2 on page 18](#)).

You can control the firewall with the following shell commands:

Table 3-2 Shell commands for controlling the firewall

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

The following controller firewall rules are stored in the “plcnx-filter” file in the /etc/nftables upon delivery:

Table 3-3 Controller firewall rules upon delivery

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

3.8 Possible fields of application of the controller

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

The controller can be used as a decentral controller of an Axioline F station which is connected to an Ethernet system. A maximum of 63 devices (Axioline F modules) can be connected to the controller. The maximum number of 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 $\leq 55^{\circ}\text{C}$).

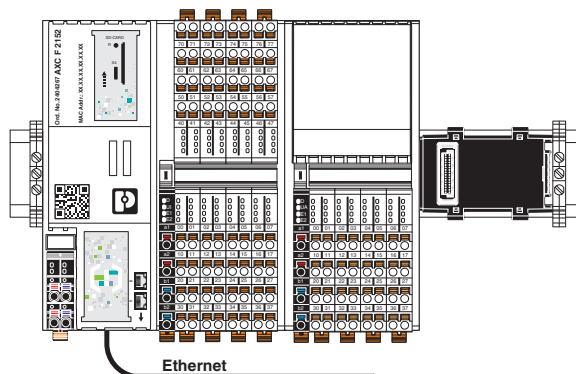


Figure 3-3 Axioline F station with AXC F 2152 controller

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

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

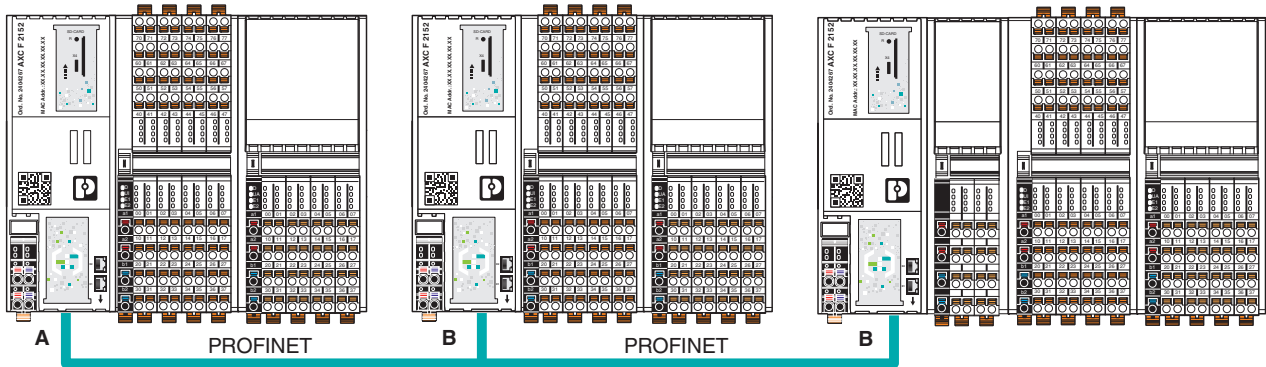


Figure 3-4 AXC F 2152 as a PROFINET controller

Key:

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



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

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

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

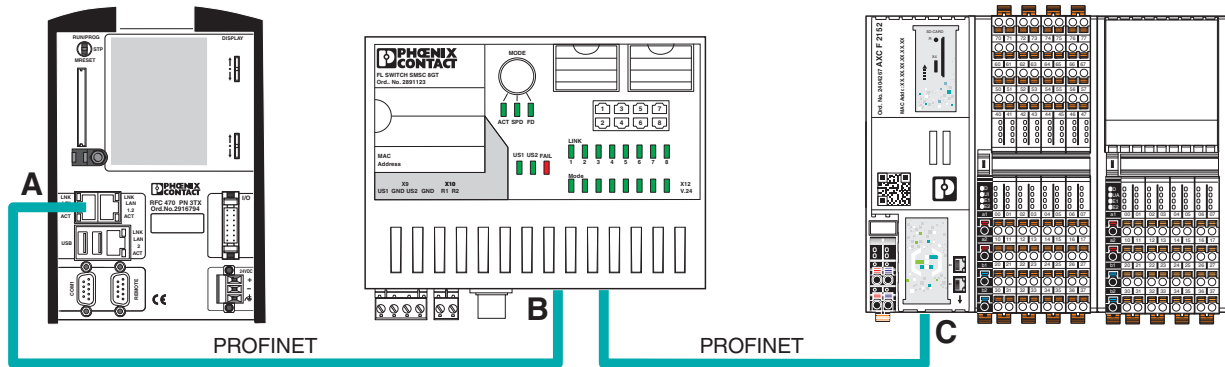


Figure 3-5 AXC F 2152 as a PROFINET device

Key:

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



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

3.9 Components of the controller

3.9.1 Connection and operating elements

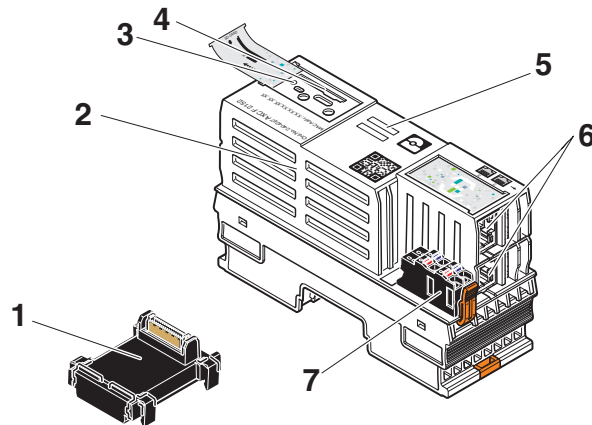


Figure 3-6 Connection and operating elements of the controller

The controller comprises 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 120](#).

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

3.9.2 Printing

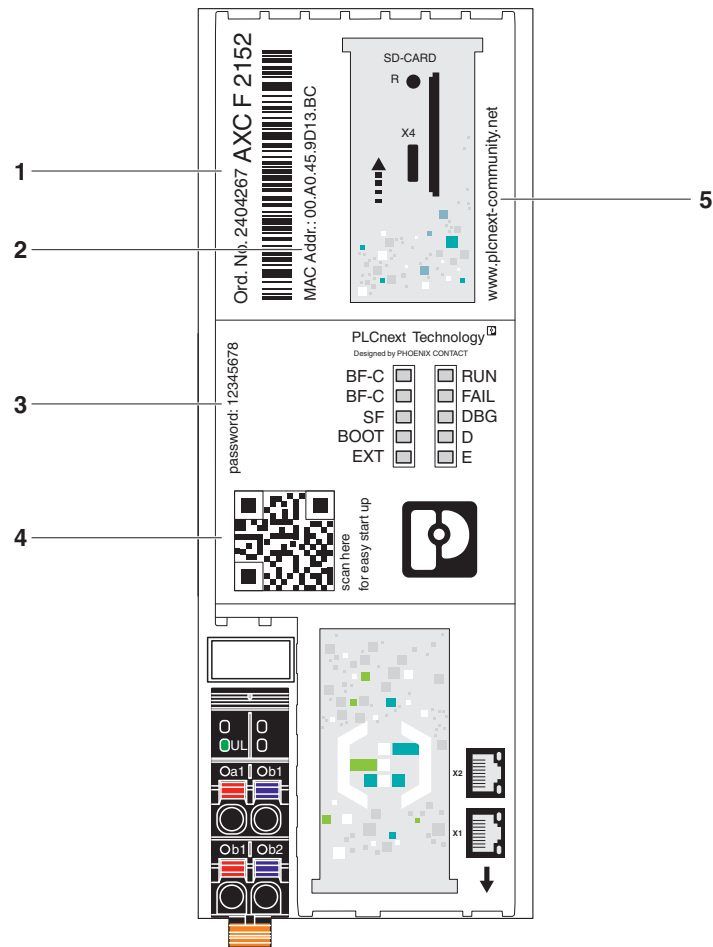


Figure 3-7 Printing

107708A003

The following information is printed on the controller:

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

Administrator password

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

- The controller file system
- Certain functions in PC Worx Engineer
- The PC Worx Engineer HMI (in preparation)
- The web-based management function (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 9.5.2.1](#)).

QR code

You can access the PLCnext community directly via the QR code.

In the PLCnext community, you will find

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

3.10 Diagnostics and status indicators

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

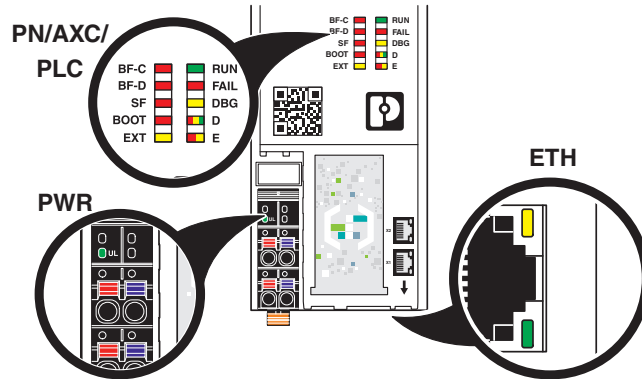


Figure 3-8 Diagnostics and status indicators

Table 3-4 Controller diagnostics and status indicators

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

Table 3-4 Controller diagnostics and status indicators

Designation	Color	Indicates	Status	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 mode, application program is not being processed.
			Flashing (2 Hz)	Controller has been reset to the default status (see Section "Reset button (concealed)" on page 31).
			On	PLCnext runtime system successfully initialized and an application program is running. The controller is in the RUN status.
FAIL	Red	Failure	On	A runtime error has occurred in the application program of the PLCnext runtime system.
			Off	A runtime error has not occurred in the application program of the PLCnext runtime system.
DBG	Yellow	Debug mode (troubleshooting)	On	The PLCnext runtime system / controller is in debug mode, i.e. debug mode has been activated in PC Worx Engineer (break-point(s) set). The 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 3-4 Controller diagnostics and status indicators

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

Table 3-4 Controller diagnostics and status indicators

Designation	Color	Indicates	Status	Description
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 is to be found in [Section “Updating the firmware” on page 125](#).



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 (1 Hz).

Information on operating the controller with an SD card is to be found in [Section “SD card \(optional\)” on page 34](#).

3.11 Reset button (concealed)

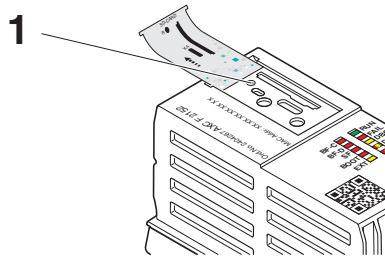


Figure 3-9 Reset button (1, concealed)

The reset button on the controller can only be operated with a pointed 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 user-specific data is deleted.
- Type 2:
The controller is restored to the delivery state.

Default setting type 1

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

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

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

- Switch off the supply voltage of the controller.
- After the LEDs have gone out, press the reset button.
- Hold 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 1.

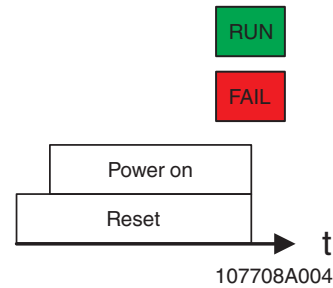


Figure 3-10 Timing when resetting to default setting type 1 and LED indicators

Default setting type 2

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



Please note:

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

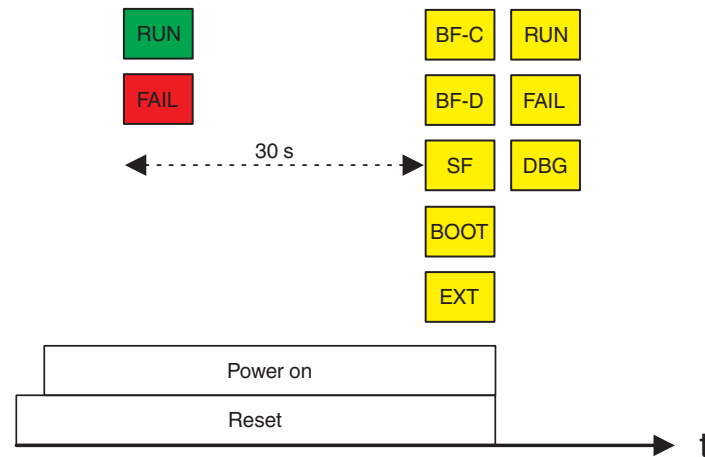
To restore the controller to default setting type 2, proceed as follows:

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

The RUN and FAIL LEDs light up.

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

The controller is reset to default setting 2.



107708A005

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

3.12 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 3.13](#).

The programs and configurations (e.g. controller IP address) belonging to your PC Worx 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 filesystem from the changed files and directories.

If you operate the controller with an SD card, the overlay filesystem is generated on the SD card.

3.13 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 PC Worx 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.

- Ensure that the SD card has been inserted before switching the controller on, in order that the controller can use it.
- Only insert and remove the SD card when the controller supply voltage is disconnected.
Refer to [Section “Diagnostics and status indicators” on page 27](#) 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 120](#).

**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 filesystem 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 filesystem on the internal parameterization memory will be deleted.

Furthermore, all application-specific data will be deleted from the parameterization memory. Any PC Worx Engineer projects and IP configurations stored there will no longer be available. The controller access the data that is 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 filesystem from the SD card:
Ensure that you only delete the "upperdir" and "work" directories, and **do not** format the SD card.



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.

- Ensure that the SD card has been inserted before switching the controller on, in order that the controller can use it.
- Only insert and remove the SD card when the controller supply voltage is disconnected.
Refer to [Section "Diagnostics and status indicators" on page 27](#) 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 120](#).

**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 filesystem on the SD card, there will be an empty overlay filesystem on the internal parameterization memory after removing the SD card and rebooting the controller. The content of the overlay filesystem on the SD card will not be transferred over to the internal parameterization memory of the controller.

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

3.14 Internal basic circuit diagram

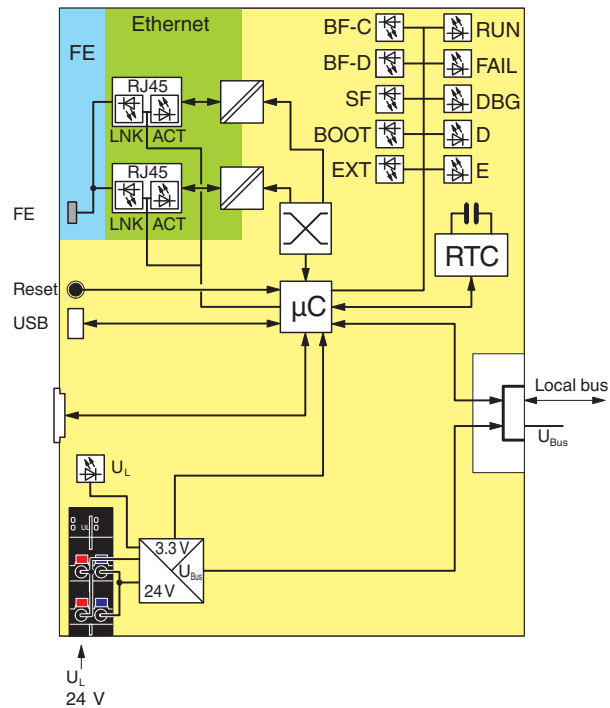


Figure 3-12 Internal basic circuit diagram

Key:

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

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

	Logic
	Ethernet interface
	Functional ground

3.15 Communication paths

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

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

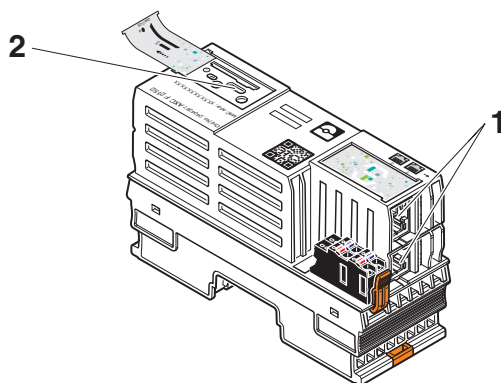


Figure 3-13 Communication paths: (1) Ethernet, (2) service interface (USB type C)

3.15.1 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:

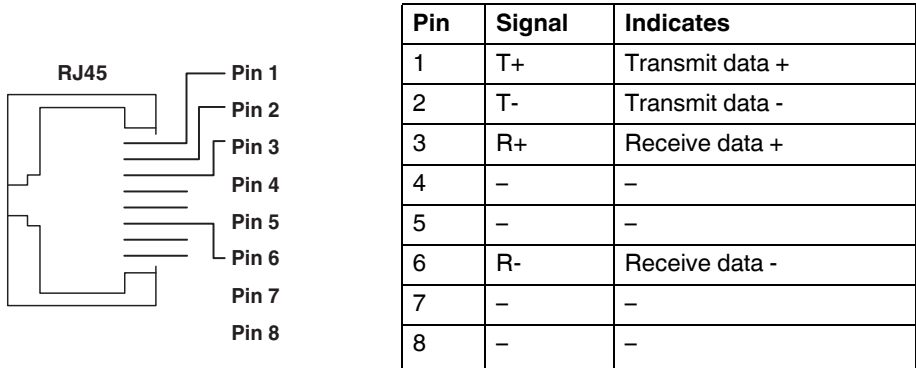


Figure 3-14 Ethernet interface and pin assignment



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

3.16 Supply plug

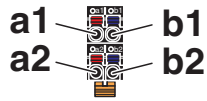


Figure 3-15 Terminal points for the supply voltage (communications power U_L)

Terminal point assignment

Table 3-5 Terminal point assignment of the supply plug

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

Key:

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

3.17 Bus base module

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

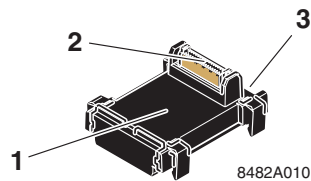


Figure 3-16 Structure of the controller bus base module

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

4 Mounting hardware



For basic information 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: Electrical damage due to inadequate external protection – No safe fuse tripping in the event of an error

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

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



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 re-activation.



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.

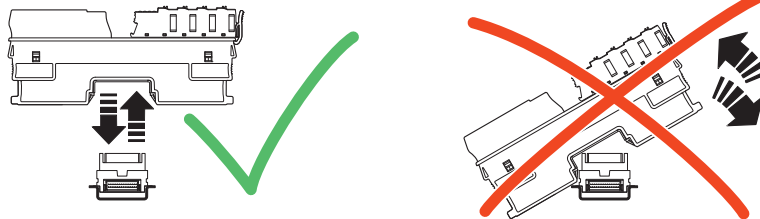


Figure 4-1 Placing the module **vertically**

4.2 Basics

Mounting location

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

Mounting / DIN rail

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

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



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

Supply plug

The controller has a supply plug for connecting the power supply. The plug has spring-cage terminal blocks. With suitable conductors, the conductor can be connected using direct connection technology (PT = 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 the 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 42 :	Normal	CLIPFIX 35, CLIPFIX 35-5
	High shock and vibration load	E/AL-NS 35
Other; B in Figure 4-2 on page 42	Normal	E/AL-NS 35
	High shock and vibration load	

Mounting position

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

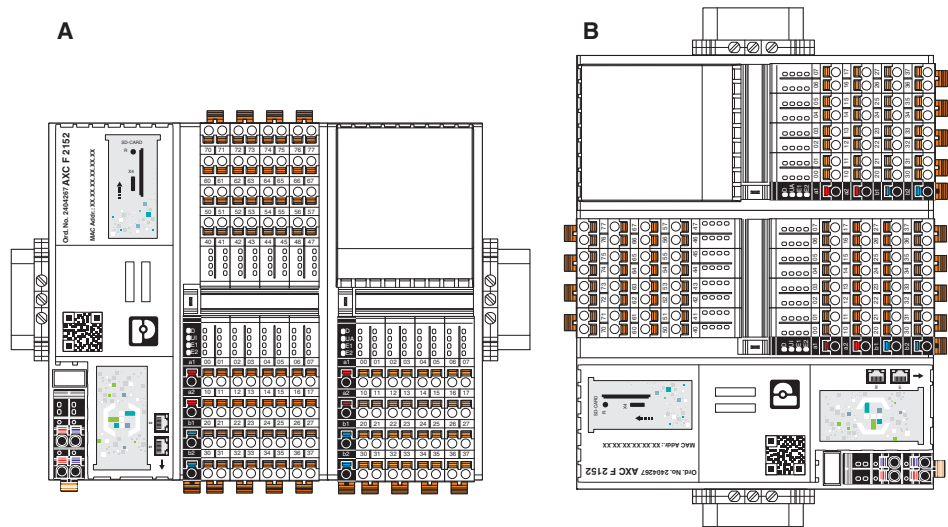


Figure 4-2 Horizontal (A) and vertical (B) mounting position

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

4.3 Structure of an Axioline F station

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

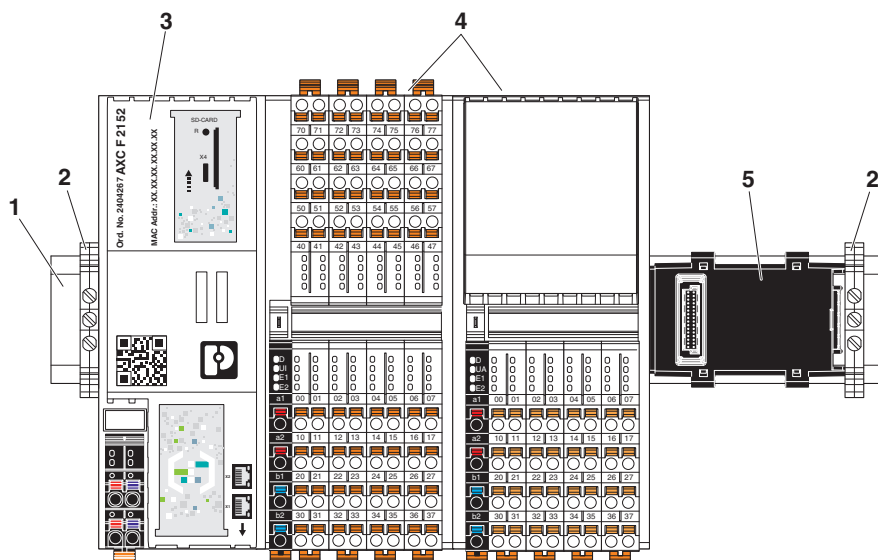


Figure 4-3 Structure of an Axioline F station

Key:

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

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

4.4 Structure of a PLCnext Inline station

As an alternative to an Axioline F station, you can set up a PLCnext Inline station using the controller (starting from firmware version 1.2). 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.

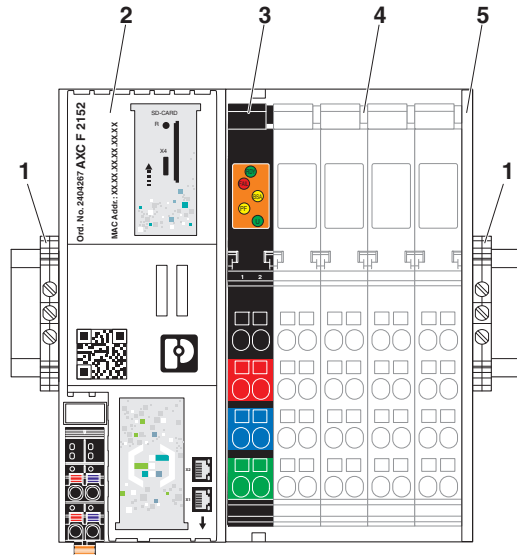


Figure 4-4 Structure of a PLCnext Inline station

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



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



For INTERBUS configuration and communication, different functions blocks are available in PC Worx Engineer.
For more detailed information, please refer to the online help for PC Worx 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 "For diagnostics in Generation 4 controller boards" (IBS SYS DIAG DSC UM E).
The documents can be downloaded at phoenixcontact.net/product/1020304.

4.5 Mounting the controller

Mounting bus base modules

- Disconnect the Axioline F station from the power supply.
- Mount the left end bracket on the Axioline F station.
- First install the bus base module for the controller and then all bus base modules necessary for the Axioline F station on the DIN rail (A in [Figure 4-5](#)).
- Push each subsequent bus base module into the connection of the previous bus base module (B in [Figure 4-5](#)).

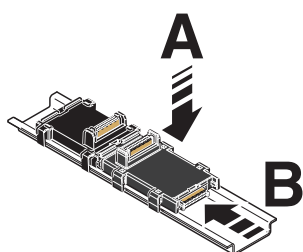


Figure 4-5 Mounting the bus base modules

Snapping the controller into place

- Push the controller vertically on the first bus base module until it snaps into place audibly.
- When doing so, ensure that the device plug for the bus base connection is situated above the corresponding socket on the bus base module.

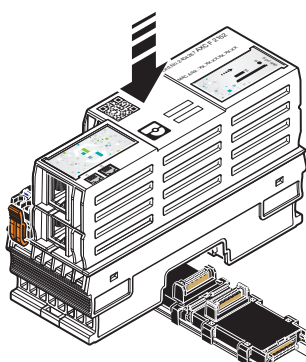


Figure 4-6 Snapping the controller into place

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 filesystem from the SD card:
Ensure that you only delete the "upperdir" and "work" directories, and **do not** format the SD card.



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.

- Ensure that the SD card has been inserted before switching the controller on, in order that the controller can use it.
- Only insert and remove the SD card when the controller supply voltage is disconnected.
Refer to [Section "Diagnostics and status indicators" on page 27](#) 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 120](#).



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 120](#).

- 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 (pos. 1 in [Figure 4-7](#)).

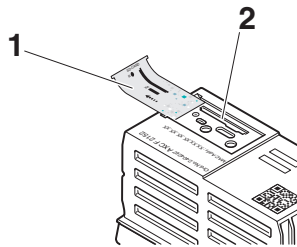


Figure 4-7 Removing the marking field

- Gently push the SD card into the SD card holder (pos. 2 in [Figure 4-7](#)) until it engages with a click in the SD card holder (see [Figure 4-8](#), "Click").

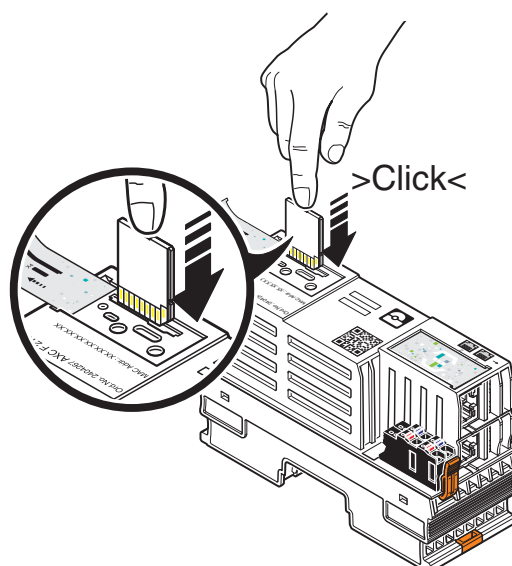


Figure 4-8 Inserting the SD card

5 Connecting and wiring hardware

5.1 Supply voltage

5.1.1 Sizing of the power supply

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



WARNING: Loss of electrical safety when using unsuitable power supplies

The controller is designed exclusively for operation with protected 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 arises briefly. At the moment of being switched on, the controller behaves as a capacitive load.

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

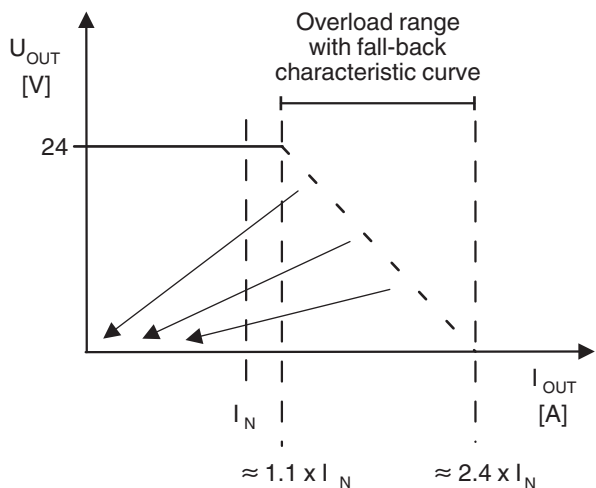


Figure 5-1 Overload range **with** fall-back characteristic curve

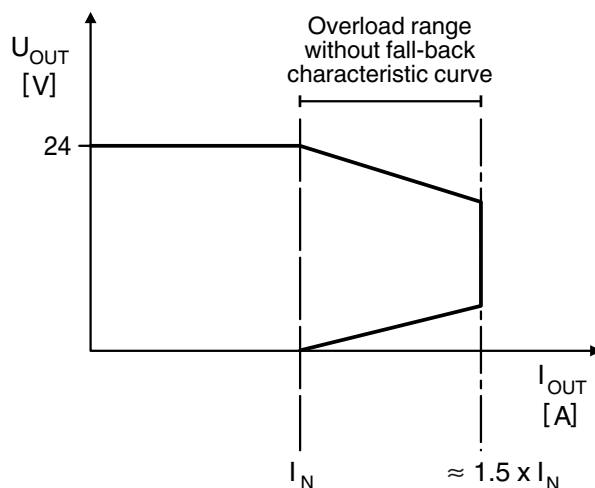


Figure 5-2 Overload range **without** fall-back characteristic curve

5.1.2 Connecting the power supply

Observe the notes in [Section 3.16](#) 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 user manual UM EN AXL F SYS INST.
- Ensure that the ferrules are correctly crimped.

Solid conductor/ferrule

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

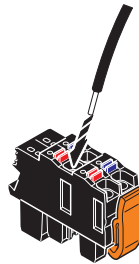


Figure 5-3 Connecting a solid conductor

Stranded 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)

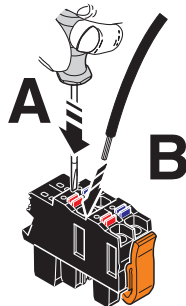


Figure 5-4 Connecting a stranded conductor

Connecting the supply plug

- Place the supply plug vertically into its position and press down firmly. Ensure that the locking latch snaps into place.

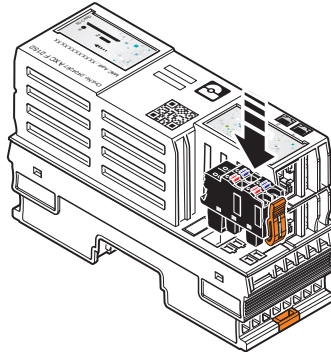


Figure 5-5 Connecting the supply plug

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 plug as shown in [Figure 5-3](#) and in [Figure 5-4](#). Note the information in [Section 3.16](#).
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.

5.2 Connecting Ethernet

- Connect the Ethernet network to the RJ45 socket.

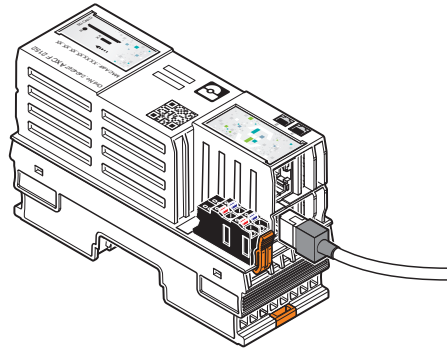


Figure 5-6 Connecting Ethernet

6 Startup



Detailed information on PC Worx Engineer and on PLCnext technology is to be found in the PLCnext community at plcnext-community.net.

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

6.1 Installing PC Worx Engineer

The software is available to download at phoenixcontact.net/product/1046008.

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

6.2 PC Worx Engineer licenses

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

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

- Log in with your access data on the product page at phoenixcontact.net/product/1046008.
- Select the necessary license(s).

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

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

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

The license is activated via the Phoenix Contact Activation Wizard.

The Phoenix Contact Activation Wizard is available to download at phoenixcontact.net/product/1046008 (stand-alone or as a component of PC Worx Engineer).

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

6.3 User interface

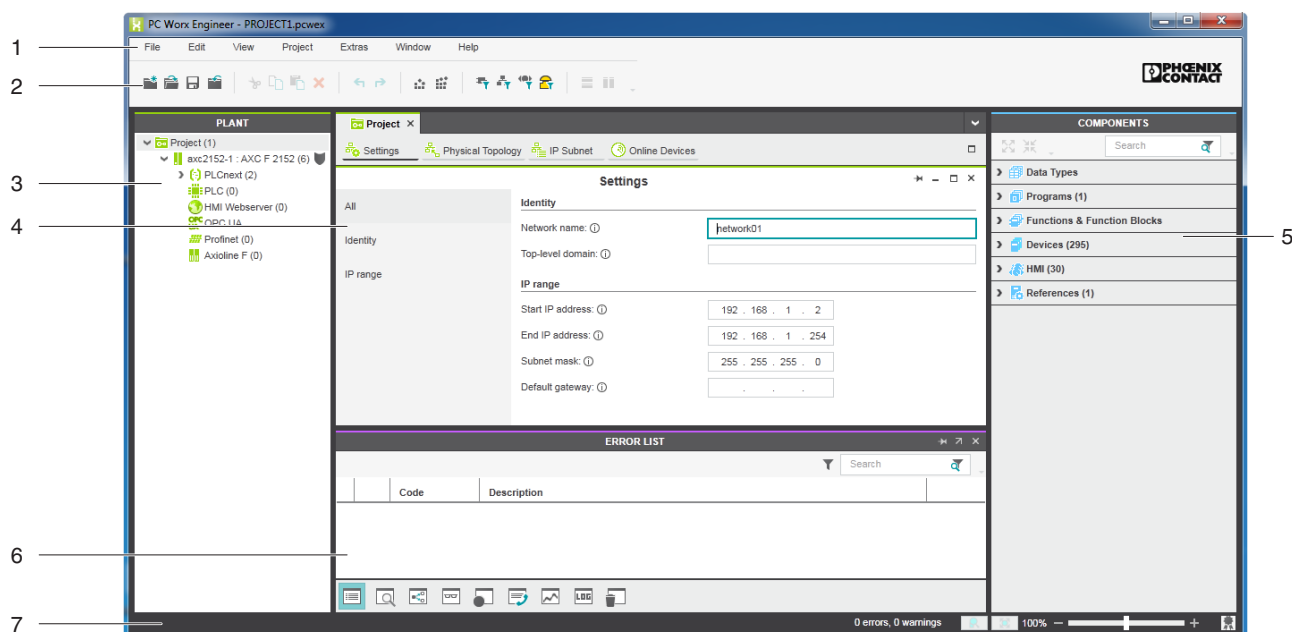


Figure 6-1 The PC Worx Engineer user interface

1. Menu bar
2. Tool bar
3. “PLANT” area
4. 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

If a node in the “PLANT” area or an element in the “COMPONENTS” area is double-clicked, the associated editor group opens 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 (“Devices”) via GSDML or FDCML
- Editing HMI pages (“HMI”)
- Adding libraries such as firmware libraries, IEC user libraries and libraries provided by Phoenix Contact (“References”)

Cross-functional area

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

- **ERROR LIST:**
Shows all errors, warnings and messages of the current project.
- **GLOBAL FIND AND REPLACE:**
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.
- **WATCHES:**
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 (in preparation):**
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. If required, you can restore deleted elements.

6.4 Creating a new project

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

The project template for an “Empty AXC F 2152 project” opens.

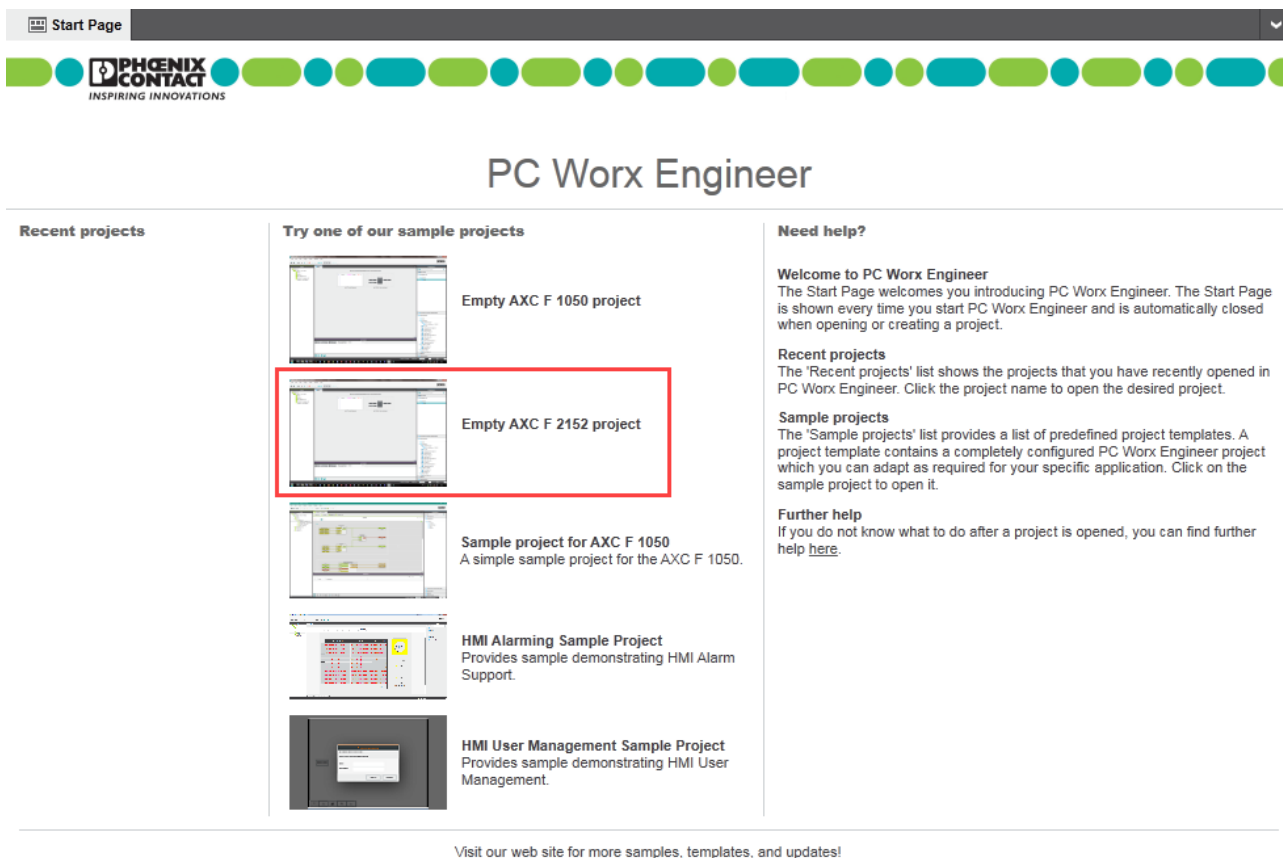


Figure 6-2 Start page, “Empty AXC F 2152 project” project template

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

6.5 Configuring the IP settings

6.5.1 Setting the IP address range

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

The “Project” editor group opens.

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

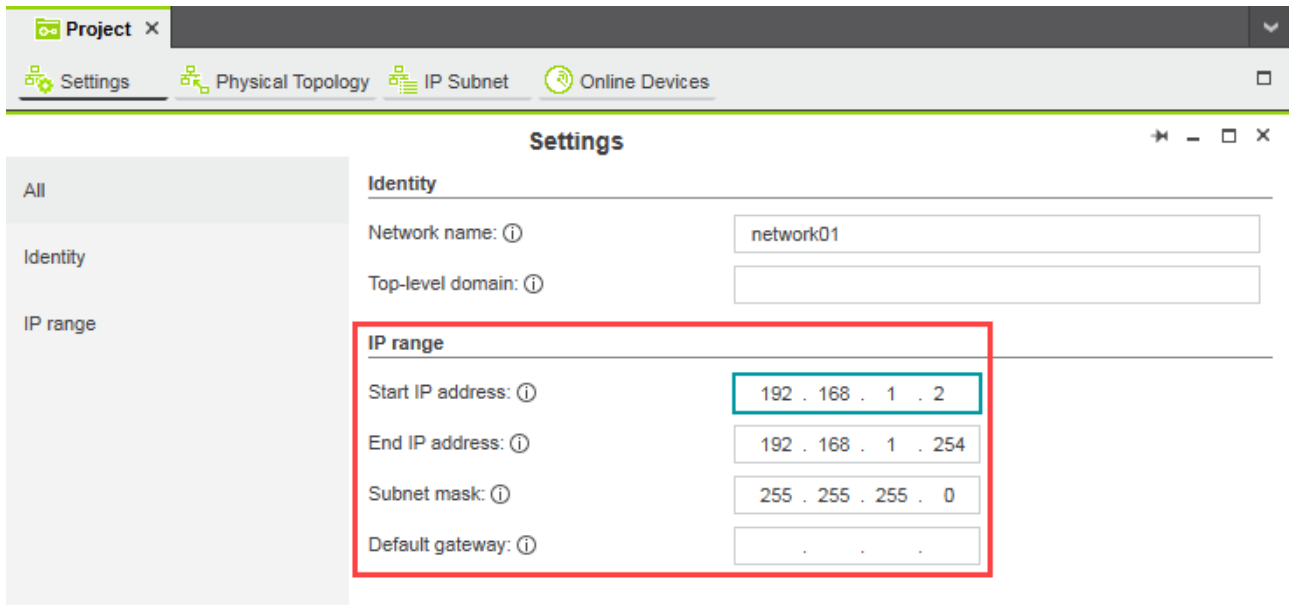


Figure 6-3 Setting the IP address range

6.5.2 Setting the IP address

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

The controller editor group opens.

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

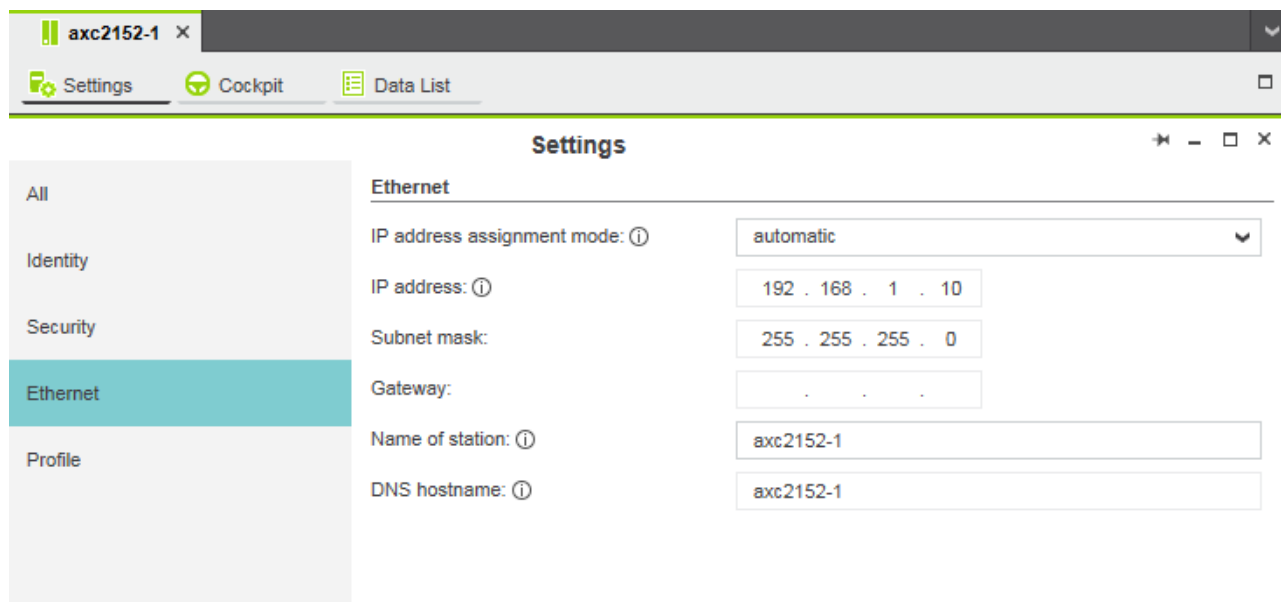


Figure 6-4 Setting the IP address

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

Setting the IP address automatically

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

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

Setting the IP address manually

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

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



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 upon inserting the SD card of the new controller.

6.6 Connecting to the controller

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

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

The “Project” editor group opens.

- Select the “Online Devices” editor.
- Select the desired 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 [Search] 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)”.

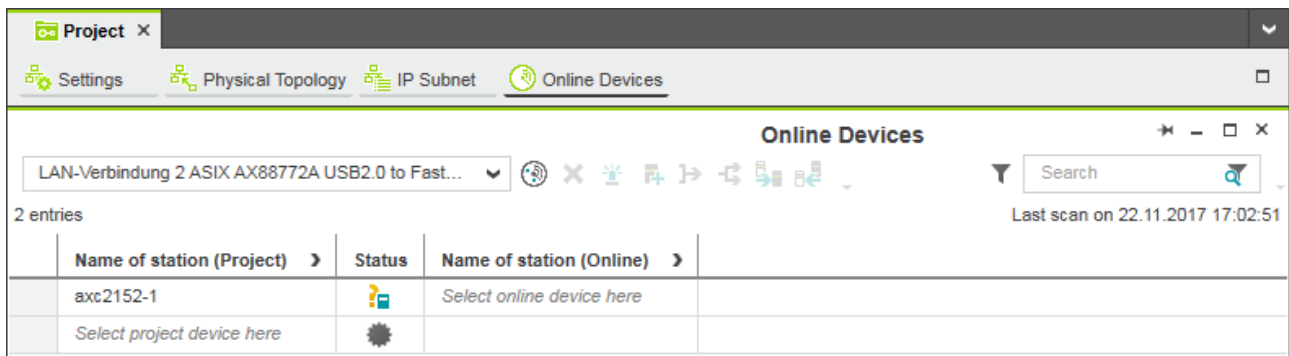


Figure 6-6 Assigning online devices

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.

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

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

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

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

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

The controller editor group opens.

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

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

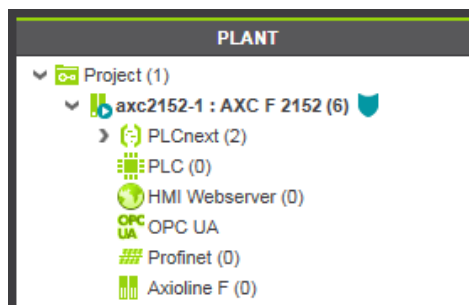


Figure 6-8 Connection to the controller was established successfully

6.7 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 in 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.

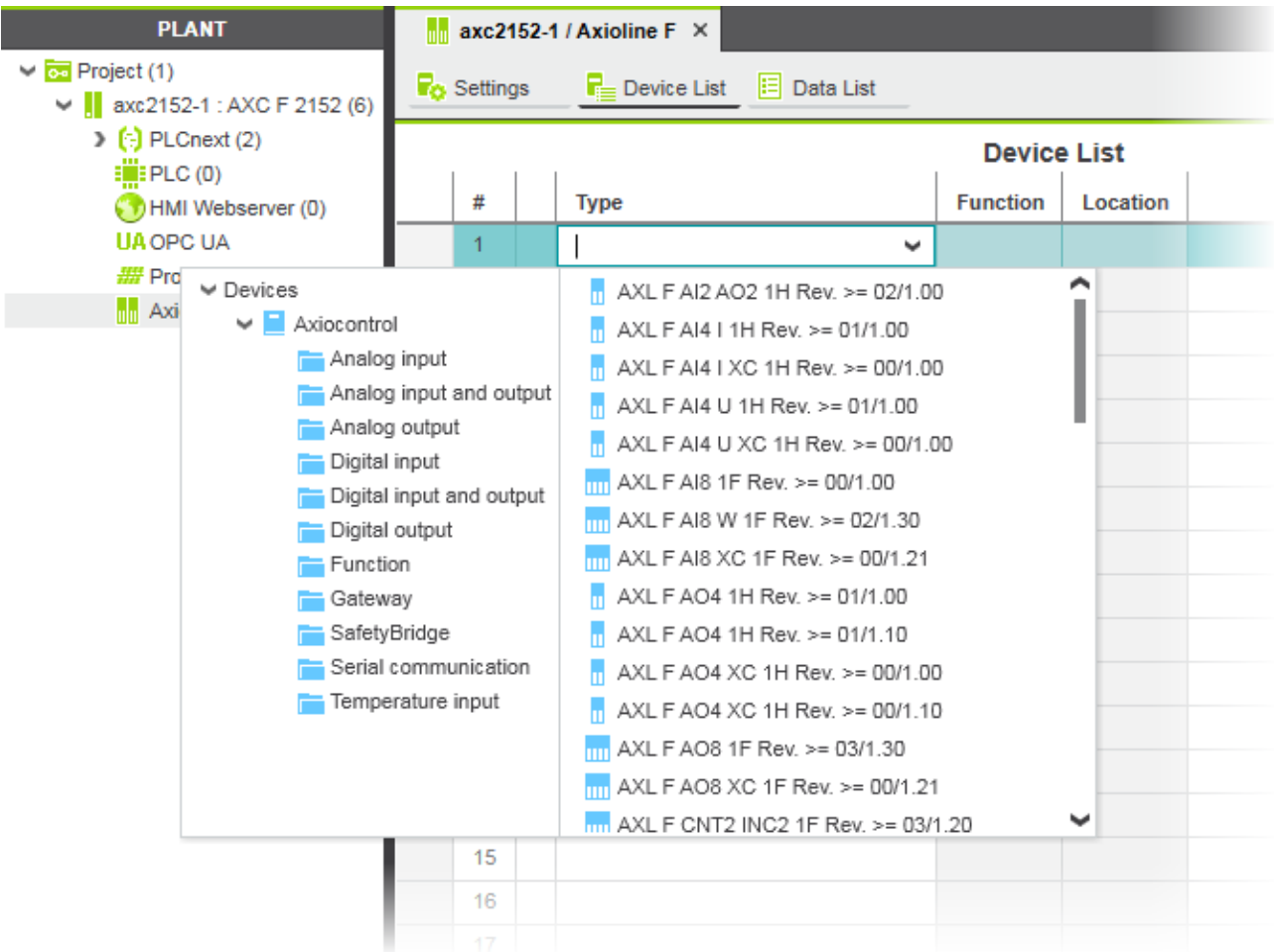


Figure 6-9 The role picker for selecting the Axioline F modules

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

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

- Proceed as described for further Axioline F modules.

The screenshot displays the software interface for configuring Axioline F modules. On the left, the 'PLANT' tree view shows a project structure with 'axc2152-1 : AXC F 2152 (6)' expanded, revealing 'PLCnext (2)', 'PLC (0)', 'HMI Webserver (0)', 'UA OPC UA', 'Profinet (0)', and 'Axioline F (2)'. Under 'Axioline F (2)', two modules are listed: 'di-1 : AXL F DI16/1 1H' and 'do-1 : AXL F DO16/1 1H'. On the right, the 'axc2152-1 / Axioline F' window is open, showing tabs for 'Settings', 'Device List', and 'Data List'. The 'Device List' tab contains a table with columns for '#', 'Type', 'Function', and 'Location'.

#	Type	Function	Location
1	AXL F DI16/1 1H		
2	AXL F DO16/1 1H		
3	Select type here		
4			
5			
6			

Figure 6-10 Axioline F modules in the “PLANT” area and in the Device List

6.8 Configuring Inline modules

As an alternative to an Axioline F station, you can set up a PLCnext Inline station using the controller (starting from firmware version 1.2). 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 “Backplane Extension” view.

From the “Local IO” drop-down list, select “Inline with AXC F IL ADAPT”.

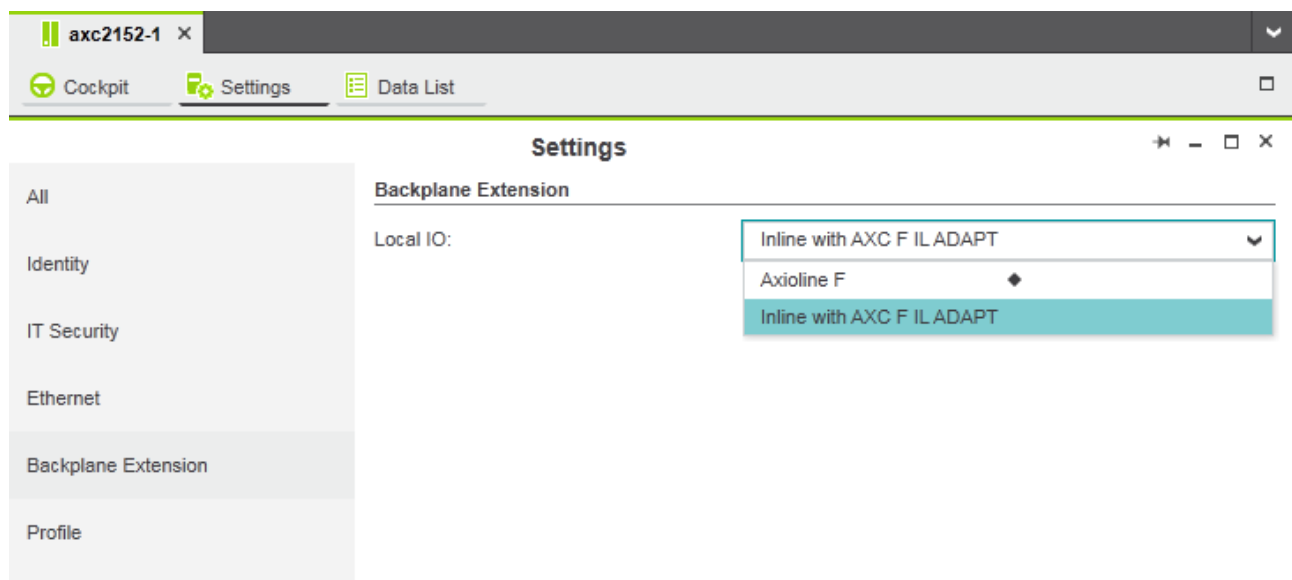


Figure 6-11 Backplane Extension, “Inline with AXC F IL ADAPT” setting

In the “PLANT” area, the AXC F IL ADAPT Inline adapter terminal is now displayed.

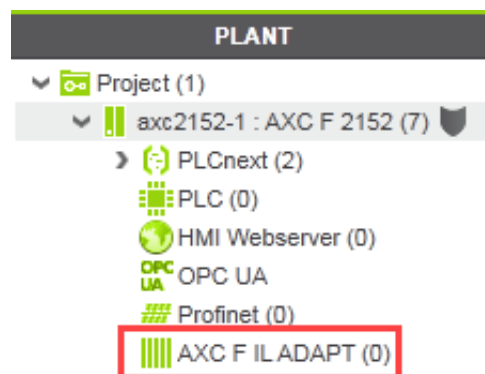


Figure 6-12 AXC F IL ADAPT Inline adapter terminal in the “PLANT” area

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 “COMPONENT” area, click on “References”.
- Right-click on “Libraries”.
- From the context menu, select “Add Library...”.

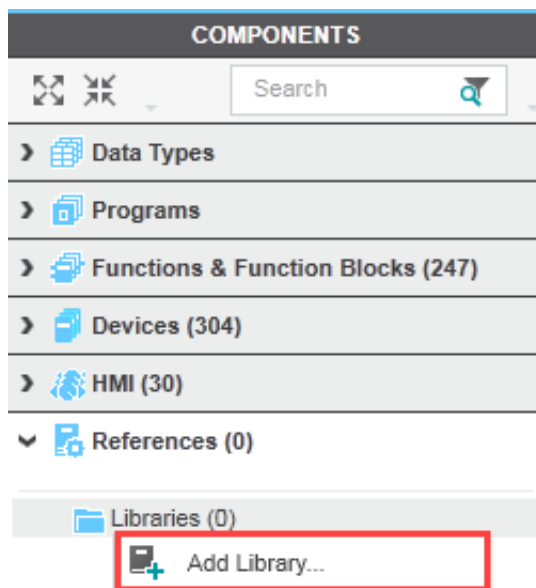


Figure 6-13 Context menu, “Add Library...”

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

The “Inline” library is now displayed in the “COMPONENTS, References” 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:

- In the “PLANT” area, double-click on the “AXC F IL ADAPT” node.

The editor group of the “AXC F IL ADAPT” Inline adapter terminal opens.

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

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

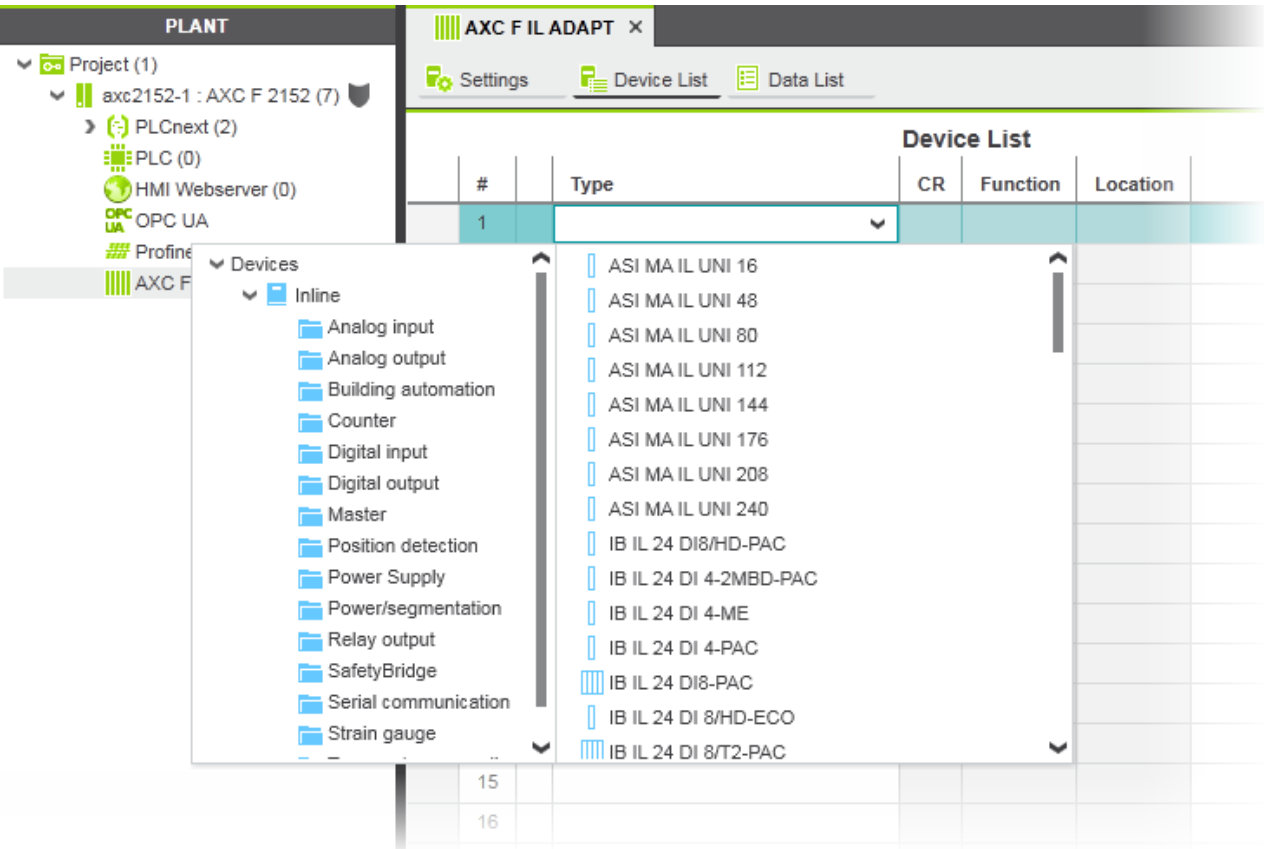


Figure 6-14 The role picker for selecting the Inline modules

- Select the relevant Inline module in the role picker.

The Inline module is added and mapped under the “AXC F IL ADAPT” node in the “PLANT” area (see [Figure 6-15](#)).

- Proceed as described for further Inline modules.

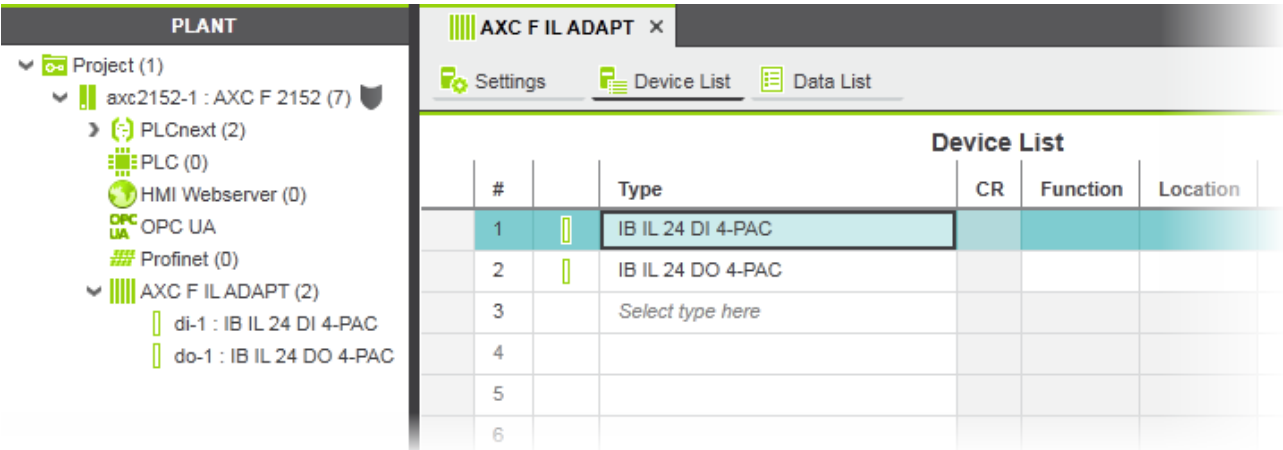


Figure 6-15 Inline modules in the “PLANT” area and in the Device List

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.

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

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

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

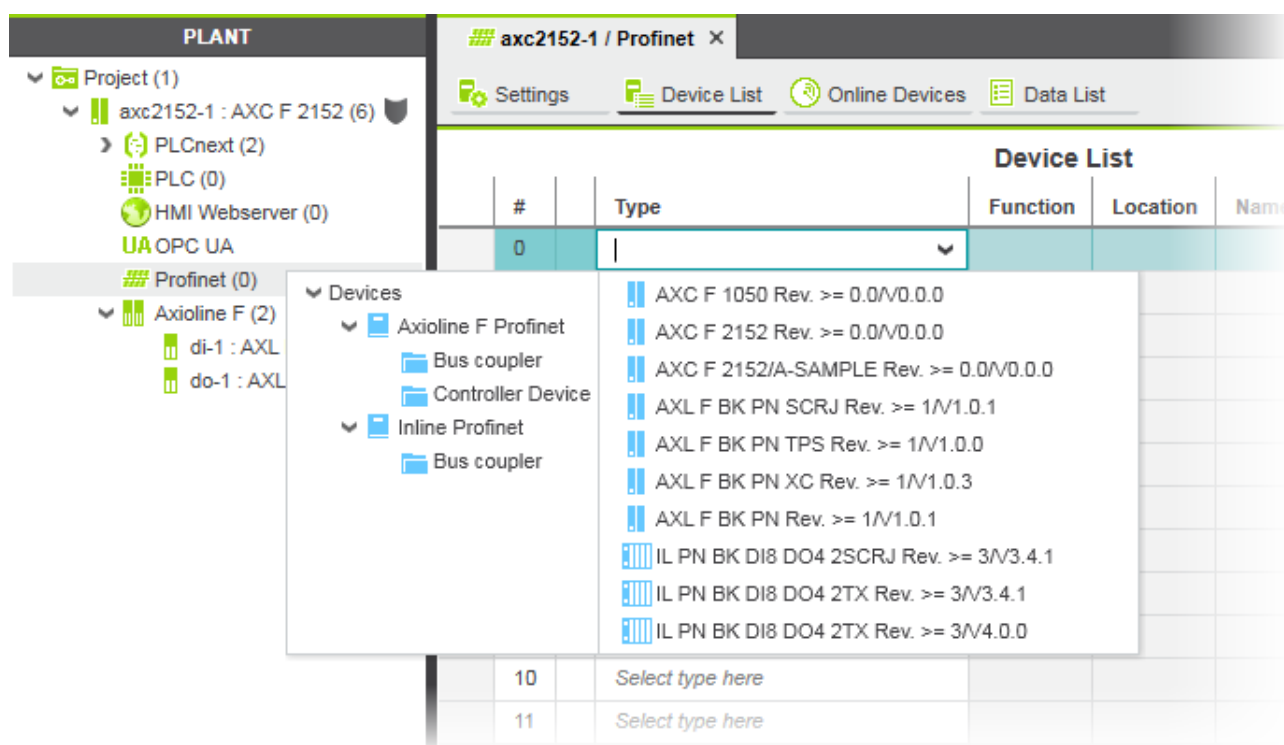


Figure 6-16 Role picker for selecting PROFINET devices

- 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 for further PROFINET devices.

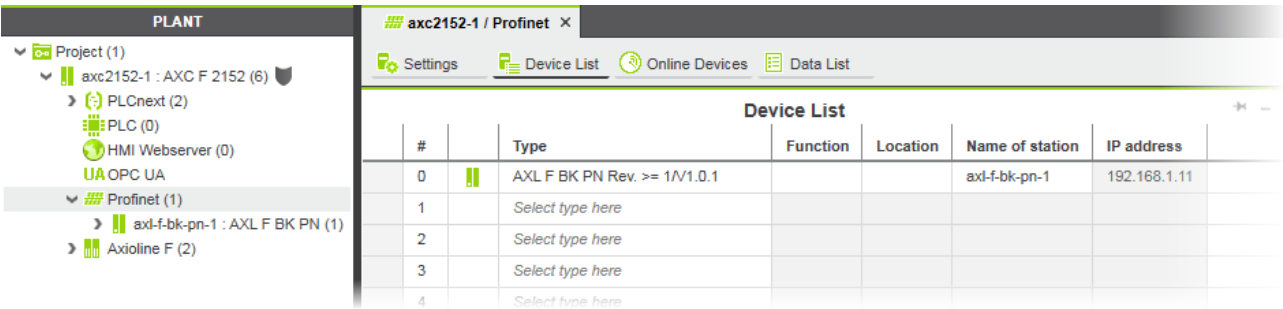


Figure 6-17 PROFINET devices in the “PLANT” area and in the Device List

6.9.2 Assigning online devices

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

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

The “/ Profinet” controller editor group opens.

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



Figure 6-18 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)”.

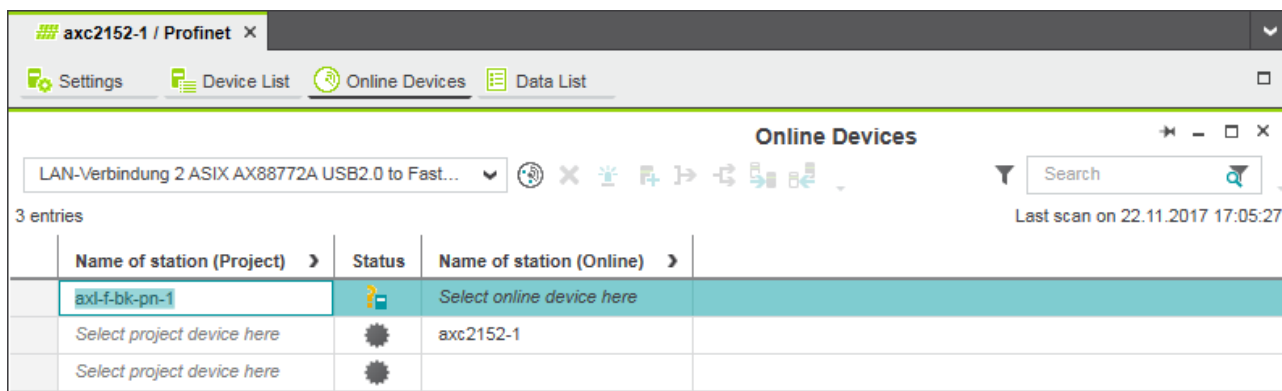


Figure 6-19 Assigning online devices

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:

Upon delivery, the PROFINET device does not have an IP address.

- When starting up the PROFINET device, 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. Successful assignment is shown in the “Status” column by the ✓ icon.

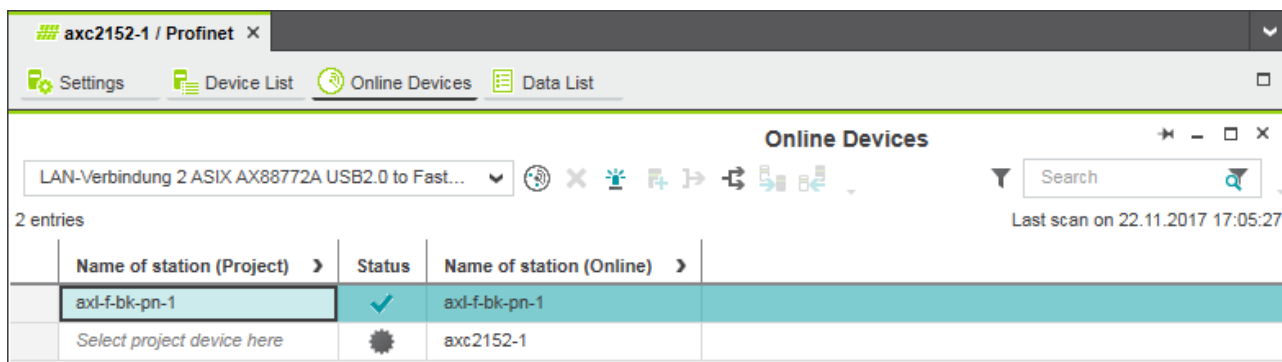


Figure 6-20 Successful assignment of the configured PROFINET device to an online device

6.9.3 Adding I/O modules

Once you have added all PROFINET devices of your bus structure to the project, you can add the I/O modules connected to the PROFINET device. There are two methods for adding 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 of the selected PROFINET device opens; “axf-f-bk-pn-1” in the example.

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

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

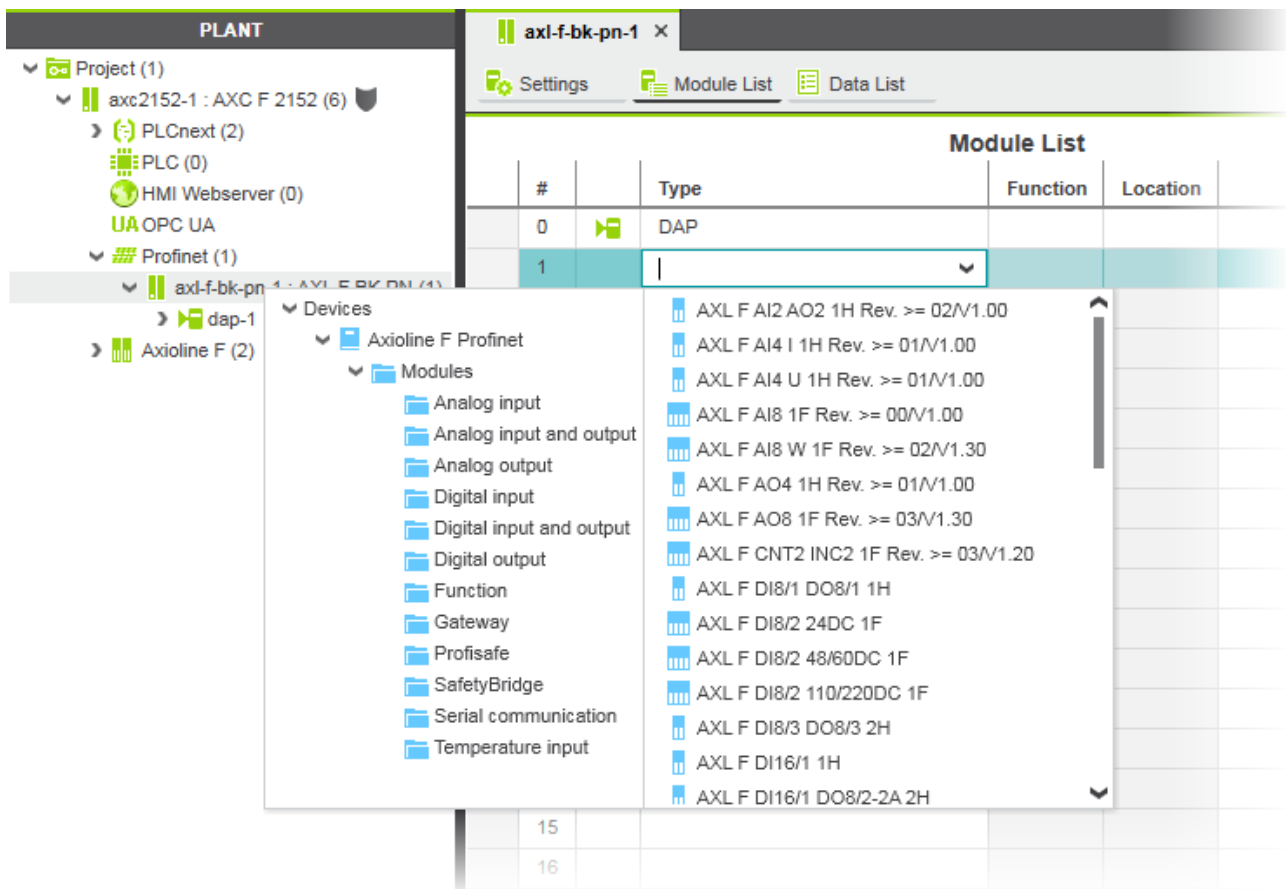


Figure 6-21 Role picker for selecting I/O modules

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

The I/O module is added and shown in the “PLANT” area under the “Profinet (x)” node for the respective PROFINET device (see [Figure 6-22](#)).

- Proceed as described to add further I/O modules.

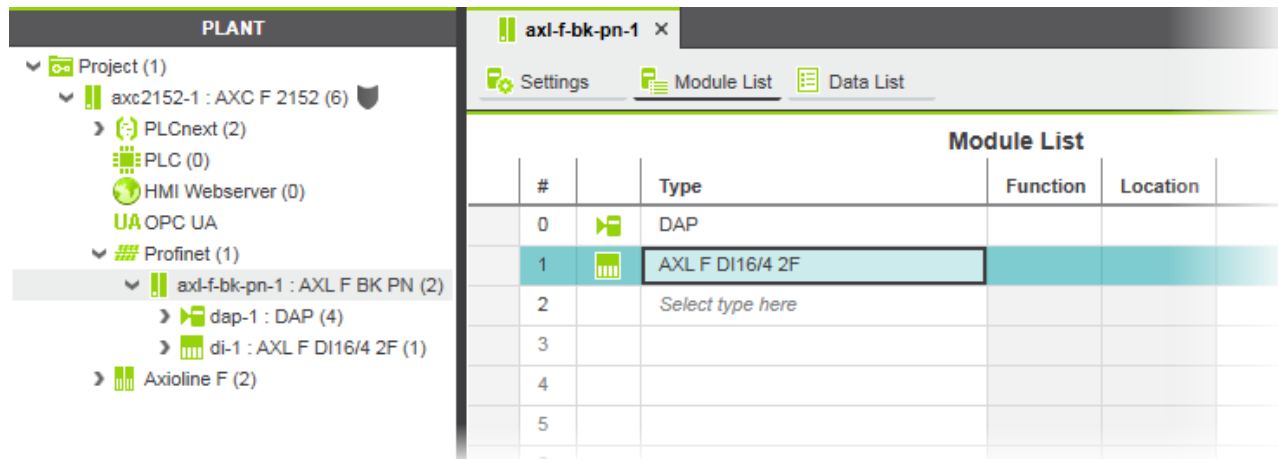


Figure 6-22 I/O modules of a PROFINET device in the “PLANT” area and in the Module List

Reading in I/O modules automatically

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

- The controller has valid IP settings (see [Section 6.5](#)).
- The PROFINET device has valid IP settings and is connected with PC Worx Engineer (see [Section 6.9.2](#)).

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

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

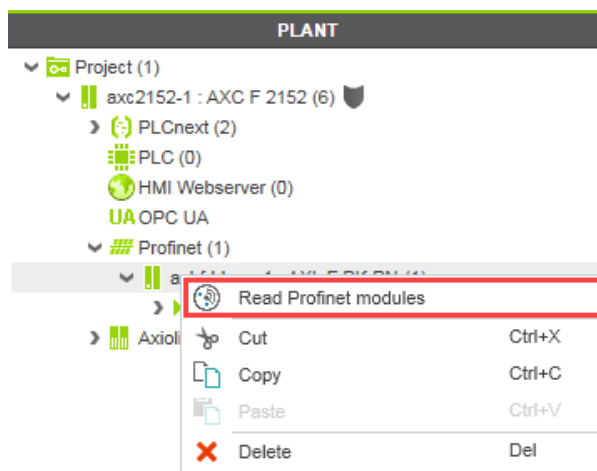


Figure 6-23 Reading in I/O modules of a PROFINET device automatically

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 of the AXC F 2152 with C++ or MATLAB® Simulink® is to 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

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

Opening the POU

To open a POU, proceed as follows:

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

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

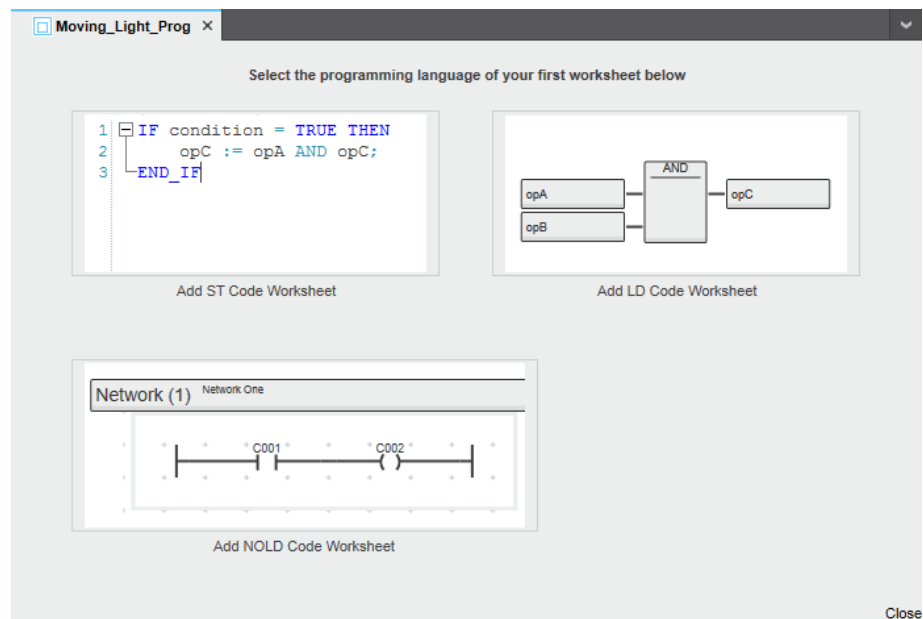


Figure 6-24 Selecting the programming language for the first worksheet

- Click on the desired programming language.

Creating a new POU

To create a new POU, proceed as follows:

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

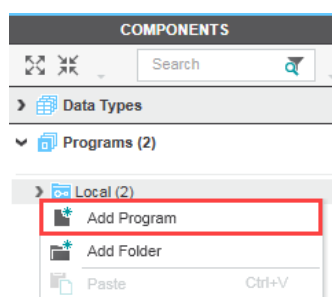


Figure 6-25 “Add Program” in the context menu

Creating variables

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

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

 The image shows a software window titled 'Moving_Light_Prog'. It has two tabs: 'Variables' (selected) and 'Code'. The 'Variables' tab displays a table with 11 entries. The table has columns: Name, Type, Usage, Comment, Init, Retain, OPC, eHMI, Proficloud, and I/Q. The first row is a header. The following rows list variables: Time_Parameter (TIME, Local, T#200ms), switch (BOOL, Local, TRUE), and seven LED variables (LED_0 to LED_7, all BOOL, External). The last row is 'Moving_Light_1' (Moving_Light, Local). The bottom row is a template 'Enter variable name here'.

Name	Type	Usage	Comment	Init	Retain	OPC	eHMI	Proficloud	I/Q
Time_Parameter	TIME	Local		T#200ms	<input type="checkbox"/>	<input type="checkbox"/>			
switch	BOOL	Local		TRUE	<input type="checkbox"/>	<input type="checkbox"/>			
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					<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Figure 6-26 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.

By default, the program editor is designated with “Code”. You can change the designation of the program editor as desired.

- Create the program.

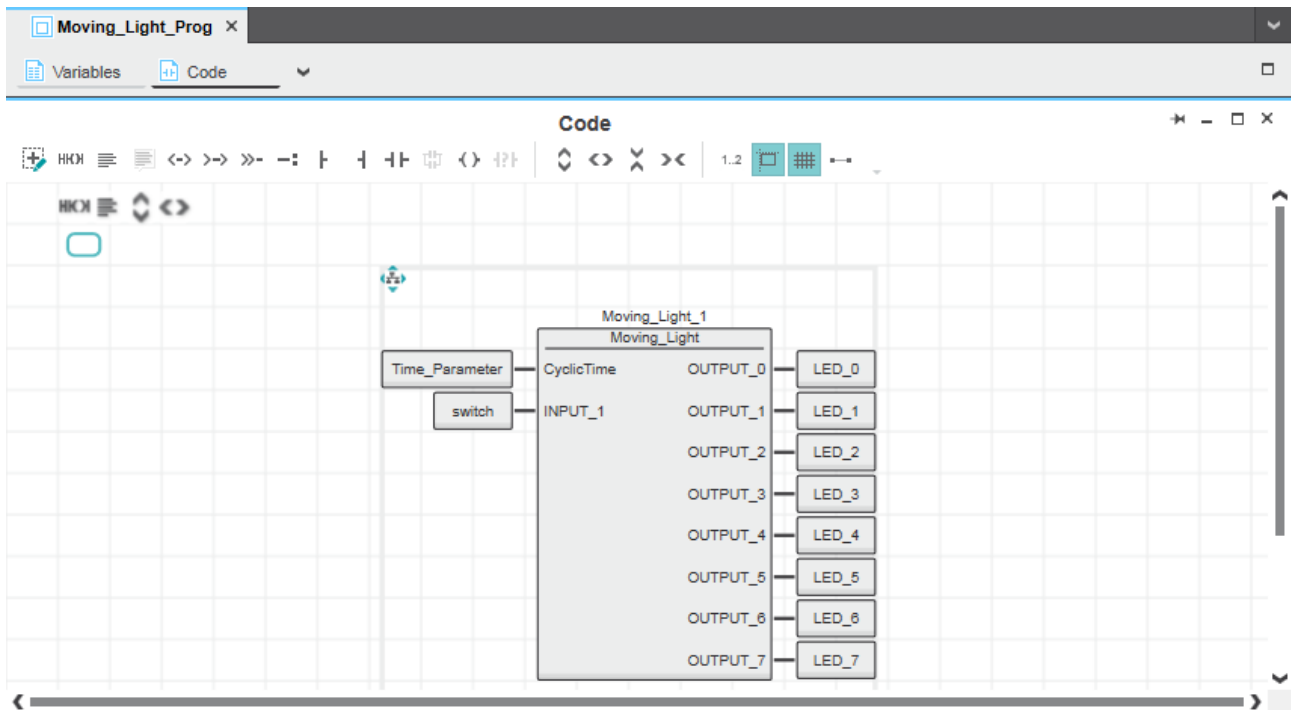


Figure 6-27 Example program in FBD

Adding worksheets

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

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

- Select a worksheet in the program editor (in the [Figure 6-28](#), “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.

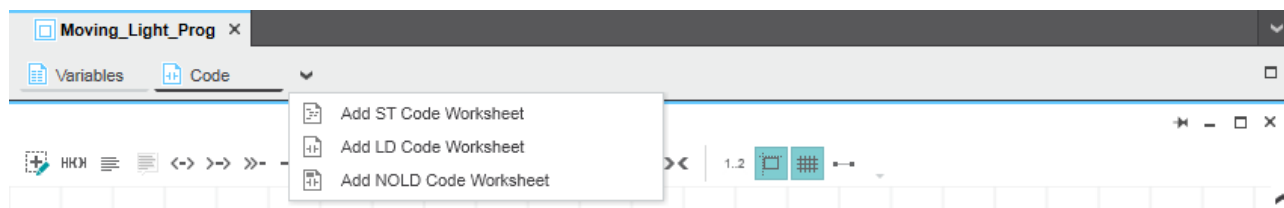


Figure 6-28 Adding a code worksheet to a POU

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:

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

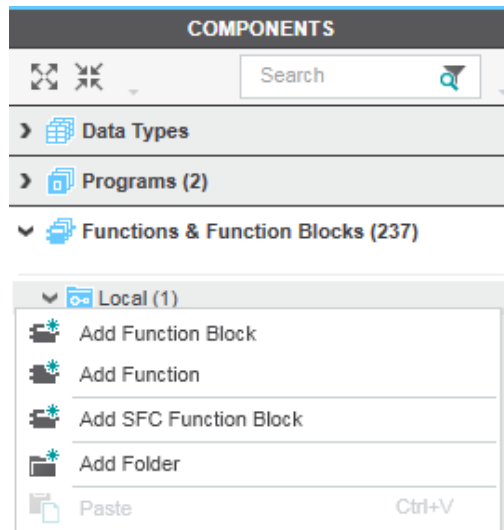


Figure 6-29 Context menu for adding a function or a function block

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

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

No spaces are allowed within a name.

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

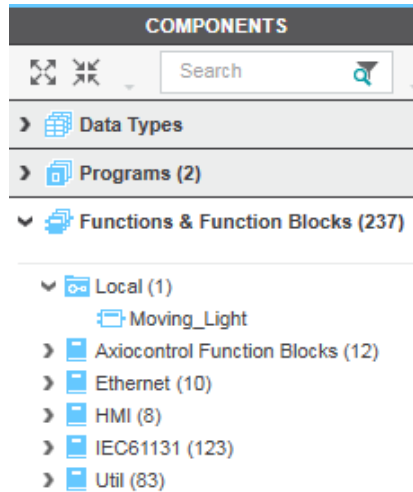


Figure 6-30 Newly created function block in the “COMPONENTS” area

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

Selecting the programming language for the first worksheet

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

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

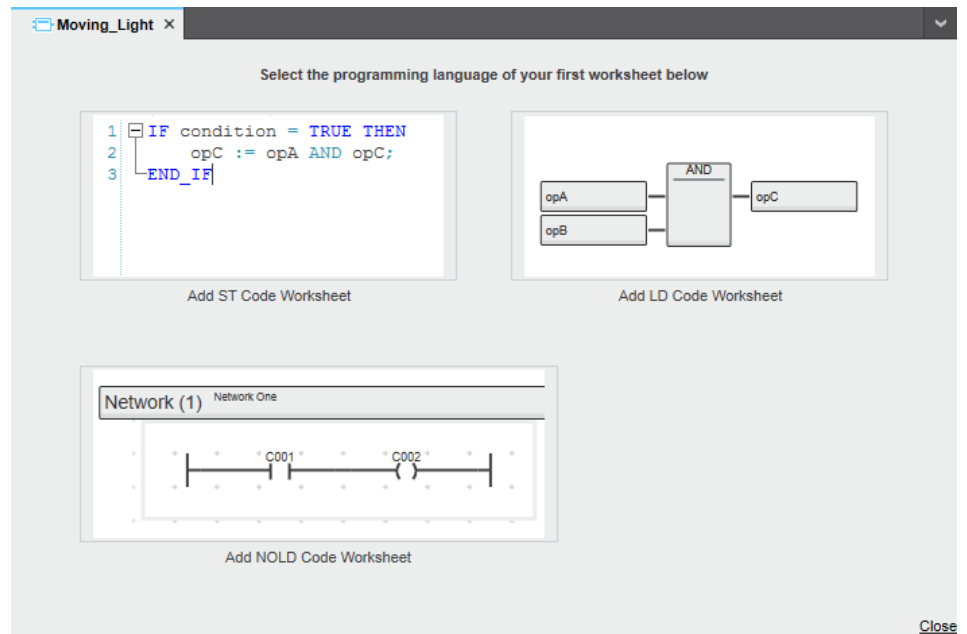


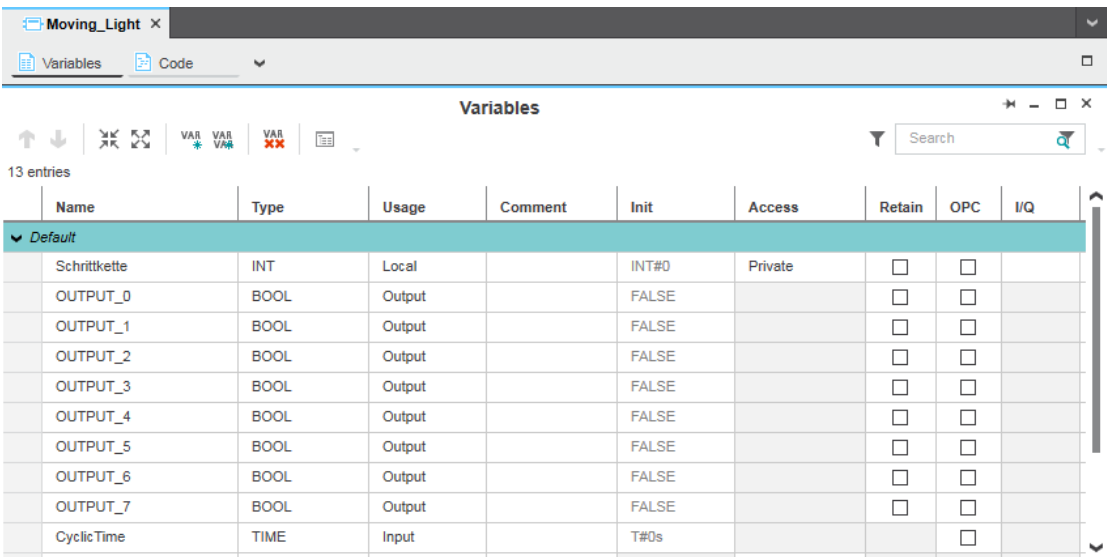
Figure 6-31 Selecting the programming language for the first worksheet

- 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 for programming the function or function block.



The screenshot shows the 'Moving_Light' Variables editor. It contains a table with 13 entries. The table has columns: Name, Type, Usage, Comment, Init, Access, Retain, OPC, and I/Q. The entries are as follows:

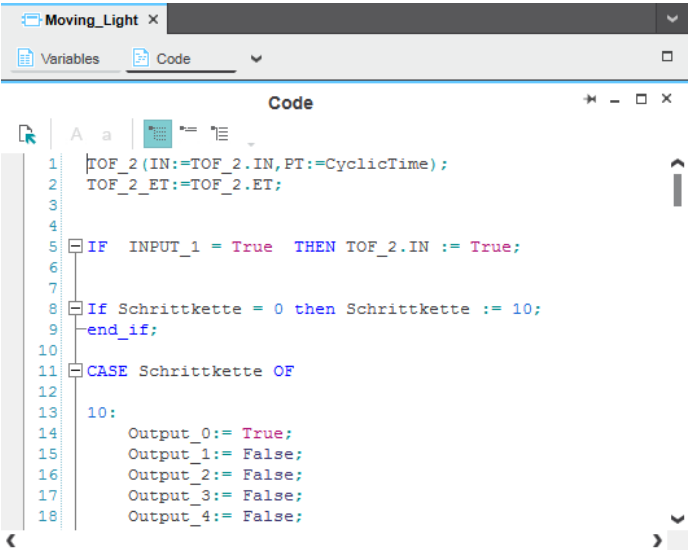
Name	Type	Usage	Comment	Init	Access	Retain	OPC	I/Q
Schrittkette	INT	Local		INT#0	Private	<input type="checkbox"/>	<input type="checkbox"/>	
OUTPUT_0	BOOL	Output		FALSE		<input type="checkbox"/>	<input type="checkbox"/>	
OUTPUT_1	BOOL	Output		FALSE		<input type="checkbox"/>	<input type="checkbox"/>	
OUTPUT_2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

Figure 6-32 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.



The screenshot shows the 'Moving_Light' Code editor. It contains the following code:

```
1 TOF_2 (IN:=TOF_2.IN,PT:=CyclicTime);
2 TOF_2_ET:=TOF_2.ET;
3
4
5 IF INPUT_1 = True THEN TOF_2.IN := True;
6
7
8 If Schrittkette = 0 then Schrittkette := 10;
9 end_if;
10
11 CASE Schrittkette OF
12
13 10:
14   Output_0:= True;
15   Output_1:= False;
16   Output_2:= False;
17   Output_3:= False;
18   Output_4:= False;
```

Figure 6-33 Example code for a function block

Adding worksheets

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

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

- 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 this to the desired program instance. Individual tasks are coordinated and processed in the Execution and Synchronization Manager (ESM). The AXC F 2152 works with a dual core processor and has one ESM (“ESM1” and “ESM2” in the “Tasks and Events” editor) per processor 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 tasks

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.

No spaces are allowed within a name.

- Click in the input field in the “Task Type” column.
- Select the “Task Type” from the drop-down list.
- Make all 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 below a task in the “Enter program instance name here” input field (“Program1_Moving_Light” in the example in [Figure 6-34](#)).

No spaces are allowed within a name.

- 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 6-34](#)).

The selected program is instantiated and assigned to a task.

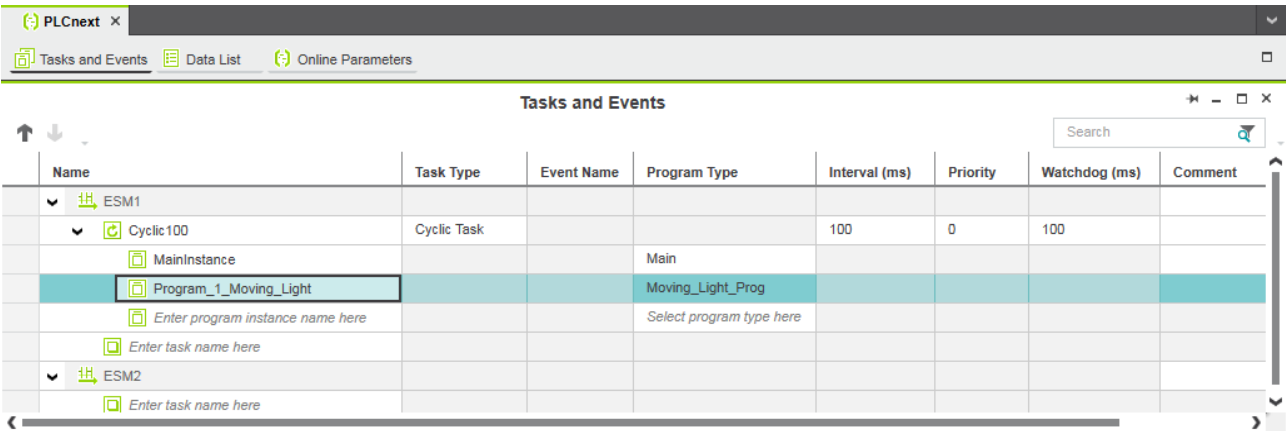


Figure 6-34 Tasks and program instances in the “Tasks and Events” editor

6.12 Assigning process data

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

There are two options for assigning process data:

- Assigning a process data item to a variable.
- Assigning a variable to a process data item.

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

Assigning a process data item to a variable

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

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

The “/ PLC” controller editor group opens.

- Select the “Data List” editor.

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

Variable (PLC)	Process Datum	HMI Tag	Function
Default			
axc2152-1 / PLC.LED_0	Select Process Datum here		
axc2152-1 / PLC.LED_1	Select Process Datum here		
axc2152-1 / PLC.LED_2	Select Process Datum here		
axc2152-1 / PLC.LED_3	Select Process Datum here		
axc2152-1 / PLC.LED_4	Select Process Datum here		
axc2152-1 / PLC.LED_5	Select Process Datum here		
axc2152-1 / PLC.LED_6	Select Process Datum here		
axc2152-1 / PLC.LED_7	Select Process Datum here		
Enter variable name here	Enter variable name here		
System Variables			
axc2152-1 / PLC.PND_S1_PLC_RUI	axc2152-1 / Profinet / PND_S1_PLC_RUN		
axc2152-1 / PLC.PND_S1_VALID_D	axc2152-1 / Profinet / PND_S1_VALID_DATA_CYCLE		
axc2152-1 / PLC.PND_S1_OUTPUT	axc2152-1 / Profinet / PND_S1_OUTPUT_STATUS_GOOD		

Figure 6-35 Example: overview of all available variables



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

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

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

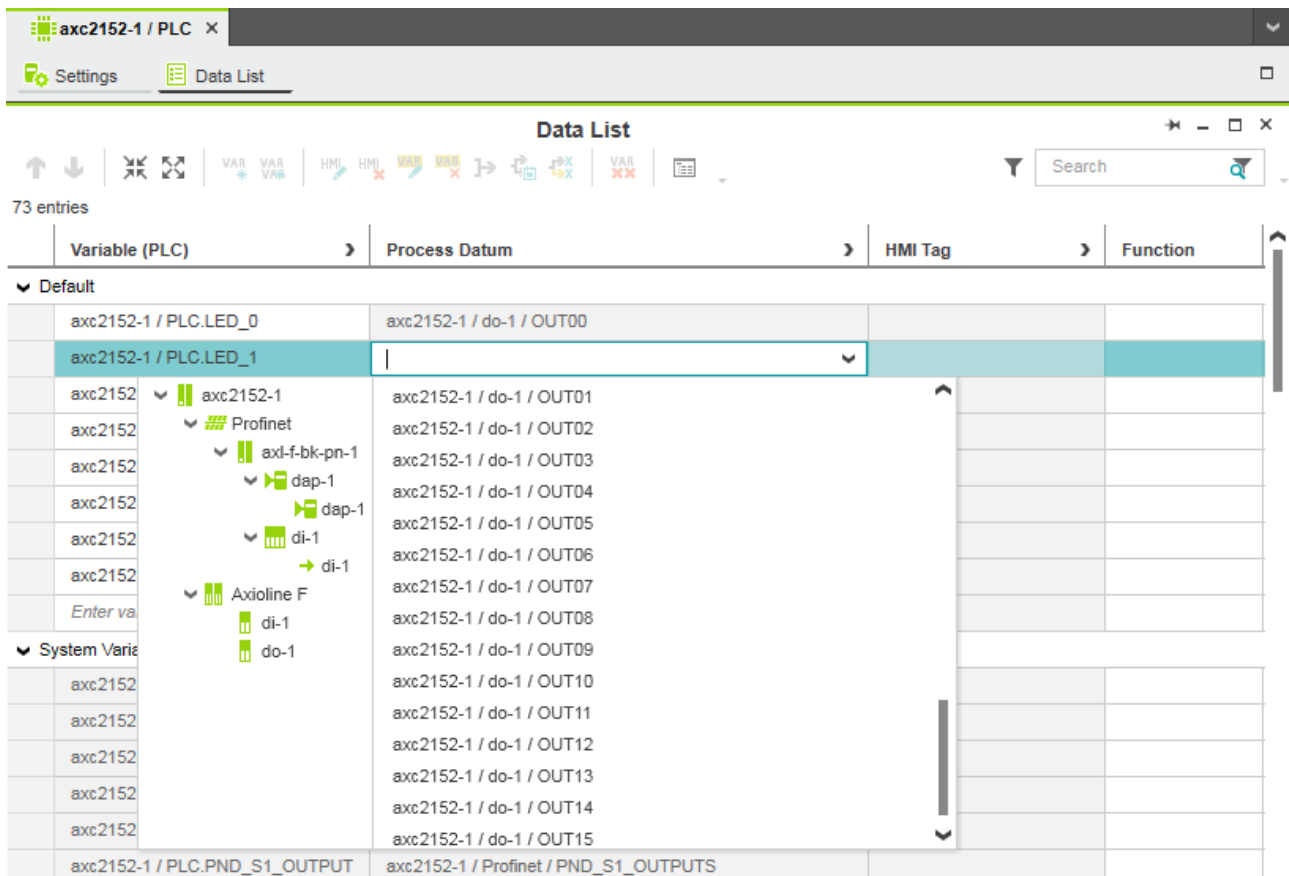


Figure 6-36 Role picker for selecting process data

- 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 for further variables.

Assigning a variable to a process data item

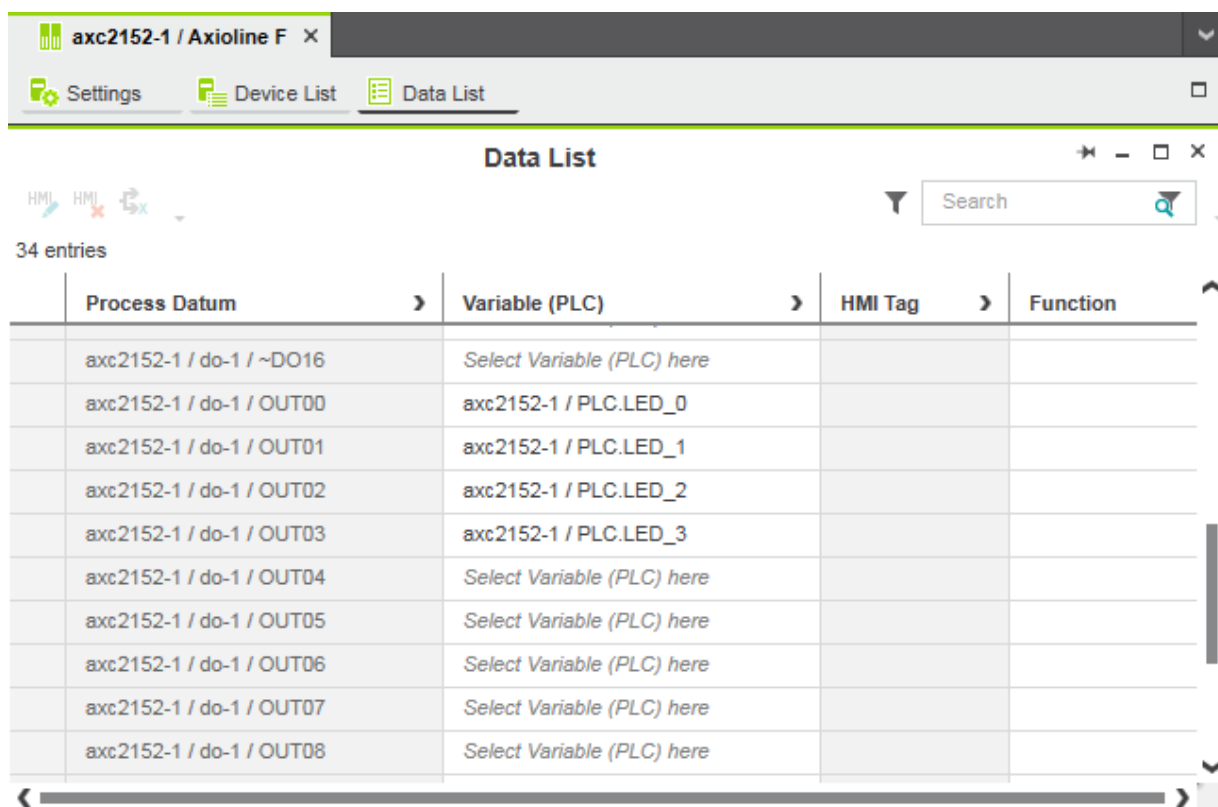
In order to assign a variable to a process data item, proceed as follows:

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

The “/ 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 in the “Data List” editor.



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

Figure 6-37 Example: overview of all available process data

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

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

The screenshot shows the 'Data List' window with the following table structure:

Process Datum	Variable (PLC)	HMI Tag	Function
axc2152-1 / do-1 / ~DO16	Select Variable (PLC) here		
axc2152-1 / do-1 / OUT00	axc2152-1 / PLC.LED_0		
axc2152-1 / do-1 / OUT01	axc2152-1 / PLC.LED_1		
axc2152-1 / do-1 / OUT02	axc2152-1 / PLC.LED_2		
axc2152-1 / do-1 / OUT03	axc2152-1 / PLC.LED_3		
axc2152-1 / do-1 / OUT04	[Role Picker Open]		
axc2152-1 / do-1 / [PLC Default]	axc2152-1 / PLC.LED_4		
axc2152-1 / do-1 / [PLC Default]	axc2152-1 / PLC.LED_5		
axc2152-1 / do-1 / [PLC Default]	axc2152-1 / PLC.LED_6		
axc2152-1 / do-1 / [PLC Default]	axc2152-1 / PLC.LED_7		

Figure 6-38 Role picker for selecting 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 for further process data.

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 “Data List” of the “PLCnext” node.

There are two options for assigning process data:

- Assigning an IN port to an OUT port.
- Assigning an OUT port to an IN port.

Opening the “Data List” editor

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

The “PLCnext” editor group opens.

- Select the “Data List” editor.

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



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

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

Figure 6-39 Example: overview of all available IN and OUT ports

Assigning an IN port to an OUT port

- In order to assign an IN port to an OUT port, click on “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.

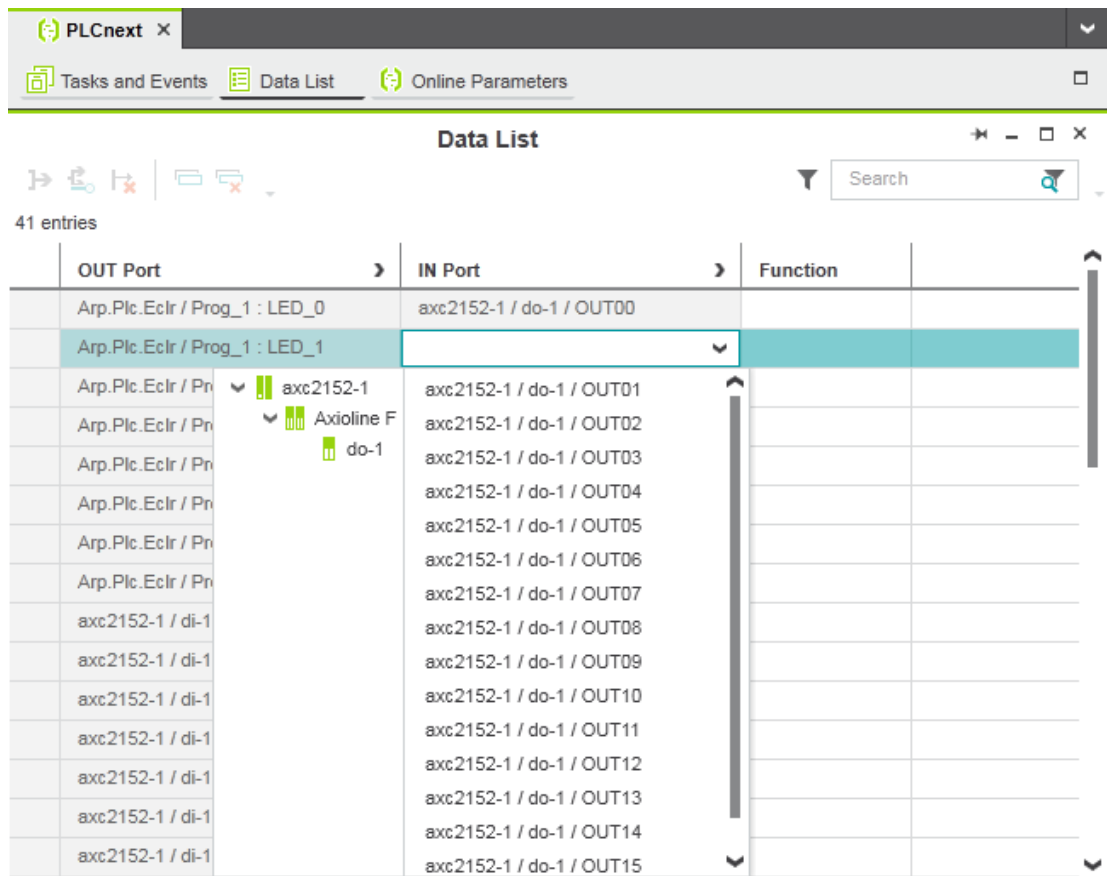


Figure 6-40 Role picker for selecting IN ports

- In the role picker, select the IN port that you want to assign to the respective OUT port.
- The IN port is assigned to the OUT port.
- Proceed as described for further IN ports.

Assigning an OUT port to an IN port

- In order 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.

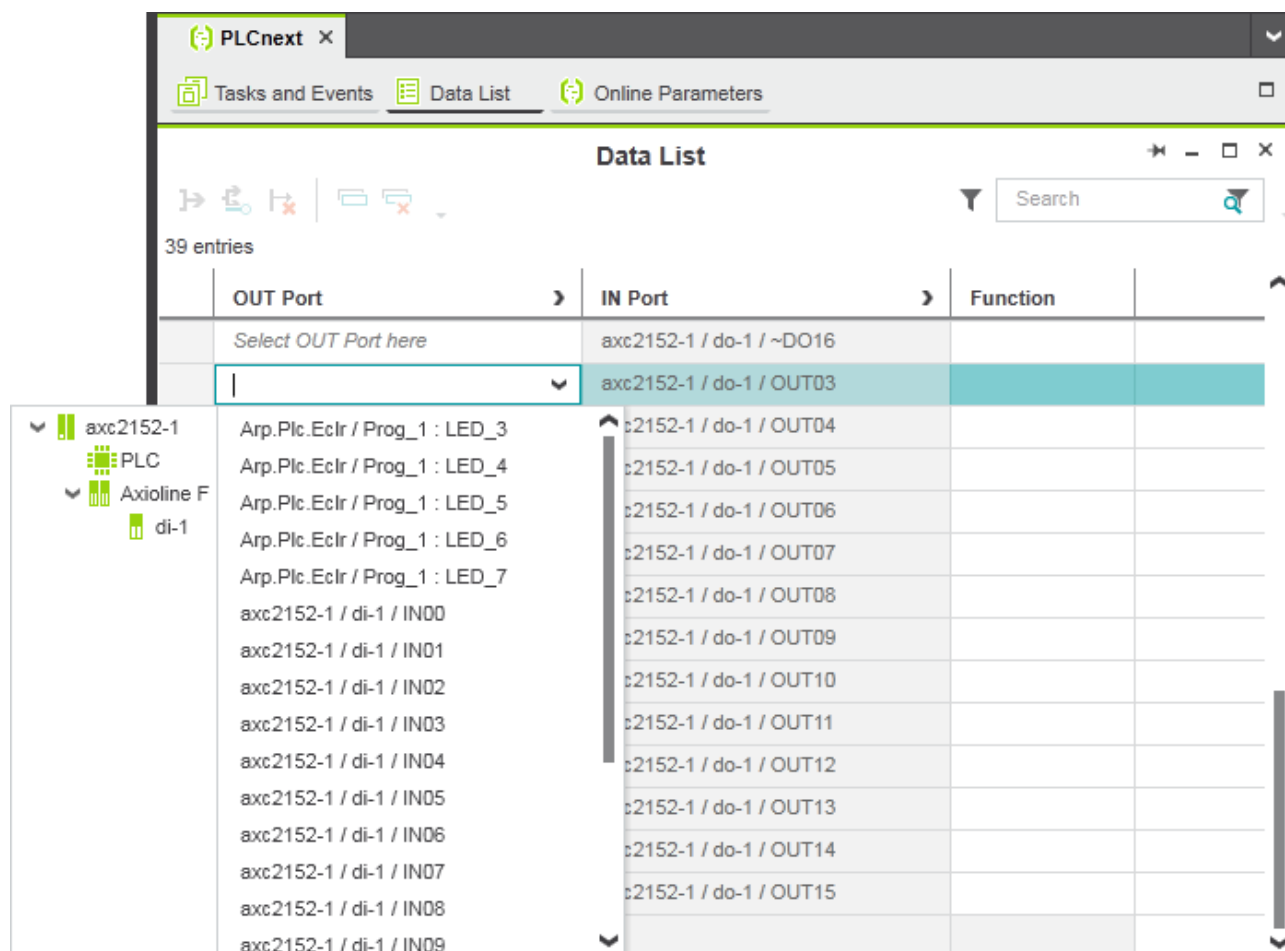


Figure 6-41 Role picker for selecting OUT ports


- In the role picker, select the OUT port that you want to assign to the relevant IN port. The OUT port is assigned to the IN port.
- Proceed as described for further OUT ports.

6.13 Transferring a project to the controller

To transfer a 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 for executing this function.

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

If User Authentication is enabled, the function can only be executed by users whose user roles contain the required authorization.

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

If you do not have the required user authorization for executing the function, PC Worx Engineer informs you of this in a message.

For information on the User Manager and the user roles, please refer to [Section 9.5.2.1](#).

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

6.14 Creating a PC Worx Engineer HMI application

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



Information on creating a PC Worx Engineer HMI application is to be found in “Installing and operating the PC Worx Engineer software” quick start guide and in the PC Worx Engineer online help.

7 Transferring variable values to the PROFICLOUD

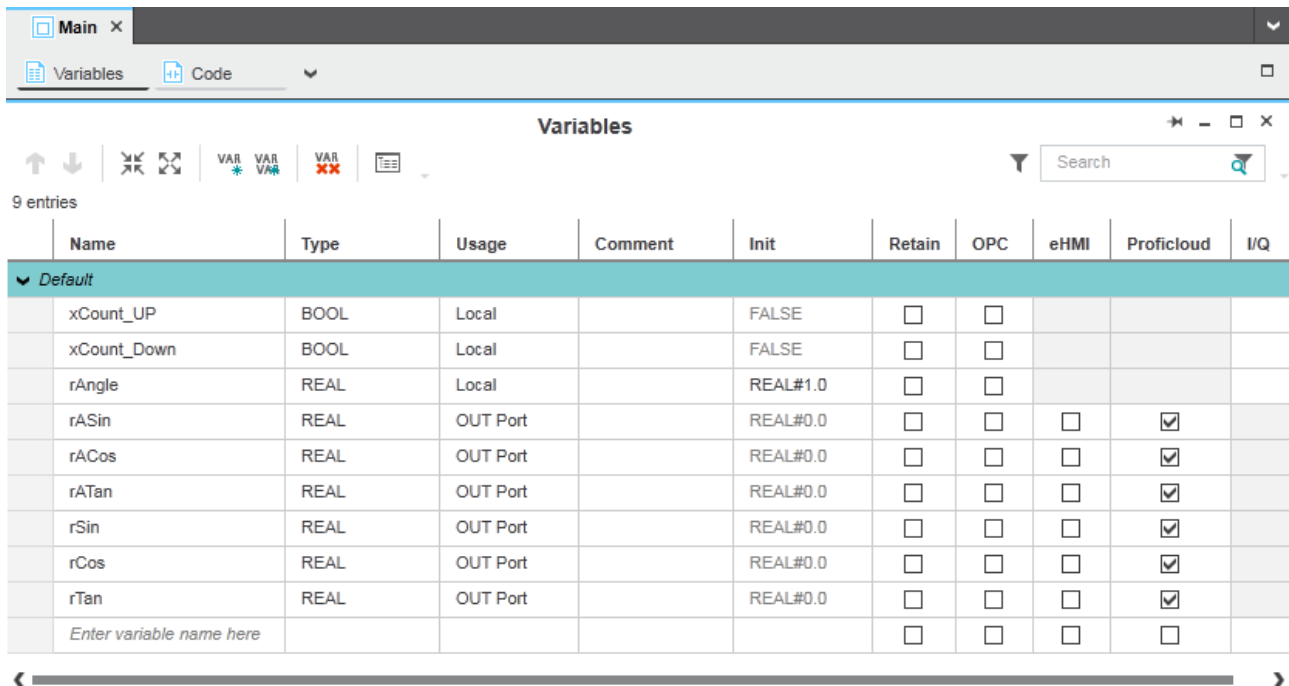
In PC Worx Engineer, you can define variables whose values are to be transferred as a metric into the PROFICLOUD. The variable values are stored in the PROFICLOUD. The metrics can be represented graphically using the Grafana open platform.

7.1 Creating variables in PC Worx Engineer as OUT ports

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

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

- Click on “Programs” in the “COMPONENTS” area and then on “Local”.
- Double-click on the desired POU from which variables are to be transferred to the PROFICLOUD.
- Select the “Variables” editor.
- Enter the variable name and data type.
- Select “OUT Port” in the “Usage” column.
- Click the check box in the “Proficloud” column.



9 entries

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

Figure 7-1 Creating variables as OUT ports

7.2 Editing the configuration file

To transfer variable values from a PC Worx Engineer project to the PROFICLOUD, you must edit the configuration file `metrics.json`. Specify the variables whose values are to be transferred from the PC Worx Engineer project to the PROFICLOUD in the `metrics.json` file. The variable values are transferred to the PROFICLOUD as metrics.

Configuring the `metrics.json` file

Configure the port and the metric in the `metrics.json` file in accordance with the variables defined in PC Worx Engineer. To do this, proceed as follows:

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

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

Figure 7-2 Example: Configuring ports and metrics in the `metrics.json` file

Restarting the controller

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

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

7.3 Configuring the PROFICLOUD

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

Establishing a connection to the web interface

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

Logging in

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

Adding an AXC F 2152

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

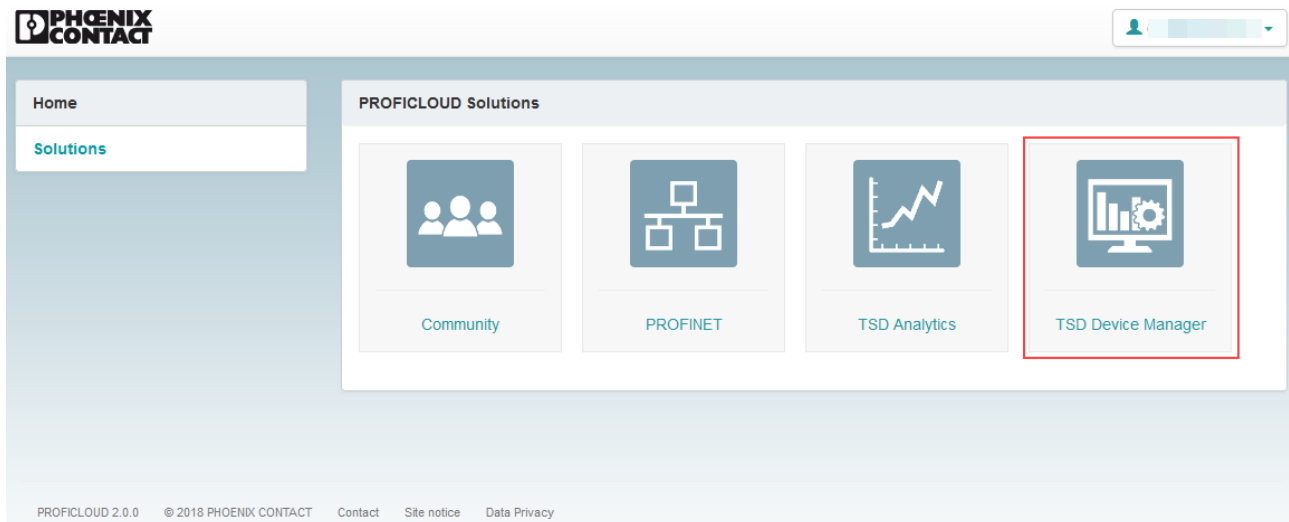


Figure 7-3 Selecting the “TSD Device Manager” PROFICLOUD solution

The “Appliances” page opens.

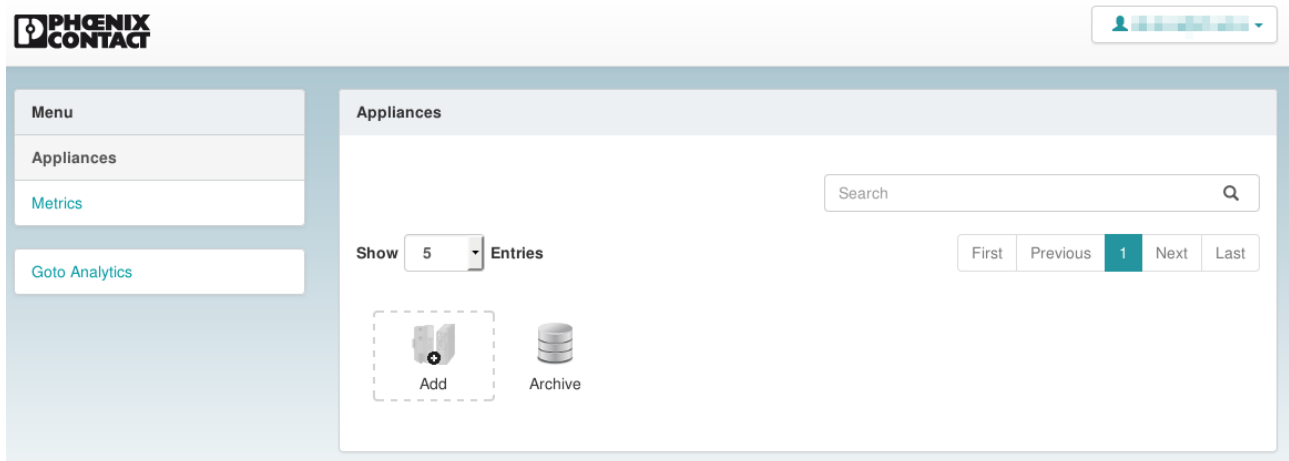
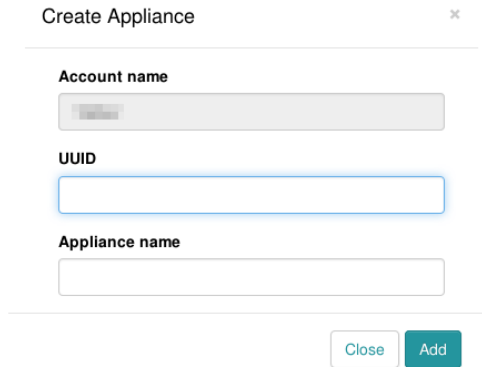


Figure 7-4 “Appliances” page

Registering a AXC F 2152

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



Create Appliance

Account name

UUID

Appliance name

Close Add

Figure 7-5 “Create Appliance” dialog

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

7.4 Displaying an overview of the PROFICLOUD device metrics

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

- Select the PROFICLOUD solution “TSD Device Manager”.

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.

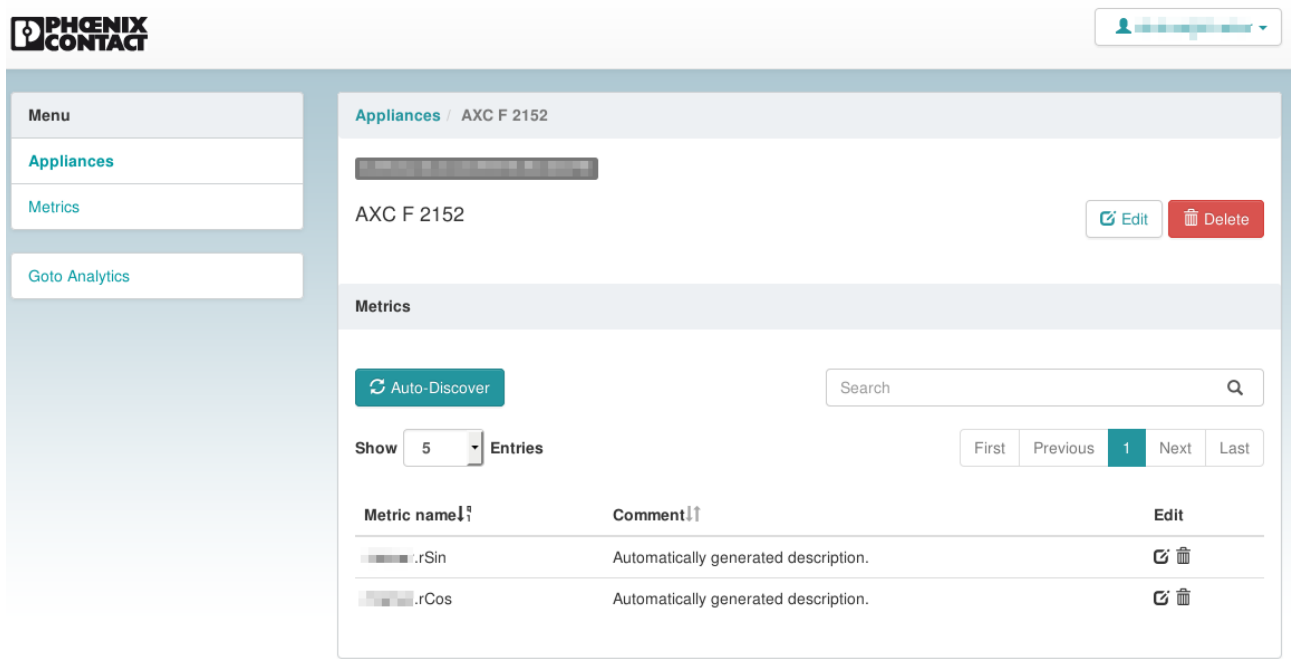


Figure 7-6 “Appliances / device name” page

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 Grafana open platform.

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

Establishing a connection to Grafana

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

The Grafana homepage opens.

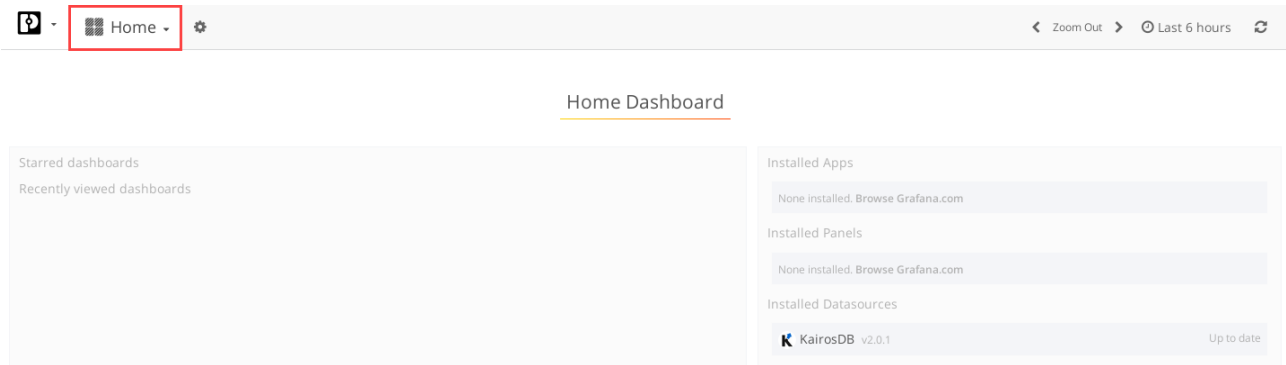


Figure 7-7 Grafana: Homepage

Creating a new dashboard

- Click on the “Home” button.

The Home page opens.

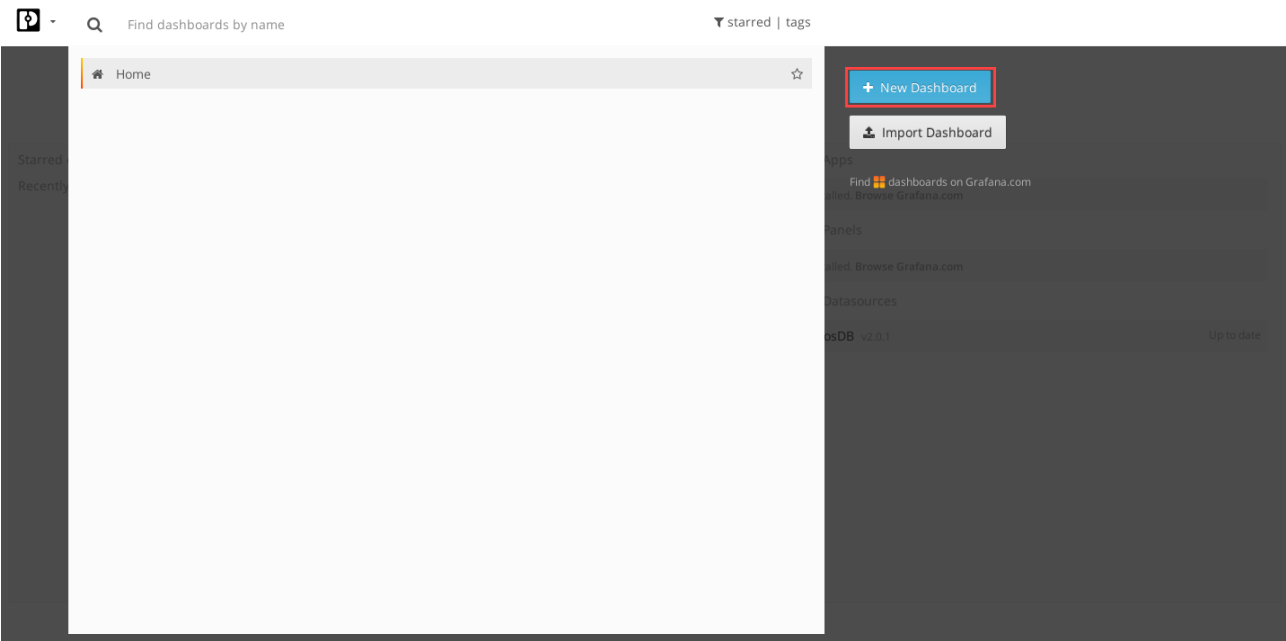


Figure 7-8 Grafana: “Home” page

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

The “New dashboard” page opens.

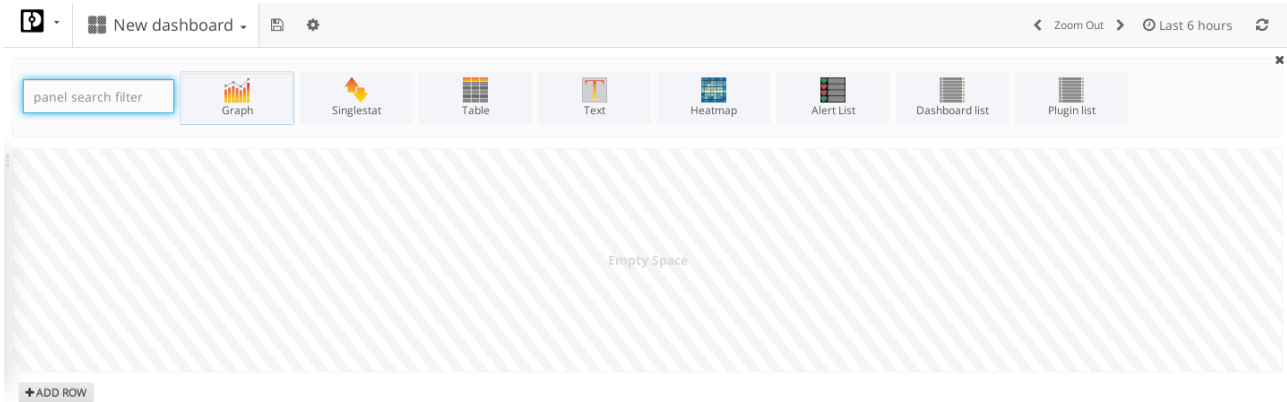


Figure 7-9 Grafana: “New dashboard” page

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 7-10](#)).

Selecting a metric

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

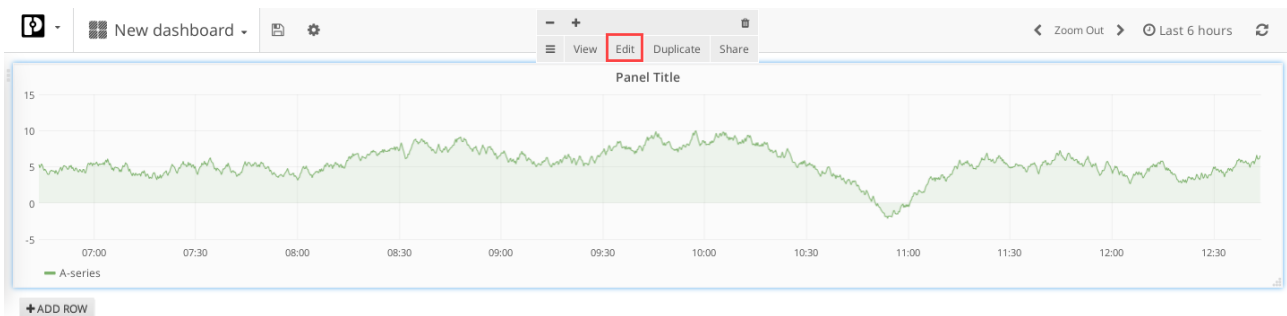


Figure 7-10 Grafana: Example graph; Edit Panel Title

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.

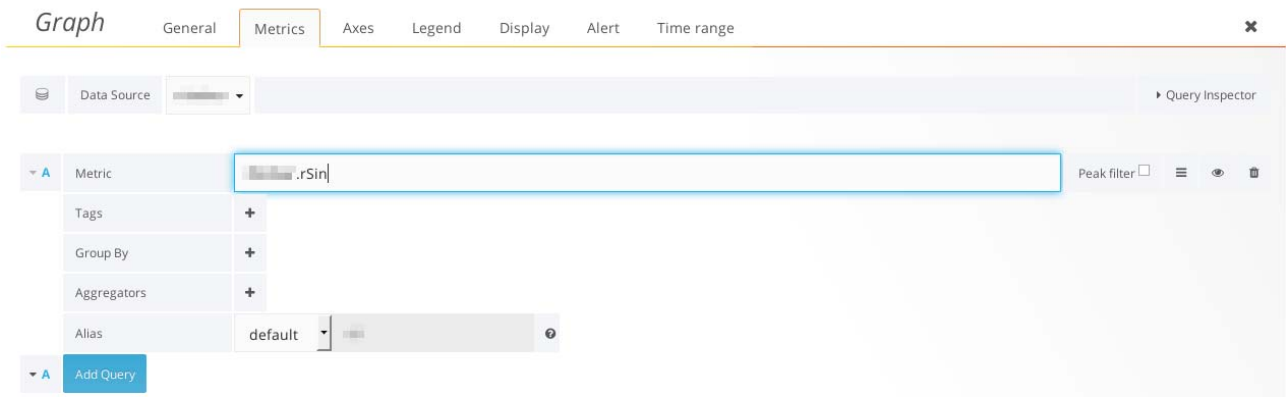


Figure 7-11 Grafana: Selecting the metric to be displayed

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

The selected metric is now displayed graphically.

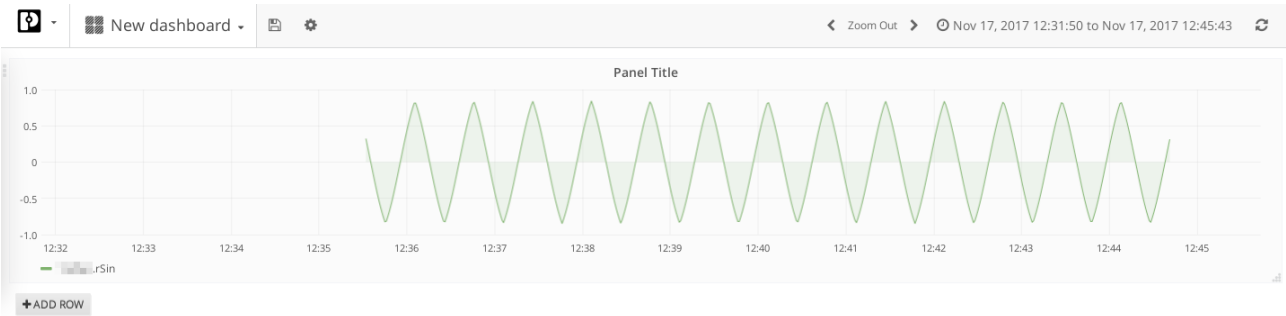


Figure 7-12 Grafana: Graphical display of the selected metric

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 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 8-1 System variables of the diagnostic status register

System variable	Type	Description
AXIO_DIAG_STATUS_REG_HI	BYTE	Diagnostic status register (high byte)
AXIO_DIAG_STATUS_REG_LOW	BYTE	Diagnostic status register (low byte)
AXIO_DIAG_STATUS_REG_PF	BOOL	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.

8.3 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.



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

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

Table 8-2 System variables of the diagnostic parameter register

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

8.4 PROFINET system variables

Table 8-3 lists the PROFINET system variables of the integrated PROFINET controller functions.

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

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 taken 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 required” 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

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

System variable	Type	Description
PNIO_CONFIG_STATUS_READY	BOOL	This variable is set if the PROFINET controller has been initialized correctly. No desired configuration has been loaded by PC Worx Engineer yet.
PNIO_CONFIG_STATUS_ACTIVE	BOOL	This variable is set if the desired configuration for the PROFINET controller has been loaded. In this state, the PROFINET controller attempts to establish a connection cyclically to all devices in the desired configuration (under the PROFINET icon).
PNIO_CONFIG_STATUS_CFG_FAULT	BOOL	The desired PROFINET controller configuration has not been applied due to a serious error. In this case, please contact Phoenix Contact.

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

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

System variable	Type	Description
PND_S1_PLC_RUN	BOOL	Status of the superordinate PROFINET controller Information on whether the superordinate PROFINET controller is active. The value is TRUE if the superordinate 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 superordinate PROFINET controller has established the connection Information on whether a connection exists and cyclic data is being exchanged between the PROFINET controller and PROFINET device (AXC F 2152) and whether the last frame received contains valid data.
PND_S1_OUTPUT_STATUS_GOOD	BOOL	IOP status of the superordinate PROFINET controller Information on 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 superordinate PROFINET controller is valid (provider status).
PND_S1_INPUT_STATUS_GOOD	BOOL	IOC status of the superordinate 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 superordinate PROFINET controller

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

System variable	Type	Description
PND_S1_INPUTS	PND_IO_512	Input process data Memory area for input process data that the PROFINET device receives from the superordinate PROFINET controller

8.5 TCP_SOCKET and UDP_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 request the number of opened IP sockets using a system variable:

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

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

8.6 Task handling

Programs and program parts are treated as tasks in PC Worx Engineer. Individual tasks are coordinated and processed in the Execution and Synchronization Manager (ESM). The following system variables can be used to call up information via the ESM task handling function:

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

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

Table 8-7 TASK_INFO data structure

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

9 Web-based management (WBM)

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

9.1 Establishing a connection to the WBM

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

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



Please note:

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



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

- To call up the WBM in this case, enter the URL “http://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.

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:

- Click the check box “Do not show this page in the future and go directly to the WBM”. The next time you access the controller web server, the login page of the WBM opens, see [Section 9.4](#).

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

In this case, the WBM is displayed immediately.

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

9.2 Licensing information on 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 the WBM:

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

All open source software licenses are shown.

9.3 Changing the language

The WBM is available in German and English.



Figure 9-2 WBM: Changing the language

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

The WBM then immediately switches to the desired language.

9.4 Login

The WBM login page is displayed when

- You access the WBM for the first time
- You have activated the WBM User Authentication function, see [Section 9.5.2.1](#).

If you disable User Authentication, logging in is not necessary to access the WBM. In this case, the start page of the WBM is displayed when accessing the WBM, see [Section 9.5](#).

Figure 9-3 WBM: Login page

Initial access as an administrator

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

- Enter the user name “admin” in the “Username” input field.
- Enter the administrator password in the “Password” input field.
The administrator password is printed on the controller (see [Figure 9-4 on page 104](#)).
- To open the WBM, click on the “Login” button.

The WBM start page opens (see [Section 9.5](#)).



Recommended:

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



Please note:

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

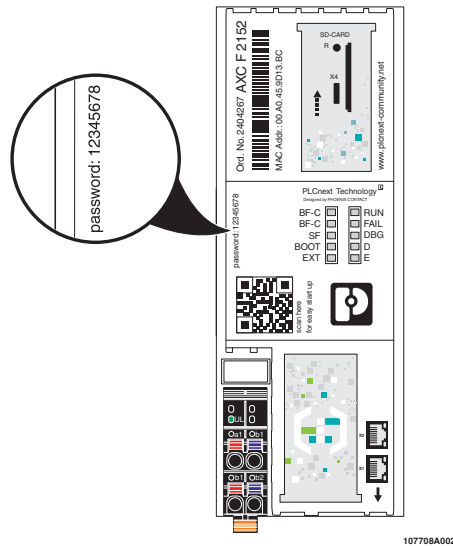


Figure 9-4 Administrator password on the controller

Logging in as user

If you have enabled WBM User Authentication, log in using your user details.

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

The WBM start page opens (see [Section 9.5](#)).

9.5 Areas and functions



Figure 9-5 WBM: Start page

The WBM is split into the following areas:

- Information
- Configuration

9.5.1 “Information” area

This area includes general device information.

9.5.1.1 “General Data” page

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

Deutsch
English
Logout

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

AXC F 2152
2404267

Information
General Data

Configuration
User Manager

General Data

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

Figure 9-6 WBM: “General Data” page

9.5.2 “Configuration” area

The User Manager is located in this area.

9.5.2.1 “User Manager” page

Deutsch **English** Logout

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

AXC F 2152
2404267

User Manager

User Authentication ☒ **Enable/Disable**

User	Roles	
admin	Admin	Set Password Modify Roles Remove User

Add User

Information
General Data

Configuration
User Manager

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Figure 9-7 WBM: “User Manager” page

User Authentication

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

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

User Authentication is enabled by default. Upon delivery, the user “admin” is already created with administrator rights.



Recommended:

- Only use the administrator password printed on the controller for logging into the WBM for the first time.
- 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 filesystem on the parameterization memory. If you operate the controller with an SD card, the overlay filesystem is saved to the SD card.

See [Section 3.5](#) for the file system directory structure.



Please note:

Enabled User Authentication only provides a limited degree of protection against unauthorized network access.

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

- Ensure that you always operate the controller with the latest firmware version.
- Follow the security advice on unauthorized network access in the [Section 1.4](#).

Enabling/disabling User Authentication

To enable/disable User Authentication, proceed as follows:

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

The “Enable/Disable User Authentication” dialog opens.

Enable/Disable User Authentication

User Authentication



Save

Cancel

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

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

User management

In the User Manager function, 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.

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

Adding a user

Proceed as follows to add a user:

- Click on the “Add User” button in the User Manager.

The “Add User” dialog box opens.

Add User

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

Figure 9-9 “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 in the User Manager.

The “Set User Password” dialog box opens.

Set User Password

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

Figure 9-10 “Set User Password” dialog box

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

Modifying user roles

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

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

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

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

The “Modify Roles” dialog opens.

Modify Roles

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

Figure 9-11 “Modify Roles” dialog

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



The EHmiLevel1 ... EHMiLevel10 user roles are in preparation and are currently without function.

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

Recommended:

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

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

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

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

Application or component of the AXC F 2152	Access permission	User role								
		Admin	UserManager	Engineer	Commissioner	Service	DataViewer	DataChanger	Viewer	EHmiLevelIX ¹
SD card / parameterization memory	SFTP access to the file system with a SFTP client Please note: Authentication with a user name and password is always required for SFTP access, even when User Authentication is disabled.	Yes								
Shell	SSH access to the shell Please note: Authentication with a user name and password is always required for SSH access, even when User Authentication is disabled.	Yes								
PC Worx Engineer	View values in the cockpit (e.g. utilization, etc.)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PC Worx Engineer	Transfer the project to the controller	Yes		Yes						
PC Worx Engineer	Start or stop controller (cold/warm start)	Yes		Yes	Yes	Yes				

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

Application or component of the AXC F 2152	Access permission	User role								
		Admin	UserManager	Engineer	Commissioner	Service	DataViewer	DataChanger	Viewer	EHmiLevelX ¹
PC Worx Engineer	Restart the controller (reboot)	Yes								
PC Worx Engineer	Reset the controller to default setting 1	Yes								
PC Worx Engineer	View online variable values	Yes		Yes		Yes	Yes	Yes	Yes	
PC Worx Engineer	Overwrite variables	Yes		Yes		Yes		Yes		
PC Worx Engineer	Set and delete breakpoints	Yes		Yes		Yes				
WBM	View "General Data" page	Yes	Yes	Yes						
WBM	Manage users	Yes	Yes							
OPC UA client	View online variable values	Yes		Yes		Yes	Yes	Yes	Yes	
OPC UA client	Overwrite variables	Yes		Yes		Yes		Yes		

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

Removing a user

Proceed as follows to remove a user:

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

The "Remove User" dialog opens.

Remove User

Username

Figure 9-12 "Remove User" dialog

- Click on the "Remove" button to delete the user.

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

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

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



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 re-activation.

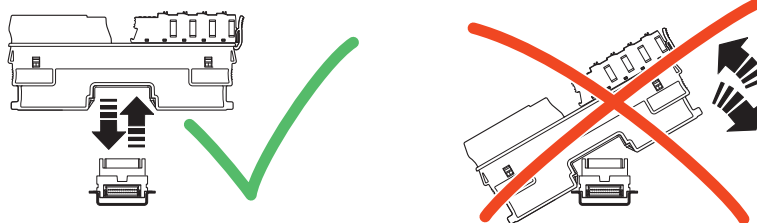


Figure 10-1 Removing the module keeping it **perpendicular** to the DIN rail

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](#)).

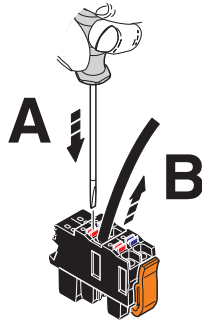


Figure 10-2 Removing the cable

10.3 Removing the plug

Removing the supply plug

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

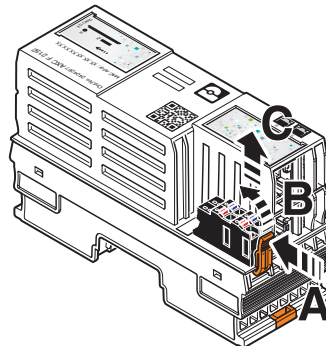


Figure 10-3 Removing the supply plug

Removing the Ethernet connector

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

10.4 Removing the SD card

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

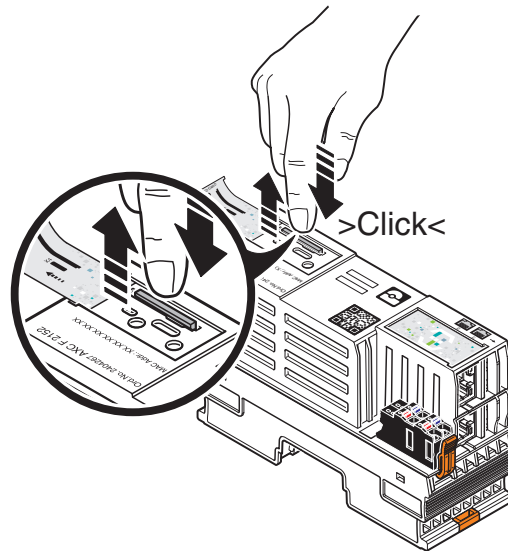


Figure 10-4 Removing the SD card

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 them (A in [Figure 10-5](#)).

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

- Remove the controller keeping it perpendicular to the DIN rail (B in [Figure 10-5](#)).

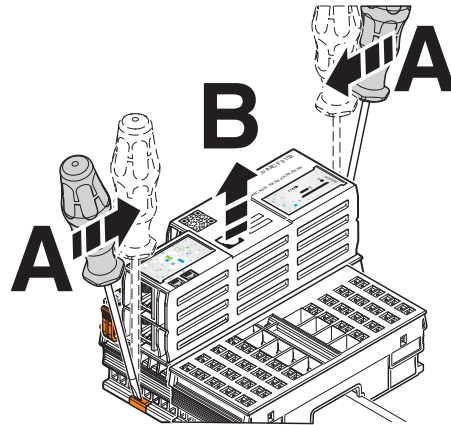


Figure 10-5 Removing the controller

11 After use

11.1 Maintenance and servicing

The controller is maintenance-free.

11.2 Device replacement

The controller can be replaced as required.

If you want to replace a controller in 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 PC Worx Engineer software package and in the integrated development environment. This procedure is only necessary for certain firmware versions. You will find information on this in the application note "Change notes for the AXC F 2152 controller".

The application note is available for downloading at phoenixcontact.net/product/2404267.

- To adopt the settings stored on the SD card, insert the SD card into the new controller.
- Once replaced, restore all of the necessary connections.

11.3 Device faults and repair

Repairs may only be carried out by Phoenix Contact.

- Send defective devices back to Phoenix Contact for repairs or to receive a replacement device.
- We strongly recommend using the original packaging to return 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 13.2](#)).
 - If necessary, use dehumidifying agents.
 - Use appropriate ESD packaging to protect components that are sensitive to electrostatic discharge.
 - Secure any loose parts.
 - Ensure that the packaging you select is large enough and sufficiently thick.

- Only use plastic bubble wrap sheets as filler material.
- Attach warning notes to the transport packaging so that they are clearly visible.
- Please ensure that the delivery note is placed inside the package in the case of packages that are to remain within the same country. However, if the package is being sent to other countries, the delivery note must be placed inside a delivery note pocket and attached to the outside such that it is clearly visible.

11.4 Disposal

Controller disposal

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

Packaging disposal

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

SD card disposal

Sensitive data is stored on the SD card. This data can even be restored after 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.

11.5 Return for disposal

As an alternative to disposal, you can return the device to Phoenix Contact.

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



Please note:

The device must not show evidence of being contaminated by oils, greases etc.

12 Troubleshooting and Frequently Asked Questions (FAQs)



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

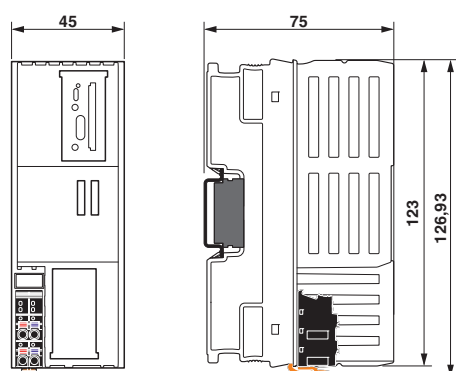
13 Ordering data and technical data

13.1 Ordering data

Description	Type	Order No.	Pcs./Pkt.
PLCnext Control for the direct control of Axioline F I/Os. With two Ethernet interfaces. Complete with connector and bus base module.	AXC F 2152	2404267	1
Accessories	Type	Order No.	Pcs./Pkt.
Program and configuration memory for storing the application programs and other files in the file system of the PLC. (Memory)	SD FLASH 2GB PLCNEXT MEMORY	1043501	1
Engineering software platform for Phoenix Contact automation controllers. PC Worx Engineer is IEC 61131-3-compliant and its functionality can be expanded using add-ins. (Software)	PC WORX ENGINEER 7	1046008	1
Right-alignable Inline adapter terminal (INTERBUS master) for a PLCnext controller for setting up of a PLCnext Inline station	AXC F IL ADAPT	1020304	1
Axioline F, Power module for the logic supply U_{Bus} , max. 4 A, degree of protection: IP20, including bus base module and Axioline F connector	AXL F PWR 1H	2688297	1
Documentation	Type	Order No.	Pcs./Pkt.
User manual, English, Axioline F: System and installation	UM EN AXL F SYS INST	-	-
User manual, English, Axioline F: Diagnostic registers, and error messages	UM EN AXL F SYS DIAG	-	-
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	-	-
User manual, English, for the Peripherals Communication Protocol (PCP), only available as a download.	IBS SYS PCP G4 UM E	-	-
Application note, English, Measures to protect network-capable devices with Ethernet connection against unauthorized access	AH EN INDUSTRIAL SECURITY	-	-
Data sheet, English, PLCnext Technology, Inline adapter terminal (INTERBUS master), right-alignable	DB DE AXC F IL ADAPT	-	-

13.2 Technical data

Dimensions (nominal sizes in mm)




Width	45 mm
Height	126.93 mm
Depth	75 mm
Note on dimensions	The depth is valid when a TH 35-7,5 DIN rail is used (according to EN 60715).

General data

Color	gray
Weight	215 g
Type	Axioline
Mounting type	DIN rail mounting
Realtime clock	Yes

Ambient conditions

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

Ambient conditions	
Vibration (storage/transport)	5g
Shock	30g, 11 ms period, half-sine shock pulse, according to IEC 60068-2-27
Shock (operation)	10g (Bump endurance test according to EN 60068-2-29)
Processor	
Processor	ARM® Cortex®-A9 2x 800 MHz
Connection data	
Designation	Axioline F connector
Connection method	Push-in connection
Conductor cross section solid / stranded	0.2 mm ² ... 1.5 mm ²
Conductor cross section [AWG]	24 ... 16
Stripping length	8 mm
Interface Axioline F local bus	
Number of interfaces	1
Connection method	Bus base module
Transmission speed	100 Mbps
Electrical isolation	No
Number of supported devices	max. 63
Interface Ethernet	
Number of interfaces	2
Connection method	RJ45 socket
Note on the connection method	Auto negotiation and autocrossing
Bus system	RJ45
No. of channels	2
Transmission speed	10/100 Mbps (full duplex)
Transmission length	max. 100 m
Transmission physics	Ethernet in RJ45 twisted pair
System limits	
Amount of process data	max. 8192 Bit (per station) max. 4096 Bit (Input) max. 4096 Bit (Output)
Number of supported devices	max. 63 (per station)
Number of local bus devices that can be connected	max. 63 (observe current consumption)
<div>  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. </div>	

PROFINET

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

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

Supply voltage	24 V DC
Supply voltage range	19.2 V DC ... 30 V DC (including all tolerances, including ripple)
Current draw	typ. 200 mA (without I/Os and $U_L = 24$ V) max. 442 mA (with 1 A at U_{Bus} for the I/Os and $U_L = 24$ V)
Power consumption	typ. 4.8 W (without I/Os) max. 10.6 W (with 1 A load at U_{Bus} for the I/Os)
Surge protection of the supply voltage	electronic
Polarity reversal protection of the supply voltage	electronic

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

Provide external fuses for the 24 V U_L area. 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

IEC 61131 runtime system

Module classification	PLCnext Control for direct control of Axioline F I/Os.
Application type	Distributed control technology
Programming tool	PC WORX ENGINEER
Application interface	OPC UA
Number of data blocks	depends on mass storage
Number of control tasks	32 (16 per processor core)

IEC 61131 runtime system

Cycle Time	500 µs (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

To update the controller firmware, proceed as follows:

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

When installing, the update file (*.raucb) and PDF files with device-specific information will be copied to the selected destination directory.

- Open your SFTP client software (e.g. WinSCP).
- Log in as an administrator.

The following access data is set by default:

User name: admin

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

- 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 3-2](#)).

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

You will be asked to enter the administrator password.

- Enter the administrator password.

The firmware will be updated. During the firmware update, the RUN LED begins to flash, 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.

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 PC Worx Engineer.
sudo /etc/init.d/plcnext start	Starts all PLCnext firmware processes
sudo /etc/init.d/plcnext restart	Restarts all PLCnext firmware processes

A 3 Replacing HTTPS certificate

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

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

- Connect to the controller via an SFTP client software package (e.g. WinSCP).
- Open the directory `/opt/plcnext/certificates/https`.

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`.

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