



# Installation and operation of the left-alignable AXC F XT SPLC 1000 safety-related controller

## User manual

UM EN AXC F XT SPLC 1000

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## Installation and operation of the left-alignable AXC F XT SPLC 1000 safety-related controller

UM EN AXC F XT SPLC 1000, Revision 01

2021-11-11

This manual is valid for:

| Designation        | Revision                    | Item No. |
|--------------------|-----------------------------|----------|
| AXC F XT SPLC 1000 | HW/FW: $\geq$ 01/01.00.0000 | 1159811  |



**Prior to commissioning the device, observe the following:**

- Ensure that you operate the device with the latest firmware version.  
If a firmware update is necessary, please contact your nearest Phoenix Contact representative. The firmware may only be updated by trained personnel.
- Ensure that the left-alignable safety-related controller is only aligned next to a PLCnext Control device which has a firmware version that is permissible for this.  
PLCnext Control devices of the type Typs AXC F ... with the following firmware versions are permitted:
  - AXC F 2152 with firmware version  $\geq$ 2021.9
  - AXC F 3152 with firmware version  $\geq$ 2021.9

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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.

This user manual is addressed to persons, who are familiar with the relevant safety concepts for handling electrical machines. The persons must be able to recognize dangers.

## 1.3 Information about this user manual

### 1.3.1 Purpose of this user manual

The information in this document describes how the AXC F XT SPLC 1000 works, its control elements, and its connection elements. The AXC F XT SPLC 1000 is a safety-related controller that, as the “PLCnext Control Extension” extension module, can be aligned to the left of an AXC F 2152 or AXC F 3152.

It also describes how the AXC F XT SPLC 1000 is integrated into the software tools listed in [Section “System requirements \(hardware and software\)” on page 20](#).

This information will enable you to use the device in accordance with your requirements.

### 1.3.2 Validity of the user manual

This user manual is only valid for the left-alignable AXC F XT SPLC 1000 safety-related controller in the versions listed on the inner cover page.

The AXC F XT SPLC 1000 will also be referred to in the following by its short form, “SPLC 1000”.

This user manual is only valid in association with the user manuals listed in [Sections 1.11 on page 18](#) and [13.1.6 on page 166](#).

## 1.4 Information on Open source software licenses and requesting source code

You can view the Open source software license information in the Web-based management system of the PLCnext Control device used.



**Please note:**

Information on the following subjects is available in the UM EN AXL F X152 user manual:

- Licensing information on Open source software
- Requesting the source code
- Web-based management system of the PLCnext Control device used

## 1.5 General safety notes



**WARNING: Depending on the application, incorrect handling of the SPLC 1000 can pose serious danger for the user**

When working with the SPLC 1000, observe all the safety notes included in this section.

|  |  |
|--|--|
| <b>Requirements</b>                      | <p>Knowledge of the following is required:</p> <ul style="list-style-type: none"> <li>– The non-safety-related target system PROFINET</li> <li>– The PROFIsafe system</li> <li>– The components used in your application (e.g., from the Axioline F product group)</li> <li>– Operation of the software tools specified under the software requirements (see <a href="#">Section “System requirements (hardware and software)” on page 20</a>)</li> <li>– Safety regulations in the field of application</li> </ul>  |
| <b>Qualified personnel</b>               | <p>In the context of the use of the PROFIsafe system, the following operations may only be carried out by qualified personnel:</p> <ul style="list-style-type: none"> <li>– Planning</li> <li>– Configuration, parameterization, programming</li> <li>– Installation, commissioning, servicing</li> <li>– Maintenance, decommissioning</li> </ul> <p>This user manual is therefore aimed at:</p> <ul style="list-style-type: none"> <li>– Qualified personnel who plan and design safety equipment for machines and systems and are familiar with regulations governing occupational safety and accident prevention.</li> <li>– Qualified personnel who install and operate safety equipment in machines and systems.</li> </ul> <p>In terms of the safety notes in this user manual, qualified personnel are persons who, because of their education, experience and instruction, and their knowledge of relevant standards, regulations, accident prevention, and service conditions, have been authorized to carry out any required operations, and who are able to recognize and avoid any possible dangers.</p> |
| <b>Documentation</b>                     | <p>You must observe all information and especially all safety notes in this user manual as well as in the documents listed in <a href="#">Section “Documentation” on page 18</a>.</p>  |
| <b>Safety of personnel and equipment</b> | <p>The safety of personnel and equipment can only be assured if the SPLC 1000 is used correctly (see <a href="#">Section “Intended use” on page 13</a>).</p>   |
| <b>Error detection</b>                   | <p>Depending on the wiring and the parameterization of the safe input/output devices, the PROFIsafe system can detect various errors within the safety equipment.</p>  |
| <b>Observe startup behavior</b>          | <p>The PROFIsafe system and the SPLC 1000 as the central component do not prevent automatic startup/restart of the safety function. The user must program this independently in the safety program using the programming software for PROFIsafe (PLCnext Engineer).</p> <p>After power up of the supply voltage or a software reset, the SPLC 1000 starts immediately if:</p> <ul style="list-style-type: none"> <li>– An SD card with a valid project is inserted in the PLCnext Control or</li> <li>– A valid project exists on the internal flash memory of the PLCnext Control and</li> </ul>  |

- The PLCnext Control mode selector switch is set to RUN.



Information on the PLCnext Control mode selector switch is available in the UM EN AXL F X152 user manual.

By selecting one of the options “Write and Start Project...” or “Write and Start Project Changes...”, the safety function becomes active immediately after downloading the PLCnext Engineer project and following the startup phase of the SPLC 1000 and the PLCnext Control device. The outputs of the F-Devices and the non-safety-relevant PROFINET devices can be set in accordance with the programming.

**Safety notes for starting applications**

Take the following into consideration when determining and programming the start conditions for your machine or system:

- The machine or system may only be started if it can be ensured that nobody is present in the danger zone.
- Meet the requirements of EN ISO 13849-1 with regard to the manual reset function. The machine must not be set in motion and/or a hazardous situation must not be triggered by the following actions, for example:
  - Switching on safe devices
  - Acknowledging device error messages
  - Acknowledging communication errors
  - Acknowledging block error messages in the application
  - Removing startup inhibits for safety functions

Observe the following when programming/configuring the safety logic:

- Switching from the safe state (substitute value = 0) to the operating state can generate an edge change (zero/one edge).
- In the safety logic, take measures to prevent this edge change resulting in unexpected machine/system startup or restart.



**Note for starting applications**

Also observe these notes to prevent unexpected machine startup after confirming an “Operator Acknowledgement”.

**Measures to prevent mismatching and polarity reversal**

Take measures to prevent mismatching, polarity reversal, and manipulation of connections. Observe the country-specific installation, safety, and accident prevention regulations.

## 1.6 Field of application of the product

### 1.6.1 Intended use

This information will enable you to use the AXC F XT SPLC 1000 (SPLC 1000 for short) in accordance with your requirements in a PROFIsafe system.

- The device is a safety-related controller which supports the PROFIsafe protocol.
- The device enables the implementation of functional safety applications.  
The safety function of the SPLC 1000 is only available when used in a PROFIsafe system.
- The device can be used as an F-Host and/or as an F-Device in a PROFIsafe system.  
With the integrated F-Device instance, the device can be operated subordinately by a superordinate F-Host and, simultaneously, can be operated as an F-Host for subordinate F-Devices.
- In an Axioline F station, the device is aligned to the left of a PLCnext Control AXC F 2152 or AXC F 3152.
- In addition to the SPLC 1000, a complete PROFIsafe system also includes F-Devices and the PLCnext Engineer software, as well as a superordinate host if you are operating the SPLC 1000 itself as an F-Device.
- The SPLC 1000 can only perform its safety-related tasks in a PROFIsafe system if the device has been integrated into the execution process correctly and in such a way as to avoid errors.
- In a PROFIsafe system, the SPLC 1000 can be used to realize safety functions with the following requirements depending on the operating conditions:
  - Up to SIL 3 in accordance with standard IEC 61508
  - Up to SIL CL 3 in accordance with standard EN 62061
  - Up to PL e/Cat. 4 in accordance with standard EN ISO 13849-1
- Use the PLCnext Engineer software to implement safety-related programming in your application.
- Observe all information in this user manual as well as in the documents listed in [“Documentation” on page 18](#).
- Only use the device in compliance with the technical data and ambient conditions stated in [Section 13, “Technical data and ordering data”](#) starting on [page 165](#).

#### Degree of protection

Degree of protection of the device: IP20.



#### NOTE:

The IP20 degree of protection (IEC 60529/EN 60529) of the device is intended for use in a clean and dry environment. Do not subject the device to mechanical and/or thermal stress that exceeds the specified limits.

To ensure correct operation, the SPLC 1000 must be installed in a lockable housing or a lockable control cabinet with a minimum degree of protection of IP54.

#### Assembly guidelines

During installation of the device, observe the sections [4 “Mounting hardware”](#) and [5 “Connecting and wiring the hardware”](#).

### 1.6.2 Foreseeable misuse



**WARNING: Serious risks due to improper use**

There is a serious risk to the user and/or equipment if the SPLC 1000 is used inappropriately or not in accordance with the intended use, or if the E-STOP box is subject to tampering.

### 1.6.3 Product changes

Modifications to the device hardware are not permitted.

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

### 1.6.4 Note on security



**NOTE: Unauthorized deletion/replacement of the safety-related project possible**

- Only provide the roles for user authentication – “Admin”, “Commissioner”, and “Engineer” – to those users who are authorized to program the safety-related controller. Otherwise, the unauthorized replacement or deletion of the safety-related project by the user cannot be ruled out.

You can set the user roles in the Web-based management system of the PLCnext Control device used. A general description of the Web-based management system can be found in the [PLCnext Info Center](#).

- It is imperative that you install the AXC F XT SPLC 1000 in a lockable housing or a lockable control cabinet.  
The device housing is not protected against tampering, and access to the device cannot be proven.
- It is possible to access the SD card, meaning that data can be read off and tampered with.

We recommend securing the slot for the configuration memory (SD card) on the PLCnext Control device used against tampering using a seal.

## 1.7 Safety notes

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

**NOTE: Property damage due to incorrect use**

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

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

**NOTE: Electrostatic discharge**

The device contains components that can be damaged or destroyed by electrostatic discharge. When working with or on 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 vents).

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

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

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

**NOTE: Device failure due to vibrations and shock levels above the permitted specifications during operation**

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 defect due to polarity reversal**

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

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

## 1.8 Electrical safety



**WARNING: Hazardous shock currents and the loss of functional safety**

Disregarding instructions for electrical safety may result in hazardous shock currents and the loss of functional safety.

In order to ensure electrical safety, please observe the following points.

**Direct/indirect contact**

Protection against direct and indirect contact according to VDE 0100 Part 410 (IEC 60364-4-41) must be ensured for all components connected to the system. In the event of an error, parasitic voltages must not occur (single-fault tolerance). This also applies to devices and components with dangerous contact voltages that are permanently connected to the network and/or diagnostic interfaces of the devices used.

This requirement can be met by:

- Using power supplies with safe isolation (PELV)
- Decoupling circuits that are not PELV systems using optocouplers, relays, and other components that meet the requirements of safe isolation.

**Safe isolation**

Only use devices with safe isolation if dangerous contact voltages can occur at their connections during normal operation or as a result of an insulation error.

**Power supply**



**WARNING: Loss of electrical safety and the safety function when using unsuitable power supplies**

The SPLC 1000 is designed exclusively for protective extra-low voltage (PELV) operation in accordance with EN 60204-1. Only protective extra-low voltages in accordance with the listed standard may be used for the supply.

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

Only use power supplies that satisfy the requirements of EN 61204-1 and feature safe isolation with PELV in accordance with IEC 61010-2-201 (PELV). They prevent short circuits between the primary and secondary side.

**Insulation rating**

When selecting the equipment, please take into consideration the dirt and surge voltages that may occur during operation.

The SPLC 1000 is designed for overvoltage category III (in accordance with DIN EN 60664-1). If you expect surge voltages in the system, which exceed the values defined in overvoltage category III, take into consideration additional measures for voltage limitation.

**DC distribution network**

DC distribution network according to IEC 61326-3-1:

A DC distribution network is a DC power supply network that supplies a complete industrial hall with DC voltage and to which any device can be connected. A typical system or machine distribution is not a DC distribution network. For devices that are provided for a typical system or machine distribution, the DC connections are viewed and tested as I/O signals according to IEC 61326-3-1.

When using a SPLC 1000 in a DC distribution network, install appropriate surge protection (e.g., PT 2+1-S-48DC/FM, item no. 2817958) directly upstream of the device.



**Installation and configuration**

Please observe the instructions for installing and configuring the PROFIsafe system (see [Section “Documentation” on page 18](#)).

**WARNING: Incorrect installation and upgrades can pose serious risks**

The user is obliged to design the devices used and their installation in the system according to these requirements. This also means that existing plants and systems retrofitted with PROFIsafe must be checked and tested again in this respect.

## 1.9 Safety of the machine or system

The manufacturers and operators of machines and systems, in which the AXC F XT SPLC 1000 device is used, are responsible for adhering to all applicable standards, directives, and legislation.

**Draw up and implement a safety concept**

In order to use the device described in this document, you must have drawn up an appropriate safety concept for your machine or system. This includes a hazard and risk analysis, among others, in accordance with the directives and standards specified in [Section “Standards and directives” on page 18](#), as well as a test report (checklist) for validating the safety function (see [Section “Appendix: Checklists” on page 175](#)).

The target safety integrity level (SIL in accordance with IEC 61508, SIL CL in accordance with EN 62061 or performance level (and category) in accordance with EN ISO 13849-1) is ascertained on the basis of the risk analysis. The required safety integrity level ascertained in this way determines how to use and parameterize the safety-related SPLC 1000 controller within the overall safety function.

**Checking hardware and parameterization**

- Carry out a **validation** every time you make a safety-related modification to your overall system.

Use your test report to ensure that:

- The safe PROFIsafe devices (F-Devices) are connected to the correct safe sensors and actuators.
- The safe input and output devices have been parameterized correctly.
- The variables have been linked to the safe sensors and actuators correctly (single-channel or two-channel).

## 1.10 Standards and directives

The standards to which the device conforms are listed in the certificate issued by the approval body and in the EC declaration of conformity (see [phoenixcontact.net/products](http://phoenixcontact.net/products)).

Directives considered in the development of the AXC F XT SPLC 1000 device:

- Machinery Directive 2006/42/EC
- EMC Directive => 2014/30/EU
  
- PROFINET Assembling Guideline, Version 2.8, September 2019
- PROFIsafe System Description, Version April 2016
- PROFIBUS Guideline, PROFIsafe Policy, Version 1.5, July 2011
- PROFIsafe – Environment related to PROFIsafe V2.6.1  
Guideline for PROFINET and PROFIBUS, Version 2.6, December 2015
- PROFIsafe – Profile for Safety Technology on PROFIBUS and PROFINET  
Profile part, related to IEC 61784-3-3  
Technical Specification, Version 2.6MU1, August 2018
- PROFIsafe Test Specification, related to PROFIsafe V2.6,  
Test Specification for PROFIBUS and PROFINET, Version 2.3, March 2018
- Functional Bonding and Shielding of PROFIBUS and PROFINET, Guideline for  
PROFIBUS and PROFINET, Version 2.4, October 2020

For additional information on the PROFINET and PROFIsafe documents, please refer to [Section “Documentation” on page 166](#).

## 1.11 Documentation



The symbol informs you that you have to observe the instructions. Only install and operate the device once you have familiarized yourself with its properties by means of the user documentation.



### Use the latest documentation

Make sure you always use the latest documentation. You can find changes or supplements to this documentation on the Internet at [phoenixcontact.net/products](http://phoenixcontact.net/products).

When working on the PROFIsafe system and/or PROFINET its components, you must always keep this user manual and other items of product documentation to hand and observe the information therein.

|                           | Document   | Description   |
|---------------------------|--|---|
| <b>PROFIsafe</b>          | <ul style="list-style-type: none"> <li>– PROFIsafe System Description</li> <li>– PROFIBUS Guideline, PROFIsafe Policy</li> <li>– PROFIsafe – Environmental Requirements Guideline</li> </ul> | For more detailed information on these documents, please refer to <a href="#">Section “Documentation” on page 166</a> . Please also observe the relevant information on PROFINET and PROFIsafe, which is available on the Internet at <a href="http://www.profisafe.net">www.profisafe.net</a> and <a href="http://www.profinet.com">www.profinet.com</a> . |
|                           | <ul style="list-style-type: none"> <li>– User manuals for the PROFIsafe I/O modules used in your application</li> </ul>  | For example, Axioline F, Axioline Smart Elements.   |
| <b>PROFINET</b>           | <ul style="list-style-type: none"> <li>– PROFINET Assembling Guideline</li> <li>– Guideline for PROFIBUS and PROFINET “Functional Bonding and Shielding of PROFIBUS and PROFINET”</li> </ul> | For more detailed information on these documents, please refer to <a href="#">Section “Documentation” on page 166</a> .   |
|                           | <ul style="list-style-type: none"> <li>– UM EN PROFINET SYS</li> </ul>   | PROFINET basic principles   |
|                           | <ul style="list-style-type: none"> <li>– UM EN PROFINET CTRL DEV</li> </ul>  | PROFINET controller/device functions  |
| <b>Software</b>           | <ul style="list-style-type: none"> <li>– Online help for the PLCnext Engineer software</li> </ul>  |   |
| <b>PLCnext Technology</b> | <ul style="list-style-type: none"> <li>= <a href="#">PLCnext Info Center</a></li> <li>= <a href="http://plcnext-community.net">plcnext-community.net</a></li> </ul>                          | Comprehensive documentation for PLCnext Technology<br>Information on troubleshooting and answers to frequently asked questions (FAQs) in the PLCnext Community  |
| <b>Security</b>           | <ul style="list-style-type: none"> <li>– AH EN INDUSTRIAL SECURITY</li> </ul>  | Application note with measures to protect network-capable devices with Ethernet connection against unauthorized access  |
| <b>Axioline F</b>         | <ul style="list-style-type: none"> <li>– UM EN AXL F SYS INST</li> </ul>   | User manual<br>Axioline F: System and installation  |
|                           | <ul style="list-style-type: none"> <li>– UM EN AXL F X152</li> </ul>   | User manual<br>Installing, commissioning, and operating the AXC F 1152, AXC F 2152, and AXC F 3152 controllers  |
|                           | <ul style="list-style-type: none"> <li>– UM EN AXL SE SYS INST</li> </ul>  | User manual<br>Axioline Smart Elements  |

## 1.12 System requirements (hardware and software)

To commission the SPLC 1000 in accordance with the examples in this user manual, you need an active connection from the PLCnext Control device that the SPLC 1000 is left-aligned to a subordinate PROFINET system (see [Section 6.4](#)).

In order to follow the examples illustrated in this user manual, corresponding PROFINET devices, Axioline F I/O modules, and Axioline Smart Elements are required.


The following table provides an overview of the required hardware and software.

- Install the PLCnext Engineer software listed in the table on your PC.  
For trouble-free operation, follow the instructions in the software documentation.



**Please note:**

The PLCnext Engineer engineering software platform for Phoenix Contact automation controllers is compliant with IEC 61131-3. Its functionality can be extended with add-ins. PLCnext Engineer can be used as an editor for programming safety-related user applications. In this way, F-Devices operated with safety-related controllers with PLCnext Technology can be configured and started up. PLCnext Engineer is certified by TÜV-Rheinland.

| Hardware/software  | Description                    | Ordering data   |
|--|--------------------------------|---|
| Left-alignable safety-related controller   | AXC F XT SPLC 1000             | For ordering data, see <a href="#">Section 13.1</a> on <a href="#">page 165</a> . |
| PLCnext Control  | AXC F 2152 or AXC F 3152       |   |
| SD card  | External optional flash memory |   |
|  <ul style="list-style-type: none"> <li>- The SD card is not supplied as standard with the SPLC 1000.</li> <li>- We recommend the use of the SD card for operating the SPLC 1000 on an AXC F 2152 or AXC F 3152.</li> </ul> |                                |   |
| Power supply   | Power supply for the SPLC 1000 |   |
| PLCnext Engineer including add-in for functional safety applications (Add-in Functional Safety Editor)   | ≥2021.9                        |   |

## 1.13 Abbreviations used

| Abbreviation | Meaning                | Standard               | Example        |
|--------------|------------------------|------------------------|----------------|
| SIL          | Safety Integrity Level | EN 61508,<br>IEC 61508 | SIL 2, SIL 3   |
| SIL CL       | SIL Claim Limit        | EN 62061               | SIL CL 3       |
| Cat.         | Category               | EN ISO 13849           | Cat. 2, Cat. 4 |
| PL           | Performance Level      | EN ISO 13849           | PL e, PL d     |

| Abbreviation    | Meaning   |
|-----------------|---|
| SPLC 1000       | Left-alignable safety-related controller of performance class 1000<br>In this document, the AXC F XT SPLC 1000 is also referred to as a safety-related controller.  |
| PLCnext Control | Controller with PLCnext Technology with which, thanks to the open control platform, automation projects can be realized without the restrictions of proprietary systems. Programming languages and development tools are freely selectable here.<br><br>The SPLC 1000 can only be operated with a controller of the product family PLCnext Control AXC F 2152 or AXC F 3152. Therefore, these devices are meant when the term "PLCnext Control" is used in this manual. |
| PELV            | Protective Extra-Low Voltage<br><br>Circuit in which, under normal conditions or under the conditions of an individual error, the voltage of 30 V AC, 42.4 V peak value, or 60 V DC is not exceeded, except by grounding errors in other circuits.<br><br>A PELV circuit is like a SELV circuit, but is connected to protective ground.<br><br>(In accordance with to EN 61131-2)   |
| F_Source_Add    | F-Source Address (F-Parameter)<br><br>PROFIsafe source address:<br><ul style="list-style-type: none"> <li>– Address of the SPLC 1000 in its function as the F-Host.</li> <li>– Address of one of the SPLC 1000 (F-Device) superordinate F-Hosts.</li> </ul>   |
| F_Dest_Add      | F-Destination Address (F-Parameter)<br><br>PROFIsafe destination address:<br><ul style="list-style-type: none"> <li>– Address of the SPLC 1000 in its function as the F-Device.</li> <li>– Address of F-Devices in the application.</li> </ul>  |



For terms and abbreviations used for PROFIsafe, please refer to ["Appendix: Terms for PROFIsafe" on page 173](#).

## 1.14 Safety hotline

If you have any technical questions, please contact the Safety Hotline:

- Phone: +49 5281 946 2777
- E-mail: [safety-service@phoenixcontact.com](mailto:safety-service@phoenixcontact.com)

## 2 Transport, storage, and unpacking

### 2.1 Transport

The device is delivered in cardboard packaging.

- Only transport the device to its destination in its original packaging.
- Observe the instructions on how to handle the package, as well as the moisture, shock, tilt, and temperature indicators on the packaging.
- Observe the humidity specifications and the temperature range specified for transport (see [Section “Technical data” on page 168](#)).
- Protect the surfaces as necessary to prevent damage.
- When transporting the equipment or storing it temporarily, make sure that the surfaces are protected from the elements and any external influences, and that they are kept clean and dry.

### 2.2 Storage

The storage location must meet the following requirements:

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

### 2.3 Unpacking

The device is delivered in packaging together with a packing slip that provides installation instructions.

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

**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.

## AXC F XT SPLC 1000

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### Checking the delivery

- Check the delivery for transport damage.  
Damaged packaging is an indicator of potential damage to the device that may have occurred during transport. This could result in a malfunction.
- Submit claims for any transport damage immediately, and inform Phoenix Contact or your supplier as well as the shipping company without delay.
- Enclose photos that clearly document the damage to the packaging and/or delivery together with your claim.
- Immediately upon delivery, refer to the delivery note to ensure that the delivery is complete.

### Scope of supply

- Safety-related AXC F XT SPLC 1000 controller
- AXL F BS BK XT bus base module (item no.: 1141222)
- AXL CN S/UL supply connector (item no.: 2701421)



## 3 Description of the AXC F XT SPLC 1000

### 3.1 General description of the SPLC 1000

The SPLC 1000 is a safety-relevant controller. It is a “PLCnext Control Extension” extension module which can be aligned to the left on an AXC F 2152 or AXC F 3152.

The SPLC 1000 supports the PROFIsafe protocol. The SPLC 1000 can be used as an F-Host and and F-Device at the same time in a PROFIsafe system. As an F-Host, the SPLC 1000 communicates directly with F-Devices within the Axioline F station modules that are connected on the right-hand side of the PLCnext Control device.

The safety-related I/O level in an Ethernet network is connected via PROFIsafe/PROFINET to the SPLC 1000 via the PLCnext Control device used.

#### Programming

You can configure and program the SPLC 1000 using the PLCnext Engineer automation software. PLCnext Engineer is connected to the SPLC 1000 via the PLCnext Control device used.



#### Password and user name for user authentication

You must authenticate yourself as a user in PLCnext Engineer using a user name and password in order to transfer the safety-related project online from the software over to the SPLC 1000. In this respect, observe the information in [Section “Note on security” on page 14](#).

Information on user authentication for the PLCnext Control device used is available in the UM EN AXC F X152 user manual.

#### Web-based management WBM system

The SPLC 1000 itself does not have an integrated Web-based management interface.

Information on the WBM system of the PLCnext Control used is available in the UM EN AXC F X152 user manual (see [Section “Documentation” on page 166](#))

#### Internal flash memory or SD card

Operating the SPLC 1000 on the PLCnext Control AXC F 2152/AXC F 3152 is permitted with and without an SD card.

The safety-related programs and configurations are saved as part of the PLCnext Engineer project in the internal flash memory of the PLCnext Control device or on the optional SD card plugged into the PLCnext Control device.



#### Using the SD card is recommended

We recommend using the SD card for operating the SPLC 1000 on an AXC F 2152 or AXC F 3152 instead of using the internal flash memory of the PLCnext Control device.

**Operation with an SD card**

Please note in this case that, when replacing the PLCnext Control device used with an identical device with suitable firmware, you can reuse the previously used SD card in the replacement device. This means that the application of the previously used safety-related and non-safety-related project is available again after plugging the SD card into the PLCnext Control.



**NOTE: Failure state possible upon removing the SD card**

Please note that the SD card may not be removed during operation. If the SD card is removed during operation, the SPLC 1000 will switch to the safe state (failure state).

Always disconnect the power supply to the SPLC 1000 and to the PLCnext Control device before removing the SD card.

**Operation without an SD card**

Please note in this case that, when replacing the PLCnext Control device used with an identical device with suitable firmware, you must use the PLCnext Engineer software to

1. Download the non-safety-related project to the PLCnext Control (standard controller) used and
2. Download the safety-related project to the SPLC 1000.



**NOTE: Project deletion possible when inserting the SD card**

Note the following points if you only use the internal flash memory of the PLCnext Control device:

- It is imperative that you take organizational measures to prevent the deletion of the safety-related and non-safety-related project.
- If you insert an SD card in the PLCnext Control device during ongoing operation of the PLCnext Control device and the SPLC 1000, the safety-related and non-safety-related project present on the internal flash memory will be deleted after a voltage reset or after the system is restarted.

In addition, any safety-related project with a different CRC checksum present on the SD card could be loaded into the SPLC 1000.



Further information on the internal flash memory of the PLCnext Control device and on the optional pluggable SD card is available in the user manual of the PLCnext Control UM EN AXC F X152 used (see [Section “Documentation” on page 166](#)).

**Diagnostics and status indicators (LEDs)**

Diagnostics and status information is displayed directly on the SPLC 1000 via LEDs (see also [Table 3-1 on page 47](#)):

- FS: Failure State: Safe state of the SPLC 1000.
- RUN: Operating state of the SPLC 1000.
- P: The state of the safety-related communication relationship between the SPLC 1000 (F-Device) and a superordinate safety-related controller (F-Host).
- C: State of the safety-related communication relationship between the SPLC 1000 (F-Host) and configured subordinate F-Devices.

The presence of the supply voltage (communications voltage  $U_L$ ) is displayed via the respective LED on the supply connector.

## 3.2 Description of the safety-related functioning of the SPLC 1000

### Behavior of the SPLC 1000 as the F-Host in PROFIsafe

The SPLC 1000 is a powerful two-channel safety-related controller for PROFIsafe. The PROFIsafe security protocol is transmitted via the PLCnext Control device used and via the PROFINET network. The safety function is programmed in the PLCnext Engineer software.

The SPLC 1000 monitors and controls the safety function in a PROFIsafe system. Its function is to decide whether or not a safe output may be set, for example.

### Behavior of the SPLC 1000 as the F-Device in PROFIsafe

The SPLC 1000 can be operated subordinately as an F-Device, for example on a safety-related compact controller such as the RFC 4072S. It will then be treated by this superordinate F-Host as an F-Device.



The SPLC 1000 can be used simultaneously as an F-Host and as an F-Device in two different PROFIsafe networks.

### Request for a programmed safety function

Following the request for a programmed safety function (e.g., safety door open), the SPLC 1000 executes the programmed safety function. The relevant safe outputs of the F-Devices are set to the programmed value of the safety function.

### Behavior in the event of an error / safe state (Failure State)

The integrated diagnostics function detects errors that have occurred. All serious errors detected in the SPLC 1000 that can lead to the loss of or adversely affect the programmed safety function switch the device to the safe state (Failure State). In this state, the safe outputs of the F-Devices are set to zero (FALSE).

The safe state will be displayed via the FS (Failure State) LED lighting up red.

In the event of an error, if you are connected online to the PLCnext Engineer, information about the error is also displayed in the software.

For descriptions of error states, associated effects, and appropriate measures for error removal, please refer to [Section “Errors: Diagnostics, messages, and removal” on page 121](#).

### Passivation and reintegration

If the communication relationship between the SPLC 1000 and an F-Device is aborted, for example due to a communication error, the F-Device will be passivated. Passivation prevents the F-Device from starting up immediately as soon as the communication relationship is reactivated. Passivation and reintegration are displayed via Boolean variables, which the PLCnext Engineer automatically generates for each F-Device. F-Devices can also be passivated or reintegrated from the application program via these variables.

If an operator acknowledge request of the passivated F-Device is present, PROFIsafe-specific acknowledgment can be performed with a subsequent operator acknowledge reintegration. A non-safety-related signal can be used, for example. This overrides the passivation. As a result, the F-Device is reintegrated.



For more information about passivation and reintegration, please refer to [Section 6, “Commissioning and validation”](#) and Sections [“Management/diagnostic variables for F-Devices” on page 98](#), [“Management/diagnostic variables for each configured F-Device” on page 144](#) and [“Global management/diagnostic variables for F-Devices” on page 147](#).

### PROFIsafe: F-Host communication diagnostics

The SPLC 1000 supports the user in monitoring and checking the communication relationships of the device-internal F-Host. The PLCnext Engineer software indicates why the communication relationship was disabled. A distinction is made between the F\_WD\_Time being exceeded (F\_WD\_Time OUT) and an F\_CRC error (see [Figure 3-1](#)).

| Variable (Safety PLC)     | Type | Usage  | I/Q/M | Comment | Init  | Variable (PLC)             | Prc |
|---------------------------|------|--------|-------|---------|-------|----------------------------|-----|
| F_ADDR_00001_ACK_REI      | BOOL | Global | Q     |         | FALSE | Select Variable (PLC) here | Prc |
| F_ADDR_00001_ACK_REQ      | BOOL | Global | I     |         | FALSE | Select Variable (PLC) here | Prc |
| F_ADDR_00001_CE_CRC       | BOOL | Global | I     |         | FALSE | Select Variable (PLC) here | Prc |
| F_ADDR_00001_DEVICE_FAULT | BOOL | Global | I     |         | FALSE | Select Variable (PLC) here | Prc |
| F_ADDR_00001_PASS_ON      | BOOL | Global | Q     |         | FALSE | Select Variable (PLC) here | Prc |
| F_ADDR_00001_PASS_OUT     | BOOL | Global | I     |         | FALSE | Select Variable (PLC) here | Prc |
| F_ADDR_00001_WD_TIMEOUT   | BOOL | Global | I     |         | FALSE | Select Variable (PLC) here | Prc |
| F_ADDR_00002_ACK_REQ      | BOOL | Global | I     |         | FALSE | Select Variable (PLC) here | Prc |
| F_ADDR_00002_CE_CRC       | BOOL | Global | I     |         | FALSE | Select Variable (PLC) here | Prc |
| F_ADDR_00002_PASS_OUT     | BOOL | Global | I     |         | FALSE | Select Variable (PLC) here | Prc |
| F_ADDR_00002_WD_TIMEOUT   | BOOL | Global | I     |         | FALSE | Select Variable (PLC) here | Prc |
| F_ADDR_00003_ACK_REQ      | BOOL | Global | I     |         | FALSE | Select Variable (PLC) here | Prc |
| F_ADDR_00003_CE_CRC       | BOOL | Global | I     |         | FALSE | Select Variable (PLC) here | Prc |
| F_ADDR_00003_PASS_OUT     | BOOL | Global | I     |         | FALSE | Select Variable (PLC) here | Prc |
| F_ADDR_00003_WD_TIMEOUT   | BOOL | Global | I     |         | FALSE | Select Variable (PLC) here | Prc |

Figure 3-1 PROFIsafe: Management/diagnostic variables for communication diagnostics of the SPLC 1000 F-Host

To support the user, seven non-safety-related management/diagnostic variables are created by default in PLCnext Engineer for each F-Device in the data list of the safety-related controller. If required by the application, PLCnext Engineer allows the user to specify whether more or fewer management/diagnostic variables are created. Alternatively, other management/diagnostic variables can be created. The user can link these variables to non-safety-related exchange variables of the standard controller in PLCnext Engineer. To do this, the user must define non-safety-related exchange variables in the software, where they can be linked to the management/diagnostic variables.



You can read more about management/diagnostic variables in [Section “Management/diagnostic variables for F-Devices”](#) on page 98.

Various functions can be implemented using the management/diagnostic variables:

- Global acknowledgment of individual or multiple communication errors
- Reintegration of F-Devices
- System diagnostics using global management/diagnostic variables
- Diagnostics/control of intelligent F-Devices

**PROFIsafe: F-Device communication diagnostics**

The S PLC 1000 supports the user in monitoring and checking the communication relationships of the device-internal F-Device. For this purpose, analogous to the above described management / diagnostic variables of the F-Host, management / diagnostic variables can also be created in the PLCnext Engineer for the F-Device of the S PLC 1000. The default setting for these variables is “Do not create”.



For additional information, please refer to [Section “Management/diagnostic variables of the S PLC 1000 as an F-Device” on page 149](#).

| Variable (Safety PLC)          | Type | Usage  | I/Q/M | Comment | Init  | Confirm | Variable (PLC)             |
|--------------------------------|------|--------|-------|---------|-------|---------|----------------------------|
| System Variables               |      |        |       |         |       |         |                            |
| F_ADDR_00003_WD_TIMEOUT        | BOOL | Global | I     |         |       | SAF...  | Select Variable (PLC) here |
| FD_ADDR_00001_ACK_REQ_DEV      | BOOL | Global | I     |         | FALSE |         | Select Variable (PLC) here |
| FD_ADDR_00001_PASS_ON_DEV      | BOOL | Global | I     |         | FALSE |         | Select Variable (PLC) here |
| FD_ADDR_00001_PASS_OUT_DEV     | BOOL | Global | Q     |         | FALSE |         | Select Variable (PLC) here |
| FD_ADDR_00001_DEVICE_FAULT_DEV | BOOL | Global | Q     |         | FALSE |         | Select Variable (PLC) here |
| FD_ADDR_00001_CE_CRC_DEV       | BOOL | Global | I     |         | FALSE |         | Select Variable (PLC) here |
| FD_ADDR_00001_WD_TIMEOUT_DEV   | BOOL | Global | I     |         | FALSE |         | Select Variable (PLC) here |

Figure 3-2 PROFIsafe: Management/diagnostic variables for communication diagnostics of the S PLC 1000 F-Device

**Address area for management/diagnostic variables**

The following total maximum address area is available for exchange variables:

- The sum of the standard input data (NSI, inputs exchange area) may not exceed 128 bytes (data direction “I”: S PLC 1000 ← standard controller).
- The sum of the standard output data (NSQ, outputs exchange area) may not exceed 128 bytes (data direction “Q”: S PLC 1000 ⇒ standard controller).



The data direction “I” and “Q” is specified from the point of view of the safety-related controller.



Also observe the information in section [“Characteristic data of the S PLC 1000 safety-related controller” on page 171](#) regarding this.

**Device identification/number of safe devices**

In PROFIsafe, safe devices (F-Devices) are identified by means of F-Addresses, which must be assigned uniquely for each safe device. PROFIsafe destination address F\_Dest\_Add (F\_Destination\_Address) is used to uniquely identify safe devices. This address is defined on the F-Device via DIP switch (see [Section 6.9.1](#)) and in the PLCnext Engineer software and checked immediately after it is entered in PLCnext Engineer. PLCnext Engineer checks the entered addresses for uniqueness in the configured network and for correct value range.

The value of the F\_Destination\_Address can be set from  $0_{dec}$  to  $65534_{dec}$ . It must be unique throughout the entire network.



For safety modules from Phoenix Contact, you can set PROFIsafe destination addresses from 1 to  $999_{dec}$ , maximum. For safety modules from other manufacturers, you can set PROFIsafe destination addresses from  $1_{dec}$  to  $65534_{dec}$ .

Source address F\_Source\_Address (F\_Source\_Add for short) uniquely identifies the F-Host of a communication relationship. The F\_Source\_Address is assigned to the safety-related controller and is used for all communication relationships that are assigned to this safety-related controller. In this way, the S PLC 1000 obtains a source address (F\_Source\_Add).

The value of the F\_Source\_Address must be between  $0_{dec}$  and  $65534_{dec}$  and must be unique throughout the entire network.



**NOTE:**

Please note that each F-Address assigned within a network must be unique and must not overlap with other addresses.



**Notes on the S PLC 1000 F-Addresses**

One F\_Source\_Address and one F\_Destination\_Address can be defined for the S PLC 1000, because:

- The S PLC 1000 itself can be used as an F-Host.
- The S PLC 1000 can be used subordinately by a compact controller, such as an RFC 4072S, as an F-Device

In addition to the rules listed above, note that both F-Addresses must each be assigned in a separate number range. Assign the F\_Source\_Address to the S PLC 1000 as the F-Host. Assign the F\_Destination\_Address as necessary depending on the settings in the superordinate network.

- The S PLC 1000 in the function of an F-Device supports the "FSCP 3/1 address type 1 (Functional Safety Communication Profile FSCP 3/1 (PROFIsafe™))" in accordance with the document:

PROFIsafe – Profile for Safety Technology on PROFIBUS and PROFINET  
 Profile part, related to IEC 61784-3-3  
 Technical Specification, Version 2.6MU1, August 2018

A maximum of 32 F-Devices can be connected to one S PLC 1000.

This results in the following maximum values:

- The sum of the safe input data (SI) may not exceed 512 kB (input user data and PROFIsafe backup data).
- The sum of the safe output data (SQ) may not exceed 512 kB (output user data and PROFIsafe backup data).



Also observe the information in section "[Characteristic data of the S PLC 1000 safety-related controller](#)" on page 171 regarding this.

### 3.3 Calculating/determining the response time (Safety Function Response Time, SFRT)

The procedure for determining the necessary times, which is explained in more detail below, is recommended.

1. Determining the maximum permissible safety function response time ( $SFRT_{max}$ ) depending on the relevant safety function to be implemented and determining the resulting maximum monitoring/watchdog times ( $F\_WD\_Time\ IN_{max}/F\_WD\_Time\ OUT_{max}$ ) as an upper limit for each individual safety function (see Section [3.3.1 on page 32](#)).
2. Determining the minimum monitoring/watchdog times ( $F\_WD\_Time\ IN_{min}/F\_WD\_Time\ OUT_{min}$ ) required for optimum system availability as a lower limit (see Section [3.3.2 on page 35](#)).
3. Defining the monitoring/watchdog times ( $F\_WD\_Time\ IN/F\_WD\_Time\ OUT$ ) to be parameterized within the determined upper and lower limits and checking/validating that each of the safety functions to be implemented may be implemented with the defined monitoring/watchdog times (see Section [3.3.3 on page 44](#)).

### 3.3.1 Determining SFRT<sub>max</sub> and F\_WD\_Time IN<sub>max</sub>/ F\_WD\_Time OUT<sub>max</sub>

In the application, the maximum permissible SFRT must be determined for each safety function implemented in the application. This maximum permissible SFRT also includes the part of the SFRT that applies to the PROFIsafe system if PROFIsafe and the SPLC 1000 are involved in the safety function.

A method of calculation for determining the part of the SFRT that applies to PROFIsafe is specified in the PROFIsafe system description (see Figure 3-3). The method of calculation specified is subject to certain general conditions.



For detailed information regarding the PROFIsafe system description, please refer to Section "Documentation" on page 166.

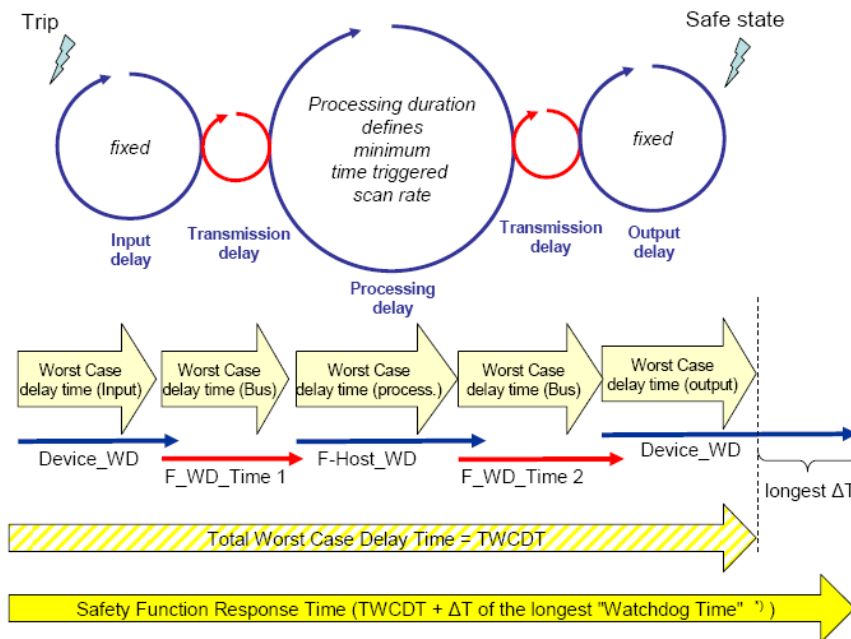


Figure 3-3 Calculation of the SFRT response time  
(\* ) = Not necessarily the output device

The TWCDT (total worst case delay time) is therefore the sum of all maximum signal run-times that may occur in the individual elements during normal operation.

The individual elements are:

- (PROFIsafe) F-Devices
- Transmission (PROFIsafe via PROFINET including all network infrastructure components and subordinate subsystems, for example of the Axioline F local bus) and
- SPLC 1000.

Due to a closely synchronized sequence of F-Host / SPLC 1000 processing, this model is simplified when using the SPLC 1000. The runtimes, cycle times, and watchdog times of the SPLC 1000 (processing delay and F-Host\_WD) are not actually relevant when determining the SFRT.



The following figure illustrates the relationship:

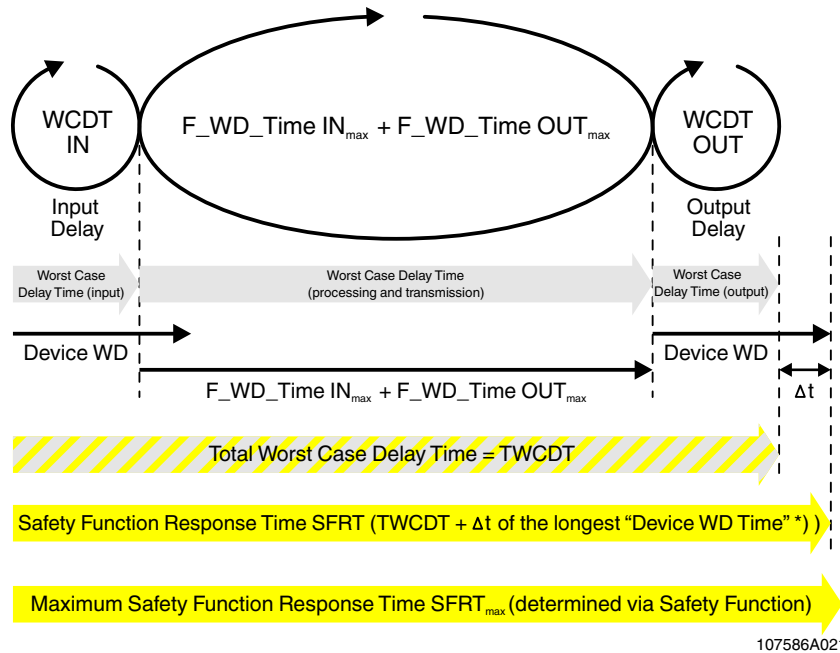


Figure 3-4 Simplified calculation of the SFRT response time  
 (\*) = Not necessarily the output device

Key:

- $SFRT_{max}$  Maximum permissible safety function response time of the PROFIsafe system involved in the safety function that is **determined for each safety function to be implemented.**
- SFRT The actual implemented safety function response time of the PROFIsafe system involved in the safety function and the SPLC 1000.
- WCDT IN Worst case delay time of the F-Device with input function.  
 For this time, please refer to the device-specific user documentation for the F-Device used.
- $F\_WD\_Time\ IN_{max}$  Value of the monitoring time  $F\_WD\_Time$  (watchdog time) which may be set as the maximum value for each individual F-Device with an input function that is involved in the safety function in order that  $SFRT_{max}$  is not exceeded (see equation [2] on [page 34](#)).
- $F\_WD\_Time\ OUT_{max}$  Value of the monitoring time  $F\_WD\_Time$  (watchdog time) which may be set as the maximum value for each individual F-Device with an output function that is involved in the safety function in order that  $SFRT_{max}$  is not exceeded (see equation [2] on [page 34](#)).

|           |   |
|-----------|---|
| WCDT OUT  | Worst case delay time of the F-Device with output function.<br>For this time, please refer to the device-specific user documentation for the F-Device used. |
| Device WD | Internal watchdog time of the F-Device involved in the safety function.   |

The central component in [Figure 3-4 on page 33](#) is deemed to be the sum of  $F\_WD\_Time\ IN_{max}$  and  $F\_WD\_Time\ OUT_{max}$ .

The sum of these times specifies the maximum internal processing time that is required for point-to-point communication via PROFIsafe between the PROFIsafe input device and the PROFIsafe output device using the S PLC 1000, even in the event of an error, such as a telegram delay.

The actual SFRT to be implemented for the PROFIsafe system can be determined according to the following equation:

$$SFRT = WCDT\ IN + (F\_WD\_Time\ IN_{max} + F\_WD\_Time\ OUT_{max}) + WCDT\ OUT \quad [1]$$



**SFRT** must therefore be  $\leq SFRT_{max}$

Always take into consideration all the links that are involved in the safety function and programmed in the safety-related application program.

**Maximum permissible watchdog times**

To incorporate the maximum permissible watchdog times  $F\_WD\_Time\ IN_{max}/F\_WD\_Time\ OUT_{max}$  in the PROFIsafe system, the following equation should be used:

$$F\_WD\_Time\ IN_{max} + F\_WD\_Time\ OUT_{max} \leq SFRT_{max} - WCDT\ IN - WCDT\ OUT \quad [2]$$



Please refer to the F-Device-specific user documentation to check whether further information is available regarding watchdog times within the internal device function.  
If F-Devices are used where there is a difference ( $\Delta t$ ) between their worst case delay time (WCDT) and the implemented device watchdog time (Device WD), this difference must be taken into consideration in accordance with the PROFIsafe model for determining the SFRT.



Timer functions that are used within the safety function in the safety-related application program must be taken into consideration.

### 3.3.2 Determining $F\_WD\_Time\ IN_{min}/F\_WD\_Time\ OUT_{min}$

The  $F\_WD\_Time$ , which you as the user must determine according to your application, is set in the PLCnext Engineer software ("Safety Parameters" editor, see [Figure 6-27 on page 95](#)). If the safety-related communication relationship has been established between the partners, monitoring is performed independently by both F-Host (SPLC 1000) and F-Device to ensure that the set  $F\_WD\_Time$  is observed during safety-related communication.



**Please note that if the  $F\_WD\_Time$  is too short for a safety-related communication relationship, systems and applications will not be available.**

This is because the value for  $F\_WD\_Time$  must be greater than or equal to the total maximum telegram runtime from F-Host to F-Device and back again to at least be able to establish safety-related communication via PROFIsafe during error-free network operation. In addition to the transmission times on the network (PROFINET cycle), internal stack and firmware runtimes in devices, delays caused by subsystem buses (e.g., device bus for modular I/O systems), etc. must also be taken into consideration.

The following figure from the PROFIsafe specification illustrates the relationship:



For detailed information on the PROFIsafe specification (PROFIsafe – Profile for Safety Technology on PROFIBUS DP and PROFINET IO, Item No. 3.192), please refer to [Section "Documentation" on page 166](#).

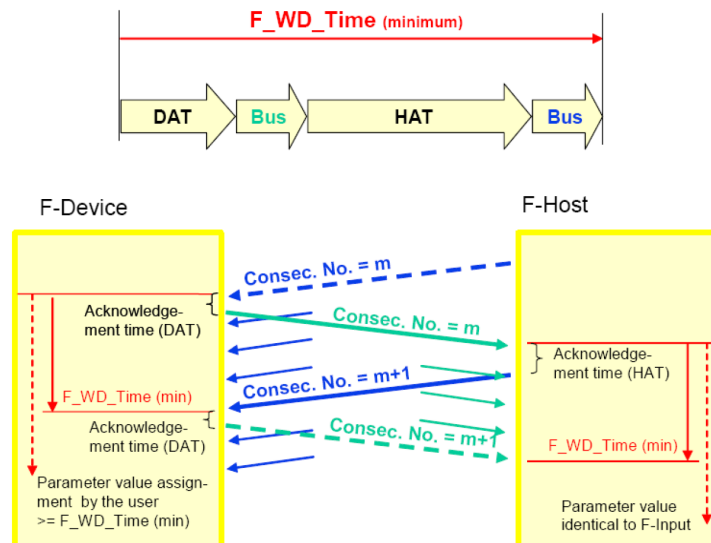


Figure 3-5  $F\_WD\_Time$  (minimum)

Key:

- DAT Cycle time of the F-Device (F-Device acknowledge time)
- Bus Bus runtime including all relevant runtime components in the devices, backplane buses, bus heads (bus couplers or controllers) etc. of modular systems
- HAT Cycle time of the SPLC 1000 (F-Host Acknowledge Time:  $T_{ZSPLC}$ )

**Determining the necessary times**

**DAT** For the cycle time of the F-Devices, please refer to the device-specific user documentation for the F-Devices used.

**Bus** The “Bus” value is the sum of all the following times in the network/bus system used:

1. External bus runtime in the network:
  - Update time of the I/O data between PROFINET controller and device set via the “Reduction ratio” multiplied by the “Monitor factor” (multiplier of the update time).  
The result (monitor time) determines the time at which the communication relationship is disconnected if no cyclic data has been transmitted in the specified time (see [Figure 3-6](#)).  
In the following example, the setting “Symmetric” has been selected for the “Timing”. An adjustment of the values may be necessary if the setting “Asymmetric” is selected.

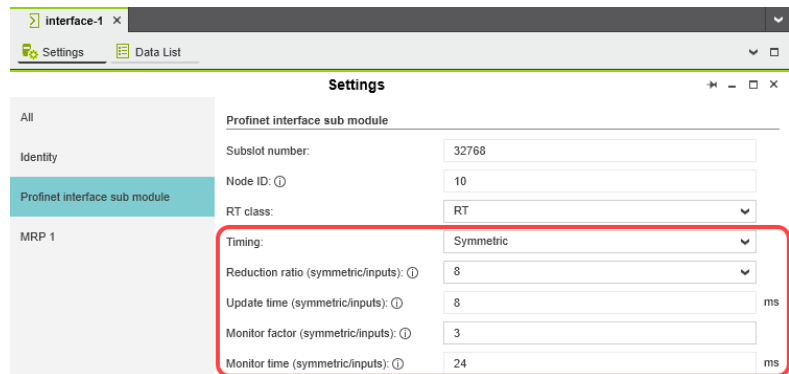


Figure 3-6 “Settings” editor of the interface editor group of the PROFINET device (settings of the AXL F BK PN TPS PROFINET bus coupler)

- Relevant runtime components in bus heads (bus coupler) and back-plane buses of modular systems.  
For these values, please refer to the manufacturer’s information.
- Any runtimes within infrastructure components.  
For these values, please refer to the manufacturer’s information.

2. Internal bus runtime within the Axioline F station comprised of left-aligned SPLC 1000, PLCnext Control, and right-aligned safety-related Axioline Smart Elements and Axioline F modules (see example in [Section “Structure of an Axioline F station” on page 54](#)):

- Internal SPLC 1000 runtime:

The internal runtime of the SPLC 1000, which is to be taken into consideration in the “Bus” value, is equivalent to one SPLC 1000 cycle ( $T_{ZSPLC}$ ).

The cycle time of the SPLC 1000 can be set in PLCnext Engineer between 5 ms and 15 ms.

Default setting (see [Figure 3-7](#)):  $T_{ZSPLC} = 5$  ms

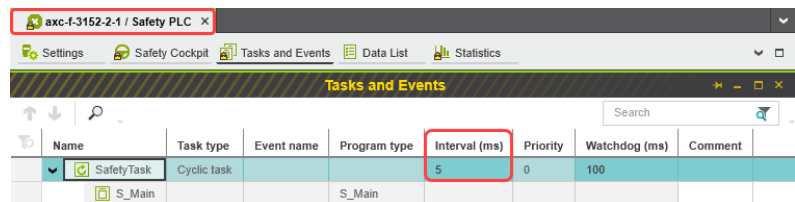


Figure 3-7 “Tasks and Events” editor in the editor group “ / Safety PLC”: Cycle time setting  $T_{ZSPLC}$  in ms

- Internal update time  $T_{UPD \text{ AXIO PLCnext}}$ :

The update time ( $T_{UPD \text{ AXIO PLCnext}}$ ) between the Axioline F local bus cycle and the PLCnext firmware, which is to be taken into consideration in the “Bus” value, depends on the setting for “Update tasks, IO controller system and global variables” (see [Figure 3-8](#)). For the selected “SafetyProxyTask” setting, the following applies:

$$T_{UPD \text{ AXIO PLCnext}} = T_{ZSPLC}$$

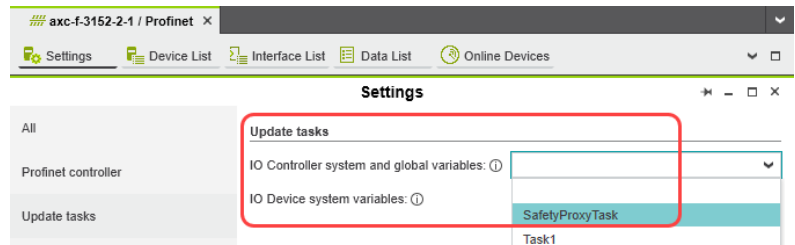


Figure 3-8 “Settings” editor of the PROFINET editor group of the AXC F 3152; Update tasks for IO controller system variables and global variables: SafetyProxyTask

HAT The cycle time of the SPLC 1000 ( $T_{ZSPLC}$ ) can be estimated during the system/machine planning phase.

**Procedure for estimating the cycle time  $T_{ZSPLC}$**

Proceed as described in the following steps to estimate the cycle time  $T_{ZSPLC}$ :

- First, estimate the Program runtime.

When using the S PLC 1000, the program runtime depends on an idle component as well as the number of F-Devices used in the application and the number of safety-related function-block instances used.

**Program runtime  $t_{idle}$**

First, the program runtime for an “empty” safety-related program (number of safety-related function-block instances = 0) is considered.

The relationship for this is:

$$\text{Program runtime}_{idle} = 1 \text{ ms} + \frac{70}{1000} \text{ ms} * n$$

With  $n = 0$  F-Devices, this results in:

$$\text{Program runtime}_{idle} = 1 \text{ ms}$$

With each F-Device used, the Program runtime $_{idle}$  is extended by 70  $\mu\text{s}$ .

The following [Figure 3-9](#) shows the dependency of the Program runtime $_{idle}$  on the number  $n$  of F-Devices used in the application:

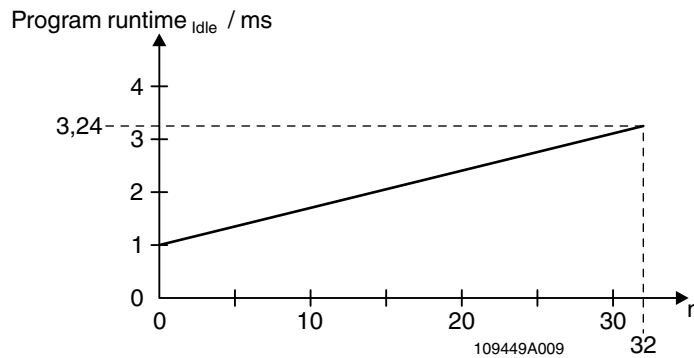


Figure 3-9 Program runtime $_{idle}$  in relation to the number of F-Devices used.

Key:

n: Number of F-Devices used in the application

**Program runtime**

In addition to the dependency of the program runtime on the number of F-Devices used in the application described above, there is an additional dependency. The program runtime also depends on the number of safety-related function-block instances (parameter a) used in the safety-related program.

With each safety-related function-block instance used in the safety-related program, the program runtime is extended on average by 20 µs.

As a result, the following applies:

$$\begin{aligned} \text{Program runtime} &= \text{Program runtime}_{\text{idle}} + a * \frac{20}{1000} \text{ ms} \\ &= 1 \text{ ms} + \frac{70}{1000} \text{ ms} * n + a * \frac{20}{1000} \text{ ms} \\ &= \left(1 + a * \frac{20}{1000}\right) \text{ ms} + \frac{70}{1000} \text{ ms} * n \end{aligned}$$

This results in the following progression of the program runtime:

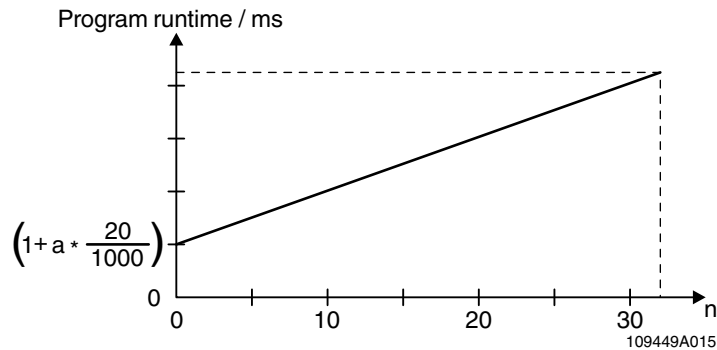


Figure 3-10 SPLC 1000 program runtime

Key:

- a: Number of safety-related function-block instances used in the safety-related program
- n: Number of F-Devices used in the application

The value of the SPLC 1000 program runtime determined approximately in the planning phase must comply with the following ratio to the cycle time of the SPLC 1000  $T_{ZSPLC}$ :

$$\Rightarrow \frac{\text{Program runtime}}{\text{Cycle time}} \leq 0.7$$

This results in the SPLC 1000 cycle time  $T_{ZSPLC}$  to be set by the user in accordance with the formula determined in the planning phase:

$$\Rightarrow \text{Cycle time } T_{ZSPLC} \geq \frac{\text{Program runtime}}{0.7}$$

**Example calculation**

This example results in the following progression of the program runtime for a number of 0 to a maximum of 32 F-Devices and a number of 20 safety-related function blocks (a = 20):

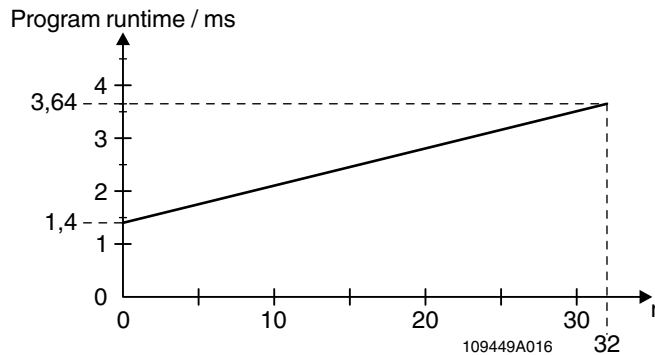


Figure 3-11 SPLC 1000 program runtime in the example

Continuing with a = 20 and the maximum 32 F-Devices, the program runtime is:

$$\begin{aligned} \text{Program runtime} &= \left(1 + 20 \times \frac{20}{1000}\right) \text{ ms} + \frac{70}{1000} \text{ ms} \times 32 \\ &= 3.64 \text{ ms} \end{aligned}$$

With the above equation for the cycle time, the following results:

$$\Rightarrow \text{Cycle time } T_{ZSPLC} \geq \frac{3.64 \text{ ms}}{0.7}$$

$$\Rightarrow \text{Cycle time } T_{ZSPLC} \geq 5.2 \text{ ms}$$

In this example, the user is to set a cycle time of 6 ms.

**Verification necessary!**

Verify the times determined above during the commissioning phase as follows online.



**NOTE: Online verification during the commissioning phase necessary**

During the commissioning phase, the values determined offline during the planning phase are to be verified online by the user.

- During the commissioning phase, verify the values determined offline in the planning phase for the program runtime and the cycle time online in PLCnext Engineer.

For verification, use two system variables shown in the PLCnext Engineer software.

If the PLCnext Engineer software is connected online with the SPLC 1000 and the PLCnext Control device, you can display the cycle time and the program runtime of the SPLC 1000 in the software (see [Figure 3-12](#)) with the following two system variables (see [Section "SPLC system variable" on page 135](#)):

- Cycle time: CYCLE\_TIME

- Program runtime: EXEC\_TIME

$$\Rightarrow \frac{\text{Program runtime (EXEC\_TIME)}}{\text{Cycle time (CYCLE\_TIME)}} \leq 0.7$$





To learn how you can access the SPLC 1000 online with the PLCnext Engineer software, refer to sections “Transferring projects to the PLCnext Control device and SPLC 1000 and displaying online values” on page 110 and “SPLC system variable” on page 135 as well as to the software online help function.

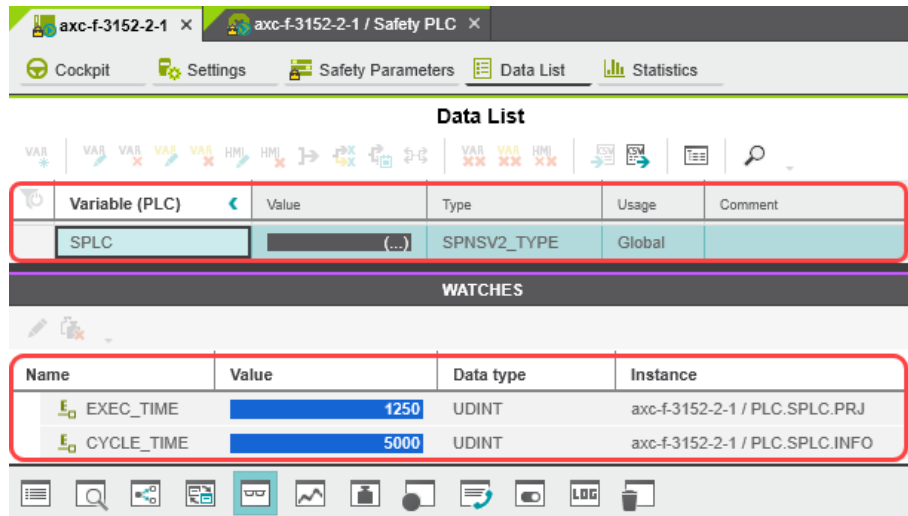


Figure 3-12 Online values of the SPLC 1000 cycle time and program runtime

The SPLC 1000 cycle time is also displayed in the “Safety Cockpit” editor:

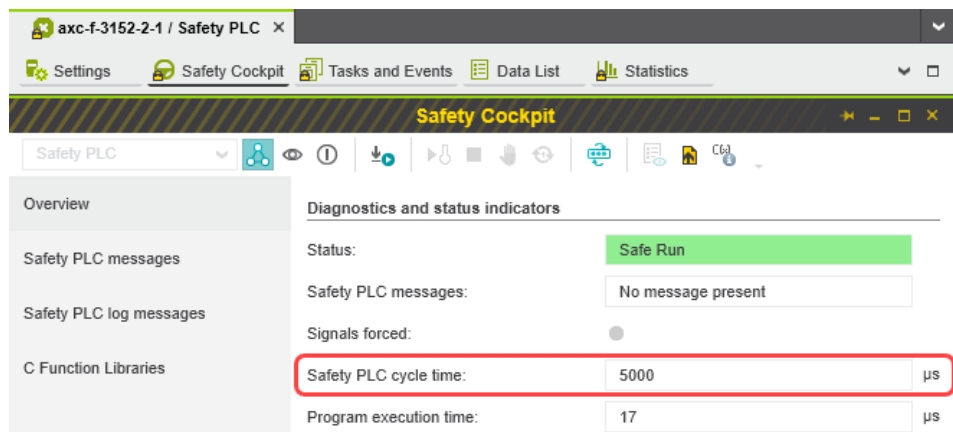


Figure 3-13 PLCnext Engineer: “Safety PLC cycle time”



Based on the actual determined value of the SPLC 1000 cycle time, it may be necessary to adjust the F\_WD\_Time in order to increase system availability, for example.



**WARNING: Avoid possible danger that may be caused by the safety function being triggered too late**  
 Make sure that the maximum permissible values for  $F\_WD\_Time\ IN_{max}$  and  $F\_WD\_Time\ OUT_{max}$  are not exceeded (see [Section “Determining SFRT<sub>max</sub> and F\\_WD\\_Time IN<sub>max</sub>/F\\_WD\\_Time OUT<sub>max</sub>” on page 32](#)).

The minimum  $F\_WD\_Time$  that can be set can be determined for each communication relationship using the following equation:

$$F\_WD\_Time_{min} > DAT + 2 \times Bus + HAT \quad [3]$$

For further calculation, a distinction will be made between the following two cases.

**Communication between F-Host and F-Device via PROFINET**

1. The F-Host of the SPLC 1000 communicates with an F-Device via PROFINET.  
 In this case, the F-Device is connected, for example, via a PROFINET bus coupler with the PLCnext Control device used (here, AXC F 3152) to which the SPLC 1000 is left-aligned.  
 Since the SPLC 1000 cycle and the PROFINET cycle run asynchronously with one another, the SPLC 1000 cycle must be included twice in the total when determining the minimum  $F\_WD\_Time$ , once as the “HAT” and again as the “internal bus runtime”. The external bus runtime is based on the relevant times of the PROFINET configuration.

$$F\_WD\_Time_{min} > DAT + 2 \times (\text{external bus runtime} + \text{internal bus runtime}) + HAT$$

$$F\_WD\_Time_{min} > DAT + 2 \times (\text{external bus runtime} + T_{ZSPLC}) + T_{ZSPLC}$$

$$F\_WD\_Time_{min} > DAT + 2 \times \text{external bus runtime} + 3 \times T_{ZSPLC} \quad [4]$$

**Communication between F-Host and F-Device via the Axioline F local bus**

2. The F-Host of the SPLC 1000 communicates with an F-Device via the Axioline F local bus.  
 In this case, the F-Device is aligned to the right of the PLCnext Control device used (here, AXC F 3152). Via the Axioline F local bus, the F-Device is connected directly to the PLCnext Control device to which the SPLC 1000 is left-aligned.  
 In this case, the internal bus runtime is the sum of the internal update time  $T_{UPD\ AXIO\ PLCnext}$  (see point “[Internal update time  \$T\_{UPD\ AXIO\ PLCnext}\$ ” on page 37](#)) and  $T_{ZSPLC}$ . As in the first case, HAT equals  $T_{ZSPLC}$ .

$$F\_WD\_Time_{min} > DAT + 2 \times (\text{internal bus runtime}) + HAT$$

$$F\_WD\_Time_{min} > DAT + 2 \times (T_{UPD\ AXIO\ PLCnext} + T_{ZSPLC}) + T_{ZSPLC}$$

With  $T_{UPD\ AXIO\ PLCnext} = T_{ZSPLC}$ , the following applies (see point “[Internal update time  \$T\_{UPD\ AXIO\ PLCnext}\$ ” on page 37](#)):

$$F\_WD\_Time_{min} > DAT + 5 \times T_{ZSPLC} \quad [5]$$

**Calculation for the example configuration**

For the example configuration in [Section “The SPLC 1000 as the F-Host with safety-related communication via PROFINET/PROFIsafe” on page 73](#) considered here, the following calculated minimum  $F\_WD\_Time\ OUT$  for communication with the F-Device AXL F PSDO8/3 1F results from the equation [4] from the above case 1 and taking the following values into account:

|                              |              |   |
|------------------------------|--------------|---|
| $T_{ZSPLC}$                  | = 5 ms       | Cycle time of the safety-related controller (here: SPLC 1000)                                     |
| $T_{ZPNIO}$                  | = 8 ms x 3   | Monitor time: PROFINET update time x monitor factor (see <a href="#">Figure 3-6 on page 36</a> ). |
| $T_{D\ AXL\ F\ BK\ PN\ TPS}$ | = 1 ms       | Update rate of the AXL F BK PN TPS PROFINET bus coupler.  |
| $T_{Z\ AXL\ LB}$             | = 10 $\mu$ s | Update rate of the Axioline F local bus with one device   |



Due to the low value this time is negligibly small in the following calculation for the given example. For larger local bus configurations, consider corresponding times in the calculation.

|              |          |   |
|--------------|----------|---|
| $DAT_{PSDO}$ | = 1.5 ms | Processing time of the AXL F PSDO8/3 1F |
|--------------|----------|---|

$$T_{Bus} = T_{ZPNIO} + 1 \times T_{D\ AXL\ F\ BK\ PN\ TPS} + 2 \times T_{Z\ AXL\ LB}$$

$$T_{Bus} = 24 + 1 \times 1\ ms + 2 \times 0\ ms$$

$$T_{Bus} = 25\ ms$$

The F\_WD\_Time OUT for available and robust system behavior with the specified PROFINET settings results as follows for the example configuration from the bus head (bus coupler AXL F BK PN TPS) and the Axioline F output module (AXL F PSDO8/3 1F). The values listed and calculated above must be used in the following equation based on [4].

$$F\_WD\_Time\ OUT_{min} = DAT + 2 \times \text{external bus runtime} + 3 \times T_{ZSPLC}$$

$$F\_WD\_Time\ OUT_{min} = 1.5\ ms + 2 \times 25\ ms + 3 \times 5\ ms$$

$$F\_WD\_Time\ OUT_{min} = 66.5\ ms$$

From this example it is clear that the bus cycle and transfer times, and in particular here the PROFINET update time as well as the monitor time, are the values that determine the minimum achievable F\_WD\_Time. In particular, the monitor factor (multiplier of the update time for aborting the connection if no data is exchanged) acts as the cut-off between availability/robustness and the minimum achievable SFRT in the overall system.

If the PROFINET update time is maintained at 1 ms via "Reduction ratio (= 1)" and the monitor factor is maintained at 3, the minimum achievable F\_WD\_Time OUT in the example is calculated as follows:

$$T_{Bus} = T_{ZPNIO} + 1 \times T_{D\ AXL\ F\ BK\ PN\ TPS} + 2 \times T_{Z\ AXL\ LB}$$

$$T_{Bus} = 3\ ms + 1 \times 1\ ms + 2 \times 0\ ms$$

$$T_{Bus} = 4\ ms$$

The minimum F\_WD\_Time OUT is calculated as follows for the example configuration:

$$F\_WD\_Time\ OUT_{min} = 1.5\ ms + 2 \times 4\ ms + 3 \times 5\ ms$$

$$F\_WD\_Time\ OUT_{min} = 24.5\ ms$$

### 3.3.3 Determining F\_WD\_Time IN/F\_WD\_Time OUT to be parameterized and checking/validating that the safety function can be implemented

Having calculated the upper and lower limits of the F\_WD\_Time IN/F\_WD\_Time OUT as described in the two previous sections, you now need to determine the F\_WD\_Time IN/F\_WD\_Time OUT watchdog times that are to be parameterized within these limits for the safety function that is to be implemented. You then need to check/validate that the required safety function can be implemented using the determined values.

The values are essentially determined as follows:

$$(F\_WD\_Time\ IN_{min} + F\_WD\_Time\ OUT_{min}) < (F\_WD\_Time\ IN + F\_WD\_Time\ OUT) < (F\_WD\_Time\ IN_{max} + F\_WD\_Time\ OUT_{max})$$

The relationship between the values for F\_WD\_Time IN and F\_WD\_Time OUT is based on the relationship for the minimum F\_WD\_Time and the system availability determined in Section 3.3.2 on page 35.

#### Example

Based on the maximum possible safety function response time, the following requirement must be met:

$$F\_WD\_Time\ IN_{max} + F\_WD\_Time\ OUT_{max} = 200\ ms \quad (\text{Upper limit from the safety function})$$

$$F\_WD\_Time\ OUT_{min} = 24.5\ ms \quad (\text{From the example in Section 3.3.2})$$

$$F\_WD\_Time\ IN_{min} = 50\ ms \quad (\text{Assumed for the example calculation})$$

The watchdog times to be parameterized are chosen as follows in the example:

$$F\_WD\_Time\ OUT \approx 2 \times 24.5\ ms \Rightarrow F\_WD\_Time\ OUT = 50\ ms$$

$$F\_WD\_Time\ IN = 2 \times 50\ ms = 100\ ms$$

Factor 2 has been chosen here so that it is still possible to later increase the PROFINET repeat cycles by the monitor factor or the PROFINET update time without endangering system availability by exceeding the F\_WD\_Time monitoring time.

As a result, the values selected in the example project (see Figure 6-27 on page 95) described in Section 6.4.2.1 are within the permissible range:

$$\text{Minimum } F\_WD\_Time\ (IN+OUT) < F\_WD\_Time\ (IN+OUT)\ \text{to be parameterized} < \text{Maximum } F\_WD\_Time\ (IN+OUT)$$

$$(50 + 24.5)\ ms < (100 + 50)\ ms < 200\ ms$$

⇒ Sum of the watchdog times is less than 200 ms.

### 3.4 Possible fields of application of the S PLC 1000



Information on the possible fields of application for the S PLC 1000 is available in Sections “Example: The S PLC 1000 as the F-Host for Axioline F and Axioline Smart Elements F-Devices” on page 72 and “Further example configurations” on page 73.

### 3.5 S PLC 1000 components

#### 3.5.1 Connection and operating elements

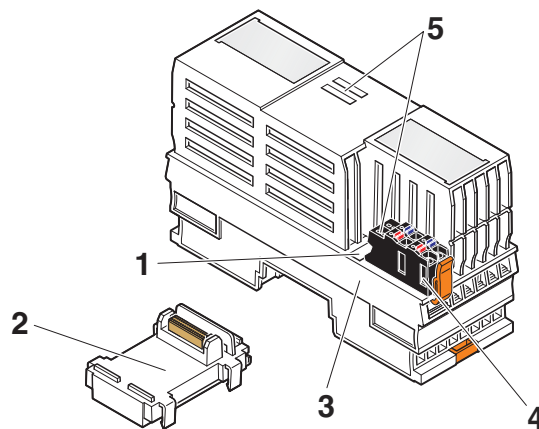


Figure 3-14 S PLC 1000 connection and operating elements

Key:

- 1 Function identification
- 2 AXL F BS BK XT bus base module (item no.: 1141222)
- 3 Electronics module
- 4 Supply connector (connector for connecting the supply voltage (communications voltage  $U_L$ , 24 V DC))
- 5 Diagnostic and status indicators

### 3.5.2 SPLC 1000 printing and test mark

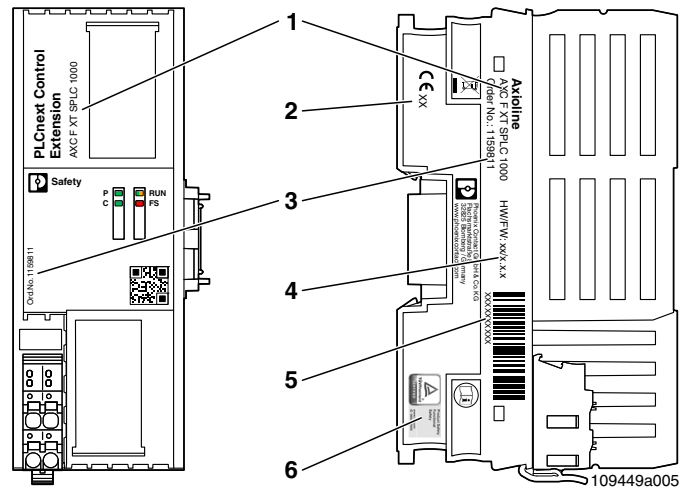


Figure 3-15 SPLC 1000 printing, including test mark

Key:

- 1 Item designation
- 2 Year of manufacture
- 3 Item number
- 4 Revision versions (HW/FW)
- 5 Serial number
- 6 Test mark

### 3.6 Diagnostic and status indicators

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

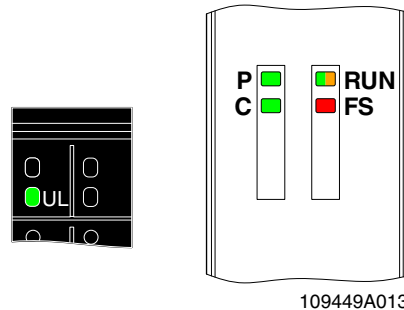


Figure 3-16 Diagnostic and status indicators

Table 3-1 Diagnostic and status indicators

| Designation | Color | Meaning  | Status          | Description  |
|-------------|-------|--|-----------------|--|
| P           | –     | The state of the safety-related communication relationship between the S PLC 1000 (F-Device) and a superordinate safety-related controller (F-Host). | Off             | The safety-related communication relationship to the superordinate safety-related controller has not been initialized.   |
|             | Green |  | Flashing (1 Hz) | The safety-related communication relationship to the superordinate safety-related controller has been interrupted.<br>After acknowledging an operator-acknowledge request and subsequent operator-acknowledge-reintegration of the S PLC 1000, the communication relationship can be re-established. |
|             |       |  | On              | The safety-related communication relationship to the superordinate safety-related controller has been initialized and established without errors.  |



**AXC F XT S PLC 1000**

Table 3-1 Diagnostic and status indicators

| Designation | Color        | Meaning   | Status          | Description   |
|-------------|--------------|---|-----------------|---|
| <b>RUN</b>  | –            | SPLC 1000 operating state   | Off             | The SPLC 1000 is not ready for operation (power off) or has not been initialized.   |
|             | Green        |   | Flashing (1 Hz) | The SPLC 1000 is in the SAFE STOP state.<br>The SPLC 1000 initialization phase is running.  |
|             | Green/orange |   | Flashing (1 Hz) | The SPLC 1000 is currently loading the project data from the SD card inserted in the PLCnext Control device to its internal memory.   |
|             | Green/orange |   | Flashing (2 Hz) | The SPLC 1000 is in the DOWNLOAD state.<br>The PLCnext Engineer software is transferring a project to the SPLC 1000.  |
|             | Orange       |   | Flashing (1 Hz) | The SPLC 1000 is in the DEBUG STOP state.   |
|             | Orange       |   | Flashing (2 Hz) | The SPLC 1000 is in the DEBUG HALT state  |
|             | Orange       |   | On              | The SPLC 1000 is in the DEBUG RUN state.  |
|             | Green        |   | On              | The SPLC 1000 is in the SAFE RUN state.<br>The safety-related application program is being executed.  |
| <b>C</b>    | –            | State of the safety-related communication relationship between the SPLC 1000 (F-Host) and configured subordinate F-Devices. | Off             | At least one configured safety-related communication relationship to a subordinate F-Device has not yet started or has been interrupted.  |
|             | Green        |   | Flashing (1 Hz) | A communication error that must be acknowledged is still present for at least one safety-related communication relationship to a subordinate F-Device.                                    |
|             |              |   | On              | All safety-related communication relationships to configured subordinate F-Devices have been initialized and established without errors. Safety-related process data will be transmitted. |



Table 3-1 Diagnostic and status indicators

| Designation | Color | Meaning   | Status             | Description   |
|-------------|-------|---|--------------------|---|
| FS          | -     | Failure State:<br>Safe state of the SPLC 1000                 | Off                | Error-free operating state of the SPLC 1000 with supply voltage present.<br>A Failure State is not present.   |
|             | Red   |   | Flashing<br>(1 Hz) |  <p>Remedy the error and perform a project download:</p> <ul style="list-style-type: none"> <li>Remedy the configuration error in PLCnext Engineer.</li> <li>Download the non-safety-related project to the PLCnext Control device used.</li> <li>Download the safety-related project to the SPLC 1000.</li> </ul>   |
|             |       |   | On                 |  <p>A critical error in the SPLC 1000 hardware has occurred and been detected.<br/>The SPLC 1000 has switched to the safe state (Failure State).</p> <p>Perform a voltage reset:</p> <ul style="list-style-type: none"> <li>Switch off the supply voltage of the SPLC 1000 and the PLCnext Control device for at least 30 seconds and then switch it back on again (Power UP).</li> </ul> <p>Or restart the standard controller (PLCnext Control) in the PLCnext Engineer software:</p> <ul style="list-style-type: none"> <li>Click on the "Reboot the controller" button in the PLCnext Control "Cockpit" editor.</li> </ul> |
| UL          | -     | Supply voltage $U_{Logic}$<br>(communications voltage $U_L$ ) | Off                | 24 V communications voltage feed-in not present or too low.   |
|             | Green |   | On                 | 24 V communications voltage feed-in present.  |



**WARNING: Avoid possible danger – outputs can be set**  
 Take appropriate measures to ensure that your system/machine does not present any danger.  
 Variables can be overwritten in the DEBUG RUN state. These are then also transmitted to the PROFIsafe output devices and output.

### 3.7 Internal basic circuit diagram

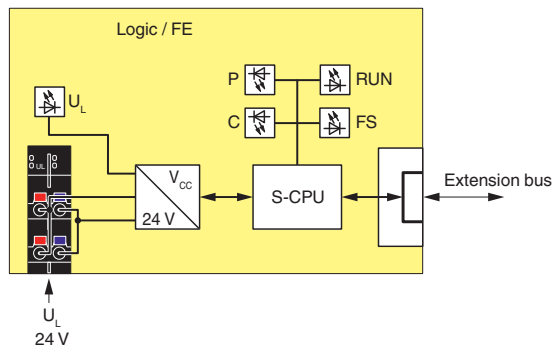



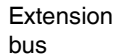


Figure 3-17 Internal basic circuit diagram SPLC 1000

Key:

- |   |                          |   |  |
|---|--------------------------|---|--|
|  | LED                      |  | Power supply unit  |
|  | Safety-related processor |   | Left-aligned<br>"PLCnext Control Extension"<br>extension modules |

## 4 Mounting hardware



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

### 4.1 Safety notes



**NOTE: Electrostatic discharge**

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



**NOTE: Damage to electronics due to inadequate external protection – no safe fuse tripping in the event of a fault**

The electronics in the device will be damaged if external fuse protection is inadequate.

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



**Please note:**

During any work on the Axioline F station, the SPLC 1000, the PLCnext Control device, or a module, switch off the power supply to the Axioline F station and make sure the supply voltage is protected against unauthorized reactivation.



**The SPLC 1000 is automatically grounded (FE) when it is snapped onto a grounded DIN rail.**

On the rear of the SPLC 1000, there are two FE springs that make contact with the DIN rail when the SPLC 1000 is placed on the DIN rail.



**NOTE: Damage to the contacts when tilting**

Tilting the modules can damage the contacts.

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

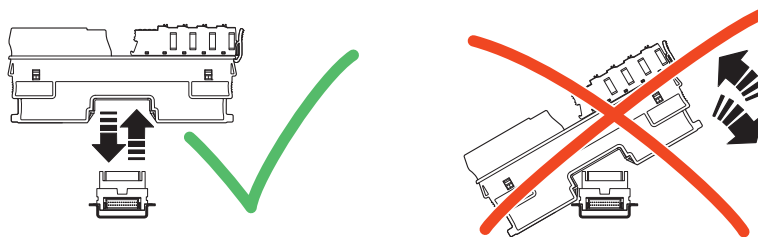


Figure 4-1 Placing the module **vertically**

## 4.2 Basic information

### Mounting location

The SPLC 1000 meets the IP20 degree of protection.

- It is imperative that you mount the SPLC 1000 in a lockable housing or in a lockable control cabinet with at least IP54 degree of protection.

### Mounting/DIN rail

The SPLC 1000 is mounted on a 35 mm standard DIN rail without any tools using the bus base module. It is mounted perpendicular to the DIN rail.

The local bus is created automatically when the bus base modules of the PLCnext Control device and the Axioline F device are aligned next to one another.

The extension bus is created automatically when the bus base modules of the SPLC 1000 and PLCnext Control device are aligned next to one another.



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

### Supply connector

The SPLC 1000 has a supply connector for connecting the power supply. The connector is fitted with spring-cage terminal blocks. When using suitable conductors, the conductors can be connected by means of direct connection technology (Push-in technology).



For additional information, please refer to [Section 5.2](#).

### FE connection

There are two FE springs (metal contacts) on the bottom of the SPLC 1000 which establish the connection to functional ground when the device 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 brackets             |
|--|-------------------------------|--------------------------|
| Horizontal; A in <a href="#">Figure 4-2 on page 53</a> : | Normal                        | CLIPFIX 35, CLIPFIX 35-5 |
|  | High shock and vibration load | E/AL-NS 35               |
| Other; B in <a href="#">Figure 4-2 on page 53</a>        | Normal                        | E/AL-NS 35               |
|  | High shock and vibration load |                          |

**Mounting position**

As standard, mount the SPLC 1000 in a horizontal position (A in [Figure 4-2](#)) on the DIN rail provided for that purpose.

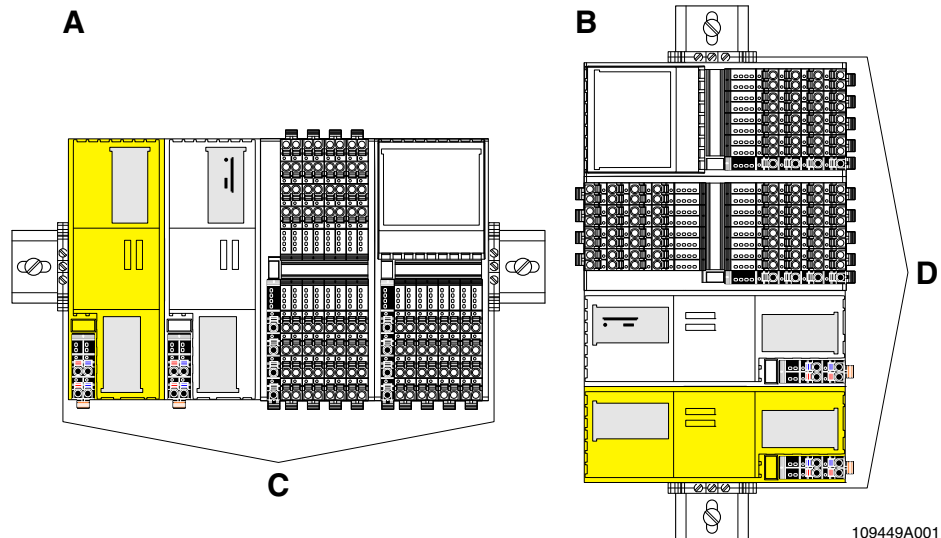


Figure 4-2 Mounting positions for the AXC F XT SPLC 1000 in an Axioline F station

**Key:**

- A** Horizontal mounting position
- B** Vertical mounting position
- C** End brackets: CLIPFIX 35, CLIPFIX 35-5, E/AL-NS 35
- D** End brackets: E/AL-NS 35

Other mounting positions are possible. In this case, temperature derating may be required. 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 with the SPLC 1000:

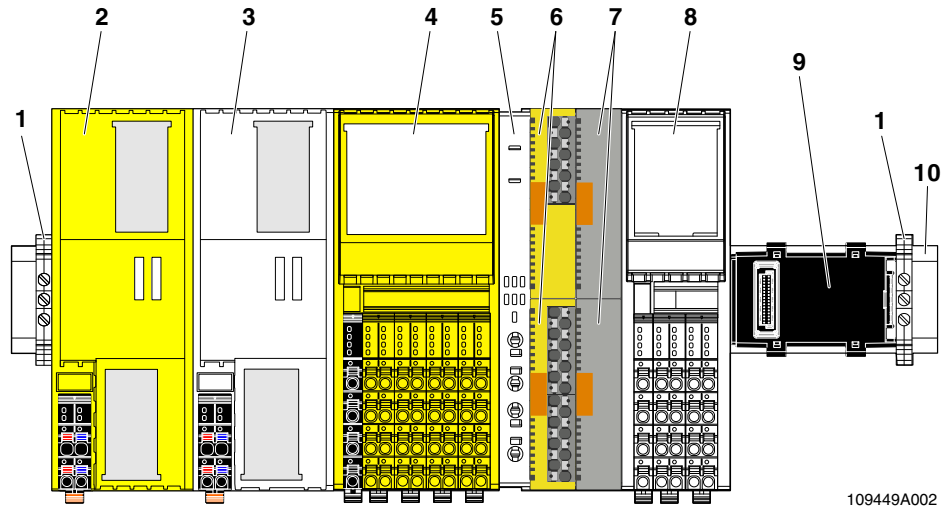


Figure 4-3 Example: Structure of an Axioline F station with left-aligned safety-related AXC F XT SPLC 1000 controller

Key:

- 1 End brackets (for securing the station; see [Section “Accessories” on page 166](#))
- 2 Left-alignable safety-related AXC F XT SPLC 1000 controller
- 3 PLCnext Control
- 4 Safety-related Axioline F I/O module
- 5 Axioline F backplane (AXL F BP SE4) for Axioline Smart Elements
- 6 Safety-related Axioline Smart Elements I/O modules
- 7 Slot covers for unused Axioline Smart Elements slots
- 8 Axioline F I/O module
- 9 Bus base module
- 10 DIN rail

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

#### Left alignment of the AXC F XT SPLC 1000

You can align the AXC F XT SPLC 1000 as a “PLCnext Control Extension” extension module to the left of the PLCnext Control AXC F 2152 and AXC F 3152.



Observe the information on the left alignment of extension modules in the UM EN AXC F X152 user manual, in particular also on the useable bus base modules.

## 4.4 Mounting the SPLC 1000

- Disconnect the Axioline F station from the power supply.

**Please note:**

Before you can mount the SPLC 1000, you must:

- Remove the PLCnext Control AXC F 2152 or AXC F 3152 used.
- Remove the PLCnext Control supply connector if necessary.
- Remove any further electronics modules and then remount them.
- Remove any bus base modules and remount them.

Follow the descriptions listed in this section.

**Please note:**

Mount all necessary modules **before** supplying power to the Axioline F station. Modules to which power is only supplied following the PLCnext Control boot process are not detected or may result in a malfunction.

To ensure that the left-alignable SPLC 1000 is detected correctly, follow the specifications of the voltage supply for the SPLC 1000 (see [Section 5.2.2](#)).

**WARNING: Unintentional machine startup**

- Do not assemble or remove the device while the power is connected.
- Before mounting or removing, disconnect the power to the device and the entire Axioline F station and ensure that it cannot be switched on again.
- Make sure the entire system is fully remounted before switching the power back on. Observe the diagnostics indicators and any diagnostic messages.

The machine/system may only be started when neither the Axioline F station nor the machine/system poses a hazard.

**Safety notes for starting applications**

Take the following into consideration when determining and programming the start conditions for your machine or system:

- The machine or system may only be started if it can be ensured that nobody is present in the danger zone.
- Meet the requirements of EN ISO 13849-1 with regard to the manual reset function. The machine must not be set in motion and/or a hazardous situation must not be triggered by the following actions, for example:
  - Switching on safe devices
  - Acknowledging device error messages
  - Acknowledging communication errors
  - Acknowledging block error messages in the application
  - Removing startup inhibits for safety functions

Observe the following when programming/configuring the safety logic:

- Switching from the safe state (substitute value = 0) to the operating state can generate an edge change (zero/one edge).
- In the safety logic, take measures to prevent this edge change resulting in unexpected machine/system startup or restart.



**Note for starting applications**

Also observe these notes to prevent unexpected machine startup after confirming an “Operator Acknowledgement”.

**4.4.1 Removing the PLCnext Control supply connector**



**Please note:**

Before you can mount the S PLC 1000, you must first remove the PLCnext Control device.

- Release the locking latch (A), tilt the supply connector upwards slightly (B), and remove it from the PLCnext Control (C).

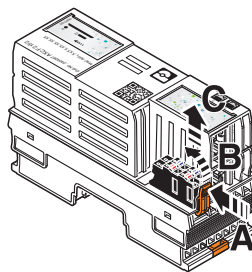


Figure 4-4 Removing the supply plug



#### 4.4.2 Removing other connectors from the PLCnext Control

- Remove all other connectors from the PLCnext Control (e.g., Ethernet cable).

#### 4.4.3 Unlatching electronics modules

Before the SPLC 1000 can be aligned to the PLCnext Control device, you must remove the PLCnext Control electronics module.

To unlatch the PLCnext Control device, proceed as follows:

- Remove the left-hand end bracket on the Axioline F station.
- Insert a suitable tool (e.g., a flat-bladed screwdriver) in the upper and lower snap-in mechanism (base latches) of the PLCnext Control/module one after the other and unlatch it (A).

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

- Pull the electronics module straight back from the DIN rail (B).

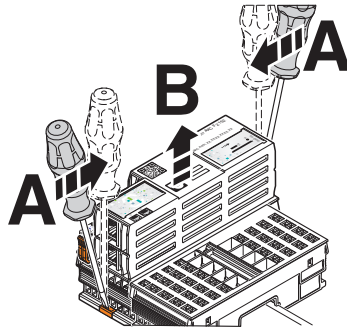


Figure 4-5 Remove electronics module

#### 4.4.4 Mounting the bus base modules



Please note:

- When snapping a bus base module onto a DIN rail, ensure that there are no electronic modules on the preceding or following bus base module.
- To operate the SPLC 1000 on a PLCnext Control AXC F 2152, this requires a special bus base module (1 in [Figure 4-8 on page 59](#)).  
The bus base module is not supplied with the AXC F 2152. For the ordering data, please refer to the UM EN AXC F X152 user manual.
- For the left alignment of a further module (AXC F XT ...) the cover cap of the previous bus base module must first be removed (A in [Figure 4-8 on page 59](#)).
- Read further information on mounting the bus base and electronics modules and in particular on the left alignment of the controller of the PLCnext Control product group in the UM EN AXL F SYS INST user manual.

#### AXC F 2152

When using the PLCnext Control AXC F 2152, you must first replace the bus base module present with the special bus base module.

To do so, proceed as follows:

- Remove the AXC F 2152 bus base module from the bus base of the first module aligned to the right.
- Remove the AXC F 2152 bus base module from the DIN rail.

When mounting the bus base modules, proceed as illustrated in [Figure 4-6](#):

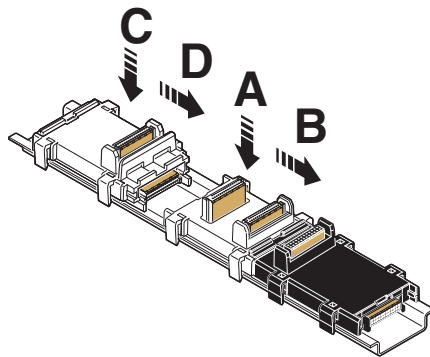


Figure 4-6 Mounting bus base module(s): AXC F 2152

- Place the special bus base module for the AXC F 2152 on the DIN rail (A in [Figure 4-6](#)).
- Push the special bus base module for the AXC F 2152 into the connection for the bus base module of the module aligned to the right (B in [Figure 4-6](#)).
- Place the bus base module for the SPLC 1000 on the DIN rail (C in [Figure 4-6](#)).
- Push the bus base module for the SPLC 1000 into the connection of the special bus base module for the AXC F 2152 (D in [Figure 4-6](#)).

**AXC F 3152**

When using the PLCnext Control AXC F 3152, you do not need to replace the bus base module.

When mounting the bus base module for the SPLC 1000, proceed as illustrated in [Figure 4-7](#):

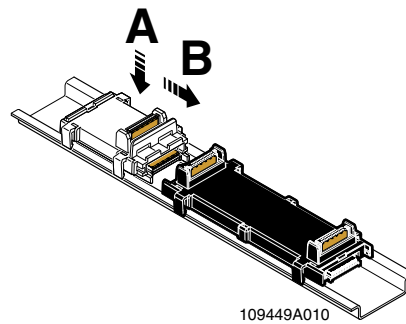


Figure 4-7 Mounting bus base module(s): AXC F 3152

- Remove the cover cap of the bus base module for the AXC F 3152 (A in [Figure 4-8](#)).
- Place the bus base module for the SPLC 1000 on the DIN rail (A in [Figure 4-7](#)).
- Push the bus base module for the SPLC 1000 into the connection of the bus base module for the AXC F 3152 (B in [Figure 4-7](#)).

**Aligning additional AXC F XT ... modules on the left (in preparation):**

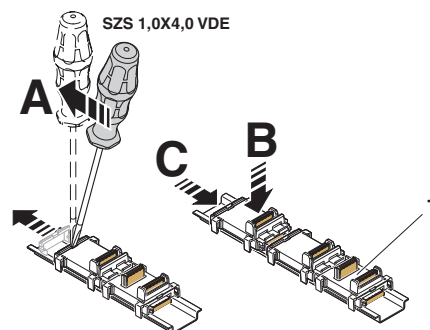


Figure 4-8 Mounting the bus base modules of further AXC F XT ... modules

- Remove the cover cap of the preceding bus base module (A in [Figure 4-8](#)).
- Place the bus base modules of the additional AXC F XT ... modules to be aligned on the left on the DIN rail (B in [Figure 4-8](#)).
- Push each subsequent bus base module into the connection of the previous bus base module (C in [Figure 4-8](#)).

#### 4.4.5 Snapping on electronics modules

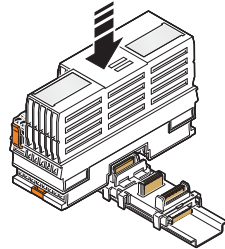


Figure 4-9 Snapping on electronics modules

- Working from right to left, place each electronics module vertically on the corresponding bus base module and on the DIN rail until it snaps into place with a click. Make sure that the device plug for the bus base connection is situated above the corresponding socket on the bus base module.

#### 4.4.6 Connecting connectors to the PLCnext Control device

- If you previously removed any connectors, for example an Ethernet cable, from the PLCnext Control device, reconnect these.

#### 4.4.7 Connecting the supply connector

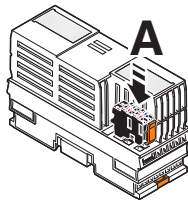


Figure 4-10 Connecting the supply connector

- Place all supply connectors in position and press them down firmly. Make sure that the respective locking latch snaps into place.
- Mount the left end bracket on the Axioline F station.

## 5 Connecting and wiring the hardware

### 5.1 Sizing of the power supply

Supply the SPLC 1000 using external 24 V DC voltage sources. The permissible voltage range is 19.2 V DC to 30 V DC (ripple included).



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

- Select a power supply 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 and the safety function when using unsuitable power supplies**

The SPLC 1000 is designed exclusively for protective extra-low voltage (PELV) operation in accordance with EN 60204-1. Only protective extra-low voltages in accordance with the listed standard may be used for the supply.

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

Only use power supplies that satisfy the requirements of EN 61204-1 and feature safe isolation with PELV in accordance with IEC 61010-2-201 (PELV). They prevent short circuits between the primary and secondary side.

Please also observe the information in [Section “Electrical safety” on page 16](#).



A power supply without a **fall-back characteristic curve** must be used for correct operation of the SPLC 1000 (see [Figure 5-2](#)).

When the SPLC 1000 is switched on, an increased inrush current is temporarily triggered. The SPLC 1000 behaves like a capacitive load when it is switched on.

Make sure the power supply and the externally required fuse are compatible. The power supply must be able to temporarily provide the tripping current. Observe the information in [Section “Technical data” on “Power supply” from page 169](#).

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

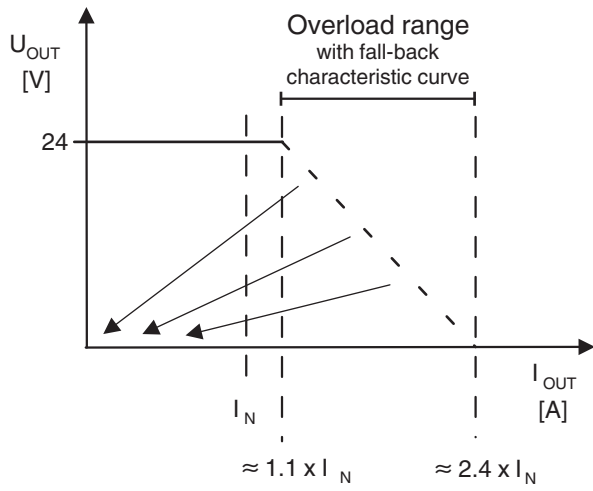


Figure 5-1 Overload range **with** fall-back characteristic curve

6219B070

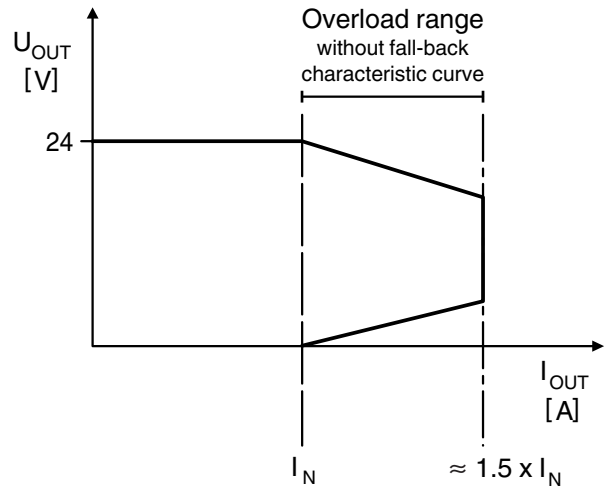


Figure 5-2 Overload range **without** fall-back characteristic curve

6219B071

## 5.2 Supply voltage

### 5.2.1 DC distribution network according to IEC 61326-3-1

A DC distribution network is a DC power supply network which supplies a complete industrial hall with DC voltage and to which any device can be connected. A typical system or machine distribution is not a DC distribution network. For devices that are provided for a typical system or machine distribution, the DC connections are viewed and tested as I/O signals according to IEC 61326-3-1.

When using a AXC F XT SPLC 1000 in a DC distribution network, install appropriate surge protection (e.g., PT 2+1-S-48DC/FM, item no. 2817958) directly upstream of the device.

### 5.2.2 Connecting the supply voltage



**Please note:**

The supply voltage of the left-alignable SPLC 1000 and the PLCnext Control device used must be fed in via a **shared** power supply unit.

For further information on this, also read the information in the controller-specific UM EN AXC F X152 user manual.

- Connect the supply voltage via the Axioline F connector.

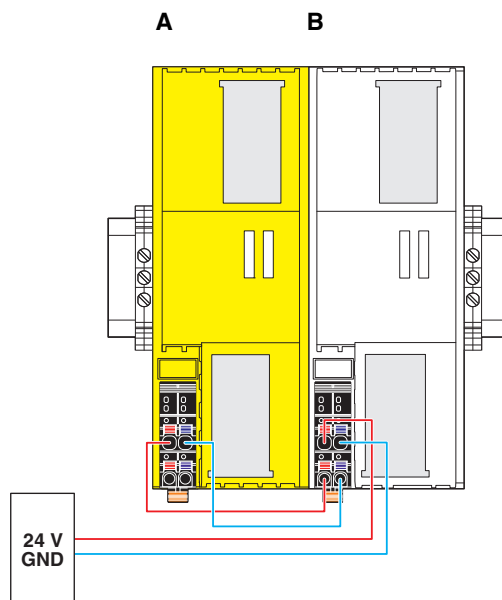


Figure 5-3 Connection of the supply voltage

Key:

A: AXC F XT SPLC 1000

B: AXC F 2152

### 5.2.3 Supply connector: terminal point assignment

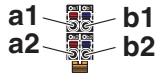


Figure 5-4 Terminal points for the supply voltage (communications voltage  $U_L$ )

Table 5-1 Feed-in of the supply voltage

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

**Key:**

- $U_L$ : Supply voltage feed-in (bridged internally)
- GND: Supply voltage reference potential (bridged internally)

### 5.2.4 Supply connector: Assembling and connecting cables

Observe the notes in [Section 5.2.3](#) when assembling the connector for the supply voltage.

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



When using ferrules:

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

**Rigid conductor/ferrule**

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



Figure 5-5 Connecting a rigid conductor

**Flexible conductor**

- Open the spring by pressing on the spring lever with a screwdriver (A in [Figure 5-6](#)).
- Insert the conductor into the terminal point (B in [Figure 5-6](#)).
- Remove the screwdriver to secure the conductor (recommended: bladed screwdriver, blade width: 2.5 mm (e.g., SZS 0,4x2,5 VDE, item no. 1205037)).



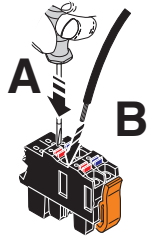


Figure 5-6 Connecting a flexible conductor

### 5.2.5 Connecting the supply connector

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

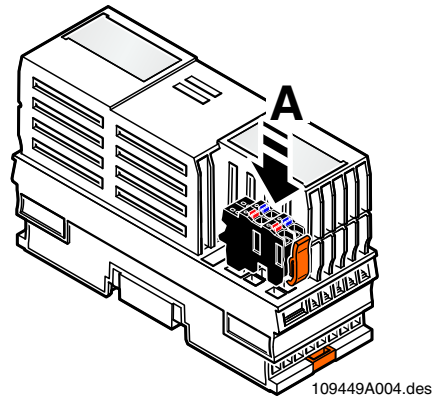


Figure 5-7 Connecting the supply connector

Supply the SPLC 1000 (together with the PLCnext Control used) with an external 24 V DC voltage supply. The permissible voltage range is 19.2 V DC to 30 V DC (ripple included).



Only use power supplies that are suitable for operation with capacitive loads (increased inrush current) (see [Section 5.1](#)).

- Connect the power supply to the supply connector as shown in [Figure 5-5](#) and in [Figure 5-6](#). Note the information in [Section 5.2.3](#).



## 6 Commissioning and validation

**WARNING: Avoid danger during commissioning**

Take appropriate measures to ensure that your system/machine does not present any danger during commissioning and validation.

**WARNING: Safety function only available following validation**

The planned system/machine safety function is only available following validation.

**WARNING: Organizational or technical measures for checking the CRC checksum after a voltage reset or restart necessary**

- Introduce organizational or technical measures for checking the CRC checksum expected for the respective system/machine after a voltage reset or system restart. The CRC checksum is displayed by the CRC element of the SPLC system variable (see [Table 8-1 “SPLC system variable and elements of the SPNSV2\\_TYPE data structure”](#)).
- Implement a technical measure for checking the CRC checksum in such a way that the check is carried out by a third technical entity beyond the SPLC 1000 and PLCnext Control.

The PLCnext Engineer software is required for commissioning the SPLC 1000.



The following topics are also available in the [PLCnext Info Center](#):

- Configuring Axioline F modules
- Adding left-alignable “PLCnext Control Extension extension modules” to the bus configuration
- Configuring PROFINET devices
- Programming in accordance with IEC 61131-3
- Instantiating programs
- Assigning process data
- Specifying the refresh interval for Axioline F I/O data
- Transmitting projects to the PLCnext Control
- Creating a PLCnext Engineer HMI application

## 6.1 Initial commissioning

The following information for commissioning the SPLC 1000 must be observed.

- Familiarization with the previous sections of this user manual and with the UM EN AXC F X152 user manual is essential in order to carry out the steps listed in the following table correctly. The UM EN AXC F X152 user manual describes, among other actions, how to install, commission and operate the PLCnext Control AXC F 2152 and AXC F 3152.

Therefore, if you have not done so already, read the previous sections and the UM EN AXC F X152 carefully. The section in the appendix of this user manual which corresponds to the previous sections must also be observed.

- The SPLC 1000 is commissioned immediately:
  - After switching on the supply voltage and subsequent successful startup, if an appropriate safety-related application program is available

Or

- Once an appropriate safety-related application program has been downloaded from PLCnext Engineer.

With appropriate safety-related programming, the safety function is active immediately after the startup phase of the SPLC 1000 and the outputs of the F-Devices and the outputs of the non-safety-related PROFINET devices and I/O participants (e.g., Axioline F modules) can be set depending on the programming.

For initial commissioning, proceed as described in [Table 6-1](#).



The following table describes all the steps from unpacking the SPLC 1000 through mounting/installation, right through to commissioning.



Table 6-1 Steps for initial commissioning of the SPLC 1000

| Step | Relevant section and literature  |
|------|--|
| 1    | Remove the device from the packaging while observing the ESD regulations. <a href="#">Section "Safety notes" on page 51</a>  |
| 2    | Mount the device in accordance with your application. <a href="#">Section "Mounting hardware" on page 51</a>   |
| 3    | <div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> <p>If you want to use the SD card for operating the SPLC 1000 on an AXC F 2152 or AXC F 3152, insert the SD card into the PLCnext Control device.</p> </div> <div style="flex: 1; border: 1px solid black; padding: 5px;"> <p>Observe the information on the SD card in <a href="#">Section 3.1, "General description of the SPLC 1000"</a> and in the controller-specific UM EN AXC F X152 user manual.</p> </div> <div style="flex: 1; border: 1px solid black; padding: 5px; margin-top: 10px;"> <p><b>WARNING:</b><br/>Follow the instructions in the note <a href="#">"WARNING: Organizational or technical measures for checking the CRC checksum after a voltage reset or restart necessary" on page 67.</a></p> </div> </div> |
| 4    | <p>Connect the power supply to the device.</p> <ul style="list-style-type: none"> <li>- Notes on using PELV power supplies in <a href="#">Section "Electrical safety" on page 16</a></li> <li>- <a href="#">Section "Supply voltage" on page 63</a></li> </ul>   |



Make sure that the PLCnext Control device as well as the PROFINET and F-Devices used in your application have been mounted and installed correctly before switching on the supply voltage.

Table 6-1 Steps for initial commissioning of the SPLC 1000

| Step  | Relevant section and literature   |
|---|---|
| <p><b>5</b> Switch on the power supply for the SPLC 1000 and the PLCnext Control device used.</p> | <div style="display: flex; flex-direction: column; gap: 10px;"> <div style="border: 1px solid black; padding: 5px;">  <p><b>WARNING:</b><br/>Take appropriate measures to ensure that your system/machine does not present any danger during commissioning and validation.</p> </div> <div style="border: 1px solid black; padding: 5px;">  <p><b>WARNING:</b><br/>The planned system/machine safety function is only available following validation.</p> </div> </div> |



**Please note:**

The SPLC 1000 and the PLCnext Control device used take approximately 1 minute to start up. This is due to the comprehensive self-tests the devices must perform. The LEDs on the two devices indicate the status.





The following steps must be performed in the PLCnext Engineer software.


When carrying out the following steps, please refer to the online help of the software. The online help function supports you during programming and configuration in PLCnext Engineer.

|           |   |   |
|-----------|---|---|
| <b>6</b>  | Carry out all the steps in order to be able to integrate the device as a PROFIsafe F-Host into a PLCnext Engineer project.                    | <ul style="list-style-type: none"> <li>- Online help for PLCnext Engineer</li> <li>- <a href="#">Section "Integration of the SPLC 1000 as the F-Host in PLCnext Engineer" on page 76</a></li> </ul>   |
| <b>7</b>  | Create the safety-related bus configuration in PLCnext Engineer.  | <ul style="list-style-type: none"> <li>- <a href="#">Section "Adding PROFINET devices" on page 84</a></li> <li>- <a href="#">Section "Adding I/O modules (F-Devices)" on page 86</a></li> </ul>   |
| <b>8</b>  | In PLCnext Engineer, set the F_Source_Address (F_Source_Add) and the F_Destination_Addresses (F_Dest_Add) that are set on the safe F-Devices. | <a href="#">Section "Assigning/checking the PROFIsafe address (F-Address) of PROFIsafe devices" on page 93</a>  |
| <b>9</b>  | Check the settings for management/diagnostic variables and adapt the settings, if necessary.  | <ul style="list-style-type: none"> <li>- <a href="#">Section "Description of the safety-related functioning of the SPLC 1000" on page 27</a></li> <li>- <a href="#">Section "Management/diagnostic variables for F-Devices" on page 98</a></li> <li>- <a href="#">Section "Management/diagnostic variables for each configured F-Device" on page 144</a></li> <li>- <a href="#">Section "Global management/diagnostic variables for F-Devices" on page 147</a></li> </ul> |
| <b>10</b> | Specify a new project password.   | <a href="#">Section "Defining a project password" on page 81</a>  |
| <b>11</b> | Create the variables for the safety-related devices for process data exchange.  | <a href="#">Section "Creating safety-related variables" on page 104</a>   |
| <b>12</b> | Link the created variables to the process data in accordance with your application.   | <a href="#">Section "Assigning safety-related process data" on page 108</a>   |


Table 6-1 Steps for initial commissioning of the SPLC 1000

| Step  | Relevant section and literature  |
|---|--|
|  <p><b>WARNING: Safety-related steps</b><br/>                     The following steps include safety-related operations in the PLCnext Engineer software and the safety validation of the PROFIsafe system.<br/>                     For the following steps, please also observe the checklists in <a href="#">Section B, "Appendix: Checklists"</a>.<br/>                     In addition, refer to the online help for the PLCnext Engineer software.</p> |  |
| 13  | Carry out the necessary device parameterization in the PLCnext Engineer software. <a href="#">Section "Programming in accordance with IEC 61131-3 – Safety-related example program" on page 93</a> |
| 14  | Check the bus configuration and variable assignment (exchange variables).  |
| 15  | Specify a new SafePLC password. <a href="#">Section "Specifying the SPLC 1000 controller password" on page 112</a>   |
| 16  | Carry out the validation using the checklist "Initial commissioning" and "recommissioning/device replacement" validation" on page 185. <a href="#">Section "Appendix: Checklists" on page 175</a>  |

 **NOTE: Unauthorized access to the SD card possible**  
 It is possible to access the SD card, meaning that data can be read off and tampered with.  
 Observe [Section "Note on security" on page 14](#), in particular in terms of access protection for the SD card.

 **WARNING: Carry out verification in accordance with safety standards**  
 Carry out verification for all the steps involved in creating the safety program for your application in accordance with the applicable safety standards for your application.

## 6.2 Recommissioning after replacing the SPLC 1000

 The device does not have to be configured again during recommissioning after replacing the SPLC 1000 (see steps 6 to 15 in [Table 6-1 "Steps for initial commissioning of the SPLC 1000"](#)).  
 Depending on the operating mode (see [page 26: "Operation with an SD card"](#) or ["Operation without an SD card"](#)), the safety-related project is either in the internal flash memory of the PLCnext Control device used or on the SD card inserted in the PLCnext Control device.

For recommissioning after the device has been replaced, proceed as described in steps 1 to 5 and 16 in [Table 6-1 on page 68](#).

The prerequisite for this is that the device to be replaced has been removed from the application in accordance with the instructions in [Section "Removing hardware" on page 153](#).

## 6.3 Recommissioning after replacing the PLCnext Control

### 6.3.1 Recommissioning after replacing the PLCnext Control without the use of an SD card

Once you have taken the steps necessary for replacing the PLCnext Control device, proceed in accordance with the instructions in [Section 6.1, "Initial commissioning"](#) and in particular in accordance with [Table 6-1 "Steps for initial commissioning of the SPLC 1000"](#) listed there.

### 6.3.2 Recommissioning after replacing the PLCnext Control with the use of a new, empty SD card

Once you have taken the steps necessary for replacing the PLCnext Control device, proceed in accordance with the instructions in [Section 6.1, "Initial commissioning"](#) and in particular in accordance with [Table 6-1 "Steps for initial commissioning of the SPLC 1000"](#) listed there.

### 6.3.3 Recommissioning after replacing the PLCnext Control with the use of a new SD card that contains a safety-related and a non-safety-related project



The device does not have to be configured again during recommissioning after replacing the PLCnext Control device (see steps 6 to 15 in [Table 6-1 "Steps for initial commissioning of the SPLC 1000"](#)) if an SD card that contains a safety-related project is inserted into the PLCnext Control device.

For recommissioning after the device has been replaced, proceed as described in steps 1 to 5 and 16 in [Table 6-1 on page 68](#).

The prerequisite for this is that the device to be replaced has been replaced with a new device in the application in accordance with the instructions in UM EN AXCFX152.



**WARNING:**

Follow the instructions in the note ["WARNING: Organizational or technical measures for checking the CRC checksum after a voltage reset or restart necessary"](#) on page 67.

## 6.4 Example SPLC 1000 commissioning

### 6.4.1 Example: The SPLC 1000 as the F-Host for Axioline F and Axioline Smart Elements F-Devices

To make your introduction to working with the SPLC 1000 as straightforward as possible, the descriptions in later sections are based on the following configuration.

The SPLC 1000 communicates as the F-Host via PROFINET/PROFIsafe with the safety-related Axioline F I/O modules and via the Axioline F local bus with the safety-related Axioline Smart Elements I/O modules.



#### Subordinate PROFINET devices and PROFIsafe F-Devices

Please note that, in principle, you can use Axioline F bus couplers as well as the corresponding I/O devices and devices from other manufacturers as subordinate PROFINET devices and/or PROFIsafe F-Devices.

In the following example configuration in [Figure 6-1](#), an Axioline F bus coupler is coupled to an Axioline F station as a subordinate. The Axioline F station consists of the modular AXC F 3152 controller and an SPLC 1000 left-aligned to this.

Communication between the SPLC 1000 and the safety-related Axioline F I/O modules is done via PROFINET/PROFIsafe through the Axioline F PROFINET bus coupler.

Furthermore, the SPLC 1000 communicates via the PLCnext Control AXC F 3152 directly via the Axioline F local bus with the safety-related Axioline Smart Elements I/O modules.

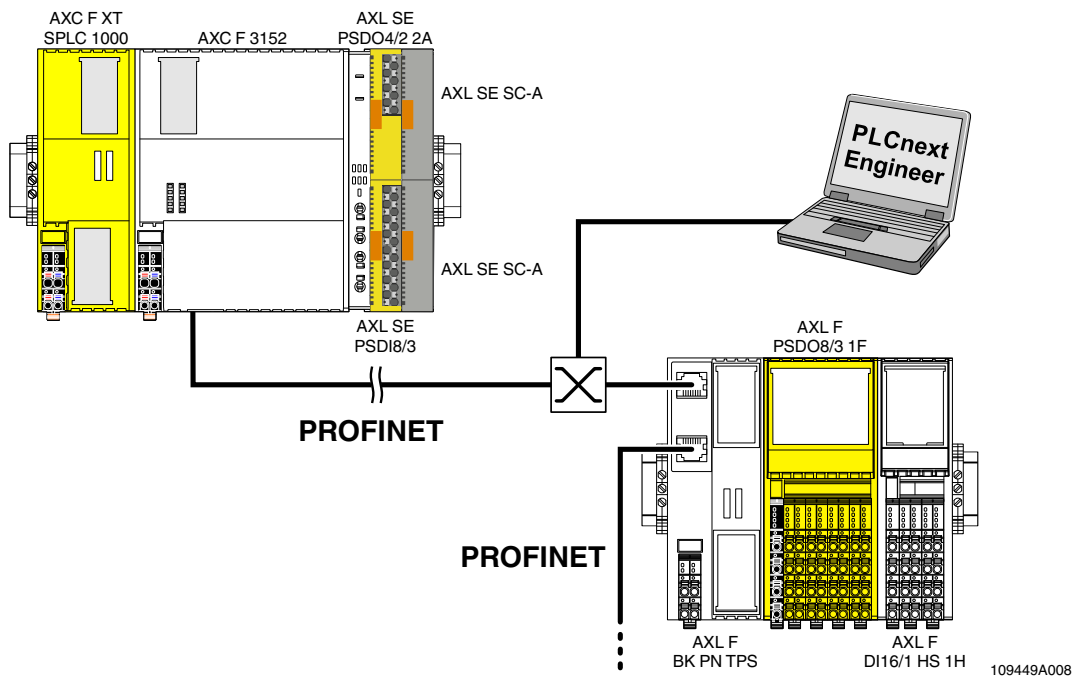


Figure 6-1 Example configuration: The SPLC 1000 as the F-Host with safety-related communication via the Axioline F local bus and via PROFINET/PROFIsafe



## 6.4.2 Further example configurations

### 6.4.2.1 The SPLC 1000 as the F-Host with safety-related communication via PROFINET/PROFIsafe

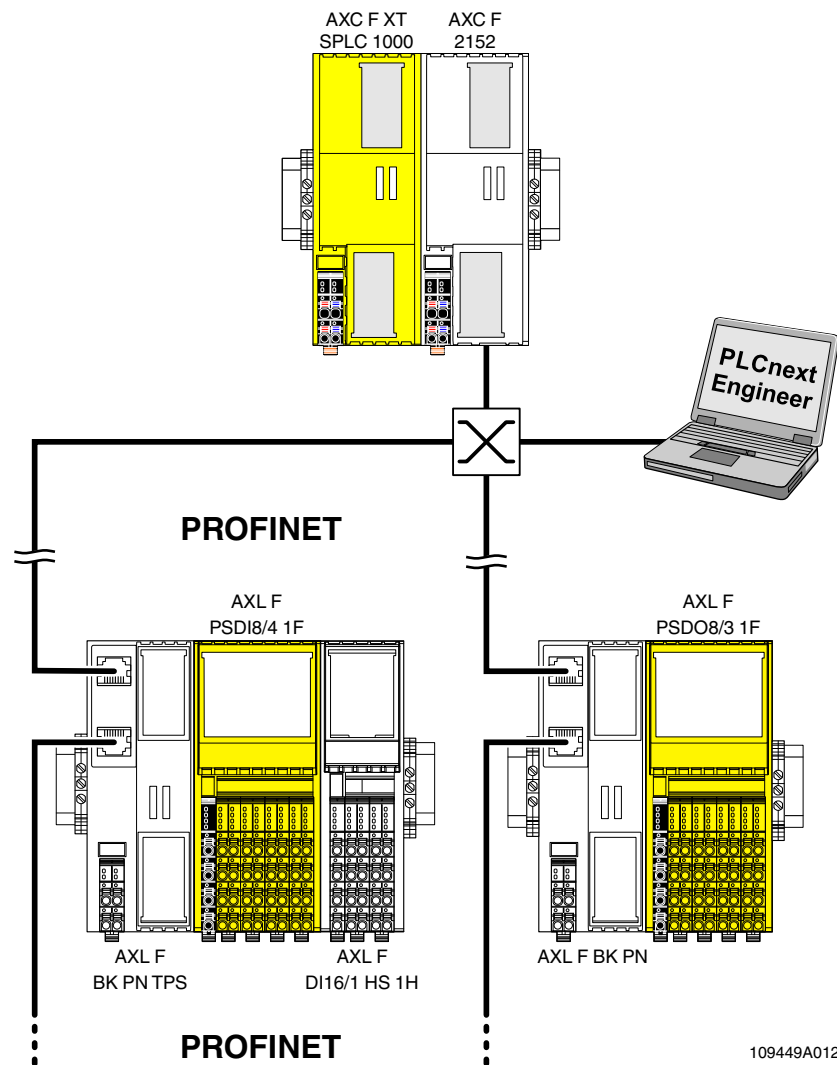


Figure 6-2 Example configuration: The SPLC 1000 as the F-Host with safety-related communication via PROFINET/PROFIsafe

In this example configuration, two Axioline F bus couplers are coupled to an Axioline F station as subordinates. The Axioline F station consists of the modular AXF 2152 small-scale controller and an SPLC 1000 left-aligned to this.

Communication between the SPLC 1000 as the F-Host and the safety-related Axioline F I/O modules is via PROFINET/PROFIsafe via the Axioline F PROFINET bus coupler.

6.4.2.2 The SPLC 1000 as the F-Host with safety-related communication via the Axioline F local bus

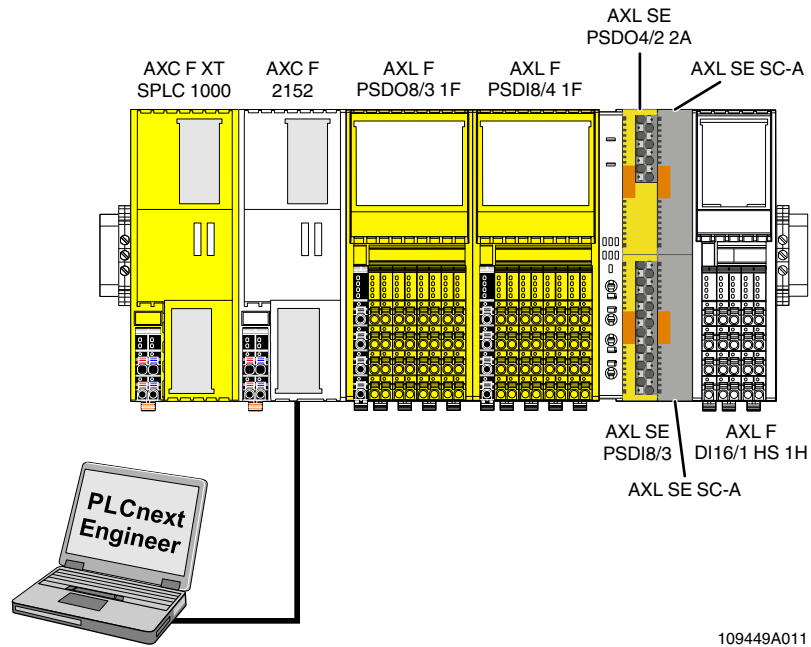


Figure 6-3 Example configuration: The SPLC 1000 as the F-Host with safety-related communication via the Axioline F local bus

In this example configuration, the SPLC 1000 is aligned to the left of the modular AXC F 2152 small-scale controller in an Axioline F station.

In the Axioline F station, various F-Devices are aligned to the right of the PLCnext Control AXC F 2152. These are safety-related Axioline F and Axioline Smart Elements I/O modules.

The SPLC 1000 as the F-Host communicates via the PLCnext Control AXC F 2152 with the safety-related Axioline Smart Elements and Axioline F I/O modules directly via the Axioline F local bus.

6.4.2.3 The SPLC 1000 as the subordinate F-Device with safety-related communication via PROFINET/PROFIsafe and as the F-Host with safety-related communication via the Axioline F local bus

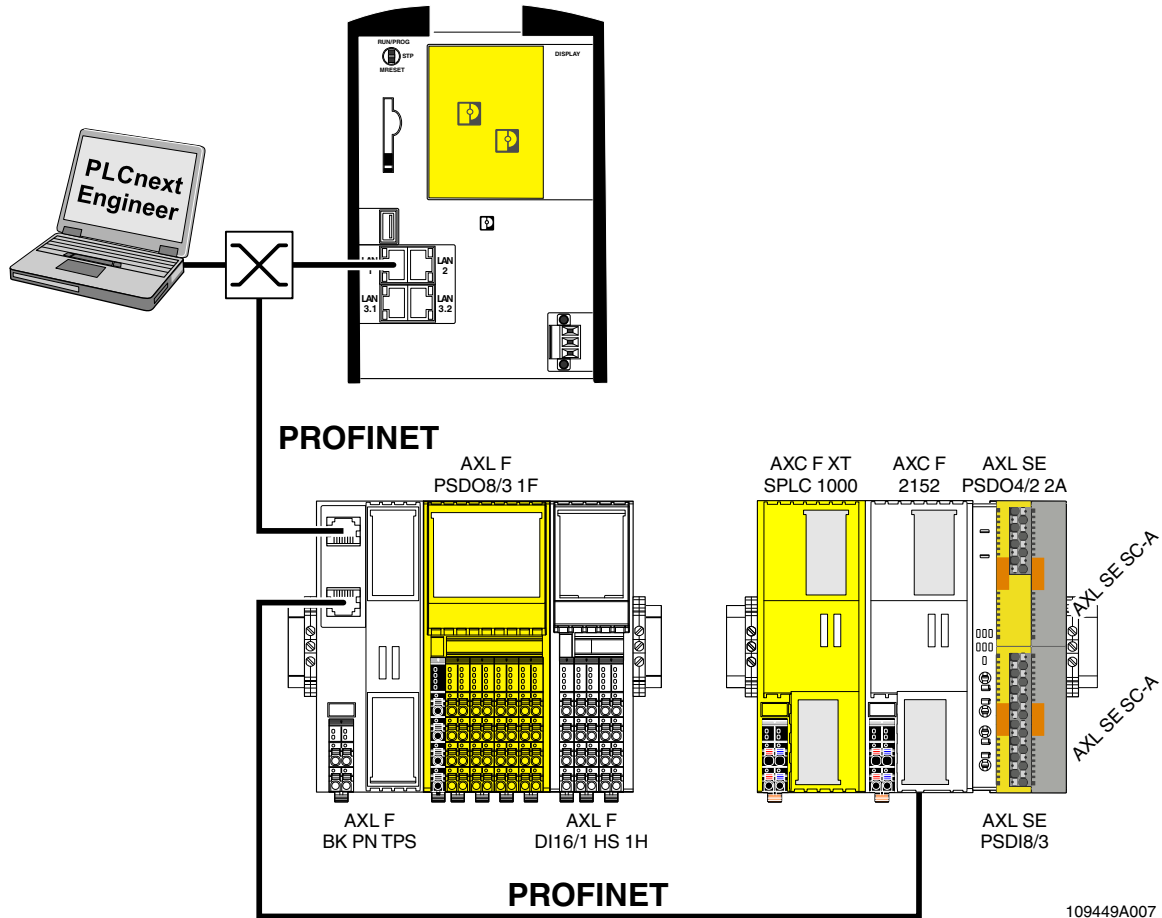


Figure 6-4 Example configuration: The SPLC 1000 as the subordinate F-Device with safety-related communication via PROFINET/PROFIsafe and as the F-Host with safety-related communication via the Axioline F local bus

In this example configuration, the SPLC 1000 communicates as the subordinate F-Device with the safety-related RFC 4072S compact controller (F-Host) via PROFINET/PROFIsafe. Furthermore, the SPLC 1000 communicates as the F-Host via the PLCnext Control AXC F 2152 with the safety-related Axioline Smart Elements and Axioline F I/O modules directly via the Axioline F local bus.

### 6.4.3 Integration of the SPLC 1000 as the F-Host in PLCnext Engineer

The following sections describe how to:

- Create a new project in PLCnext Engineer (see [Section 6.5.5](#)).
- Add F-Devices connected to the SPLC 1000 (see [Section 6.7.2](#)).
- Program a safety-related program in PLCnext Engineer, including creating and linking variables (see [Section 6.9](#)).
- Configure F-Devices in PLCnext Engineer (see [Section 6.9.1](#) and [Section 6.9.2](#)).
- Download the non-safety-related project to the PLCnext Control device and initiate the execution (see [Section 6.10.1](#)).
- Download the safety-related project to the SPLC 1000 and initiate the execution (see [Section 6.10.2](#)).
- Display safety-related online values in PLCnext Engineer (see [Section 6.10.3](#)).



For the chronological sequence of the steps carried out, please refer to the example application.

This section assumes the following:

- You have installed the PLCnext Engineer software on your PC in accordance with the online help.
- You have installed the connected F-Devices in accordance with the device-specific user documentation.



When carrying out the following steps, please refer to the online help of the PLCnext Engineer software. The online help assists you in programming and parameterizing the software.

## 6.5 Software requirements

### 6.5.1 PLCnext Engineer software



Detailed information on PLCnext Engineer and on PLCnext technology can be found in the PLCnext community at [plcnext-community.net](http://plcnext-community.net) and in particular in the [PLCnext Info Center](#).

The PLCnext Engineer software is required for commissioning the SPLC 1000.

### 6.5.2 Installing PLCnext Engineer

The software can be downloaded at [phoenixcontact.net/product/1046008](http://phoenixcontact.net/product/1046008).

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

### 6.5.3 PLCnext Engineer license

Ensure that you install a version of the PLCnext Engineer software ( $\geq 2021.9$ ) suitable for the SPLC 1000 you will be using.



#### **PLCnext Engineer add-in for functional safety applications**

Note that the “Add-in Functional Safety Editor” is necessary for creating functional safety applications in PLCnext Engineer.

### 6.5.4 User interface

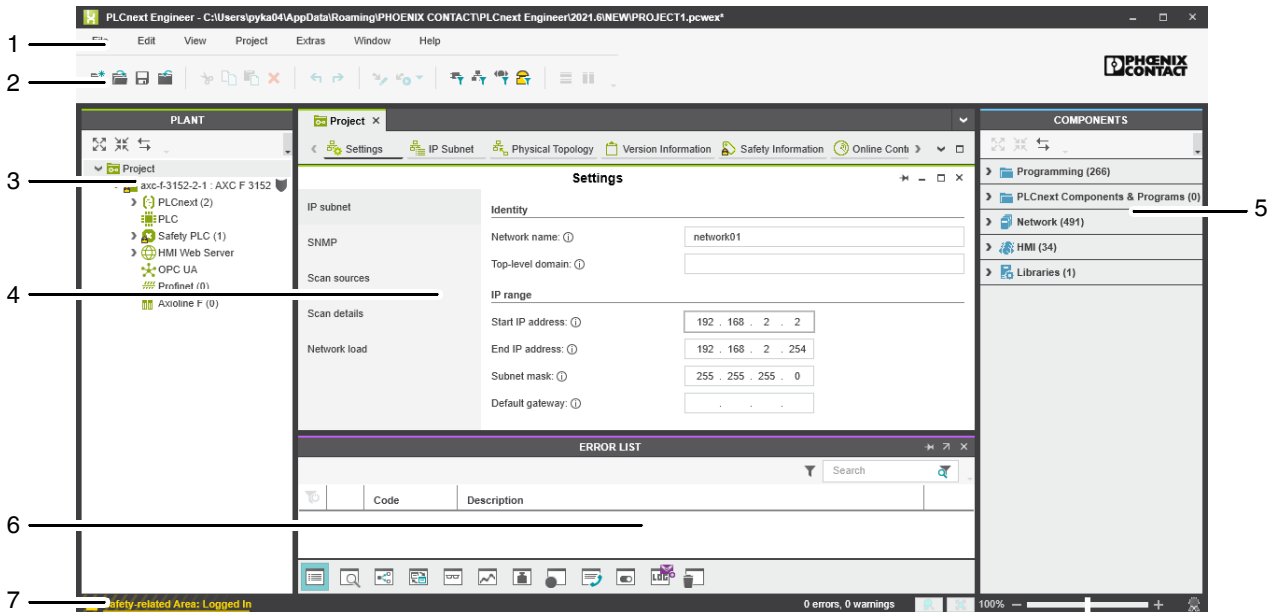


Figure 6-5 PLCnext Engineer user interface

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

**“PLANT” area**

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

**Editors area**

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

**“COMPONENTS” area**

The “COMPONENTS” area contains all of the components available for the project.

The components can be divided into the following types based on their function:

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

**Cross-functional area**

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

- **ERROR LIST:**  
Shows all errors, warnings, and messages for the current project.
- **GLOBAL FIND AND REPLACE:**  
Finds and replaces strings in the project.
- **CROSS REFERENCES:**  
Displays all cross-references within the project, for example, the use and declaration of all variable types or HMI tags.
- **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:**  
Records and visualizes variable values at runtime.
- **ONLINE STATE:**  
While there is an online connection established to the controller and to the safety-related controller, a superordinate symbol of their operating state is displayed in the ONLINE STATE window.
- **LOGGING:**  
Shows all errors, warnings, and messages. A distinction is made between “online” (messages regarding the runtime environment, as well as errors and warnings that concern online communication) and “engineering” (messages regarding software events, e.g., GSDML and FDCML files; not project-related).
- **RECYCLE BIN:**  
Elements that have recently been deleted from the “PLANT” or “COMPONENTS” areas are moved to the recycle bin. Deleted elements can be restored from here, if needed.

### 6.5.5 Creating a new project

- Open PLCnext Engineer.
- Create a new project.

Two PLCnext Control devices are available for selection in the PLCnext Engineer software for operating the left-alignable SPLC 1000.

- In the COMPONENTS area under “Network, Axioccontrol, Devices, Controller with AXC F XT SPLC 1000 (x)” click on the PLCnext Control device “AXC F 3152 Rev. >= 00/2021.9.0”.

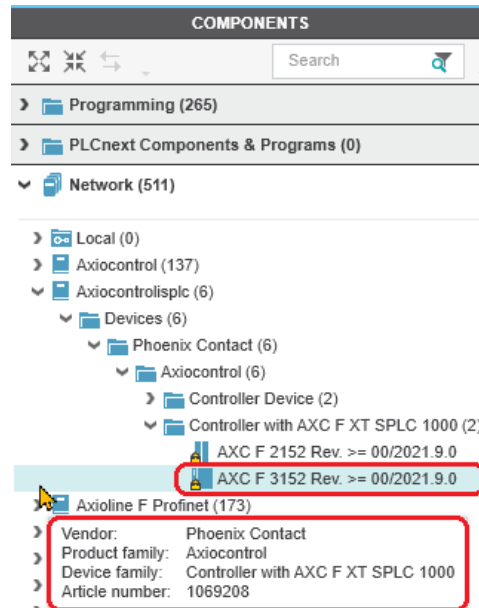


Figure 6-6 Selecting the PLCnext Control AXC F 3152

- Drag the selected PLCnext Control into the “PLANT” area while pressing the mouse button.
- Paste the PLCnext Control to the project node.
- Open the “File, save project as...” menu.
- Enter a unique and meaningful name for the project (in the example: “UM\_SPLC\_1000”).
- Click the “Save” button.



Further information on creating a new project is available in the UM EN AXC F X152 user manual and in the PLCnext Engineer software online help function.



### 6.5.6 Defining a project password

If prompted by PLCnext Engineer, enter a project password in the “PROJECT PASSWORD DEFINITION” dialog.

The project password in PLCnext Engineer allows you to edit safety-related parts of the PLANT, the COMPONENT area, the code, and the variables. Safety-related parts of the project can only be edited if you are logged into the safety-related area. This area is only accessible to authorized users.

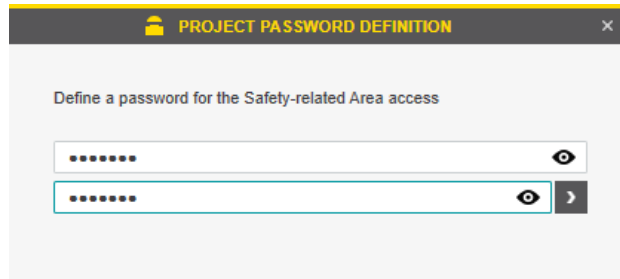


Figure 6-7 Defining a project password

The project password must contain between 6 and 64 characters.

- Save the project using an appropriate project name (in the example: “UM\_SPLC\_1000”).

## 6.6 Further actions/steps in the PLCnext Engineer software

### 6.6.1 Creating the IP address range in the project



- For the following steps/settings in the project, proceed in accordance with the descriptions in the UM EN AXC F X152 user manual.
- Specify an IP address range for the project to be able to operate it in your network.

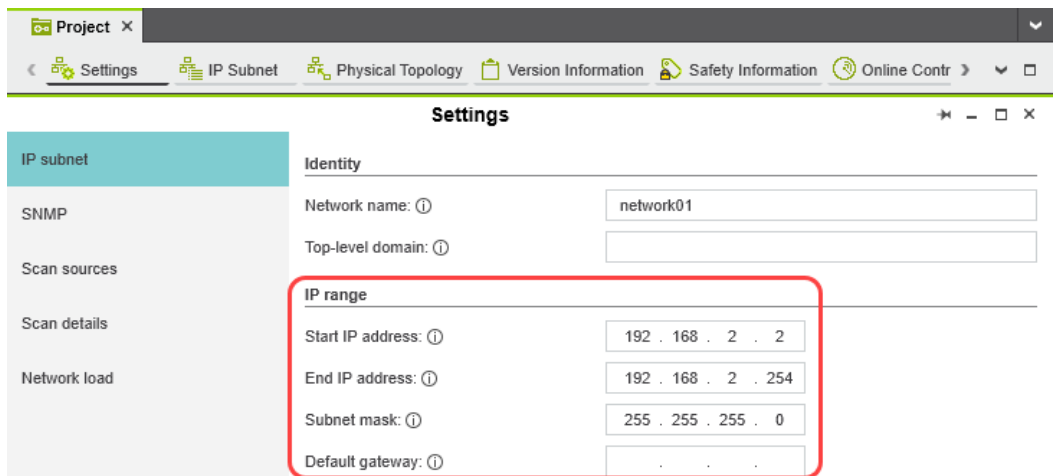


Figure 6-8 IP address range set in the project

### 6.6.2 Setting the IP address of the controller in the project

- Specify an IP address for the controller that lies within the previously set IP address range.

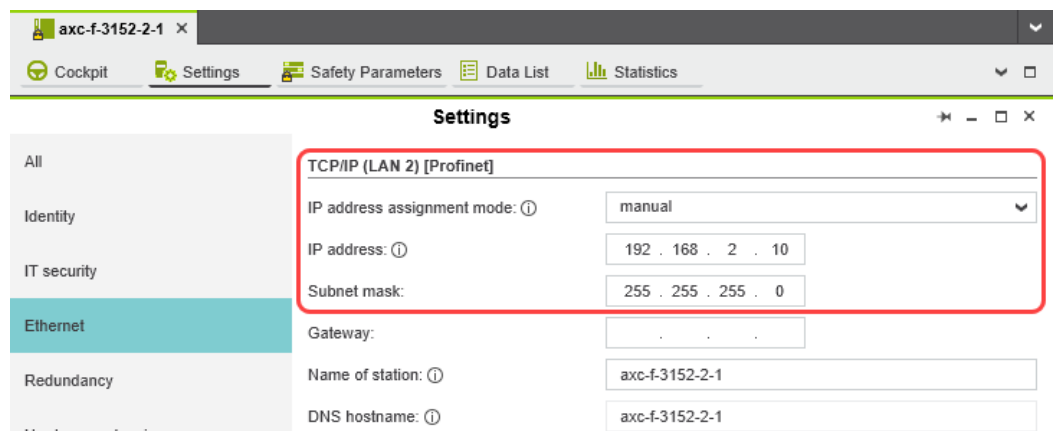


Figure 6-9 Controller IP address set

### 6.6.3 Connecting PLCnext Engineer to the controller

- Connect PLCnext Engineer to the controller to be able to transfer a project to the controller. To do so, select the controller available online in PLCnext Engineer.

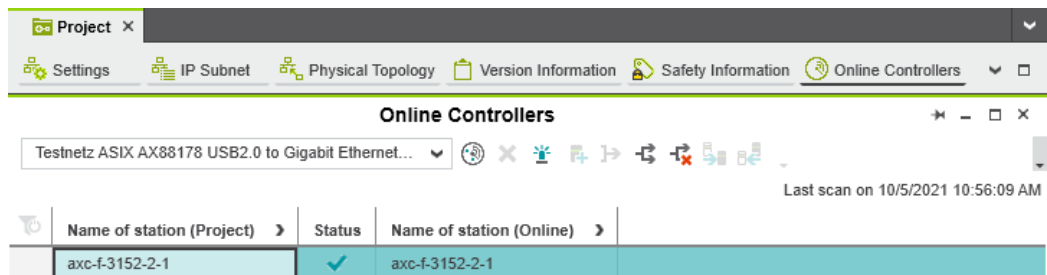


Figure 6-10 Configured controller assigned to an online device

### 6.6.4 User authentication

- Upon the request of PLCnext Engineer, enter a user name and a password if user authentication is enabled (default setting).

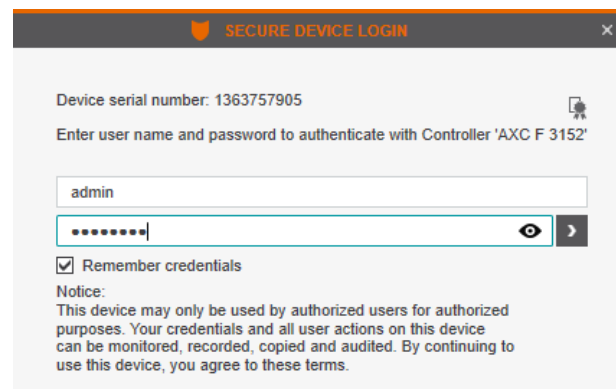


Figure 6-11 “SECURE DEVICE LOGIN” dialog

The user name, the password, and further information on user authentication preset in the delivery state can be found in the UM EN AXC F X152 user manual.

A successful connection will be displayed in the “PLANT” area on the node of the controller.

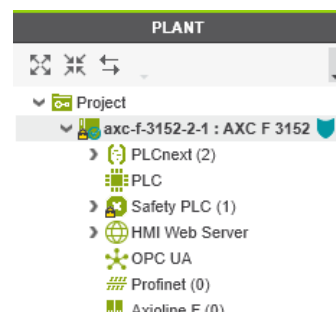


Figure 6-12 Controller successfully connected



Further information is available in the [PLCnext Info Center](#) and in the PLCnext Engineer online help function.

## 6.7 Configuring PROFINET devices



A description of the procedure for configuring PROFINET devices is available in the PLCnext Community at [plcnext-community.net](http://plcnext-community.net) and in particular in the [PLCnext Info Center](#) as well as in the PLCnext Engineer online help function.

### 6.7.1 Adding PROFINET devices

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

The “/ Profinet” controller editor group opens.

- Select the “Device List” editor.

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

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

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

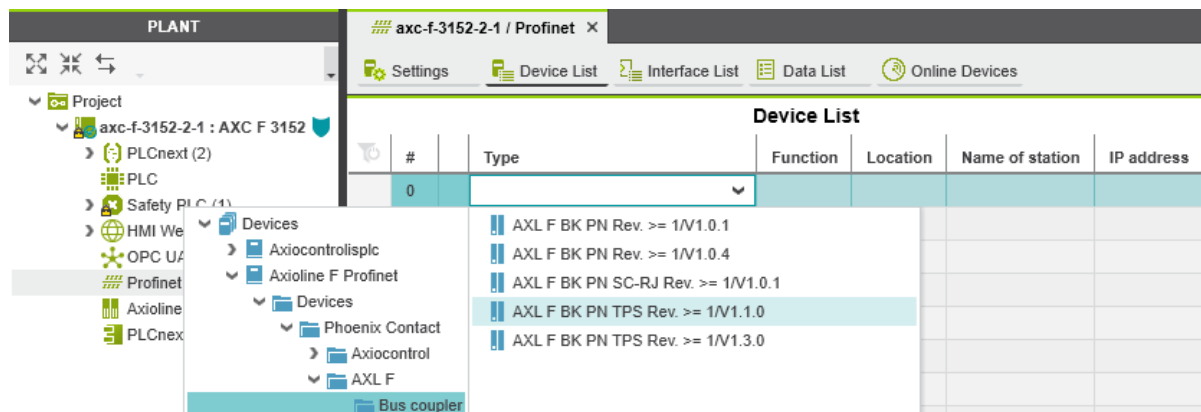


Figure 6-13 Role picker for selecting PROFINET devices

- 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 above to add more PROFINET devices.

The screenshot displays the 'PLANT' area on the left and the 'Device List' table on the right. The 'PLANT' area shows a project tree with the following structure:

- Project
  - axc-f-3152-2-1 : AXC F 3152
    - PLCnext (2)
    - PLC
    - Safety PLC (1)
    - HMI Web Server
    - OPC UA
    - Profinet (1)
      - axl-f-bk-pn-tps-1 : AXL F BK PN TPS (1)
        - dap-1 : DAP (4)
      - Axioline F (0)

The 'Device List' table is as follows:

| # | Type                             | Function | Location | Name of station   | IP address   |
|---|----------------------------------|----------|----------|-------------------|--------------|
| 0 | AXL F BK PN TPS Rev. >= 1/V1.1.0 |          |          | axl-f-bk-pn-tps-1 | 192.168.2.20 |
| 1 | Select type here                 |          |          |                   |              |
| 2 | Select type here                 |          |          |                   |              |
| 3 | Select type here                 |          |          |                   |              |
| 4 | Select type here                 |          |          |                   |              |
| 5 | Select type here                 |          |          |                   |              |

Figure 6-14 PROFINET devices in the “PLANT” area and in the Device List

### 6.7.2 Adding I/O modules (F-Devices)



A description of the procedure for adding I/O modules is available in the PLCnext Community at [plcnext-community.net](http://plcnext-community.net) and in particular in the [PLCnext Info Center](#) as well as in the PLCnext Engineer online help function.

This section describes how to **manually** add I/O modules (here, F-Devices) to PROFINET devices and to the “Axioline F (x)” node.

#### Adding I/O modules to PROFINET devices

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-tps-1” in the example.

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

The role picker opens.

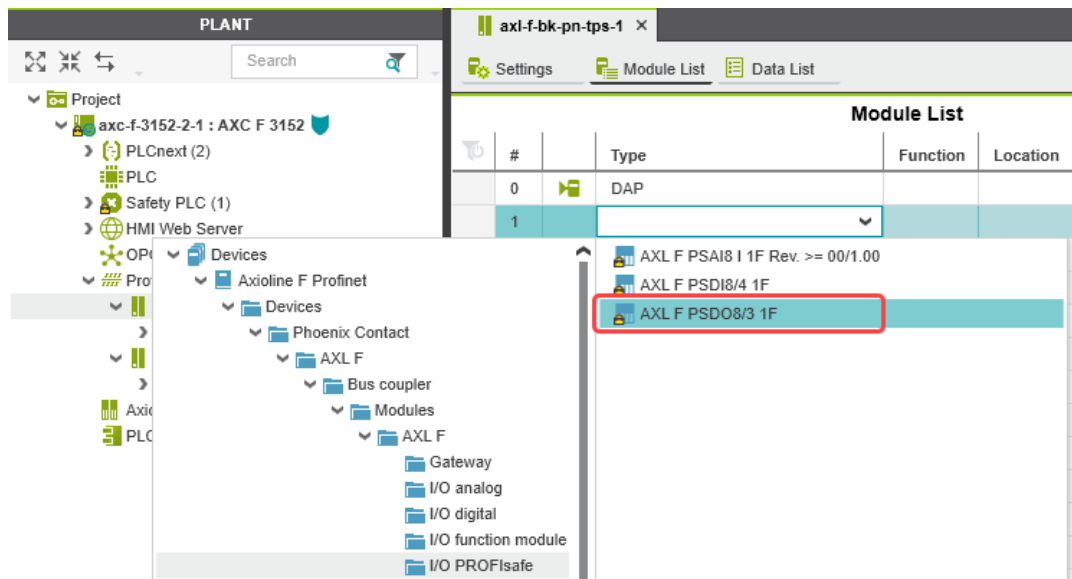


Figure 6-15 Role picker for selecting the I/O modules

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

#### Project password: Logging into the Safety-related Area

In this area, you will be changing the safety-related project by adding F-Devices. If you are not logged into the “Safety-related Area”, PLCnext Engineer will prompt you to enter a password.

Through the targeted distribution of the password, you can specify the circle of users who may make changes to the safety-related project.

- Enter the password in the following dialog and confirm your entry by clicking on the arrow.

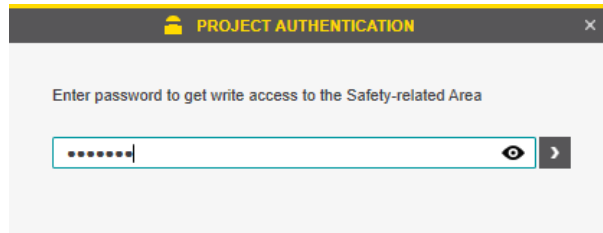


Figure 6-16 Entering the project password

A successful login is indicated by text highlighted in yellow:

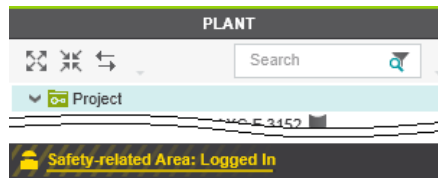


Figure 6-17 Successful login to the safety-related area

The I/O module is added and shown in the “PLANT” area under the “Profinet (x)” node for the respective PROFINET device (see Figure 6-18).

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

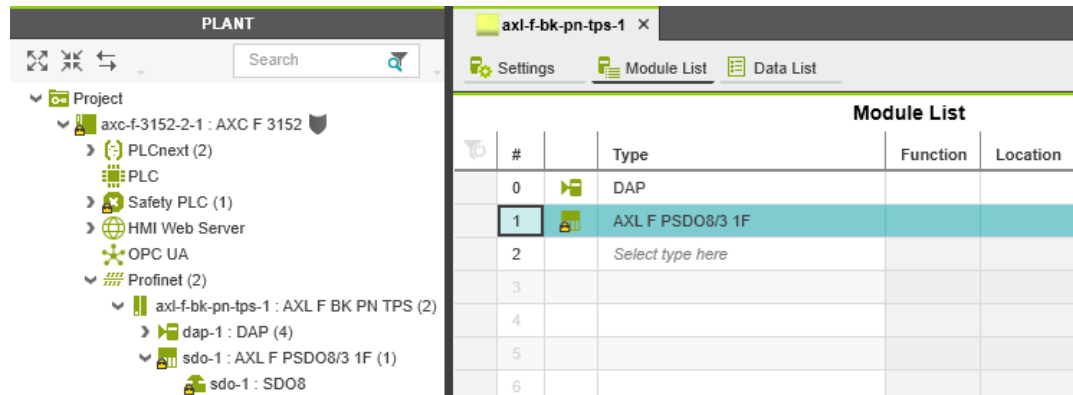


Figure 6-18 I/O modules connected to the PROFINET device

**Adding I/O modules to the “Axioline F (x)” node**

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

The “/ Axioline F” controller editor group opens.

- Select the “Device List” editor.

Add the I/O modules in the “Device List” editor. To do so, proceed as follows:

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

The role picker opens.

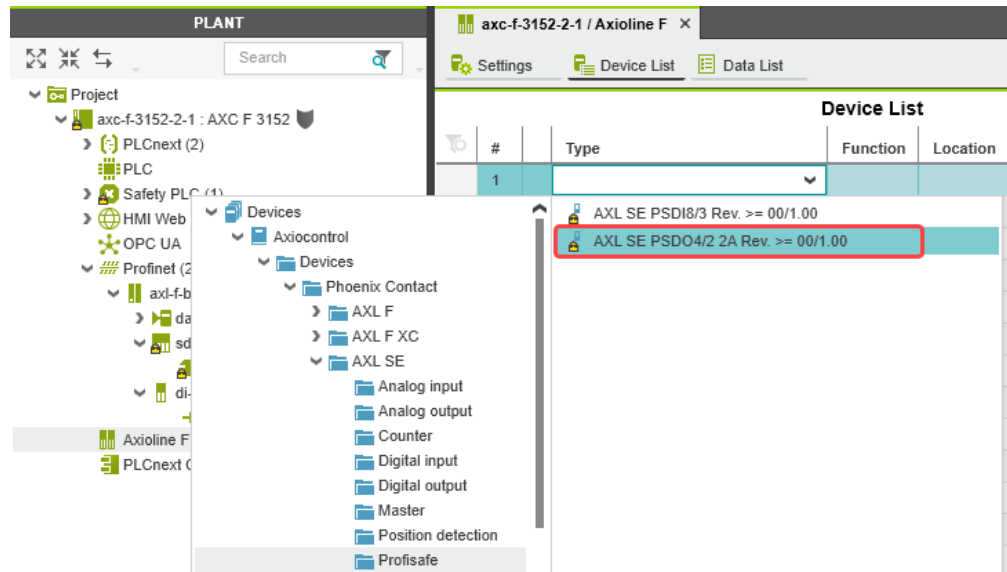


Figure 6-19 Role picker for selecting the I/O modules

- In the role picker, select the respective I/O modules.

If, as in this example, you are using Axioline Smart Elements slot covers of the type AXL SE SC-A, configure these accordingly.

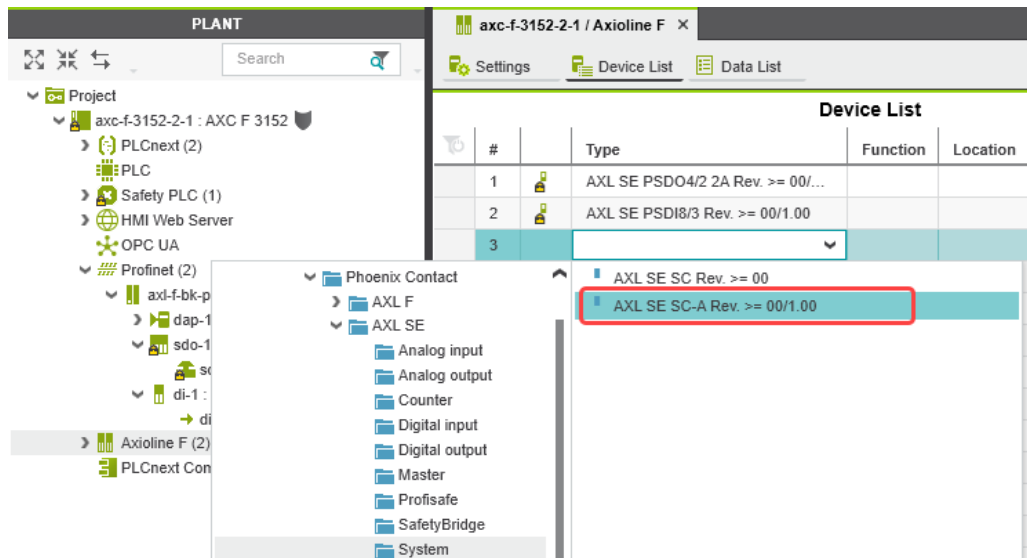


Figure 6-20 Role picker for selecting the I/O modules



The figure below shows all I/O modules contained in the example project.

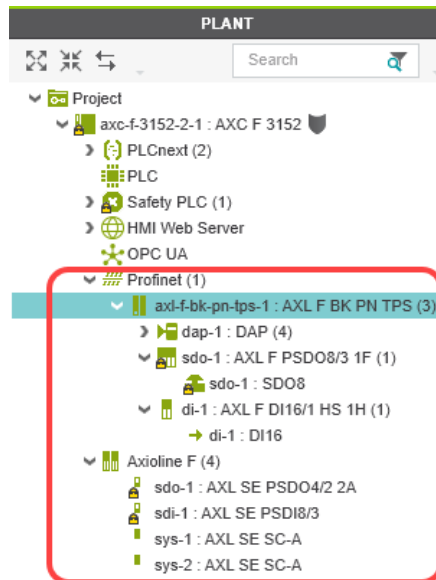


Figure 6-21 Example project

## 6.8 Programming in accordance with IEC 61131-3 – Non-safety-related example program

Information on programming a non-safety-related program is not a part of this user manual.



Information on programming in accordance with IEC 61131-3 can be found in the PLCnext community at [plcnext-community.net](http://plcnext-community.net) and in particular in the [PLCnext Info Center](#) as well as in the PLCnext Engineer online help function.

In the above listed sources, read how to:

- Open and create a program organization unit (POU) (see [Section 6.8.1](#)).
- Create non-safety-related variables.
- Create non-safety-related programs.
- Assign non-safety-related process data.
- Instantiate programs (see [Section 6.8.2](#)).
- Create PLCnext Engineer HMI applications.



**Please note:**

Due to the creation of a new project for the SPLC 1000 described in [Section 6.5.5](#), you have to carry out the steps in sections [6.8.1 “Creating a POU”](#) and [6.8.2 “Instantiating programs”](#) for the SPLC 1000 yourself.

### 6.8.1 Creating a POU

If you have created a new project for the SPLC 1000, you must create the program organization unit (POU) with the name “Main” in the “COMPONENTS” area under “Programs” for the non-safety-related part of the project (see [Figure 6-23](#)). The POU with the name “S\_Main” has been created automatically.

To create a new POU, proceed as follows:

- Click on “Programming (x)” in the “COMPONENTS” area.
- Click on the arrow next to “Local (x)”.
- Right-click “Programs (x)”.
- In the context menu, select “Add Program”.

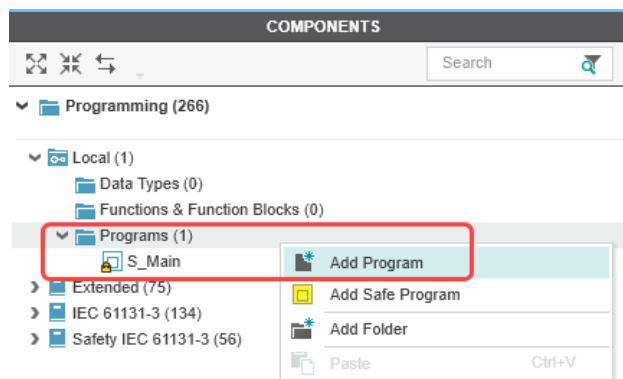


Figure 6-22 “Add Program” program POU context menu

- Enter the name “Main” for the new POU.

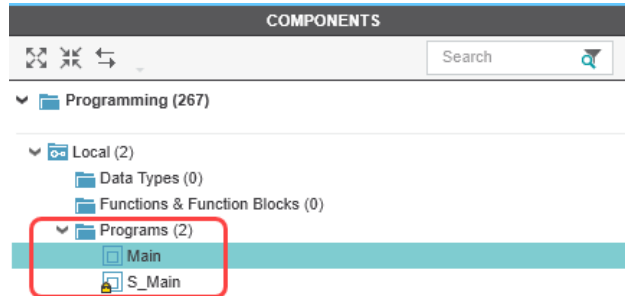


Figure 6-23 Program POUs: Main and S\_Main

## 6.8.2 Instantiating programs

Programs are instantiated in the “Tasks and Events” editor. To instantiate a program, create the required task and assign it to the desired program instance.

Individual tasks are coordinated and processed in the Execution and Synchronization Manager (ESM). The S PLC 1000 uses a dual-core processor and has one ESM (“ESM1” and “ESM2” in the “Tasks and Events” editor) per processor core.

### Opening the “Tasks and Events” editor

To open the “Tasks and Events” editor, proceed as follows:

- Double-click on the “PLCnext (x)” 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 (“Task1” in the example in [Figure 6-24](#)).  
The name may not contain any spaces.
- In the “Task type” column, click in the input field.
- Select the “Task type” from the drop-down list.
- Make all of the required settings for the task in the remaining columns.

### Instantiating a program

To instantiate a program, proceed as follows:

- In the “Name” column, enter a name for the program instance under a task in the “Enter program instance name here” input field (“Main1” in the example in [Figure 6-24](#)).  
The name may not contain any spaces.
- Click on “Select program type here” in the “Program type” column.
- Select the program to be instantiated from the drop-down list (“Main” in the example in [Figure 6-24](#)).

The selected program is instantiated and assigned to a task.

The screenshot shows the 'Tasks and Events' editor interface. At the top, there are navigation tabs: 'Tasks and Events', 'Port List', 'Data Logger Sessions', and 'Online Parameters'. Below the tabs is a search bar and window controls. The main area contains a table with the following columns: Name, Component name, Task type, Event name, Program type, Interval (ms), Priority, Threshold (ms), Watchdog (ms), and Comment. The table lists two main tasks: ESM1 and ESM2. ESM1 has a sub-task 'Task1' which is a 'Cyclic task' with an interval of 100 ms, priority 0, and a watchdog of 100 ms. Under 'Task1', there is a program instance 'Main1' with component name 'Arp.Plc.Eclr' and program type 'Main'. ESM2 has a sub-task 'SafetyProxyTask' which is a 'Cyclic task' with an interval of 5 ms, priority 0, and a watchdog of 100 ms. Under 'SafetyProxyTask', there is a program instance 'sproxy\_1' with component name 'Arp.Services.SpnsProxy' and program type 'SpnsProxyProgram'. A red box highlights the 'Task1' row and its sub-row 'Main1'.

| Name                             | Component name         | Task type   | Event name | Program type             | Interval (ms) | Priority | Threshold (ms) | Watchdog (ms) | Comment |
|----------------------------------|------------------------|-------------|------------|--------------------------|---------------|----------|----------------|---------------|---------|
| ESM1                             |                        |             |            |                          |               |          |                |               |         |
| Task1                            |                        | Cyclic task |            |                          | 100           | 0        | 0              | 100           |         |
| Main1                            | Arp.Plc.Eclr           |             |            | Main                     |               |          |                |               |         |
| Enter program instance name here |                        |             |            | Select program type here |               |          |                |               |         |
| Enter task name here             |                        |             |            |                          |               |          |                |               |         |
| ESM2                             |                        |             |            |                          |               |          |                |               |         |
| SafetyProxyTask                  |                        | Cyclic task |            |                          | 5             | 0        | 0              | 100           |         |
| sproxy_1                         | Arp.Services.SpnsProxy |             |            | SpnsProxyProgram         |               |          |                |               |         |
| Enter task name here             |                        |             |            |                          |               |          |                |               |         |

Figure 6-24 Tasks and program instances in the “Tasks and Events” editor

## 6.9 Programming in accordance with IEC 61131-3 – Safety-related example program

Once you have created the non-safety-related part of the example project, you can start creating the safety-related part.

### 6.9.1 Assigning/checking the PROFIsafe address (F-Address) of PROFIsafe devices

The PROFIsafe address (F-Address) is a unique ID for each F-Device in the network. The F-Host is assigned an F\_Source\_Address (F\_Source\_Add), while each F-Device is assigned its own F\_Destination\_Address (F\_Dest\_Add).

You must set the PROFIsafe address via the DIP switches directly on the F-Device prior to installation. Check the set F-Address in the project in PLCnext Engineer and adapt the settings there, if necessary.



#### Unique F-Address assignment – Avoid addresses overlapping

- Assign a unique F-Address to each F-Device that is used. Each F-Address assigned within a network must be unique.
- Avoid overlapping F-Addresses. They are not permitted.

In the example, the F-Devices are assigned the F-Destination addresses:

- AXL F PSDO8/3 1F: 1
- AXL SE PSDO4/2 2A: 2
- AXL SE PSDI8/3: 3

For more detailed information on setting the PROFIsafe F-Addresses, please refer to [“Device identification/number of safe devices” on page 29](#) and the device-specific user documentation.

#### F\_Source\_Address (F\_Source\_Add)

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

The controller editor group opens.

- Select the “Safety Parameters” editor.



If you are not currently logged into the safety-related area, you will now be prompted to enter the password in the “PROJECT AUTHENTICATION” dialog that opens (see [“Project password: Logging into the Safety-related Area” on page 86](#)).

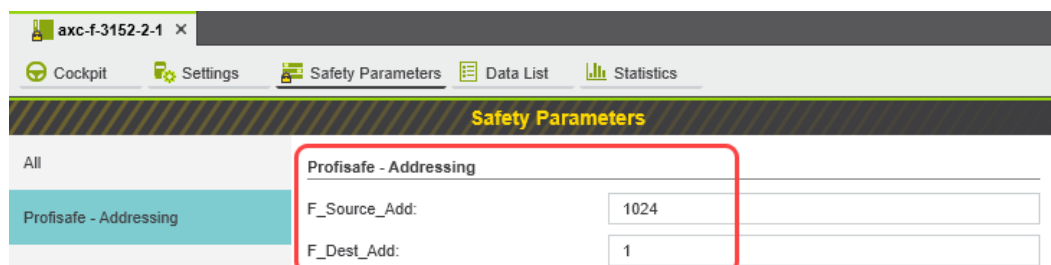


Figure 6-25 F-Address of the F-Host: F\_Source\_Add (F\_Source\_Address)

- In the “PROFIsafe Addressing” view, check the setting for the F\_Source\_Add F-Address. In the example, set F\_Source\_Add to “1024”. If necessary, adapt the value of F\_Source\_Add to your application.

An adjustable range of “1 ... 65534<sub>dec</sub>”, maximum, is permitted.

**F\_Destination\_Address (F\_Dest\_Add)**



When using the SPLC 1000 as an F-Host, an adjustable range of “1 ... 65534<sub>dec</sub>” maximum is permitted for the F-Addresses of the safety modules used (F\_Dest\_Add / F\_Destination\_Address). Please note the following points:

- Only assign F\_Dest\_Add values once.
- For safety modules from Phoenix Contact, you can set PROFIsafe destination addresses from 1 to 999<sub>dec</sub> maximum.
- For safety modules from other manufacturers, you can set PROFIsafe destination addresses from 1 to 65534<sub>dec</sub>.



**SPLC 1000 as the F-Device: Setting F-Dest\_Add**

If you are using the SPLC 1000 in your application as an F-Device, you can also set its F\_Dest\_Add in the “Safety Parameters” editor (see [Figure 6-25](#)).

- Only assign F\_Dest\_Add values once.
- For the SPLC 1000, you can set PROFIsafe destination addresses from 1 to 999<sub>dec</sub> maximum.

- Under the “Profinet (x)” and “AxioLine F (x)” nodes in the “PLANT” area, double-click on the subordinate node of the safety module whose F-Address you want to set.

The safety module editor group opens.

- Select the “Safety Parameters” editor.

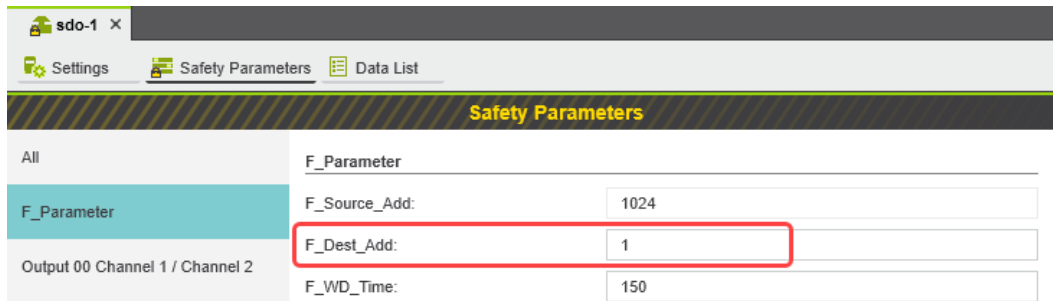


Figure 6-26 F-Address of the PROFIsafe F-Device: F\_Dest\_Add (F\_Destination\_Address)

- In the “F\_Parameter” view, check the setting for the F\_Dest\_Add F-Address.
- Set F\_Dest\_Add to the value that corresponds to the DIP switch setting of the safety module.
- In the example, set F\_Dest\_Add for the safety modules used to the following values:
  - “1” for the AXL F PSDO8/3 1F (see [Figure 6-26](#))
  - “2” for the AXL SE PSDO4/2 2A
  - “3” for the AXL SE PSDI8/3
- If necessary, adapt the F\_Dest\_Add values to your application.

An adjustable range of “1 ... 65534<sub>dec</sub>”, maximum, is permitted.

- Proceed as described above for other safety modules in your application.

### 6.9.2 Checking/setting safety parameters for configured F-Devices

For configured F-Devices, you must check and possibly set various safety parameters, depending on the safety function and safety integrity. Specifically, these are F-Address F\_Dest\_Add, watchdog time F\_WD\_Time, and the input/output parameters.



**WARNING: Safety and availability of the system/machine**

Select a suitable watchdog time F\_WD\_Time to ensure the safety and availability of your system/machine.

Select a watchdog time that is long enough to ensure the safety of your system/machine with maximum possible availability.



For further information on selecting the watchdog time, please refer to [Section 3.3](#) on [page 31](#).

1. Call up the safety parameters for the AXL F PSDO8/3 1F:
  - Under the “Profinet (x)” node in the “PLANT” area, double-click on the lower-level node of the safety module whose safety parameters you want to set (in the example in [Figure 6-27: AXL F PSDO8/3 1F](#)).

The safety module editor group opens.

- Select the “Safety Parameters” editor.

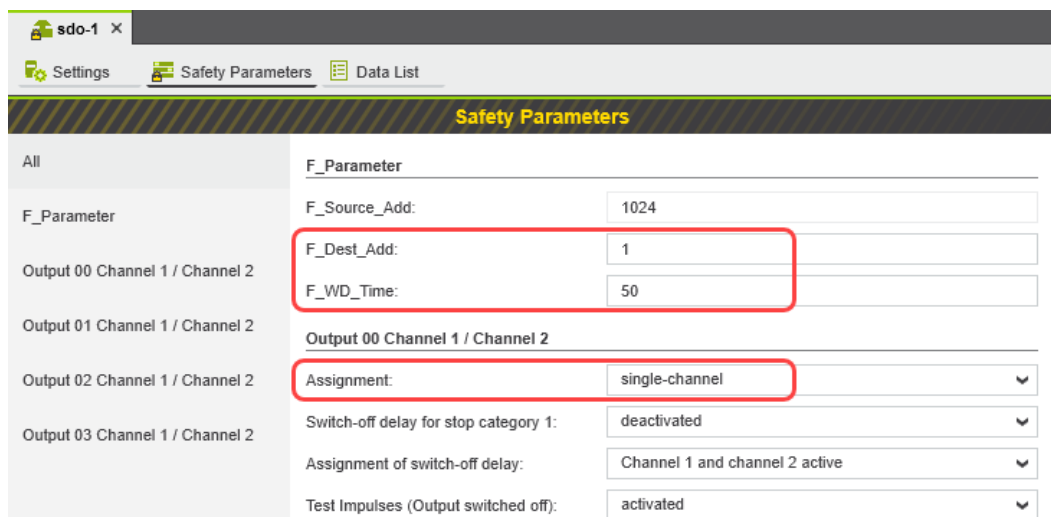


Figure 6-27 “Safety Parameters” editor: AXL F PSDO8/3 1F

2. Call up the safety parameters for the AXL SE PSDO4/2 2A:
  - Under the “Profinet (x)” node in the “PLANT” area, double-click on the lower-level node of the safety module whose safety parameters you want to set (in the example in [Figure 6-28: AXL SE PSDO4/2 2A](#)).

The safety module editor group opens.

- Select the “Safety Parameters” editor.

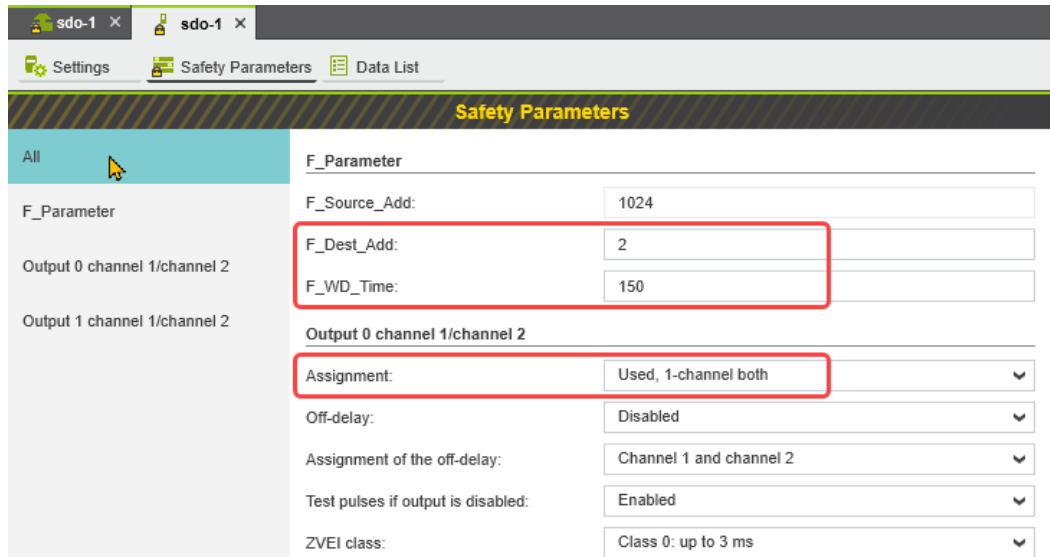


Figure 6-28 “Safety Parameters” editor: AXL SE PSDO4/2 2A

3. Call up the safety parameters for the AXL SE PSDI8/3:
  - Under the “Profinet (x)” node in the “PLANT” area, double-click on the lower-level node of the safety module whose safety parameters you want to set (in the example in [Figure 6-29: AXL SE PSDI8/3](#)).

The safety module editor group opens.

- Select the “Safety Parameters” editor.



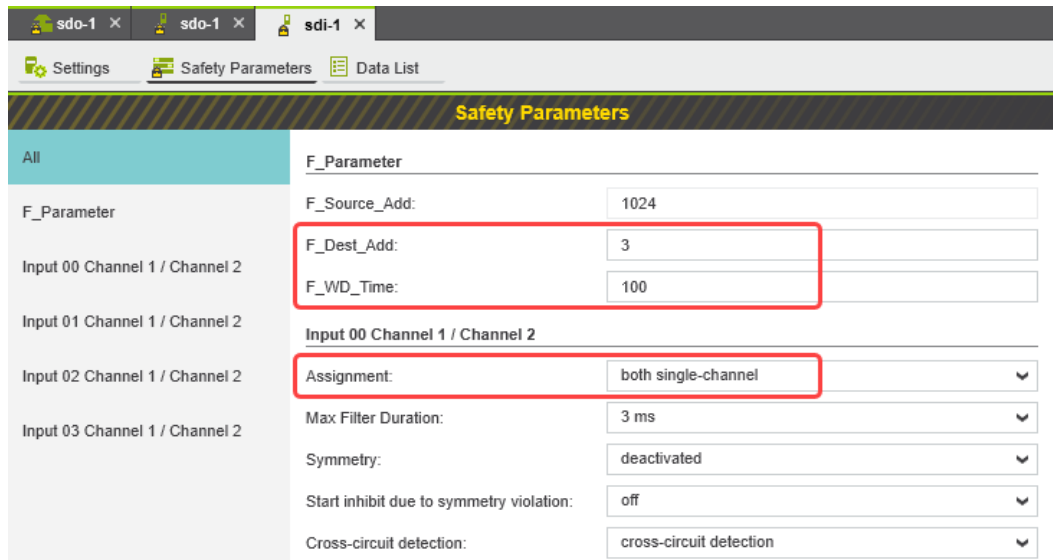


Figure 6-29 “Safety Parameters” editor: AXL SE PSDI8/3

4. Set the safety parameters:

- Set the required safety parameters.

In the example in the figures 6-27, 6-28, and 6-29, these values are as follows:

Table 6-2 Safety-related parameters in the example

| Value  | AXL F PSDO8/3 1F                       | AXL SE PSDO4/2 2A                             | AXL SE PSDI8/3                         |
|--|--|---|--|
| Figure   | <a href="#">Figure 6-27 on page 95</a> | <a href="#">Figure 6-28 on page 96</a>        | <a href="#">Figure 6-29 on page 97</a> |
| F-Address<br>F_Dest_Add                                  | 1                                      | 2   | 3                                      |
| Watchdog time<br>F_WD_Time                               | 50 ms                                  | 150 ms  | 100 ms                                 |
| Assignment of channels 1 and 2 for the inputs or outputs | Output 00:<br>single-channel           | Output 0:<br>assigned,<br>both single-channel | Input 00:<br>both single-channel       |

If necessary, adapt the settings to your application.

- Repeat the above safety parameter settings for each safety module used in your application.

### 6.9.3 Management/diagnostic variables for F-Devices

In PLCnext Engineer, you can specify whether management/diagnostic variables are to be created for F-Devices in the project.

One part of these management/diagnostic variables is created by default.

These non-safety-related variables support you in the reintegration of passivated F-Devices, for example.

For this purpose, you can define non-safety-related exchange variables in PLCnext Engineer. You then connect these exchange variables to corresponding management/diagnostic variables in the safety-related “S\_Main” POU (see [Section “Creating a safety-related program” on page 106](#)).



For further information on management/diagnostic variables, please refer to [“Management/diagnostic variables for each configured F-Device” on page 144](#) and [“Global management/diagnostic variables for F-Devices” on page 147](#).

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

The “/ Safety PLC” editor group opens.

- Select the “Settings” editor.

In the “Profisafe – device diagnostic variables” view, you can specify which management/diagnostic variables are to be generated for each F-Device configured in the project (see [Figure 6-30](#)).

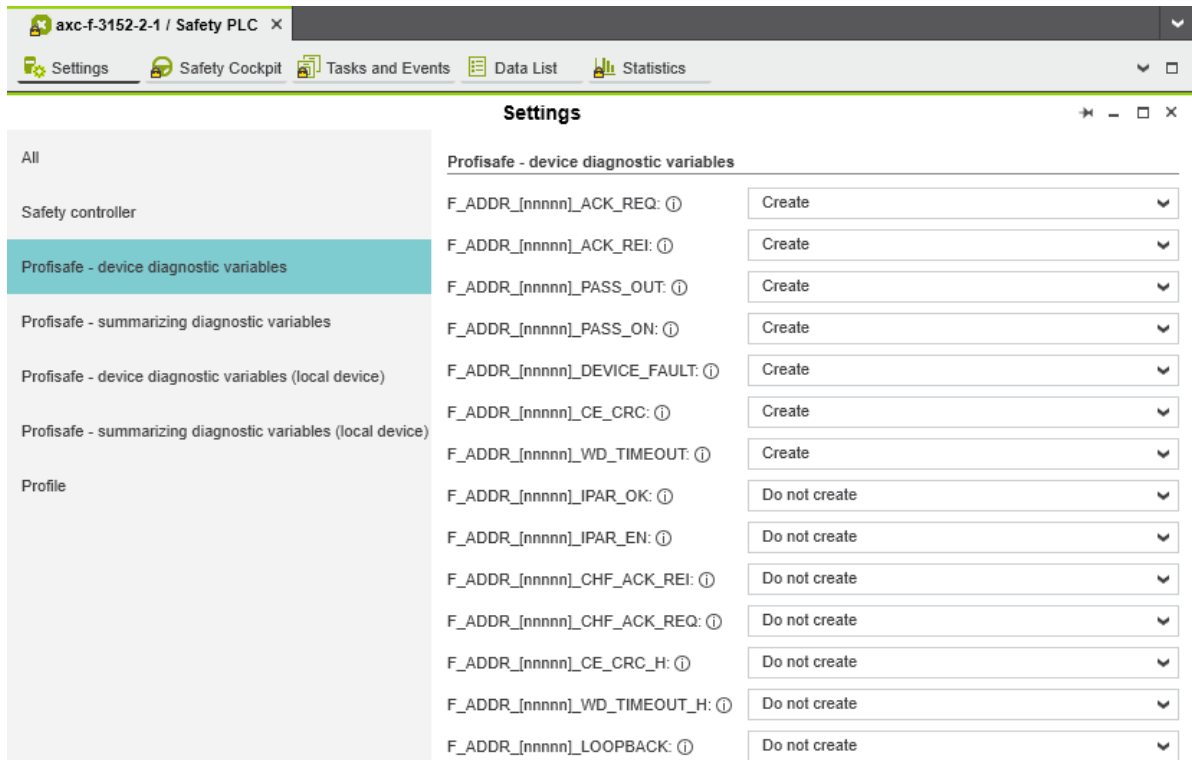


Figure 6-30 Management/diagnostic variables for each configured F-Device

In the “Profisafe – summarizing diagnostic variables” view, you can specify which management/diagnostic variables are to be globally generated once for all PROFIsafe F-Devices configured in the project (see [Figure 6-31](#)).

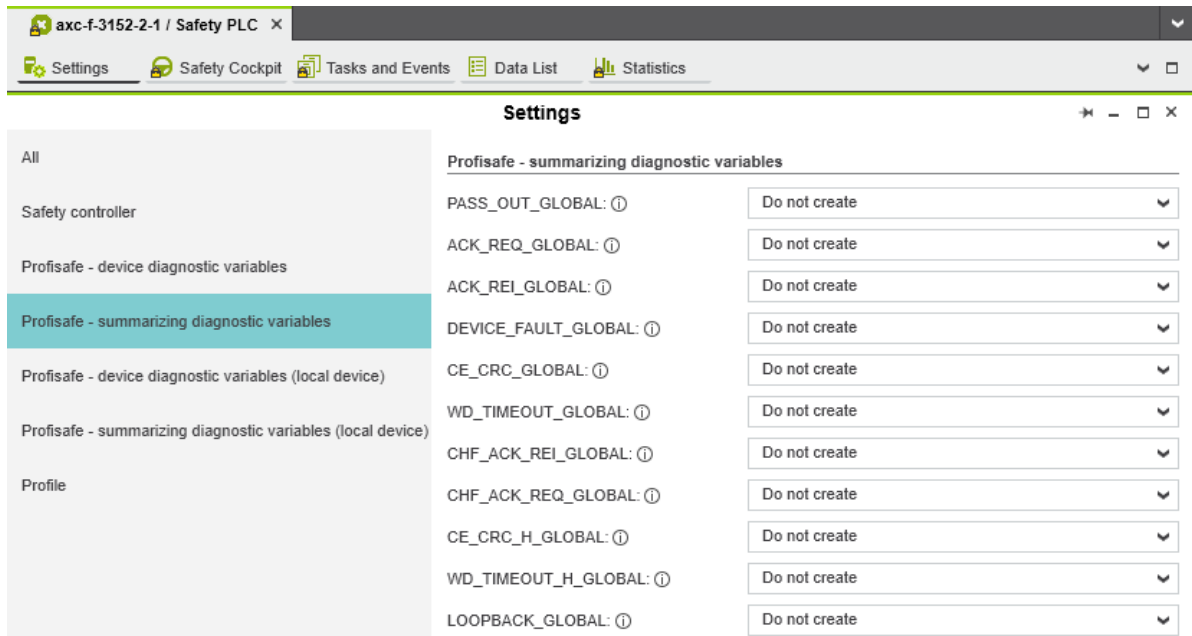


Figure 6-31 Management/diagnostic variables for all configured F-Devices

Created variables are displayed in the “Data List” editor of the controller node:

The screenshot shows the 'Data List' editor in PLCnext Engineer. The interface includes a top navigation bar with 'Cockpit', 'Settings', 'Safety Parameters', 'Data List', and 'Statistics'. Below the navigation bar is a toolbar with various icons for variable management. The main area contains a table with the following columns: Variable (PLC), Variable (Safety PLC), Type, Usage, I/Q/M, Comment, Init, and Confirm. The table lists 21 variables, all of type 'BOOL' and usage 'Global'. Each variable has an 'Init' value of 'FALSE' and a 'Confirm' column. The variables are organized into three groups based on device address: F\_ADDR\_00001, F\_ADDR\_00002, and F\_ADDR\_00003. Each group contains seven variables: ACK\_REI, ACK\_REQ, CE\_CRC, DEVICE\_FAULT, PASS\_ON, PASS\_OUT, and WD\_TIMEOUT.

| Variable (PLC)             | Variable (Safety PLC)     | Type | Usage  | I/Q/M | Comment | Init  | Confirm |
|----------------------------|---------------------------|------|--------|-------|---------|-------|---------|
| Select Variable (PLC) here | F_ADDR_00001_ACK_REI      | BOOL | Global | Q     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00001_ACK_REQ      | BOOL | Global | I     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00001_CE_CRC       | BOOL | Global | I     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00001_DEVICE_FAULT | BOOL | Global | I     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00001_PASS_ON      | BOOL | Global | Q     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00001_PASS_OUT     | BOOL | Global | I     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00001_WD_TIMEOUT   | BOOL | Global | I     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00002_ACK_REI      | BOOL | Global | Q     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00002_ACK_REQ      | BOOL | Global | I     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00002_CE_CRC       | BOOL | Global | I     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00002_DEVICE_FAULT | BOOL | Global | I     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00002_PASS_ON      | BOOL | Global | Q     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00002_PASS_OUT     | BOOL | Global | I     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00002_WD_TIMEOUT   | BOOL | Global | I     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00003_ACK_REI      | BOOL | Global | Q     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00003_ACK_REQ      | BOOL | Global | I     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00003_CE_CRC       | BOOL | Global | I     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00003_DEVICE_FAULT | BOOL | Global | I     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00003_PASS_ON      | BOOL | Global | Q     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00003_PASS_OUT     | BOOL | Global | I     |         | FALSE |         |
| Select Variable (PLC) here | F_ADDR_00003_WD_TIMEOUT   | BOOL | Global | I     |         | FALSE |         |

Figure 6-32 Management/diagnostic variables of F-Devices (default)

For the three F-Devices used in the example, PLCnext Engineer creates 21 management/diagnostic variables by default.

### 6.9.4 Creating variables (exchange variables)

To exchange data between a standard controller and safety-related PLC, you can define “exchange variables” in PLCnext Engineer. These exchange variables are of a non-safety-related data type.

The aim is to link the created exchange variables with specific management/diagnostic variables described in [Section 6.9.3](#).



#### Data direction for exchange variables

A data direction must be specified for exchange variables. The data direction determines whether the variable can be read (“I” data direction) or written (“Q” data direction) by the safety-related application. Depending on the set data direction, the standard application has write or read access to the respective variable.

1. In PLCnext Engineer, first create the “Exchange” variable group as shown in [Figure 6-33](#) once you have opened the “PLC” node in the “PLANT” area.
2. Next, create 4 variables for each F-Device used in the “Variable (PLC)” column in this group.
3. Then, in the “Variable (Safety PLC)” column, create the corresponding non-safety-related exchange variables.  
These exchange variables are assigned to the safety-related PLC.
4. Finally, set the data direction of the exchange variables.

In the example in [Figure 6-33](#), the 4 variables/exchange variables will be created for the AXL SE PSDI8/3 F-Device.

| Variable (PLC)           | Variable (Safety PLC) | Process data item             | HMI tag | Function |
|--------------------------|-----------------------|-------------------------------|---------|----------|
| Exchange                 |                       |                               |         |          |
| AXLSE_PSDI_ACK_REQ       | AXLSE_PSDI_ACK_REQ    | Select Process data item here |         |          |
| AXLSE_PSDI_ACK_REI       | AXLSE_PSDI_ACK_REI    | Select Process data item here |         |          |
| AXLSE_PSDI_PASS_OUT      | AXLSE_PSDI_PASS_OUT   | Select Process data item here |         |          |
| AXLSE_PSDI_PASS_ON       | AXLSE_PSDI_PASS_ON    | Select Process data item here |         |          |
| Enter variable name here |                       |                               |         |          |

Figure 6-33 Exchange variables in the example

- Double-click on the “PLC” node in the “PLANT” area.  
The “/ PLC” controller editor group opens.
- Select the “Data List” editor.
- Click on the button to generate a new variable group.
- Rename the new variable group to “Exchange”, for example.
- Enter the names of the variables in the “Variable (PLC)” column in turn as shown in [Figure 6-33](#).
- In the “Variable (Safety PLC)” column, select “Add Variable (Safety PLC)” in the context menu for each variable you created earlier in turn (see [Figure 6-34](#)).

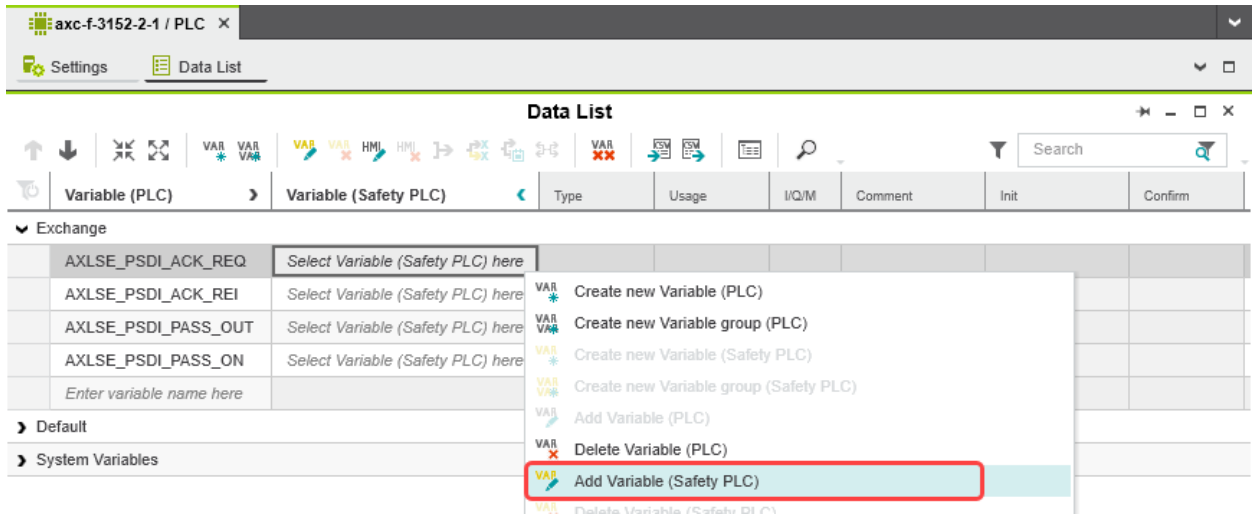


Figure 6-34 “Add Variable (Safety PLC)” context menu

After you have created the exchange variables, you need to specify the data direction (I/Q).

**Data direction**

Set the data direction for the exchange variables. Refer to the information provided at the start of this section on [page 101](#).

- Set the data direction in turn for each variable created earlier as shown in [Figure 6-35](#).

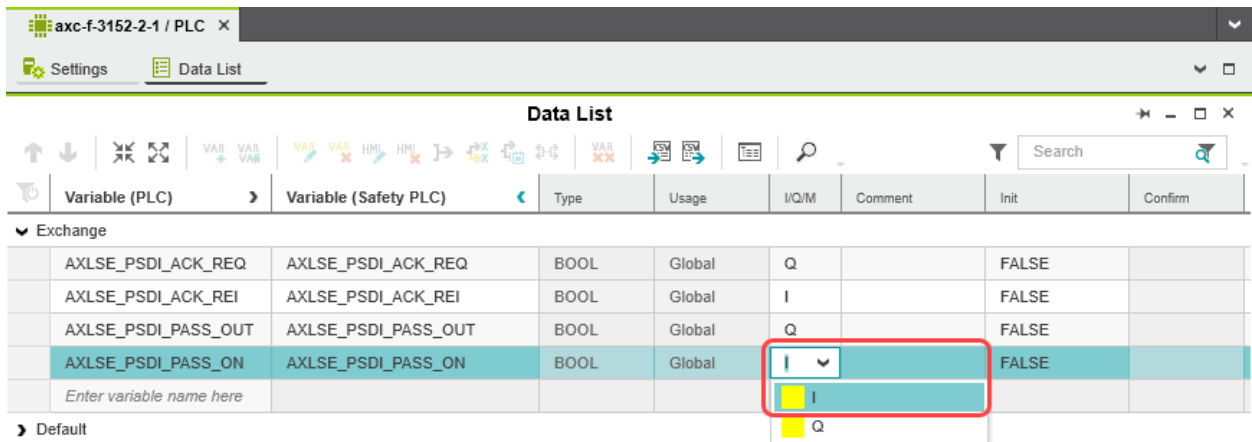


Figure 6-35 Setting the data direction

## 6.9.5 Opening a safety-related POU



For further information on opening and creating POU's, please refer to [Section "Creating a POU" on page 90](#).

For detailed notes on operating the PLCnext Engineer software, please refer to the online help for the software.

When you create a project, a POU with the name "S\_Main" is created automatically for safety-related controllers in the "COMPONENTS" area under "Programs" (see [Figure 6-23 on page 91](#)).

- Click on "Programming (x)" in the "COMPONENTS" area.
- Then click on the arrow next to "Local (x)", then on "Programs (x)".
- Double-click on the desired safety-related POU (in the example: "S\_Main" program).

The editor group for the selected POU opens.

### 6.9.6 Creating safety-related variables

**Variables in the example project**

The following table lists the safety-related variables used in the safety-related example program.

Table 6-3 Input/output variables in the example

| Parameter | Variable name   | Data type | Use      | Description   |
|-----------|-----------------|-----------|----------|---|
| IN1       | AXLSE_PSDI_IN1  | SAFEBOOL  | External | AXL SE PSDI8/3:<br>Input 0 channel 1 (IN0_CH1)<br>PD: sdi-1 / IN0 CH1/2                                   |
| IN2       | AXLSE_PSDI_IN2  | SAFEBOOL  | External | AXL SE PSDI8/3:<br>Input 0 channel 2 (IN0_CH2)<br>PD: sdi-1 / IN0 CH2                                     |
| OUT1      | AXLSE_PSDO_OUT1 | SAFEBOOL  | External | AXL SE PSDO4/2 2A:<br>Output 0 channel 1 (OUT0_CH1)<br>PD: sdo-1 / OUT00 CH1/2                            |
| OUT2      | AXLSE_PSDO_OUT2 | SAFEBOOL  | External | AXL SE PSDO4/2 2A:<br>Output 0 channel 1 (OUT0_CH2)<br>PD: sdo-1 / OUT00 CH2                              |
| OUT3      | AXLF_PSDO_OUT   | SAFEBOOL  | External | AXL F PSDO8/3 1F:<br>Output 0 channel 1 (OUT0_CH1)<br>PD: axl-f-bk-pn-tps-1 / sdo-1 / sdo-1 / OUT00 CH1/2 |

Key: PD = Process Data element in PLCnext Engineer

- Select the “Variables” editor.
- Create the variables that you need for the selected POU (in the example in [Figure 6-36: S\\_Main](#)).
- Set the type and use for all created variables.

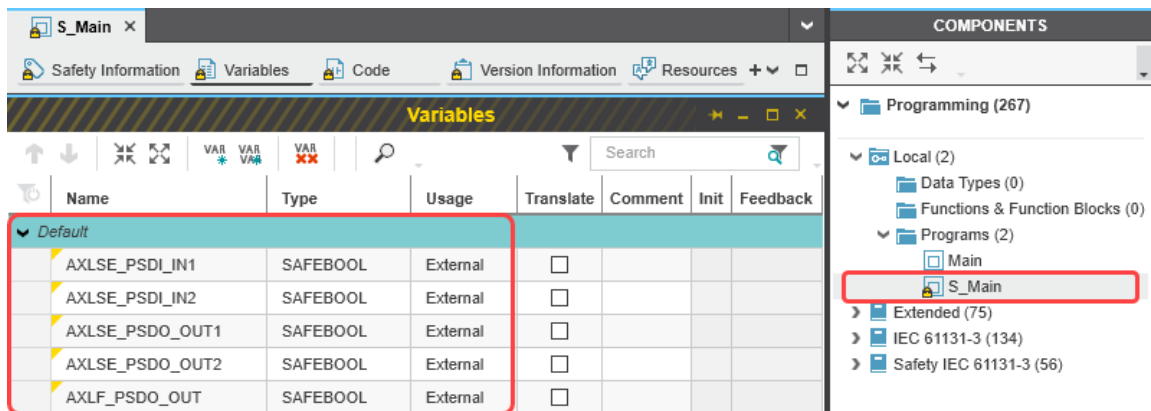


Figure 6-36 Creating variables for a POU (in the example: for the “S\_Main” POU)

**Selecting diagnostic/management variables and exchange variables**

Before the diagnostic/management variables and exchange variables that you created earlier can be used in the code worksheet, you must select these variables in the variables worksheet.

- Select the “Variables” editor.
- Open the selection list by clicking on the arrow in the “Name” field (see [Figure 6-37](#)).



- Select the “Safety PLC”.
- Select the corresponding variable on the right-hand side of the window.
- Repeat this step for all the diagnostic/management variables and exchange variables shown in [Figure 6-37](#).

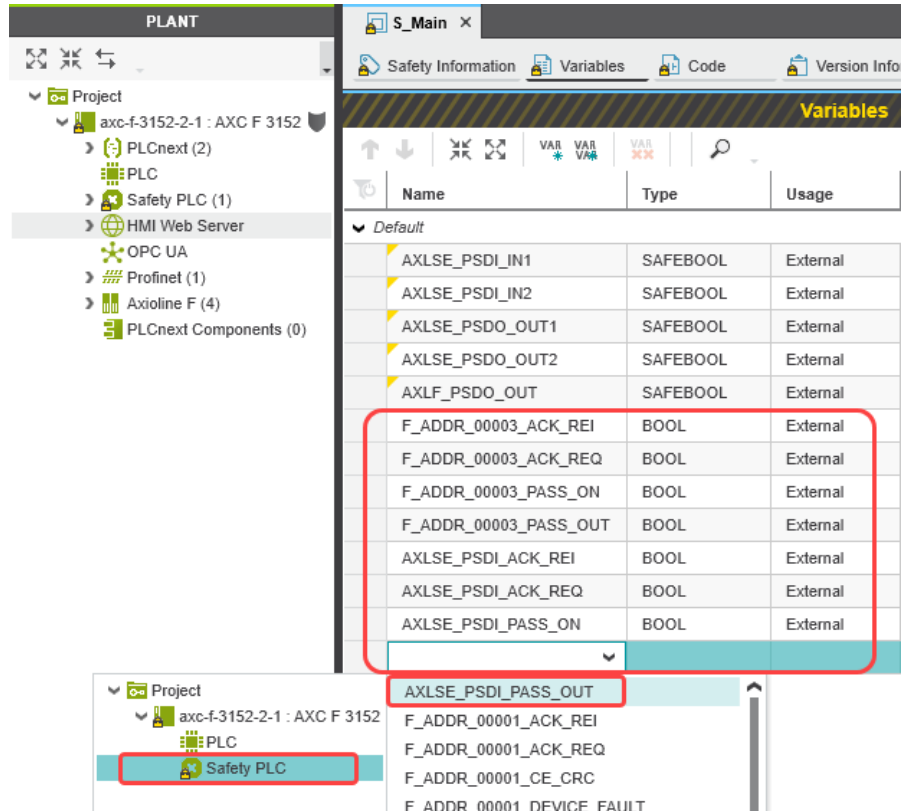


Figure 6-37 Selecting diagnostic/management variables

Once you have created all of the necessary variables, create the program for the selected POU, see [Section 6.9.7](#).

## 6.9.7 Creating a safety-related program

### Safety-related example program

The safety-related example program in [Figure 6-38 on page 107](#) includes the following functions:

- In the first part of the example, two inputs of the safety-related AXL SE PSDI8/3 input module are linked to two outputs of the safety-related AXL SE PSDO4/2 2A.
- In the second part of the example, two inputs of the safety-related AXL SE PSDI8/3 input module are linked with AND logic via the safety-related AND\_S function block. The result will be linked to an output of the safety-related AXL F PSDO8/3 1F output module.
- In the third part of the example, exchange variables for the safety-related AXL SE PSDI8/3 input module from the “Exchange” variable group will be linked with the diagnostic/management variables. In the example, the passivation of an F-Device will be canceled via the variables with an operator acknowledge request and subsequent operator acknowledge reintegration (see [Section “Operator acknowledge” on page 118](#)).

The input/output variables are connected to process data in due course.

### Creating a program

To create a program, proceed as follows:

- Select the code editor.

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

- Create the program as shown in [Figure 6-38 on page 107](#).

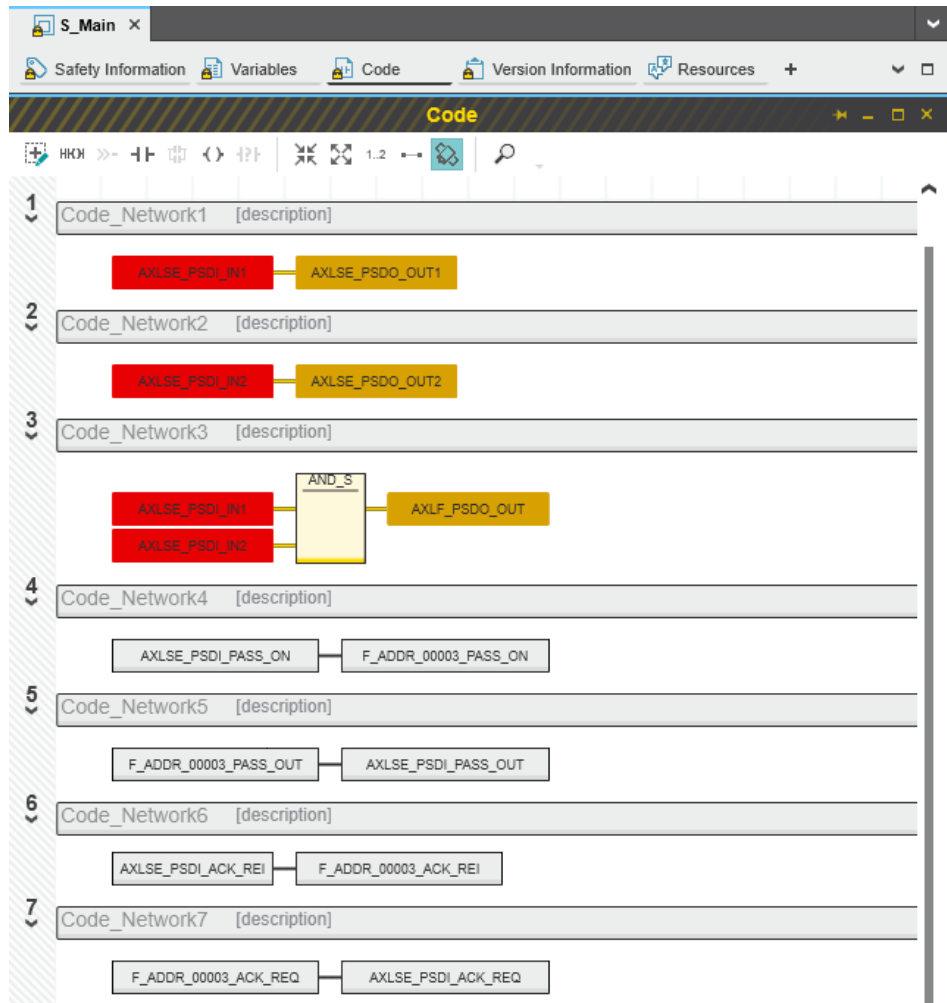


Figure 6-38 Safety-related example program with errors displayed

The errors and warnings shown in Figure 6-38 on page 107 (color-coded input and output variables in networks 1 to 3) are due to the fact that no process data has yet been assigned to these variables. You will execute this step in the following section.

| ERROR LIST |          |   |
|------------|----------|---|
| Search     |          |   |
|            | Code     | Description   |
| ✖          | SSEM0016 | The variable 'AXLSE_PSDI_IN1' is read before written.                           |
| ✖          | SSEM0016 | The variable 'AXLSE_PSDI_IN2' is read before written.                           |
| ⚠          | SSEM0020 | The global variable 'AXLSE_PSDI_IN1' is used within a single POU. Consider to t |
| ⚠          | SSEM0020 | The global variable 'AXLSE_PSDI_IN2' is used within a single POU. Consider to t |
| ⚠          | SSEM0019 | The variable 'AXLSE_PSDO_OUT1' is written but not read.                         |
| ⚠          | SSEM0019 | The variable 'AXLSE_PSDO_OUT2' is written but not read.                         |
| ⚠          | SSEM0019 | The variable 'AXLF_PSDO_OUT' is written but not read.                           |

Figure 6-39 Error list

### 6.9.8 Assigning safety-related process data

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

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

The “Safety PLC (x)” controller editor group opens.

- Select the “Data List” editor.

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

- In the “Process data item” column, use the role picker to assign the corresponding process data to all variables (see marking in section [Figure 6-41](#)).

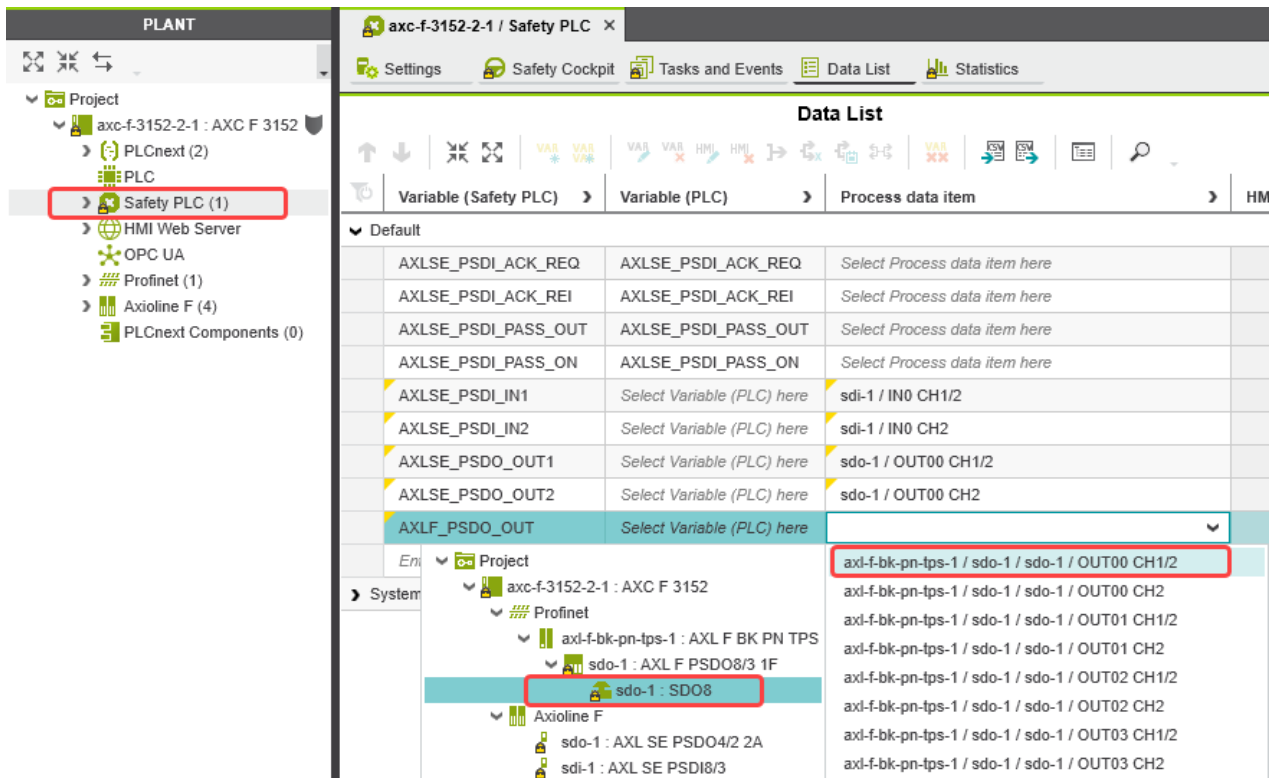


Figure 6-40 Assigning safety-related process data

The following figure shows all safety-related variables created and the assigned process data:

| Variable (Safety PLC) | Variable (PLC)             | Process data item                               | I/Q | Type | Offset |
|-----------------------|----------------------------|---|-----|------|--------|
| AXLSE_PSDI_ACK_REQ    | AXLSE_PSDI_ACK_REQ         | Select Process data item here                   |     |      |        |
| AXLSE_PSDI_ACK_REI    | AXLSE_PSDI_ACK_REI         | Select Process data item here                   |     |      |        |
| AXLSE_PSDI_PASS_OUT   | AXLSE_PSDI_PASS_OUT        | Select Process data item here                   |     |      |        |
| AXLSE_PSDI_PASS_ON    | AXLSE_PSDI_PASS_ON         | Select Process data item here                   |     |      |        |
| AXLSE_PSDI_IN1        | Select Variable (PLC) here | sdi-1 / IN0 CH1/2                               | I   | BOOL | 0.0    |
| AXLSE_PSDI_IN2        | Select Variable (PLC) here | sdi-1 / IN0 CH2                                 | I   | BOOL | 0.1    |
| AXLSE_PSDO_OUT1       | Select Variable (PLC) here | sdo-1 / OUT00 CH1/2                             | Q   | BOOL | 0.0    |
| AXLSE_PSDO_OUT2       | Select Variable (PLC) here | sdo-1 / OUT00 CH2                               | Q   | BOOL | 0.1    |
| AXLF_PSDO_OUT         | Select Variable (PLC) here | axl-f-bk-pn-tps-1 / sdo-1 / sdo-1 / OUT00 CH1/2 | Q   | BOOL | 0.0    |

Figure 6-41 Safety-related variables: Process data assigned

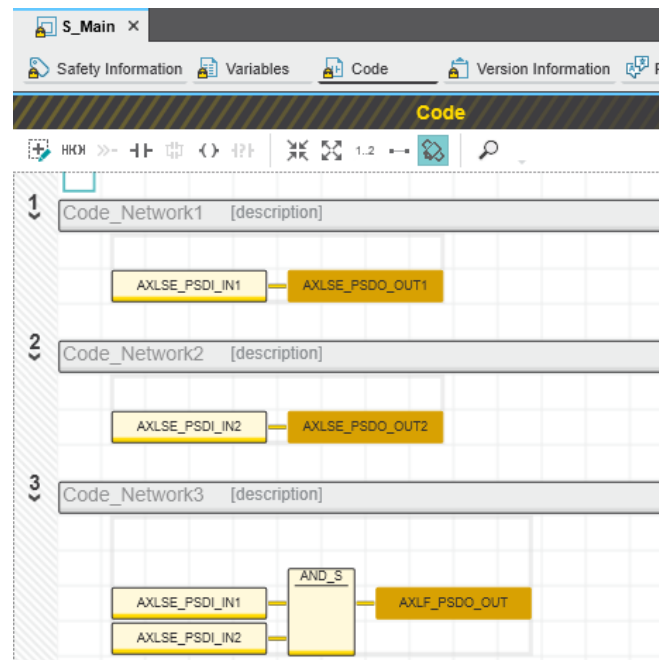


Figure 6-42 Safety-related program without errors


## 6.10 Transferring projects to the PLCnext Control device and SPLC 1000 and displaying online values

### 6.10.1 Transferring a non-safety-related project to the PLCnext Control

To transfer the project to the AXC F 3152 (standard controller), proceed as follows:

- Double-click 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)”)



#### User authentication

If necessary, refer to the note on user authentication in [Section 6.6.4](#).

- If necessary, enter the user name and password in the dialog that opens.

The non-safety-related project will be compiled and transferred to the controller. Project execution will be initiated.

If the non-safety-related commissioning has been completed successfully, the controller changes to the RUN state, indicated by the RUN LED continuously lit green.

The following information is displayed in the “Cockpit” editor:

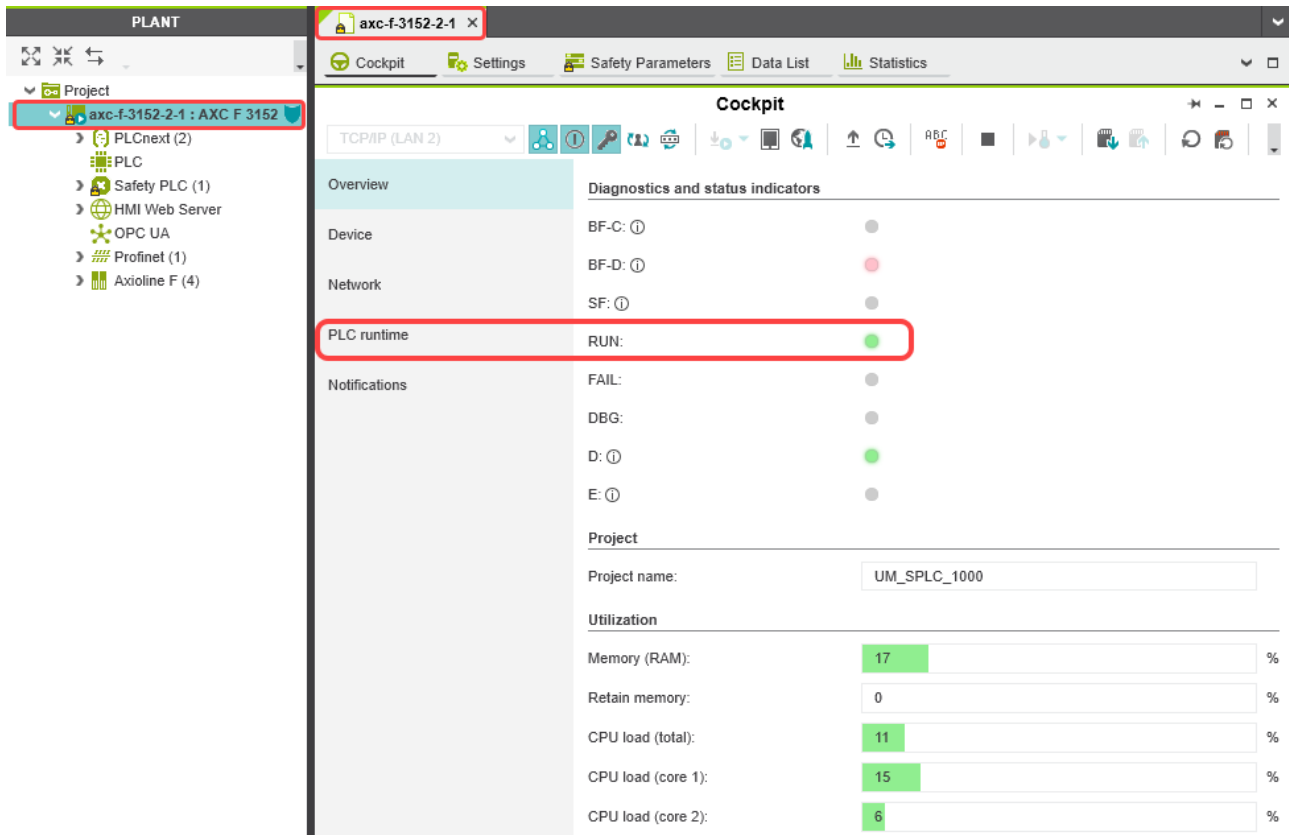


Figure 6-43 Controller in the “RUN” state

If the system cannot be commissioned, for example due to an installation error, a corresponding error message appears in PLCnext Engineer.

The LEDs on the controller indicate this status. Read further information on the controller diagnostics and status indicators in the UM EN AXC F X152 user manual.




The SPLC 1000 is in the safe state (Failure State) because so far, a safety-related project has not been transferred to the SPLC 1000.

### 6.10.2 Transferring a safety-related project to the SPLC 1000 (specifying a controller password if necessary)

To transfer the project to the SPLC 1000, proceed as follows:

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

The “Safety PLC” editor group opens.

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



**User authentication**

If necessary, refer to the note on user authentication in [Section 6.6.4](#).

- If necessary, enter the user name and password in the dialog that opens.

**Specifying the SPLC 1000 controller password**

The SPLC 1000 is protected by a controller password. Writing data to the SPLC 1000 or changing its operating mode is only possible after entering the controller password in PLCnext Engineer.

If this is the first time you are establishing a connection to the SPLC 1000, PLCnext Engineer will prompt you to specify a controller password.

- Specify a controller password, if you have not already done so, and the following dialog will be displayed.

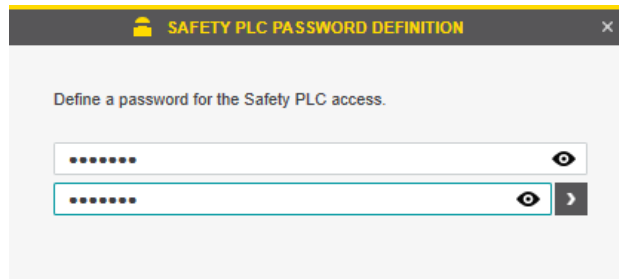


Figure 6-44 Controller password: entering the SPLC 1000 password



**Please note: read information dialogs carefully and follow the instructions provided**

If information dialogs appear, please refer to the online help for the PLCnext Engineer software for further information.

- Acknowledge the messages in accordance with your application.

In the example:

Make sure no hazard is posed when the SPLC 1000 is started and/or stopped, e.g., after downloading a project.

Ensure the safety function is in order.



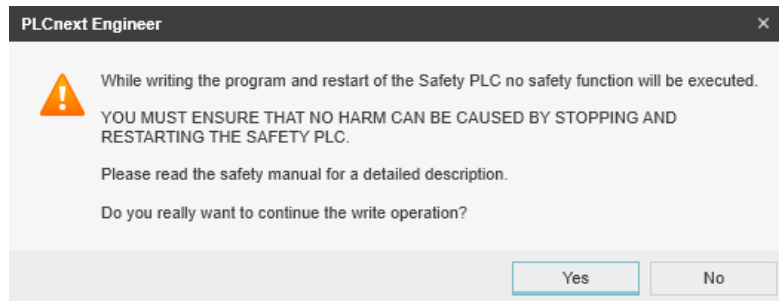


Figure 6-45 Info dialog: Avoid any hazard posed when starting and stopping the SPLC 1000

The project will be compiled and transferred to the SPLC 1000. Execution of the safety-related project will be initiated and the SPLC 1000 switches to the "RUN" state.

If commissioning was successful, the RUN LED is continuously lit green.

The following information is displayed in the “Safety Cockpit” editor:

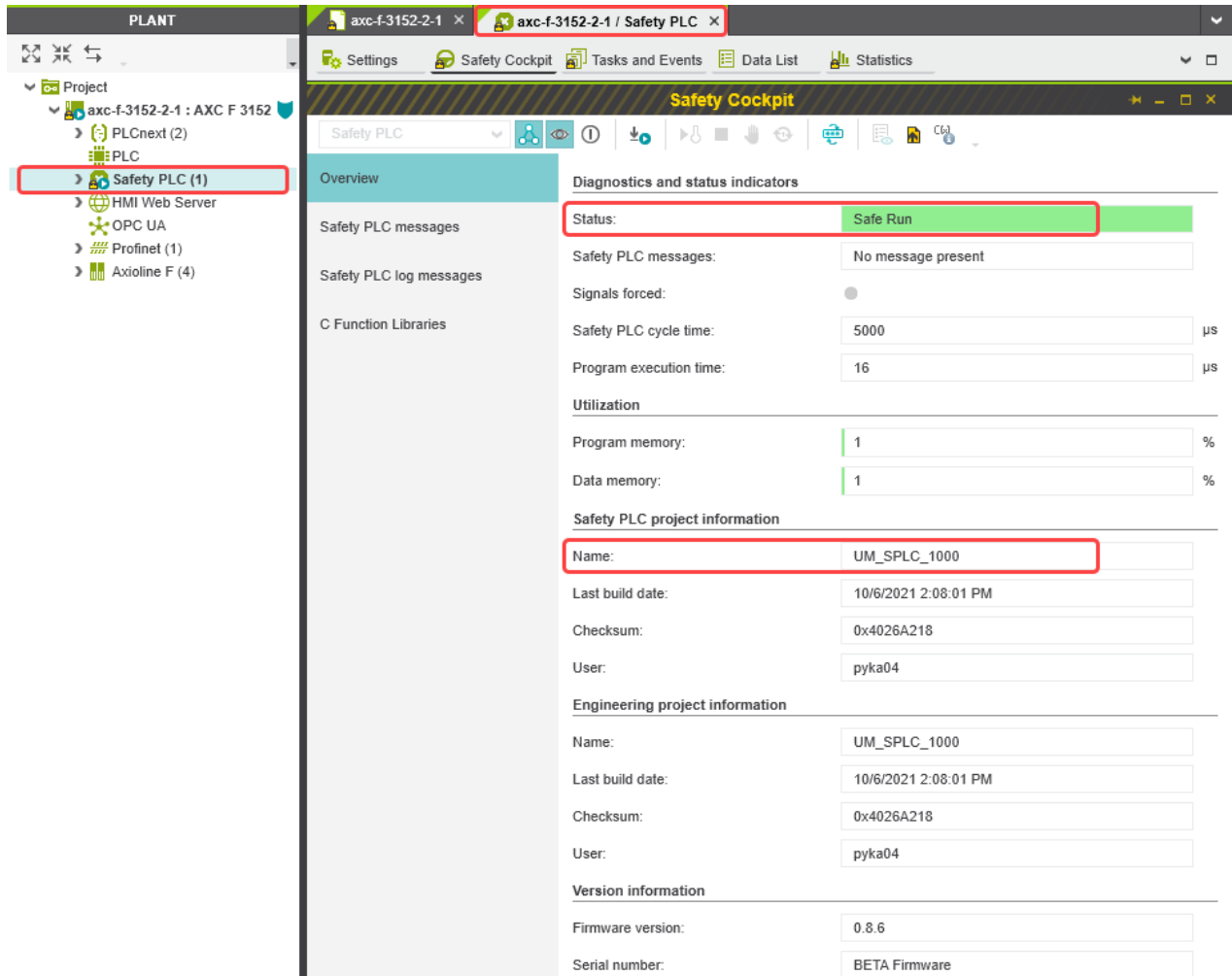


Figure 6-46 Safety Cockpit: SPLC 1000 in the “RUN” state – Safe Run

If the system cannot be commissioned, for example due to an installation error, a corresponding error message appears in PLCnext Engineer.

The LEDs on the SPLC 1000 indicate this status (see [Section “Diagnostic and status indicators” on page 47](#)).

### 6.10.3 Displaying safety-related online values



To view online variable values, you must have:

- Successfully compiled both projects (non-safety-related and safety-related)
- Transferred the non-safety-related project to the standard controller
- Transferred the safety-related project to the SPLC 1000
- Started both projects (non-safety-related and safety-related) without errors
- Connected the PLCnext Engineer online to the SPLC 1000 and the standard controller.

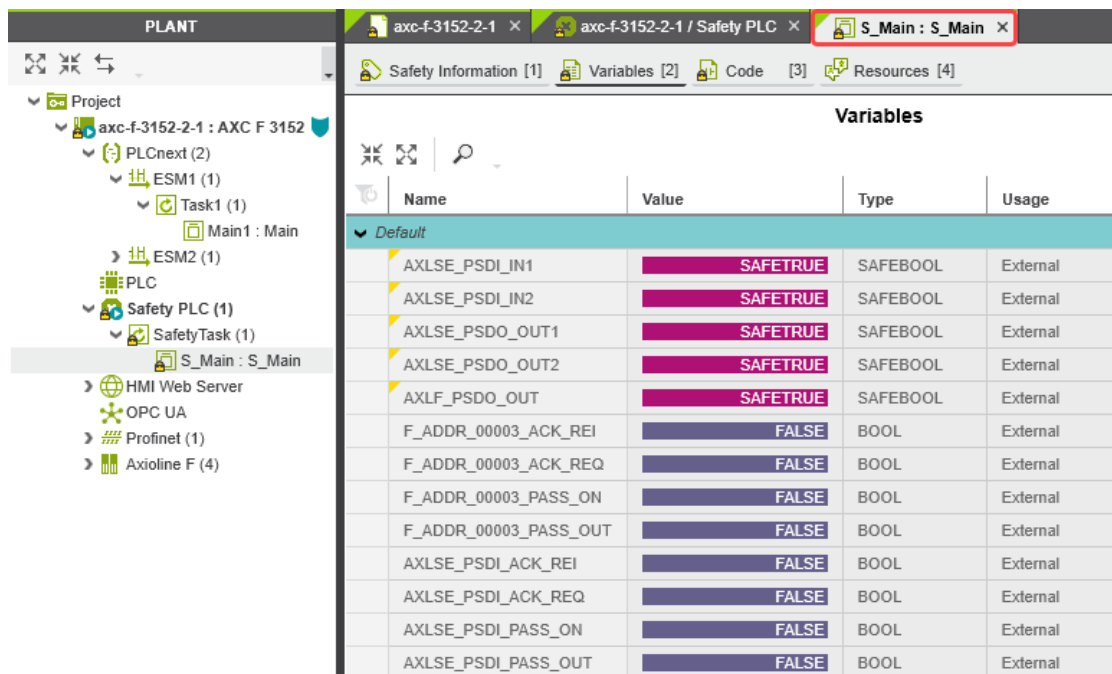
Proceed as follows:

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

The “Safety PLC” editor group opens.

- Select the “Safety Cockpit” editor.
- Click on the  button (“Connect to the controller to establish communication with online services.”).
- Click on the  button (“Enables or disables the monitoring mode for safety-related editors to see online values.”).
- Open the instance editor of the “S\_Main” POU by double-clicking on the “S\_Main : S\_Main” node.

The online values of the variables used in the “S\_Main” POU are displayed in the “Variables” and “Code” editors.



| Name                  | Value    | Type     | Usage    |
|-----------------------|----------|----------|----------|
| ▼ Default             |          |          |          |
| AXLSE_PSDI_IN1        | SAFETRUE | SAFEBOOL | External |
| AXLSE_PSDI_IN2        | SAFETRUE | SAFEBOOL | External |
| AXLSE_PSDO_OUT1       | SAFETRUE | SAFEBOOL | External |
| AXLSE_PSDO_OUT2       | SAFETRUE | SAFEBOOL | External |
| AXLF_PSDO_OUT         | SAFETRUE | SAFEBOOL | External |
| F_ADDR_00003_ACK_REI  | FALSE    | BOOL     | External |
| F_ADDR_00003_ACK_REQ  | FALSE    | BOOL     | External |
| F_ADDR_00003_PASS_ON  | FALSE    | BOOL     | External |
| F_ADDR_00003_PASS_OUT | FALSE    | BOOL     | External |
| AXLSE_PSDI_ACK_REI    | FALSE    | BOOL     | External |
| AXLSE_PSDI_ACK_REQ    | FALSE    | BOOL     | External |
| AXLSE_PSDI_PASS_ON    | FALSE    | BOOL     | External |
| AXLSE_PSDI_PASS_OUT   | FALSE    | BOOL     | External |

Figure 6-47 “Variables” editor (S\_Main): Online values of the variables used

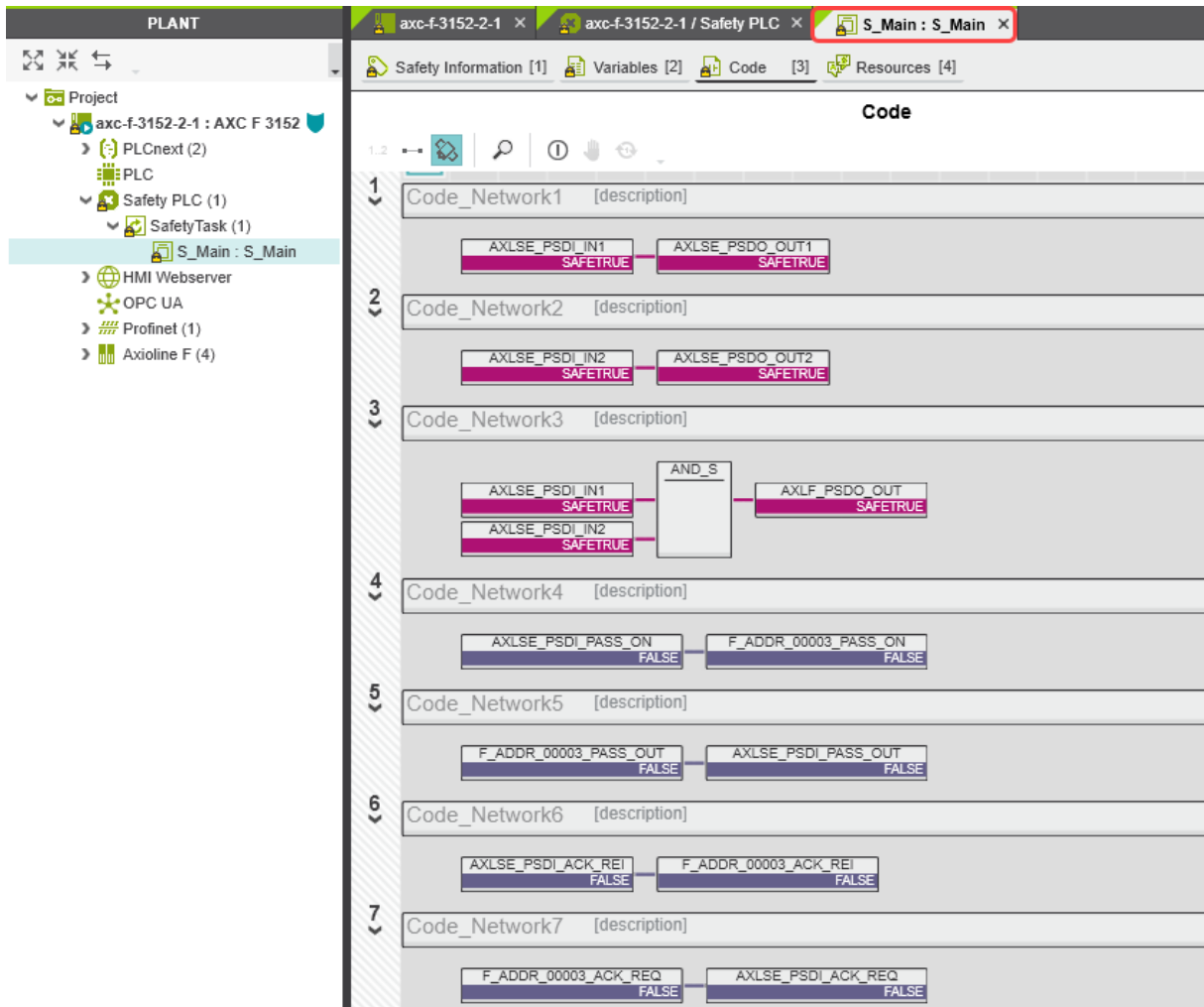




Figure 6-48 "Code" editor (S\_Main): Online values of the variables used

## 6.11 PLCnext Engineer – Debug mode

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

The “Safety PLC” editor group opens.

- Select the “Safety Cockpit” editor.
- Click on the  button (“Connect to the controller to establish communication with online services.”).
- To enable debug mode, click on the  button (“Enables or disables the debug mode at the safety-related PLC.”).



### WARNING:

Switching to debug mode means that you will exit normal mode.

Make sure that your system/machine cannot pose a hazard to people or equipment.

- Acknowledge the following message to switch to debug mode.

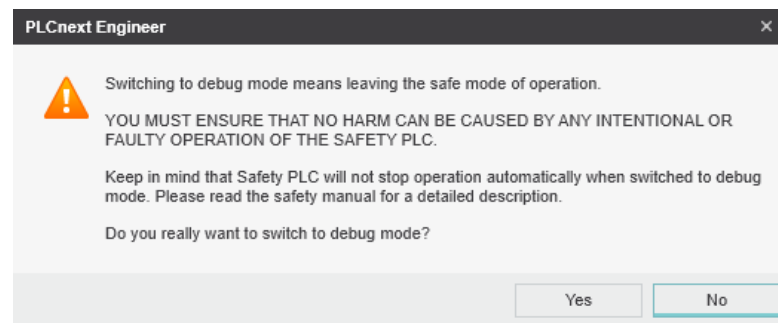


Figure 6-49 Exiting safe mode – switching to debug mode

The device LEDs indicate debug mode in the following way:

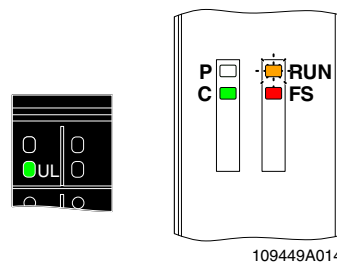



Figure 6-50 LEDs in debug mode



Refer to [Section “Diagnostic and status indicators” on page 47](#) for additional information on the LEDs.

- To disable debug mode and switch to safe mode, click on the  button.



**WARNING:**  
Make sure that your system/machine cannot pose a hazard to people or equipment.

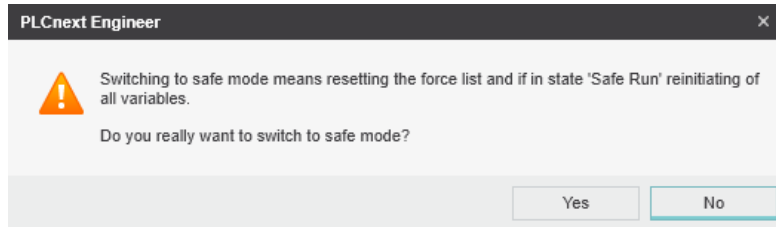


Figure 6-51 Exiting debug mode – switching to safe mode

## 6.12 Operator acknowledge

F-Devices whose communication relationship with the SPLC 1000 is aborted, for example due to a communication error, are passivated. Passivated F-Devices indicate this with the `F_ADDR_XXXXX_PASS_OUT` diagnostic/management variable.

To request reintegration immediately upon re-establishment of the communication relationship between the F-Device and F-Host, the F-Devices generate an operator acknowledge request. This is displayed with the `F_ADDR_XXXXX_ACK_REQ` diagnostic/management variable. This operator acknowledge request is acknowledged via an operator acknowledge reintegration (`F_ADDR_XXXXX_ACK_REI`).



**WARNING: Outputs can be set**  
Do not acknowledge an operator acknowledge request automatically from the application program. Acknowledgment must be triggered by an intentional user action.  
When reintegrating passivated PROFIsafe devices, safety-related outputs can be set. Take appropriate measures to ensure that your system/machine does not present any danger when passivated PROFIsafe devices are reintegrated.

In the following example, the communication relationship between the AXL SE PSDI8/3 F-Device and the SPLC 1000 is broken. The subsequent passivation of the F-Device prevents it from starting up again immediately once the communication relationship is re-established. This passivation is indicated by the Boolean diagnostic/management variable `F_ADDR_00003_PASS_OUT`.

Once the communication relationship has been re-established successfully, the passivated F-Device signals an operator acknowledge request via the Boolean diagnostic/management variable `F_ADDR_00003_ACK_REQ`. The F-Device thus waits for a reintegration acknowledgement.

Setting the Boolean exchange variable `AXLSE_PSDI_ACK_REI` in the non-safety-related part of the example program cancels the passivation of the F-Device. As a result, the F-Device can be reintegrated into the network and can re-establish the communication relationship.

The following [Figure 6-52](#) shows the passivated AXL SE PSDI8/3 F-Device.

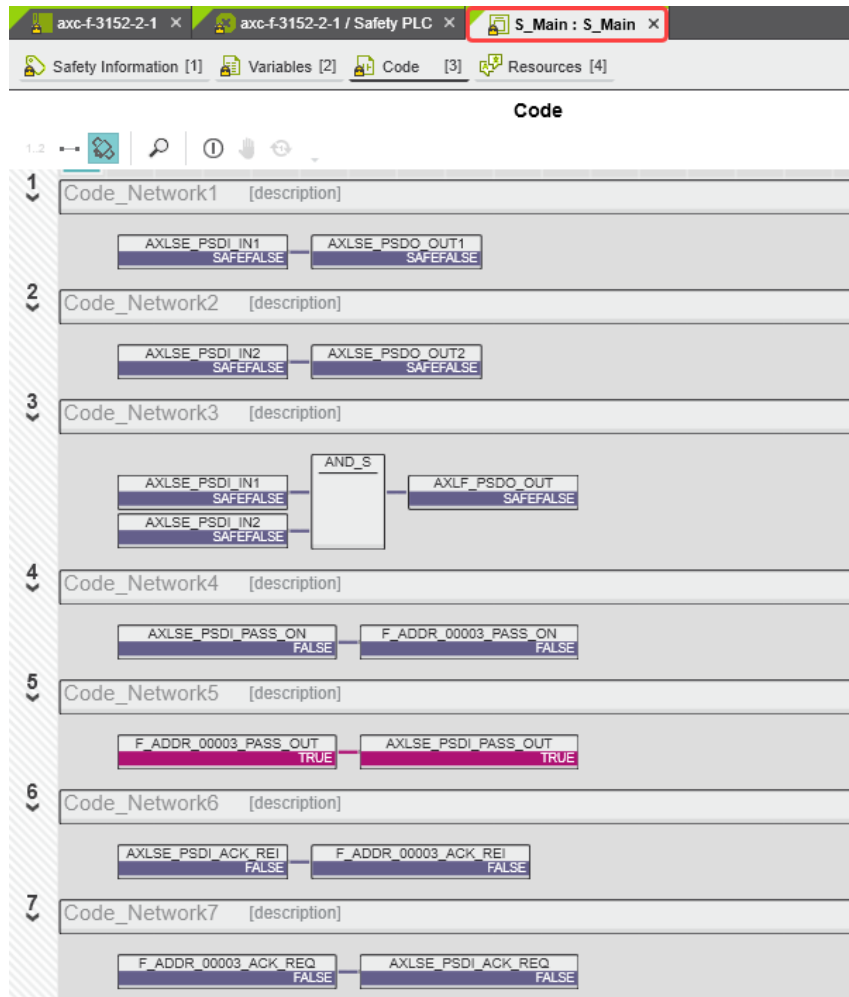


Figure 6-52 PLCnext Engineer – Passivated PROFIsafe F-Devices

In the example in [Figure 6-52](#), the safe inputs and outputs have entered the SAFEFALSE state. This behavior is due to the passivation of the F-Device.





## 7 Errors: Diagnostics, messages, and removal

The SPLC 1000 diagnostics and troubleshooting mechanisms are described in the following sections.



You will find further information on diagnostics for, among others, PLCnext Technology, Axioline F and PROFINET online at the listed addresses, in the listed user manuals, and in the PLCnext Engineer online help function:

- PLCnext Community at [plcnext-community.net](http://plcnext-community.net) and in particular in the [PLCnext Info Center](#)
- “Installing, commissioning, and operating the AXC F 1152, AXC F 2152, and AXC F 3152 controllers” (UM EN AXC F X152)
- “Axioline F: Diagnostic registers and error messages” (UM EN AXL F SYS DIAG).

### 7.1 Diagnostics for F-Devices

PROFIsafe provides comprehensive diagnostic mechanisms that are defined in the PROFIsafe specification. For information on the PROFIsafe specification, please refer to [Section “Documentation” on page 166](#).

Diagnostic messages for F-Devices are available as follows:

- Entries in the Notification Logger (Notification Manager)
- PROFIsafe-specific system variables in PLCnext Engineer (can be accessed in the application program, see [Section 8.3 on page 135](#))



Refer to the device-specific user documentation for the F-Devices being used.

### 7.2 Diagnostics for SPLC 1000

The diagnostic and monitoring function integrated in the SPLC 1000 detects errors that have occurred. All serious errors detected in the SPLC 1000, which can lead to the loss of or adversely affect the programmed safety function, switch the device to the failure state. In this state, the outputs of the F-Devices are set to zero after the parameterized F\_WD\_TIME for the relevant output has elapsed at the latest. The PROFIsafe system switches to the safe state.



#### Exiting the Failure State of the SPLC 1000

Note that you can only leave the Failure State by doing the following:

- Download the safety-related project in the PLCnext Engineer software again, or
- Switch off the supply voltage of the SPLC 1000 and the PLCnext Control device for at least 30 seconds and then switch it back on again (Power UP) or
- Restart the SPLC 1000 and the PLCnext Control device in the PLCnext Engineer software in the following editors:
  - “Cockpit” of the PLCnext Control (in the example: AXC F 3152)
  - “Safety Cockpit” of the SPLC 1000

Diagnostic messages for the SPLC 1000 are available as follows:

- Entries are stored in the diagnostic memory of the SPLC 1000 (can be read with PLCnext Engineer)
- As a hexadecimal value in the diagnostic parameter registers of the SPLC 1000. The registers are elements of the SPNSV2\_TYPE structure, see [Table 8-1 on page 135](#).  
Diagnostic parameter register 1: DIAG.PARAM\_REG and  
Diagnostic parameter register 2: DIAG.PARAM\_2\_REG



For detailed information on diagnostics in the PLCnext Engineer software, please refer to the online help for the software.



Please contact your nearest Phoenix Contact representative if:

- One of the errors described in [Section “Errors and error codes of the SPLC 1000 as the F-Host” on page 124](#) occurs again.
- Errors occur that are not listed in [Section “Possible errors” on page 122](#).

### 7.3 Possible errors

This section describes possible errors, their causes, effects, and remedy. [Section “Errors and error codes of the SPLC 1000 as the F-Host” on page 124](#) lists errors according to their error code.

**Important notes:**



**FS LED/FS bit/failure state**  
Please note that for all error codes listed in the following [Table 7-1 on page 124](#), the FS LED of the SPLC 1000 is always on and the FS bit is set in the SPNS\_DIAG\_STATUS\_REG register.  
The SPLC 1000 enters the failure state.



**Observe error codes**  
If errors occur, always provide the service/support personnel from Phoenix Contact with the complete error code. These details provide important information for error analysis and repair.  
The error codes are displayed in the SPNS\_DIAG\_PARAM\_REG and SPNS\_DIAG\_PARAM\_2\_REG diagnostic parameter registers or in the PLCnext Engineer software.  
For the safety hotline number, please refer to [Section “Safety hotline” on page 22](#).



**Error codes – Channel-dependent representation**

Identical errors may occur on both independent processing channels of the SPLC 1000. Depending on the channel they are marked as follows:

- 0x8xxx      Channel 1  
   (0x9xxx)    Channel 2
- for example:  
0x8001      Channel 1  
(0x9001      Channel 2)

In the following tables, both channel-dependent codes are listed for each error.



**Order of project downloads**

If further project downloads are required to ensure the consistency of projects, for example, please proceed as follows:

1. Download the non-safety-related project to the PLCnext Control (standard controller) used.
2. Download the safety-related project to the SPLC 1000.

Manual, user-initiated compilation of projects is not required. The PLCnext Engineer software compiles the projects prior to each project download.



**Configuration memory**

The terms “SD card” and “(pluggable) configuration memory” used in this user manual are synonyms.



**Phoenix Contact**

If the measures/remedies listed in the following tables do not help to remove the error, please contact your nearest Phoenix Contact representative.

### 7.3.1 Errors and error codes of the SPLC 1000 as the F-Host

Table 7-1 Errors codes of the SPLC 1000 as the F-Host

| Error code (hex)                         | Error cause                                | Remedy or response   |
|--|--|--|
| 0x8001 (0x9001)<br>to<br>0x8007 (0x9007) | Internal error                             | Please contact your nearest Phoenix Contact representative.  |
| 0x8008 (0x9008)                          | The boot project is missing or incomplete. | <ul style="list-style-type: none"> <li>• Check whether the non-safety-related project is loaded on the PLCnext Control device used.                             <ul style="list-style-type: none"> <li>– If the non-safety-related project is loaded on the PLCnext Control device, download the safety-related project to the SPLC 1000 again.</li> <li>– If the non-safety-related project is not loaded on the PLCnext Control device, follow the instructions in the note on “Order of project downloads” above this table.</li> </ul> </li> </ul> |
| 0x8009 (0x9009)<br>to<br>0x8012 (0x9012) | Internal error                             | Please contact your nearest Phoenix Contact representative.  |
| 0x8013 (0x9013)                          | The CPU load is higher than 90%.           | <ul style="list-style-type: none"> <li>• Reduce the processor load.</li> <li>• Analyze the safety-related project. Optimize the program code for better performance.</li> <li>• Avoid redundancies in the safety-related project so that the CPU load is not increased unnecessarily.</li> <li>• Check if the maximum number of F-Devices to be configured was exceeded. Reduce the number according to the information in <a href="#">Section “Technical data” on page 168</a>, if necessary.</li> </ul>  |

Table 7-1 Errors codes of the SPLC 1000 as the F-Host



| Error code (hex)                         | Error cause    | Remedy or response  |
|--|----------------|---|
| 0x8014 (0x9014)<br>to<br>0x8031 (0x9031) | Internal error | Please contact your nearest Phoenix Contact representative. |
| 0x8041 (0x9041)<br>to<br>0x804A (0x904A) |                |   |
| 0x8061 (0x9061)<br>to<br>0x806A (0x906A) |                |   |
| 0x8081 (0x9081)<br>to<br>0x8085 (0x9085) |                |   |
| 0x80A1 (0x90A1)<br>to<br>0x80A8 (0x90A8) |                |   |
| 0x80AA (0x90AA)<br>to<br>0x80B0 (0x90B0) |                |   |
| 0x80C1 (0x90C1)<br>to<br>0x80CE (0x90CE) |                |   |
| 0x80D1 (0x90D1)<br>to<br>0x80D5 (0x90D5) |                |   |
| 0x80E1 (0x90E1)<br>to<br>0x80E8 (0x90E8) |                |   |
| 0x80E9 (0x90E9)                          |                |   |

**AXC F XT S PLC 1000**

Table 7-1 Errors codes of the S PLC 1000 as the F-Host

| Error code (hex)                         | Error cause                                 | Remedy or response   |
|--|---|--|
| 0x80EA (0x90EA),<br>0x80EB (0x90EB)      | Internal error                              | Please contact your nearest Phoenix Contact representative.  |
| 0x8101 (0x9101)<br>to<br>0x8107 (0x9107) |   |  |
| 0x8110 (0x9110),<br>0x8111 (0x9111)      |   |  |
| 0x8121 (0x9121)<br>to<br>0x8125 (0x9125) |   |  |
| 0x8126 (0x9126)                          | Unknown version of the "pniodev.bin" file.  | <ul style="list-style-type: none"><li>• Check the PLCnext Engineer version that you are using.</li><li>• Download the non-safety-related project to the PLCnext Control device used. Download the safety-related project to the S PLC 1000. Follow the instructions provided in the note on "Order of project downloads" above this table.</li><li>• If the error cannot be removed, please contact your nearest Phoenix Contact representative.</li></ul> |
| 0x8127 (0x9127)                          | Unknown version of the "sdevpara.saf" file. |  |
| 0x8128 (0x9128)                          | Unknown version of the "swap.list" file.    |  |

Table 7-1 Errors codes of the SPLC 1000 as the F-Host

| Error code (hex) | Error cause                            | Remedy or response   |
|------------------|--|--|
| 0x8129 (0x9129)  | Inconsistent device parameters.        | <ul style="list-style-type: none"> <li>• Check the device parameterization in your safety-related program.</li> <li>• Boot the SPLC 1000 and the used PLCnext Control device by means of a power-off/power-on for both devices.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;">  <p><b>NOTE: Startup of the SPLC 1000 and PLCnext Control device not ensured</b><br/>For correct startup of the SPLC 1000 and the PLCnext Control device, the supply voltage may only be switched on at the earliest 30 seconds after the device LEDs go out.</p> </div> <ul style="list-style-type: none"> <li>• Download the non-safety-related project to the PLCnext Control device used. Download the safety-related project to the SPLC 1000. Follow the instructions provided in the note on “Order of project downloads” above this table.</li> </ul> <p>If none of the steps described above remove the error:</p> <ul style="list-style-type: none"> <li>• Carry out the project downloads described in the note on “Order of project downloads” above this table if you are using an SD card not containing a project.</li> <li>• Boot the SPLC 1000 and the used PLCnext Control device by means of a power-off/power-on for both devices.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin: 10px 0;">  <p><b>NOTE: Startup of the SPLC 1000 and PLCnext Control device not ensured</b><br/>For correct startup of the SPLC 1000 and the PLCnext Control device, the supply voltage may only be switched on at the earliest 30 seconds after the device LEDs go out.</p> </div> <ul style="list-style-type: none"> <li>• Replace the SPLC 1000.</li> </ul> <p>If the procedure described above does not rectify the error, please contact your nearest Phoenix Contact representative.</p> |
| 0x812A (0x912A)  | Inconsistent process data description. | <ul style="list-style-type: none"> <li>• Check process data assignment in your safety-related project.</li> <li>• Download the non-safety-related project to the PLCnext Control device used. Download the safety-related project to the SPLC 1000. Follow the instructions provided in the note on “Order of project downloads” above this table.</li> <li>• If the error cannot be removed, please contact your nearest Phoenix Contact representative.</li> </ul>   |

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Table 7-1 Errors codes of the SPLC 1000 as the F-Host

| Error code (hex)                         | Error cause  | Remedy or response   |
|--|--|--|
| 0x812B (0x912B)                          | Internal error   | Please contact your nearest Phoenix Contact representative.  |
| 0x812C (0x912C)                          | Maximum number of supported F-Devices exceeded.                        | Reduce the number of F-Devices connected to the SPLC 1000.   |
| 0x812D (0x912D)                          | Internal error   | Please contact your nearest Phoenix Contact representative.  |
| 0x812E (0x912E)                          |  |  |
| 0x812F (0x912F)                          | The F-Destination address is invalid or outside the permissible range. | <ul style="list-style-type: none"> <li>Check the F-Destination addresses used in the project.</li> <li>If necessary, correct the corresponding addresses.</li> </ul>   |
| 0x8130 (0x9130)                          | Maximum number of supported process data descriptions exceeded.        | Reduce the number of the process data descriptions.  |
| 0x8131 (0x9131)<br>to<br>0x8136 (0x9136) | Inconsistent process data description.                                 | <ul style="list-style-type: none"> <li>Check the process data and process data assignment.</li> <li>Download the non-safety-related project to the PLCnext Control device used. Download the safety-related project to the SPLC 1000. Follow the instructions provided in the note on "Order of project downloads" above this table.</li> <li>If the error cannot be removed, please contact your nearest Phoenix Contact representative.</li> </ul> |
| 0x8137 (0x9137)<br>to<br>0x813C (0x913C) | Internal error   | Please contact your nearest Phoenix Contact representative.  |
| 0x8141 (0x9141)<br>to<br>0x8150 (0x9150) |  |  |
| 0x8161 (0x9161)<br>to<br>0x8165 (0x9165) |  |  |
| 0x8181 (0x9181)<br>to<br>0x8186 (0x9186) |  |  |
| 0x8241 (0x9241)<br>to<br>0x8247 (0x9247) |  |  |
| 0x8248 (0x9248)                          |  |  |
| 0x8249 (0x9249)                          | The supply voltage (24 V) is above the specified range.                | <ul style="list-style-type: none"> <li>Check the supply voltage.</li> <li>Make sure the supply voltage is OK.</li> </ul>   |
| 0x824A (0x924A)<br>to<br>0x824C (0x924C) | Internal error   | Please contact your nearest Phoenix Contact representative.  |
| 0x824D (0x924D)                          | Ambient temperature is not in the specified range.                     | Check the ambient conditions (e.g., sufficient ventilation in the control cabinet) and operate the SPLC 1000 within the range specified.   |





Table 7-1 Errors codes of the SPLC 1000 as the F-Host

| Error code (hex)                         | Error cause                                    | Remedy or response  |
|--|--|---|
| 0x824E (0x924E)<br>to<br>0x825C (0x925C) | Internal error                                 | Please contact your nearest Phoenix Contact representative.                     |
| 0x8F00 (0x9F00)<br>to<br>0x8F02 (0x9F02) |  |   |
| 0x8F03 (0x9F03)<br>to<br>0x8F07 (0x9F07) | Hardware fault.                                |   |
| 0x8F08 (0x9F08)<br>to<br>0x8F0B (0x9F0B) | An error occurred during the firmware upgrade. | Observe further instructions from a person instructed in performing the update. |

### 7.3.2 Errors and error codes of the SPLC 1000 as an F-Device

Table 7-2 Errors codes of the SPLC 1000 as an F-Device

| Error code (hex)                         | Error cause                | Remedy or response   |
|--|----------------------------|--|
| 0x8141 (0x9141)<br>to<br>0x8147 (0x9147) | Internal error             | Please contact your nearest Phoenix Contact representative.  |
| 0x8148 (0x9148)                          | F-Parameter length invalid | <ul style="list-style-type: none"> <li>• Check the F-Device parameterization in your superordinate safety-related controller (F-Host).</li> <li>• If necessary, download the safety-related project to the superordinate safety-related controller.</li> <li>• Boot the SPLC 1000 and the used PLCnext Control device by means of a power-off/power-on for both devices.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;">  <p><b>NOTE: Startup of the SPLC 1000 and PLCnext Control device not ensured</b><br/>For correct startup of the SPLC 1000 and the PLCnext Control device, the supply voltage may only be switched on at the earliest 30 seconds after the device LEDs go out.</p> </div>   |
| 0x8149 (0x9149)                          | F-Device not initialized   | <ul style="list-style-type: none"> <li>• Check the F-Device parameterization in your superordinate safety-related controller (F-Host).</li> <li>• If necessary, download the safety-related project to the superordinate safety-related controller.</li> <li>• Boot the SPLC 1000 and the used PLCnext Control device by means of a power-off/power-on for both devices.</li> </ul> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;">  <p><b>NOTE: Startup of the SPLC 1000 and PLCnext Control device not ensured</b><br/>For correct startup of the SPLC 1000 and the PLCnext Control device, the supply voltage may only be switched on at the earliest 30 seconds after the device LEDs go out.</p> </div> |

## 7.4 Evaluation and acknowledgment of module-specific diagnostic messages

Depending on the error type, errors that are diagnosed in the Axioline F and Axioline Smart Elements PROFI-safe modules from Phoenix Contact used are transmitted to the S PLC 1000 as diagnostic messages via PROFINET.



The product documentation for the modules used contains an overview of the diagnosed errors, their causes, effects, and possible measures for error removal. It also includes information regarding module behavior following acknowledgment of diagnostic messages.

- For every error that occurs, the cause of the error must first be removed. If necessary, the error is then acknowledged.

Phoenix Contact provides special function blocks for device-specific diagnostics for the Axioline F backplane bus system. These function blocks enable global or local device-specific diagnostics.

For this purpose, the `AsynCom_PN_1` function block from the `AsynCom_9` library for PLCnext Engineer must be used. This function block is used for reading information of the connected PROFINET devices. The function block receives this information from the configuration of the S PLC 1000 (device IDs, PROFINET names, etc.).

In addition, function blocks from the `PN_Dev_Diag_5` library for PLCnext Engineer must also be used. An example of device-specific PROFI-safe diagnostics is the `PNFD_AXL_Diag_2` function block. This function block is used to perform diagnostics on a safety-related device of the Axioline F product group via the PROFI-safe address. Displayed diagnostic messages can be confirmed (acknowledged) with the help of the function block.

### 7.4.1 `AsynCom_PN_1` function block

Function block for reading information of the connected PROFINET devices.

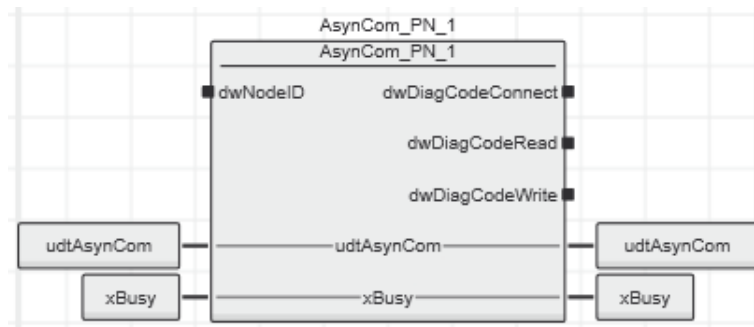


Figure 7-1 `AsynCom_PN_1` function block  
(instance: `AsynCom_PN_1`)

### 7.4.2 PNFD\_AXL\_Diag\_2 function block

Function block for diagnostics of a secure device of the Axioline F product group via the PROFIsafe address. Diagnostic messages that need to be confirmed can be confirmed with the help of the block.

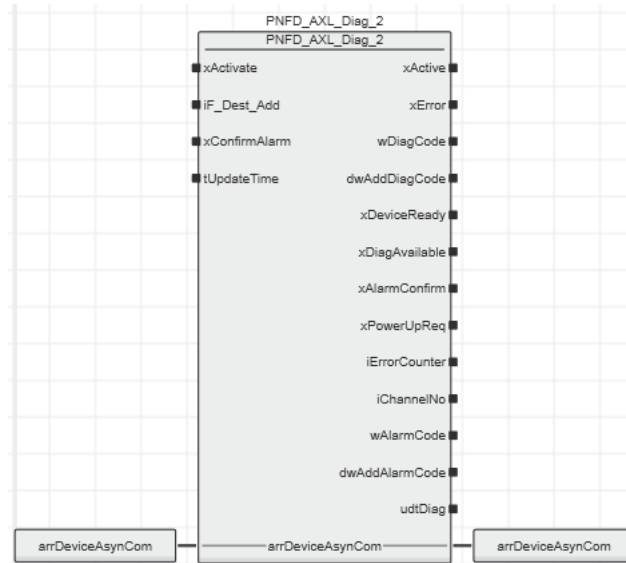


Figure 7-2 PNFD\_AXL\_Diag\_2 function block (instance: PNFD\_AXL\_Diag\_2)

#### Safety notes for starting applications

Take the following into consideration when determining and programming the start conditions for your machine or system:

- The machine or system may only be started if it can be ensured that nobody is present in the danger zone.
- Meet the requirements of EN ISO 13849-1 with regard to the manual reset function. The machine must not be set in motion and/or a hazardous situation must not be triggered by the following actions, for example:
  - Switching on safe devices
  - Acknowledging device error messages
  - Acknowledging communication errors
  - Acknowledging block error messages in the application
  - Removing startup inhibits for safety functions

Observe the following when programming/configuring the safety logic:

- Switching from the safe state (substitute value = 0) to the operating state can generate an edge change (zero/one edge).
- In the safety logic, take measures to prevent this edge change resulting in unexpected machine/system startup or restart.



#### Note for starting applications

Also observe these notes to prevent unexpected machine startup after confirming an "Operator Acknowledgement".

## 8 System variables and status information

### 8.1 General information

This section describes the system variables that are available for the SPLC 1000.

The SPLC 1000 has a register set that is used for diagnostics and simple control of the SPLC 1000.

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

### 8.2 Data structures

Some system variables of the SPLC 1000 are organized as data structures. The data structure for this type of system variable contains further system variables. In the Init Value Configuration of PLCnext Engineer, you can see which specific system variables belong to a system variable that is organized as a data structure.

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

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

The “/ PLC” controller editor group opens.


- Select the “Data List” editor.



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

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

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

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

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

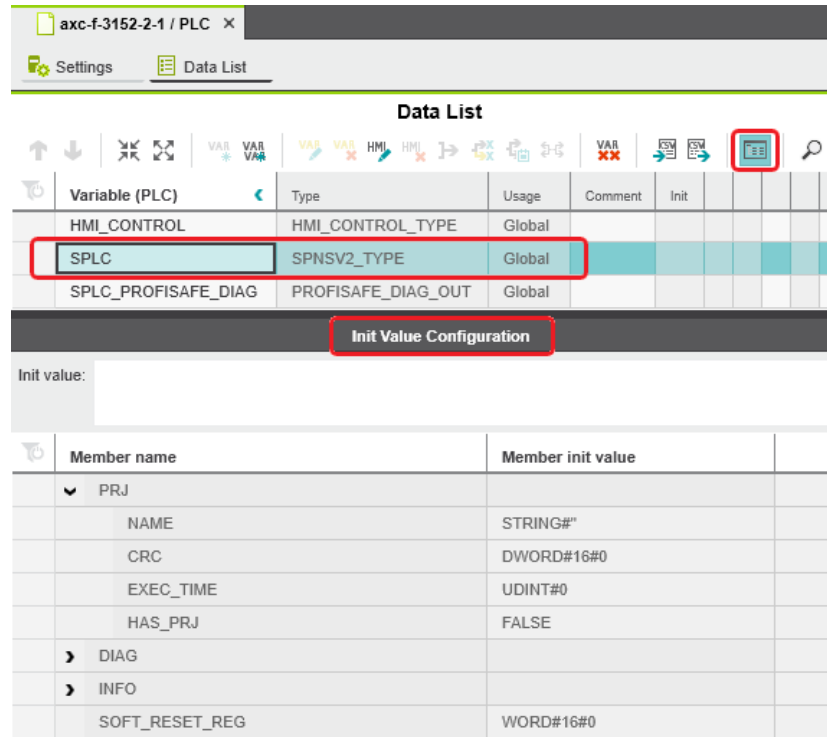


Figure 8-1 Example AXC F 3152: Init Value Configuration for the SPLC system variable organized as a data structure (SPNSV2\_TYPE data type)

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

## 8.3 System variables of the SPLC 1000

### 8.3.1 SPLC system variable

The SPLC system variable uses the SPNSV2\_TYPE data structure to provide the following information on the SPLC 1000.

Table 8-1 SPLC system variable and elements of the SPNSV2\_TYPE data structure

| System variable/elements | Type        | Meaning  |
|--------------------------|-------------|--|
| SPLC                     | SPNSV2_TYPE | The SPLC system variable provides the information in the SPNSV2_TYPE data structure.   |
| PRJ                      |             |  |
| NAME                     | STRING      | PLCnext Engineer project name.   |
| CRC                      | DWORD       | Project CRC (32 bits) of the SPLC 1000 boot project.   |
| EXEC_TIME                | UDINT       | Runtime of the SPLC 1000 program cycle in $\mu$ s.   |
| HAS_PRJ                  | BOOL        | The safety-related application program and the program sources are contained in the memory of the SPLC 1000.   |
| DIAG                     |             |  |
| STATUS_REG               | WORD        | Diagnostic status register of the SPLC 1000<br><br>The diagnostic status register of the SPLC 1000 contains the status information of the SPLC 1000. It mirrors the state of the SPLC 1000 at all times including any error states that have occurred on the SPLC 1000. Additional information and error parameters, in particular in the failure state (FS), are included in the relevant diagnostic parameter registers of the SPLC 1000 (elements SPNS.DIAG.PARAM_REG and SPNS.DIAG.PARAM_2).<br><br>The information in the diagnostic status register is detailed in <a href="#">Table 8-2 on page 137</a> . |
| PARAM_REG                | WORD        | Diagnostic parameter register 1 of the SPLC 1000 (error code).   |
| PARAM_2_REG              | WORD        | Diagnostic parameter register 2 of the SPLC 1000 (additional error messages for service/support).  |
| EXT_PARAM_REG            | DWORD       | Extended diagnostic parameter register of the SPLC 1000 (additional error messages for service/support).   |
| CH2_PARAM_REG            | WORD        | Diagnostic parameter register 1 of the SPLC 1000 channel 2 (CH2) (error code).   |
| CH2_PARAM_2_REG          | WORD        | Diagnostic parameter register 2 of the SPLC 1000 channel 2 (CH2) (additional error messages for service/support).  |
| CH2_EXT_PARAM_REG        | DWORD       | Extended diagnostic parameter register of the SPLC 1000 channel 2 (CH2) (additional error messages for service/support).   |
| INFO                     |             |  |
| CYCLE_TIME               | UDINT       | SPLC 1000 cycle in $\mu$ s   |
| TEMP                     |             |  |
| TEMP_CURRENT             | INT         | Currently measured SPLC 1000 temperature   |

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Table 8-1 SPLC system variable and elements of the SPNSV2\_TYPE data structure

| System variable/elements | Type | Meaning   |
|--------------------------|------|---|
| TEMP_MIN                 | INT  | Minimum measured SPLC 1000 temperature since the last power-on of the device.   |
| TEMP_MAX                 | INT  | Maximum measured SPLC 1000 temperature since the last power-on of the device.   |
| STATUS_REG               | WORD | SPLC 1000 temperature status register<br>0x0000: The temperature of the SPLC 1000 is in the non-critical range.<br>0x0080: The temperature of the SPLC 1000 is in the critical range, close to the tolerance threshold. The SPLC 1000 remains in RUN state and, in parallel, issues a warning with error code 0xFA41.<br>0x8000: The temperature of the SPLC 1000 is beyond the permitted range. The SPLC 1000 goes into safe state and issues an error message with error code 0x924D. |
| CPU                      |      |   |
| LOAD_CURRENT             | INT  | Current SPLC 1000 CPU load  |
| LOAD_MIN                 | INT  | Minimum measured SPLC 1000 CPU load since the last power-on of the device.  |
| LOAD_MAX                 | INT  | Maximum measured SPLC 1000 CPU load since the last power-on of the device.  |
| STATUS_REG               | WORD | SPLC 1000 CPU status register   |
| FW_VERSION               |      |   |
| VERSION_MAJOR            | BYTE | Major version of the SPLC 1000 firmware   |
| VERSION_MINOR            | BYTE | Minor version of the SPLC 1000 firmware   |
| VERSION_BUILD            | WORD | Build number of the SPLC 1000 firmware  |
| FPGA_VERSION             |      |   |
| VERSION_MAJOR            | BYTE | Major version of the SPLC 1000 hardware FPGA  |
| VERSION_MINOR            | BYTE | Minor version of the SPLC 1000 hardware FPGA  |
| VERSION_BUILD            | WORD | Build number of the SPLC 1000 hardware FPGA   |
| NUM_OF_ACTIVE_ARS        | UINT | Number of active PROFINET application relations (AR)  |
| FW_UPDATE_STATUS         | UINT | Status of safety-related firmware update  |
| SOFT_RESET_REG           | WORD | Software reset register of the SPLC 1000  |



### 8.3.2 SPLC.DIAG.STATUS\_REG.xxx diagnostic status register

The following table describes the information of the individual bits (0 ... 15) in the diagnostic status register (SPLC.DIAG.STATUS\_REG.xxx)

Table 8-2 Elements in the diagnostic status register (SPLC.DIAG.STATUS\_REG.xxx)

| System variable/elements | Type      | Meaning  |
|--------------------------|-----------|--|
| SPLC                     | See above | See above  |
| DIAG                     | See above | See above  |
| STATUS_REG               | See above | See above  |
| DBG <sup>3</sup>         | BOOL      | Non-safe debug mode of the SPLC 1000<br>The SPLC 1000 is in one of the two DEBUG states (DEBUG RUN or DEBUG STOP/DEBUG HALT).  |
| DD                       | BOOL      | Diagnostic message of an F-Device is present.  |
| EST                      | BOOL      | There is an entry in the error memory of the safe operating system (error stack) of the SPLC 1000.<br>Diagnostic and error messages from the safe SPLC 1000 operating system are present.<br>These messages can be read and evaluated via PLCnext Engineer.<br>This variable is always set to TRUE if there is at least one entry in the error memory of the safe operating system.<br>As soon as the error memory has been read and emptied via PLCnext Engineer, the value of the variable changes to FALSE. |
| FS                       | BOOL      | Failure State of the SPLC 1000<br>An error has been detected which sets the SPLC 1000 to the failure state. The corresponding additional error code is included in this state in the diagnostic parameter registers of the SPLC 1000 (SPLC.DIAG.PARAM_REG and SPLC.DIAG.PARAM_2_REG).  |
| INIT <sup>2</sup>        | BOOL      | Initialization of the SPLC 1000<br>Initialization of the SPLC 1000 firmware (safe operating system) has been performed and completed without errors.   |
| IO <sup>2</sup>          | BOOL      | Initialization of the SPLC 1000 F-Host for I/O channel communication<br>Initialization of the F-Host for PROFIsafe communication with the PROFIsafe I/O devices has been completed without any errors.   |
| PON <sup>2</sup>         | BOOL      | Power-on process<br>The SPLC 1000 is supplied with power. The firmware was downloaded to the main memory of the SPLC 1000 and started.<br>The comprehensive self-test routines of the device have been completed successfully.   |
| POST                     | BOOL      | Power-on self-test of the SPLC 1000 ( <b>POWER ON SELFTEST</b> )<br>Power-on self-test of the SPLC 1000 is active.   |
| PRO <sup>2</sup>         | BOOL      | Loading and starting of the safety-related application program<br>The safety-related application program, which was created using PLCnext Engineer, has been loaded without any errors to the safe SPLC 1000 operating system and started.   |

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Table 8-2 Elements in the diagnostic status register (SPLC.DIAG.STATUS\_REG.xxx)

| System variable/elements | Type   | Meaning  |
|--------------------------|--|--|
| RUN <sup>3</sup>         | BOOL   | Execution of the safety-related application program (RUN)<br>The S PLC 1000 executes the safety-related application program and is in one of the two RUN states (SAFE RUN or DEBUG RUN). |
| SYN <sup>2</sup>         | BOOL   | Synchronization of S PLC 1000 and PROFINET controller<br>Synchronization between the S PLC 1000 and the PROFINET controller was completed successfully.                                  |
| WARN                     | BOOL   | Warning of the S PLC 1000<br>A group warning message of the S PLC 1000 is present.   |
| <sup>2</sup>             | The variables indicate the startup status of the S PLC 1000. The startup sequence of the S PLC 1000 is divided into the following five consecutive sections:<br><ol style="list-style-type: none"><li>1. Power-on process</li><li>2. Initialization of the S PLC 1000</li><li>3. Loading and starting of the safety-related application program</li><li>4. Synchronization of the S PLC 1000 and the standard controller (PLCnext Control device)</li><li>5. Initialization of the S PLC 1000 F-Host for I/O channel communication</li></ol> |  |
| <sup>3</sup>             | The variables indicate the RUN and DEBUG operating states of the S PLC 1000.   |  |

**SPLC.DIAG.STATUS\_REG diagnostics status register: Meaning of the individual bits**

The SPLC.DIAG.STATUS\_REG diagnostic status register contains the status information of the SPLC 1000. It mirrors the state of the SPLC 1000 at all times including any error states that have occurred on the SPLC 1000. Additional information and error parameters, in particular in the failure state (FS), are contained in the associated diagnostic parameter registers of the SPLC 1000 (SPLC.DIAG.PARAM\_REG and SPLC.DIAG.PARAM\_2\_REG) and in the extended diagnostic parameter register (SPLC.DIAG.EXT.PARAM\_REG).

Table 8-3 Diagnostic status register of the SPLC 1000: SPLC.DIAG.STATUS\_REG

| Bit 15 | 14   | 13   | 12  | 11  | 10   | 9   | 8   | 7    | 6   | 5   | 4   | 3   | 2   | 1    | 0   |
|--------|------|------|-----|-----|------|-----|-----|------|-----|-----|-----|-----|-----|------|-----|
| FS     | POST | Res. | EST | Res | Res. | Res | Res | WARN | DBG | RUN | I/O | SYN | PRO | INIT | PON |

**Bits 0 to 4**

Bits 0 to 4 indicate the startup status of the SPLC 1000. The startup sequence of the SPLC 1000 is divided into the following five steps:

- PON** Power-on process complete  
This bit is set as soon as the SPLC 1000 is supplied with power. The firmware was downloaded to the main memory of the SPLC 1000 and started. The comprehensive self-test routines of the device have been completed successfully.
- INIT** Initialization of the SPLC 1000 complete  
This bit is set as soon as initialization of the SPLC 1000 firmware (safe operating system) has been completed without errors.
- PRO** Safety-related application program loaded and started  
This bit is set as soon as the safety-related application program, which was created using PLCnext Engineer, has been loaded to the safe SPLC 1000 operating system without any errors and started.
- SYN** Synchronization of the SPLC 1000 and the standard controller  
The bit is set when the SPLC 1000 and the standard controller are synchronized.
- I/O** I/O channel communication initialized  
This bit is set as soon as initialization of the F-Host for PROFIsafe communication with the PROFIsafe I/O devices has been completed without any errors.

**Bits 5 and 6**

The RUN and DBG bits indicate the operating status of the SPLC 1000.

- RUN** RUN mode of the SPLC 1000  
This bit is set when the SPLC 1000 executes the safety-related application program and is in one of the two RUN states (SAFE RUN or DEBUG RUN).

|             |   |
|-------------|---|
| <b>DBG</b>  | <p>Non-safe debug mode of the S PLC 1000</p> <p>This bit is set when the S PLC 1000 is in one of the two DEBUG states (DEBUG RUN or DEBUG STOP/DEBUG HALT).<br/>This bit is not set in the SAFE STOP and SAFE RUN states.</p> <p><b>Bits 7 and 10</b></p>   |
| <b>WARN</b> | <p>The set WARN (WARNING) bit indicates a group warning message of the S PLC 1000.</p> <p><b>Bit 12</b></p>   |
| <b>EST</b>  | <p>The EST (error stack) bit indicates that diagnostic and error messages for the safe S PLC 1000 operating system are present. These messages can be read and evaluated via PLCnext Engineer.</p> <p>This bit is always set if there is at least one entry in the error memory of the safe operating system. As soon as the error memory has been read and emptied via PLCnext Engineer, this bit is automatically reset to zero.</p> <p><b>Bit 14</b></p> |
| <b>POST</b> | <p>POWER ON SELF TEST</p> <p>This bit is set for the duration of the comprehensive power-on self-test of the S PLC 1000. It is reset once the power-on self-test is complete.</p> <p><b>Bit 15</b></p>  |
| <b>FS</b>   | <p>Failure State</p> <p>This bit is set as soon as an error has been detected, which sets the S PLC 1000 to the failure state. The corresponding additional error code is included in this state in the diagnostic parameter registers of the S PLC 1000 (S PLC.DIAG.PARAM_REG and S PLC.DIAG.PARAM_2_REG).</p>   |
| <b>Res.</b> | <p>Reserved</p>   |

### 8.3.3 SPLC\_PROFISAFE\_DIAG system variable

The SPLC\_PROFISAFE\_DIAG system variable uses the PROFISAFE\_DIAG\_OUT data structure to provide further information on the SPLC 1000.

Table 8-4 SPLC\_PROFISAFE\_DIAG system variable and elements of the PROFISAFE\_DIAG\_OUT structure

| System variable/elements | Type               | Meaning  |
|--------------------------|--------------------|--|
| SPLC_PROFISAFE_DIAG      | PROFISAFE_DIAG_OUT | The data structure provides PROFIsafe diagnostic information of the individual configured F-Devices. |
| MAX_PS_RECORDS           | UINT               | Maximum number of F-Devices to be configured   |
| USED_PS_RECORDS          | UINT               | Configured number of F-Devices   |
| PS_RECORDS               |                    |  |
| [1] ... [300]            |                    | PROFIsafe records 1 ... 300  |
| CODE_NAME                | DWORD              | –  |
| DIAG_BIT_FIELD           | DWORD              | –  |
| SRT_MIN                  | UINT               | Minimum roundtrip time between F-Host and F-Device   |
| SRT_MAX                  | UINT               | Maximum roundtrip time between F-Host and F-Device   |
| SRT_CUR                  | UINT               | Current roundtrip time between F-Host and F-Device   |
| FWD_TIME                 | UINT               | Watchdog time  |
| VALID_REG                | UINT               | –  |
| NODE_ID                  | UDINT              | Node ID  |
| Reserved                 | UINT               | Reserved   |
| PS_GLOBAL_RECORD         | DWORD              | –  |

### 8.3.4 SPLC\_CONTROL\_COMMAND and SPLC\_CONTROL\_CONFIRM system variables

The SPLC\_CONTROL\_COMMAND system variable is used to request the resetting of diagnostic values from the non-safety-related project. Via the system variable SPLC\_CONTROL\_CONFIRM, the SPLC 1000 confirms that the diagnostic values have been reset in the non-safety-related project.

#### SPLC\_CONTROL\_COMMAND

This system variable requests the resetting of diagnostic values from the non-safety-related project.

Table 8-5 SPLC\_CONTROL\_COMMAND system variable and elements of the SPNS\_CONTROL\_TYPE data structure

| System variable/elements | Type              | Meaning   |
|--------------------------|-------------------|---|
| SPLC_CONTROL_COMMAND     | SPLC_CONTROL_TYPE | Data structure with 32 bits for enabling SPLC 1000 functions.   |
| CODE                     | DWORD             | Bit 0:<br>Resets the minimum and maximum safety roundtrip times (SRT_MIN, SRT_MAX).<br>Data direction: Standard controller → SPLC 1000 (F-Host) |
| PARAM                    | DWORD             | Bits 1 ... 31: Reserved.  |

#### SPLC\_CONTROL\_CONFIRM

This system variable shows in the non-safety-related project the acknowledgement from the SPLC 1000 that diagnostic values have been reset.

Table 8-6 SPLC\_CONTROL\_CONFIRM system variable and elements of the SPNS\_CONTROL\_TYPE data structure

| System variable/elements | Type              | Meaning  |
|--------------------------|-------------------|--|
| SPLC_CONTROL_CONFIRM     | SPLC_CONTROL_TYPE | Data structure with 32 bits for confirming functions of the SPLC 1000 that have been requested via the SPLC_CONTROL_COMMAND variable.                              |
| CODE                     | DWORD             | Bit 0:<br>Confirms the resetting of the minimum and maximum safety roundtrip times (SRT_MIN, SRT_MAX).<br>Data direction: SPLC 1000 (F-Host) → standard controller |
| PARAM                    | DWORD             | Bits 1 ... 31: Reserved.   |

### 8.3.5 FDEV\_INx and FDEV\_OUTx (x = 0 ... 7) system variables

These system variables are used for the data exchange between the F-Device of the SPLC 1000 and the superordinate safety-related controller (F-Host).

- The eight system variables FDEV\_IN0 to FDEV\_IN7 contain the input process data (8 \* 1 byte) of the F-Device instance of the SPLC 1000.
- The eight system variables FDEV\_OUT0 to FDEV\_OUT7 contain the output process data (8 \* 1 byte) of the F-Device instance of the SPLC 1000.

The data direction is described from the view of the engineering:

- FDEV\_INx = I
- FDEV\_OUTx = Q

Table 8-7 FDEV\_INx and FDEV\_OUTx (x = 0 ... 7) system variables

| System variable         | Type     | Meaning   |
|-------------------------|----------|---|
| FDEV_IN0 ... FDEV_IN7   | SAFEBYTE | Input process data of the F-Device instance of the SPLC 1000  |
| FDEV_OUT0 ... FDEV_OUT7 | SAFEBYTE | Output process data of the F-Device instance of the SPLC 1000 |

### 8.3.6 Management/diagnostic variables for each configured F-Device

The table below lists management/diagnostic variables. These variables can be created in PLCnext Engineer for each configured F-Device. The table shows which variables are created by default. This setting can be modified by changing the value (Create / Do not create) (see [Figure 6-30 on page 98](#)).

| Management/diagnostic variable | Default setting |
|--------------------------------|-----------------|
| F_ADDR_XXXXX_ACK_REQ           | Create          |
| F_ADDR_XXXXX_ACK_REI           | Create          |
| F_ADDR_XXXXX_PASS_OUT          | Create          |
| F_ADDR_XXXXX_PASS_ON           | Create          |
| F_ADDR_XXXXX_DEVICE_FAULT      | Create          |
| F_ADDR_XXXXX_CE_CRC            | Create          |
| F_ADDR_XXXXX_WD_TIMEOUT        | Create          |
| F_ADDR_XXXXX_IPAR_OK           | Do not create   |
| F_ADDR_XXXXX_IPAR_EN           | Do not create   |
| F_ADDR_XXXXX_CHF_ACK_REI       | Do not create   |
| F_ADDR_XXXXX_CHF_ACK_REQ       | Do not create   |
| F_ADDR_XXXXX_CE_CRC_H          | Do not create   |
| F_ADDR_XXXXX_WD_TIMEOUT_H      | Do not create   |
| F_ADDR_XXXXX_LOOPBACK          | Do not create   |

Table 8-8 Management/diagnostic variables for each configured F-Device


| System variable          | Type | Meaning  |
|--------------------------|------|--|
| F_ADDR_XXXXX_PASS_ON *)  | BOOL | <p>F-Device XXXXX is passivated when this variable is set to TRUE from the application program.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p> <b>WARNING:</b><br/>Resetting this variable to FALSE means that the safe input and output data is transmitted immediately. Take appropriate measures to ensure that your system/ machine does not present any danger when passivation of the F-Device is reset.</p> </div> |
| F_ADDR_XXXXX_PASS_OUT *) | BOOL | <p>F-Device XXXXX is passivated.</p> <p>Possible reasons for passivation:</p> <ul style="list-style-type: none"> <li>- Programmed passivation via the F_ADDR_XXXXX_PASS_ON system variable</li> <li>- Communication, device, and parameterization errors (see F_ADDR_XXXXX_ACK_REQ system variable)</li> </ul>   |



Table 8-8 Management/diagnostic variables for each configured F-Device





| System variable              | Type | Meaning  |
|------------------------------|------|--|
| F_ADDR_XXXXX_ACK_REQ *)      | BOOL | F-Device XXXXX requires an operator acknowledge request after removing an error. Possible reasons for activating the operator acknowledge request: <ul style="list-style-type: none"> <li>– Communication error (CRC, F_WD_TIME_OUT)</li> <li>– Error in an F-Device. Please refer to the user documentation for the F-Devices used.</li> </ul>  |
| F_ADDR_XXXXX_ACK_REI *)      | BOOL | If F-Device XXXXX requires an operator acknowledge request, it can be acknowledged by an operator acknowledge reintegration (F_ADDR_XXXXX_ACK_REI).  |
| F_ADDR_XXXXX_DEVICE_FAULT *) | BOOL | Error in an F-Device.<br>If this variable was set to TRUE during operation, the cause of the error must be removed first so that acknowledgment can be carried out using the F_ADDR_XXXXX_ACK_REI or ACK_REI_GLOBAL variable. If the cause has been removed, the F_ADDR_XXXXX_DEVICE_FAULT variable is set to FALSE again.<br><br><div style="border: 1px solid black; padding: 5px; display: inline-block;">  For information on which errors cause the used F-Device to control this variable, please refer to the device-specific user documentation.                 </div>   |
| F_ADDR_XXXXX_CE_CRC *)       | BOOL | Communication error (F_CE_CRC)<br>This parameter is set if at least one of the following reasons applies: <ul style="list-style-type: none"> <li>– Inconsistent parameterization between F-Host and F-Device.</li> <li>– A communication error between F-Host and F-Device is present; for example, the F-Device has detected a communication error during operation that was caused by an incorrect CRC checksum.</li> </ul> If this variable was set to TRUE during operation, the cause of the error must be removed first so that acknowledgment can be carried out using the F_ADDR_XXXXX_ACK_REI or ACK_REI_GLOBAL variable. If the cause has been removed, the F_ADDR_XXXXX_CE_CRC variable is set to FALSE again.<br><br><div style="border: 1px solid black; padding: 5px; display: inline-block;">  In terms of system availability, this type of CRC error should only occur once every 10 hours at the most (see PROFIsafe specification regarding “SIL Monitor” and “Operator Acknowledge”).                 </div><br><br><div style="border: 1px solid black; padding: 5px; display: inline-block;">  During PROFIsafe system startup, e.g., following a program download in PLCnext Engineer, this variable is briefly set as a result of the PROFIsafe system startup behavior. This is not relevant for the 10-hour monitoring period described above following a CRC error that occurred during operation.                 </div> |

Table 8-8 Management/diagnostic variables for each configured F-Device

| System variable  | Type | Meaning   |
|--|------|---|
| F_ADDR_XXXXX_WD_TIME_OUT *)  | BOOL | <p>Communication error (F_WD_TIME_OUT)</p> <p>Set if the F-Device has detected a communication error caused by the parameterized F_WD_Time being exceeded.</p> <p>If this variable was set to TRUE during operation, the cause of the error must be removed first so that acknowledgment can be carried out using the F_ADDR_XXXXX_ACK_REI or ACK_REI_GLOBAL variable. If the cause has been removed, the F_ADDR_XXXXX_WD_TIME_OUT variable is set to FALSE again.</p>  |
| F_ADDR_XXXXX_IPAR_OK *)  | BOOL | <p>F-Device indicates that the iParameters have been applied</p> <p>This variable is set when the F-Device indicates that it has applied the iParameters.</p>   |
| F_ADDR_XXXXX_IPAR_EN *)  | BOOL | <p>Initiate application of the iParameters</p> <p>This variable is set in the application in order to initiate the application of the iParameters.</p> <p>Intentionally setting of the F_ADDR_XXXXX_IPAR_EN variable starts the process for applying the iParameters. The process depends on the F-Device used. For more detailed information, please refer to the device-specific user documentation.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;">  <p><b>WARNING:</b><br/>Depending on the application, applying the iParameters can result in hazardous states<br/>Take appropriate measures to ensure that your system/machine does not present any danger when the application of the iParameters is initiated and/or iParameters are applied.</p> </div> |
| F_ADDR_XXXXX_CHF_ACK_REQ *)  | BOOL | <p>A channel error in the F-Device can be acknowledged (CHF_ACK_REQ_S).</p> <p>(Only for F-Devices in accordance with PROFIsafe profile version <b>2.6MU1</b>)</p>  |
| F_ADDR_XXXXX_CHF_ACK_REI *)  | BOO  | <p>Channel error acknowledgement (CHF_ACK_C)</p> <p>(Only for F-Devices in accordance with PROFIsafe profile version <b>2.6MU1</b>)</p>   |
| F_ADDR_XXXXX_CE_CRC_H *)   | BOOL | <p>Communication error (F_CE_CRC_H)</p> <p>Local F-Host driver reports communication error.</p>   |
| F_ADDR_XXXXX_WD_TIMEOUT_H *)   | BOOL | <p>Communication error (F_WD_TIMEOUT_H)</p> <p>Local F-Host driver reports communication error.</p>   |
| F_ADDR_XXXXX_LOOPBACK *)   | BOOL | <p>Communication error (loopback check)</p> <p>Local F-Host driver reports communication error.</p>   |
| *) XXXXX = Number of the F-Device (e.g., F_ADDR_00001_PASS_ON, see <a href="#">Figure 6-32 on page 100</a> ) |      |   |



**WARNING:**

The variables specified in the table can be toggled. Program an evaluation function in the PLCnext Engineer software (e.g., using edge detection).

### 8.3.7 Global management/diagnostic variables for F-Devices

The table below describes management/diagnostic variables, which are globally created in PLCnext Engineer for all F-Devices. These variables indicate that the condition for setting these variables applies to at least one configured F-Device. The variables are not created by default. To create them, the relevant parameters must be set to “Create” in PLCnext Engineer (see [Figure 6-31 on page 99](#)).



**WARNING: Outputs can be set**

Do not acknowledge an operator acknowledge request automatically from the application program. Acknowledgment must be triggered by an intentional user action.

When reintegrating passivated PROFIsafe devices, safety-related outputs can be set.

Take appropriate measures to ensure that your system/machine does not present any danger when passivated PROFIsafe devices are reintegrated.

Table 8-9 Management/diagnostic variables for F-Devices



| System variable     | Type | Meaning   |
|---------------------|------|---|
| PASS_OUT_GLOBAL     | BOOL | At least one F-Device is passivated.<br><br>Possible reasons for passivation:<br><ul style="list-style-type: none"> <li>- Programmed passivation via the F_ADDR_XXXXX_PASS_ON system variable</li> <li>- Communication, device, and parameterization errors (see F_ADDR_XXXXX_ACK_REQ system variable)</li> </ul>   |
| ACK_REQ_GLOBAL      | BOOL | At least one F-Device requires an operator acknowledge request after removing an error. Possible reasons for activating the operator acknowledge request:<br><ul style="list-style-type: none"> <li>- Communication error (CRC, F_WD_TIME_OUT)</li> <li>- Error in an F-Device. Please refer to the user documentation for the F-Devices used.</li> </ul>   |
| ACK_REI_GLOBAL      | BOOL | If at least one F-Device requires an operator acknowledge request, this can be acknowledged by means of an operator acknowledge reintegration (ACK_REI_GLOBAL).   |
| DEVICE_FAULT_GLOBAL | BOOL | Error in at least one F-Device.<br><br>If this variable was set to TRUE during operation, the cause of the error must be removed first so that acknowledgment can be carried out via the F_ADDR_XXXXX_ACK_REI or ACK_REI_GLOBAL variables. If the cause has been removed, the F_ADDR_XXXXX_DEVICE FAULT variable is set to FALSE again.<br><br><div style="border: 1px solid black; padding: 5px; display: inline-block;">  For information on which errors cause the used F-Device to control this variable, please refer to the device-specific user documentation. </div> |

Table 8-9 Management/diagnostic variables for F-Devices [...]

| System variable     | Type | Meaning  |
|---------------------|------|--|
| CE_CRC_GLOBAL       | BOOL | <p>Communication error (F_CE_CRC)</p> <p>This parameter is set if at least one of the following reasons applies:</p> <ul style="list-style-type: none"> <li>- Inconsistent parameterization between F-Host and F-Device.</li> <li>- A communication error between F-Host and F-Device(s) is present; for example, at least one F-Device has detected a communication error during operation that was caused by an incorrect CRC checksum.</li> </ul> <p>If this variable was set to TRUE during operation, the cause of the error must be removed first so that acknowledgment can be carried out via the F_ADDR_XXXXX_ACK_REI or ACK_REI_GLOBAL variables. If the cause has been removed, the F_ADDR_XXXXX_CE_CRC variable is set to FALSE again.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;">  In terms of system availability, this type of CRC error should only occur once every 10 hours at the most (see PROFIsafe specification regarding "SIL Monitor" and "Operator Acknowledge").         </div> |
| WD_TIME_OUT_GLOBAL  | BOOL | <p>Communication error (F_WD_TIME_OUT)</p> <p>Set if at least one F-Device has detected a communication error caused by the parameterized F_WD_Time being exceeded.</p> <p>If this variable was set to TRUE during operation, the cause of the error must be removed first so that acknowledgment can be carried out via the F_ADDR_XXXXX_ACK_REI or ACK_REI_GLOBAL variables. If the cause has been removed, the F_ADDR_XXXXX_WD_TIME_OUT variable is set to FALSE again.</p>   |
| CHF_ACK_REI_GLOBAL  | BOOL | <p>At least one F-Device reports a channel error in the F-Device and can be acknowledged (CHF_ACK_C).</p> <p>(Only for F-Devices in accordance with PROFIsafe profile version <b>2.6MU1</b>)</p>   |
| CHF_ACK_REQ_GLOBAL  | BOOL | <p>At least one F-Device reports a channel error in the F-Devices and can be acknowledged (CHF_ACK_REQ_S).</p> <p>(Only for F-Devices in accordance with PROFIsafe profile version <b>2.6MU1</b>)</p>  |
| CE_CRC_H_GLOBAL     | BOOL | At least one local F-Host driver reports a communication error (F_CE_CRC_H).   |
| WD_TIMEOUT_H_GLOBAL | BOOL | At least one local F-Host driver reports a communication error (F_WD_TIMEOUT_H).   |
| LOOPBACK_GLOBAL     | BOOL | At least one local F-Host driver reports a communication error (loopback check).   |



**WARNING:**

The variables specified in the table can be toggled. Program an evaluation function in the PLCnext Engineer software (e.g., using edge detection).

### 8.3.8 Management/diagnostic variables of the SPLC 1000 as an F-Device

#### 8.3.8.1 PROFIsafe: Device diagnostics variables (local device)

The table below lists management/diagnostic variables. These variables can be created in PLCnext Engineer for the SPLC 1000 configured as an F-Device. The table shows which variables are created by default. This setting can be modified by changing the value (Create/Do not create).

The F\_Destination\_Address of the SPLC 1000 (F\_Dest\_Add) is specified by the “[nnnn]” in the variable name.

| Management/diagnostic variable | Default setting |
|--------------------------------|-----------------|
| F_ADDR_[nnnn]_ACK_REQ_DEV      | Do not create   |
| F_ADDR_[nnnn]_PASS_ON_DEV      | Do not create   |
| F_ADDR_[nnnn]_PASS_OUT_DEV     | Do not create   |
| F_ADDR_[nnnn]_IPAR_EN_DEV      | Do not create   |
| F_ADDR_[nnnn]_IPAR_OK_DEV      | Do not create   |
| F_ADDR_[nnnn]_DEVICE_FAULT_DEV | Do not create   |
| F_ADDR_[nnnn]_CHF_ACK_REI_DEV  | Do not create   |
| F_ADDR_[nnnn]_CHF_ACK_REQ_DEV  | Do not create   |
| F_ADDR_[nnnn]_CE_CRC_DEV       | Do not create   |
| F_ADDR_[nnnn]_WD_TIMEOUT_DEV   | Do not create   |

Table 8-10 PROFIsafe: Device diagnostics variables (local device)


| System variable              | Type | Meaning   |
|------------------------------|------|---|
| F_ADDR_[nnnn]_ACK_REQ_DEV *) | BOOL | The SPLC 1000 (F-Device) requests an operator-acknowledge request from the superordinate safety-related controller (F-Host) after removing an error. Possible reasons for activating the operator acknowledge request:<br>– Communication error (CRC, F_WD_TIME_OUT)  |
| F_ADDR_[nnnn]_PASS_ON_DEV *) | BOOL | The SPLC 1000 (F-Device) will be passivated by the superordinate safety-related controller (F-Host) when this variable is set to TRUE from the application program.<br><br><div style="border: 1px solid black; padding: 5px; display: inline-block;">  <p><b>WARNING:</b><br/>Resetting this variable to FALSE means that the safe input and output data is transmitted immediately.<br/>Take appropriate measures to ensure that your system/machine does not present any danger when passivation of the SPLC 1000 (F-Device) is reset.</p> </div> |

Table 8-10 PROFIsafe: Device diagnostics variables (local device)




| System variable                   | Type | Meaning   |
|-----------------------------------|------|---|
| F_ADDR_[nnnn]_PASS_OUT_DEV *)     | BOOL | <p>The SPLC 1000 (F-Device) is passivated.</p> <p>Possible reasons for passivation:</p> <ul style="list-style-type: none"> <li>- Programmed passivation via the F_ADDR_[nnnn]_PASS_ON_DEV system variable</li> <li>- Communication, device, and parameterization errors (see F_ADDR_[nnnn]_ACK_REQ_DEV system variable)</li> </ul>  |
| F_ADDR_[nnnn]_IPAR_EN_DEV *)      | BOOL | <p>Initiate application of the iParameters</p> <p>This variable is set in the application in order to initiate the application of the iParameters.</p> <p>Intentionally setting the F_ADDR_[nnnn]_IPAR_EN_DEV from the superordinate safety-related controller (F-Host) starts the process for applying the iParameters to the SPLC 1000 as an F-Device.</p> <p>The process depends on the superordinate safety-related controller used. For more detailed information, please refer to the device-specific user documentation.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;">  <p><b>WARNING:</b><br/>Depending on the application, applying the iParameters can lead to dangerous states. Take appropriate measures to ensure that your system/machine does not present any danger when the application of the iParameters is initiated and/or iParameters are applied.</p> </div> |
| F_ADDR_[nnnn]_IPAR_OK_DEV *)      | BOOL | <p>The SPLC 1000 (F-Device) reports “adoption of the iParameters”.</p> <p>This variable is set when the SPLC 1000 (F-Device) indicates that it has adopted the iParameters.</p>   |
| F_ADDR_[nnnn]_DEVICE_FAULT_DEV *) | BOOL | <p>Error in the SPLC 1000 (F-Device).</p> <p>If this variable was set to TRUE during operation, the cause of the error must be removed first to enable the superordinate safety-related controller (F-Host) to carry out acknowledgment and reintegration. If the cause has been removed, the F_ADDR_[nnnn]_DEVICE_FAULT_DEV variable is set to FALSE again.</p>  |

Table 8-10 PROFIsafe: Device diagnostics variables (local device)

| System variable  | Type | Meaning  |
|--|------|--|
| F_ADDR_[nnnn]_CE_CRC_DEV *)  | BOOL | <p>Communication error (F_CE_CRC)</p> <p>This parameter is set if at least one of the following reasons applies:</p> <ul style="list-style-type: none"> <li>- The S PLC 1000 (F-Device) has detected a communication error during operation that was caused by an incorrect CRC checksum.</li> <li>- Inconsistent parameterization between the superordinate safety-related controller (F-Host) and the S PLC 1000 (F-Device).</li> <li>- There is a communication error between the superordinate safety-related controller (F-Host) and the S PLC 1000 (F-Device).</li> </ul> <p>If this variable was set to TRUE during operation, the cause of the error must be removed first to enable the superordinate safety-related controller (F-Host) to carry out acknowledgment and reintegration. If the cause has been removed, the F_ADDR_[nnnn]_CE_CRC_DEV variable is set to FALSE again.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p> In terms of system availability, this type of CRC error should only occur once every 10 hours at the most (see PROFIsafe specification regarding "SIL Monitor" and "Operator Acknowledge").</p> </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p> During PROFIsafe system startup this variable is briefly set as a result of the PROFIsafe system startup behavior. This is not relevant for the 10-hour monitoring period described above following a CRC error that occurred during operation.</p> </div> |
| F_ADDR_[nnnn]_CHF_ACK_REQ_DEV *)   | BOOL | A channel error in the S PLC 1000 (F-Device) can be acknowledged.  |
| F_ADDR_[nnnn]_CHF_ACK_REI_DEV *)   | BOOL | Channel error acknowledgement  |
| F_ADDR_[nnnn]_WD_TIME_OUT_DEV *)   | BOOL | <p>Communication error (F_WD_TIME_OUT)</p> <p>Set if the S PLC 1000 (F-Device) has detected a communication error caused by the parameterized F_WD_Time being exceeded.</p> <p>If this variable was set to TRUE during operation, the cause of the error must be removed first to enable the superordinate safety-related controller (F-Host) to carry out acknowledgment and reintegration. If the cause has been removed, the F_ADDR_[nnnn]_WD_TIME_OUT_DEV variable is set to FALSE again.</p>  |
| <p>*) [nnnn] = F_Destination-Adresse (F_Dest_Add) of the S PLC 1000 used in the application as an F-Device is in the range: 1 ... 65534.</p> |      |  |



**WARNING:**

The variables specified in the table can be toggled. Program an evaluation function in the PLCnext Engineer software (e.g., using edge detection).

**8.3.8.2 PROFIsafe: Collective diagnostics variables (local device)**

The table below describes management/diagnostic variables, which are globally created in PLCnext Engineer for the SPLC 1000 as an F-Device. These variables indicate that the condition for setting these variables applies to at least one SPLC 1000 configured as an F-Device. The variables are not created by default. To create them, the relevant parameters must be set to “Create” in PLCnext Engineer (see [Figure 6-31 on page 99](#)).



**WARNING: Outputs can be set**

Do not acknowledge an operator acknowledge request automatically from the application program. Acknowledgment must be triggered by an intentional user action.

When reintegrating passivated PROFIsafe devices, safety-related outputs can be set.

Take appropriate measures to ensure that your system/machine does not present any danger when passivated PROFIsafe devices are reintegrated.

Table 8-11 PROFIsafe: Collective diagnostics variables (local device)

| System variable       | Type | Meaning  |
|-----------------------|------|--|
| ACK_REQ_DEV_GLOBAL    | BOOL | At least one SPLC 1000 configured as an F-Device requires an operator-acknowledge request after removing an error. Possible reasons for activating the operator acknowledge request:<br>– Communication error (CRC, F_WD_TIME_OUT) |
| CE_CRC_DEV_GLOBAL     | BOOL | Communication error (F_CE_CRC)<br><br>The SPLC 1000 currently only supports one F-Device instance: see F_ADDR_[nnnn]_CE_CRC_DEV system variable.   |
| WD_TIMEOUT_DEV_GLOBAL | BOOL | Communication error (F_WD_TIME_OUT)<br><br>The SPLC 1000 currently only supports one F-Device instance: see F_ADDR_[nnnn]_WD_TIMEOUT_DEV system variable.  |



**WARNING:**

The variables specified in the table can be toggled. Program an evaluation function in the PLCnext Engineer software (e.g., using edge detection).

**8.4 PLC\_CRC\_PRJ system variable**

The PLC\_CRC\_PRJ system variable provides information on the CRC of the non-safety-related project.

Table 8-12 PLC\_CRC\_PRJ system variable

| System variable | Type | Meaning  |
|-----------------|------|--|
| PLC_CRC_PRJ     | UINT | Information on the CRC of the non-safety-related project |



## 9 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”).

### 9.1 Safety notes



**NOTE: Electrostatic discharge**

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



**NOTE: Damage to electronics due to inadequate external protection – no safe fuse tripping in the event of a fault**

The electronics in the device will be damaged if external fuse protection is inadequate.

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



**Please note:**

During any work on the Axioline F station, the SPLC 1000, the PLCnext Control device, or a module, switch off the power supply to the Axioline F station and make sure the supply voltage is protected against unauthorized reactivation.



**NOTE: Damage to the contacts when tilting**

Tilting the modules can damage the contacts.

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

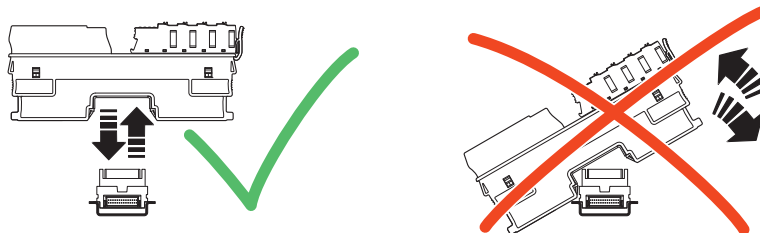


Figure 9-1 Removing the module **vertically**

## 9.2 Removing cables

- Disconnect the Axioline F station from the power supply.
- Open the spring by pressing the screwdriver onto the spring lever (A).
- Remove the cable (B).

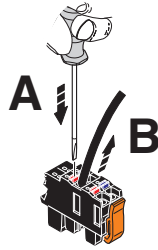


Figure 9-2 SPLC 1000: Removing cables

## 9.3 Removing the connector

- Release the locking latch (A), tip the connector slightly upwards (B), and remove it from the module (C).

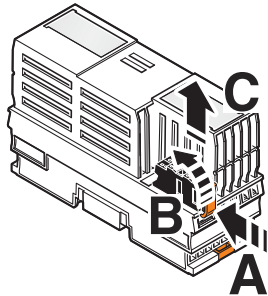


Figure 9-3 SPLC 1000: Removing the connector

## 9.4 Unlatching the SPLC 1000

- Insert a suitable tool (e.g., a flat-bladed screwdriver) in the upper and lower snap-in mechanism (base latches) of the module one after the other and unlock it (A). The base latches are locked in place in the open position.
- Pull the electronics module straight back from the DIN rail (B).

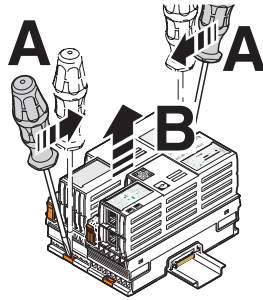


Figure 9-4 Unlatching the SPLC 1000

## 9.5 Removing the bus base module



**Please note:**

The bus base module of the SPLC 1000 has snap-in latches that are held in place by the electronics module on the right.

- First remove the electronics module on the right before you pull off and remove the SPLC 1000 bus base module.
- Remove the bus base module in accordance with the description in the UM EN AXL F SYS INST user manual.



Read the information on removing bus base modules of the Axioline F modules in the UM EN AXL F SYS INST user manual (Axioline F: System and installation).



# 10 Device replacement, device defects, and repairs

## 10.1 Device replacement

The device can be replaced, if necessary.

### Observe the device type and version

The replacement device must satisfy the following conditions:

- Same device type (pos. 1 in [Figure 3-15 on page 46](#))
- Same or later version (pos. 4 in [Figure 3-15 on page 46](#))

### Procedure

If you want to replace the device, proceed in accordance with the following section:

- [“Removing hardware” on page 153](#)
- [“Mounting hardware” on page 51](#)
- [“Connecting and wiring the hardware” on page 61](#)
- [“Commissioning and validation” on page 67](#)
- Disconnect the Axioline F station from the power supply.
- Replace the SPLC 1000 in your application with an identical device (same item number).
- Once the controller is replaced, restore all the necessary connections.

## 10.2 Device defect and repair

### Do not open the housing

Do not open the housing of the SPLC 1000. If the housing is opened, the function of the device can no longer be ensured.

### Device defects/repairs

Please contact Phoenix Contact. Repairs may only be carried out by Phoenix Contact.

- Send defective devices back to Phoenix Contact for repair or to receive a replacement device.
- We strongly recommend using the original packaging to return the product.
- Include a note in the packaging indicating that the contents are returned goods.
- Where possible, provide a detailed description of the errors that have occurred.
- 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 “Technical data” on page 168](#)).
  - If necessary, use dehumidifying agents.
  - Use suitable ESD packaging to protect components that are sensitive to electrostatic discharge.
  - Secure any loose parts.
  - Make sure that the packaging you select is large enough and the material is sufficiently thick.
  - Only use plastic bubble wrap sheets as wadding.
  - Attach warnings to the transport packaging so that they are clearly visible.
  - Please be aware that the delivery note is to be placed inside the package if the package is sent within the same country. If the package is being sent abroad, the delivery note must be placed inside a delivery note pocket and attached to the outside so that it is clearly visible.

# 11 Maintenance, decommissioning, and disposal

## 11.1 Maintenance

The device is maintenance-free.

## 11.2 Decommissioning and disposal

Carry out decommissioning in accordance with the requirements of the machine or system manufacturer.

When decommissioning the system or parts of the system, ensure the following for the devices used.

### The device continues to be used as intended:

- Observe the storage and transport requirements (see [Section “Transport, storage, and unpacking” on page 23](#)).

### The device is not used anymore:



The device contains valuable recyclable materials, which should be utilized.

### Device disposal

- Do not dispose of the device with household waste; it should 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, tubular bags, etc.) with household waste in accordance with the currently applicable national regulations.





## 12 Extended SPLC 1000 settings and further useful information

### 12.1 Startup parameterization of PROFINET devices

In a PROFINET network used in systems manufacturing, devices must be coupled and decoupled. This function is managed by the program, depending on the application. In the off state, the device should be viewed as a missing device, with the difference being that the PROFINET controller does not search for it cyclically. Switching on and switching off correspond to application-driven connection establishment and release of the PROFINET device.



Make sure that the basic specifications of a PROFINET controller (e.g., maximum number of PROFINET devices that can be connected) cannot be exceeded by deactivating devices in the configuration.

In the “Settings” editor of the PROFINET device, you must specify whether the controller establishes an application relationship when the PROFINET device is started.

When set to “No”, an application relationship is created for each PROFINET device but is not started; it remains inactive. In this case, an application relationship to the PROFINET device can be established using the AR\_MGT function block (see [Section “Function block for managing PROFINET application relationships \(AR\)” on page 163](#)).

When set to “Yes”, the PROFINET device is started up directly. If an application relationship is not started, the PROFINET device is not started up.

This option is set to “Yes” by default.

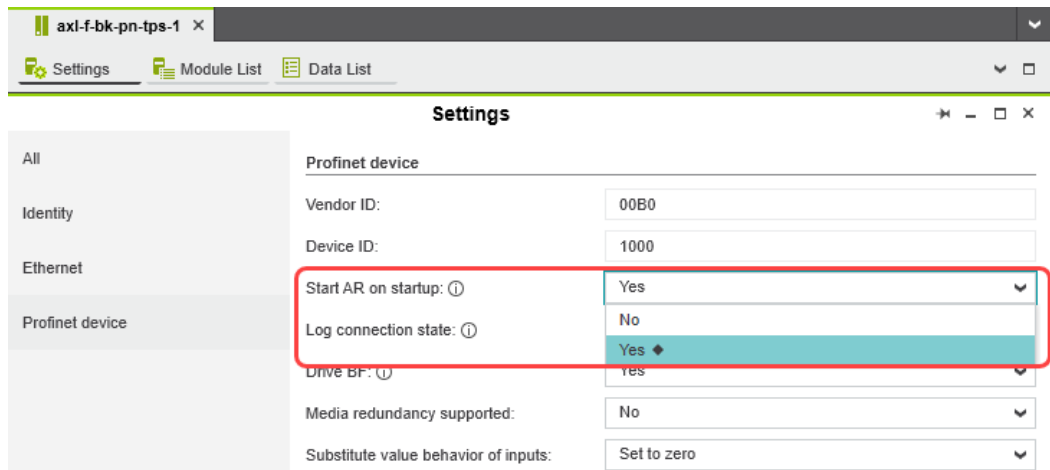


Figure 12-1 PROFINET device – “Start AR on startup”

### Safety notes for starting applications

Take the following into consideration when determining and programming the start conditions for your machine or system:

- The machine or system may only be started if it can be ensured that nobody is present in the danger zone.
- Meet the requirements of EN ISO 13849-1 with regard to the manual reset function. The machine must not be set in motion and/or a hazardous situation must not be triggered by the following actions, for example:
  - Switching on safe devices
  - Acknowledging device error messages
  - Acknowledging communication errors
  - Acknowledging block error messages in the application
  - Removing startup inhibits for safety functions

Observe the following when programming/configuring the safety logic:

- Switching from the safe state (substitute value = 0) to the operating state can generate an edge change (zero/one edge).
- In the safety logic, take measures to prevent this edge change resulting in unexpected machine/system startup or restart.



#### Note for starting applications

Also observe these notes to prevent unexpected machine startup after confirming an “Operator Acknowledgement”.

## 12.2 Function block for managing PROFINET application relationships (AR)

You can use the AR\_MGT function block to activate or deactivate PROFINET application relationships (AR) from a project. For example, process data and process data states (IOPS) are transmitted via the application relationships between the PROFINET controller and PROFINET device.

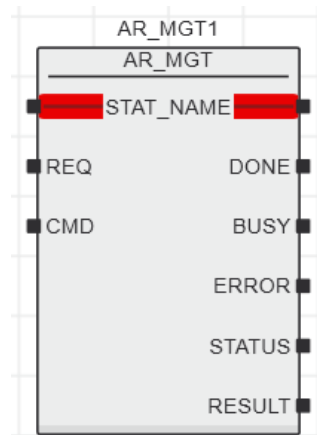


Figure 12-2 AR\_MGT function block

The function block supports multiple instantiation. The maximum possible number of function block instances that can be activated simultaneously is limited by the maximum number of application relationships permitted by the PROFINET controller.



The function block for managing communication blocks is documented in the PLCnext Engineer online help.

### 12.3 Substitute value behavior for PROFINET devices and PROFIsafe F-Devices

The substitute value behavior for the input data of the PROFINET controller must be specified in your PLCnext Engineer project. By default, the input data of the PLCnext Control is set to zero if the connection to a PROFINET device is interrupted.

Set the substitute value behavior for each PROFINET device individually in PLCnext Engineer (see [Figure 12-3](#)).

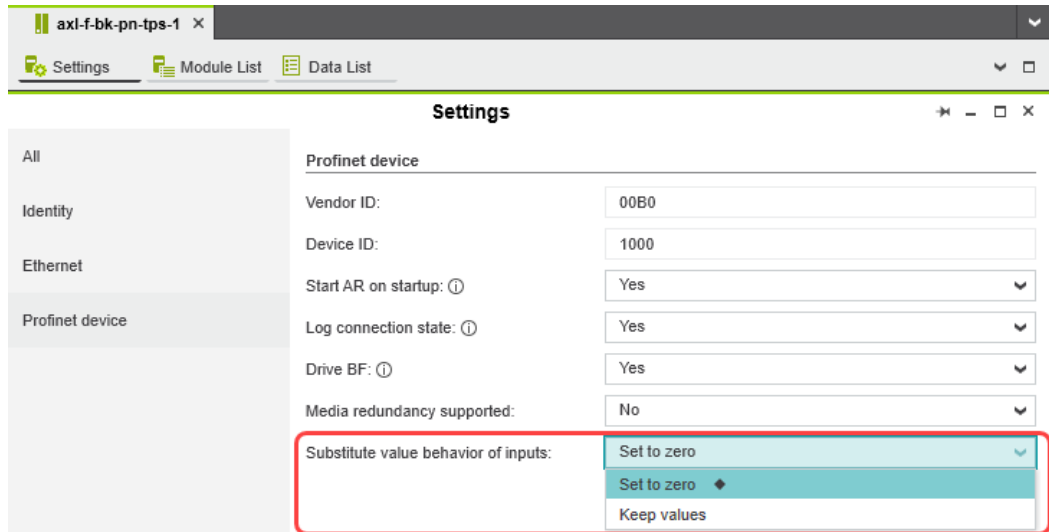


Figure 12-3 PROFINET device – “Substitute value behavior of inputs”

If the connection to a PROFINET device is interrupted, the “Set to zero” option means that the corresponding input data of the PLCnext Control is set to zero. The “Keep values” option means that if the connection to a PROFINET device is interrupted, the input values that were valid immediately before the interruption are present as the input data in the application program.

When the connection to the PROFINET device is restored, the substitute values remain valid as input data until the PROFINET device has been started up completely. Once the connection has been established again, the latest input data is used.



**Note on the substitute value behavior for F-Devices**

Observe the following when programming/configuring the safety logic:

- Switching from the safe state (substitute value = 0) to the operating state can generate an edge change (zero/one edge).
- In the safety logic, take measures to prevent this edge change resulting in unexpected machine/system startup or restart.

## 13 Technical data and ordering data

### 13.1 Ordering data

#### 13.1.1 Extension module

| Description   | Type               | Item No. | Pcs./Pkt. |
|---|--------------------|----------|-----------|
| Left-alignable safety-related controller for connecting safety-related devices via Ethernet or Axioline F local bus to the AXC F 2152 or AXC F 3152 modular controllers of the PLCnext Control series | AXC F XT SPLC 1000 | 1159811  | 1         |

#### 13.1.2 Controller

| Description   | Type       | Item 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         |
| PLCnext Control for the direct control of Axioline F I/Os. With three independent Ethernet interfaces. Complete with connector and bus base module. | AXC F 3152 | 1069208  | 1         |

#### 13.1.3 Modules

| Description   | Type               | Item No. | Pcs./Pkt. |
|---|--------------------|----------|-----------|
| Axioline F bus coupler for PROFINET   | AXL F BK PN TPS    | 2403869  | 1         |
| Axioline Smart Elements, digital input module, safe digital inputs: 8 (1-channel assignment), 4 (2-channel assignment), 24 V DC, connection technology: 3-conductor, degree of protection: IP20   | AXL SE PSDI8/3     | 1079241  | 1         |
| Axioline Smart Elements, digital output module, safe digital outputs: 4 (1-channel assignment), 2 (2-channel assignment), 24 V DC, connection technology: 2-conductor, degree of protection: IP20 | AXL SE PSDO4/2 2A  | 1079231  | 1         |
| Axioline Smart Elements, slot cover, transmission speed in the local bus: see system in which you use the Smart Element, degree of protection: IP20   | AXL SE SC-A        | 1088134  | 11        |
| Axioline F, backplane, 4 slots for Axioline Smart Elements, transmission speed in the local bus: 100 Mbps, degree of protection: IP20   | AXL F BP SE4       | 1088135  | 1         |
| Axioline F module with safe digital outputs   | AXL F PSDO8/3 1F   | 2701560  | 1         |
| Axioline F digital input module, 16 inputs, high-speed, 24 V DC, 1-wire connection technology   | AXL F DI16/1 HS 1H | 2701722  | 1         |

### 13.1.4 Accessories

| Description   | Type   | Item No. | Pcs./Pkt |
|---|--|----------|----------|
| QUINT POWER and TRIO POWER power supplies from Phoenix Contact  | See the latest Phoenix Contact INTERFACE catalog |          |          |
| Program and configuration memory for storing the application programs and other files in the file system of the PLC, pluggable, 2 GB  | SD FLASH 2GB PLCNEXT MEMORY                      | 1043501  | 1        |
| Program and configuration memory for storing the application programs and other files in the file system of the PLC, pluggable, 8 GB  | SD FLASH 8GB PLCNEXT MEMORY                      | 1061701  | 1        |
| End bracket, width: 9.5 mm, color: gray (mounting)  | E/NS 35 N  | 0800886  | 50       |
| End bracket, for the end support bearing for the UKH 50 to UKH 240, for pushing onto DIN rail NS 35 and clamping in place using 2 screws, width: 10 mm, color: aluminum (mounting)          | E/AL-NS 35                                       | 1201662  | 10       |
| Quick mounting end bracket for NS 35/7.5 DIN rail or NS 35/15 DIN rail, with marking option, width: 9.5 mm, color: gray (mounting)  | CLIPFIX 35                                       | 3022218  | 50       |
| Quick mounting end bracket for NS 35/7.5 DIN rail or NS 35/15 DIN rail, with marking option, with parking option for FBS...5, FBS...6, KSS 5, KSS 6, width: 5.15 mm, color: gray (mounting) | CLIPFIX 35-5                                     | 3022276  | 50       |
| End bracket, width: 9.5 mm, height: 35.3 mm, Material: PA, length: 50.5 mm, mounting on DIN rail NS 32 or NS 35, color: gray (mounting)   | E/UK   | 1201442  | 50       |

### 13.1.5 Software

| Description      | Type                               | Item No. |  |
|------------------|------------------------------------|----------|--|
| PLCnext Engineer | See latest Phoenix Contact catalog |          |  |

### 13.1.6 Documentation



Make sure you always use the latest documentation.  
It is available for download at [phoenixcontact.net/products](http://phoenixcontact.net/products).

| Description                              | Type               | Item No. | Pcs./Pkt. |
|--|--------------------|----------|-----------|
| <b>Safety technology, general</b>        |                    |          |           |
| <b>PROFINET</b>                          |                    |          |           |
| User manual<br>PROFINET basic principles | UM EN PROFINET SYS | -        | 1         |

| Description   | Type                    | Item No. | Pcs./Pkt. |
|---|-------------------------|----------|-----------|
| User manual<br>PROFINET controller/device functions | UM EN PROFINET CTRL DEV | –        | 1         |

PROFINET Assembling Guideline,  
Version 2.8, September 2019, Item No.: 8.072  
“PROFINET\_Assembling\_8072\_V28\_Sep19.pdf”

Functional Bonding and Shielding of PROFIBUS and  
PROFINET, Guideline for PROFIBUS and PROFINET,  
Version 2.4, October 2020, Item No.: 8.102  
“Earthing-Shielding\_8102\_V24\_Oct20.pdf”

**PROFIsafe**

PROFIsafe System Description, Technology and Applica-  
tion,  
Version April 2016, Item No. 4.342  
“PROFIsafe\_SystemDescription\_ENG\_\_2016\_web.pdf”

PROFIsafe Policy, Guideline for PROFIBUS and  
PROFINET,  
Version 1.5, July 2011, Item No. 2.282  
“PROFIsafe-Policy\_2282\_V15\_Jul11.pdf”

PROFIsafe Environment related to PROFIsafe V2.6.1  
Guideline for PROFINET and PROFIBUS,  
Version 2.6, December 2015, Item No. 2.232  
“PROFIsafe-Environment\_2232\_V26\_Dec15.pdf”

PROFIsafe – Profile for Safety Technology on PROFIBUS  
and PROFINET, Item No.: 3.192  
Profile part, related to IEC 61784-3-3  
Technical Specification, Version 2.6MU1, August 2018  
“PROFIsafe\_3192\_V26MU1\_Aug18.pdf”

PROFIsafe Test Specification, related to PROFIsafe V2.6,  
Test Specification for PROFIBUS and PROFINET  
Version 2.3, March 2018, Item No.: 2.242  
“Psafe-Testspec\_2242\_V23\_Mar18.pdf”

For the latest versions of the documents visit  
[www.profinet.com](http://www.profinet.com) or contact your nearest Phoenix Contact  
representative regarding the document

For the latest versions of the documents visit  
[www.profisafe.net](http://www.profisafe.net) or contact your nearest Phoenix Contact  
representative regarding the documents.

**PLCnext Technology**



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



Comprehensive documentation on PLCnext Technology is available in the [PLCnext Info Center](#).

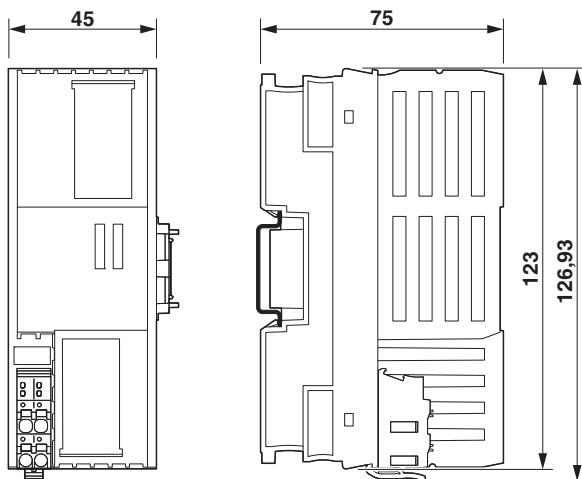
| Axioline F documentation   | Type                  | Item No. | Pcs./Pkt. |
|--|-----------------------|----------|-----------|
| User manual<br>Axioline F: System and installation                 | UM EN AXL F SYS INST  | –        | –         |
| User manual<br>Axioline F: Diagnostic registers and error messages | UM EN AXL F SYS DIAG  | –        | –         |
| User manual<br>Axioline Smart Elements                             | UM EN AXL SE SYS INST | –        | –         |

## AXC F XT SPLC 1000

| Description  | Type                      | Item No. | Pcs./Pkt. |
|--|---------------------------|----------|-----------|
| User manual<br>Installing, commissioning, and operating the AXC F 1152, AXC F 2152, and AXC F 3152 controllers   | UM EN AXL F X152          | –        | –         |
| <b>Documentation for software</b>  |                           |          |           |
| Online help<br>PLCnext Engineer  |                           |          |           |
| <b>Security</b>  |                           |          |           |
| Application note, English<br>Measures to protect network-capable devices with communication interfaces, solutions, and PC-based software against unauthorized access | AH EN INDUSTRIAL SECURITY | –        | 1         |

## 13.2 Technical data

### Dimensions (nominal sizes in mm)



Outer dimensions (width x height x depth)

45 mm x 126.93 mm x 75 mm (the depth applies when a TH 35-7.5 DIN rail is used (in accordance with EN 60715)).

### General data

|               |                |
|---------------|----------------|
| Color         | Yellow         |
| Weight        | 142 g          |
| Design        | Axioline       |
| Mounting type | DIN rail mount |



**Power supply**



**WARNING: Loss of electrical safety and the safety function when using unsuitable power supplies**

The AXC F XT SPLC 1000 is designed exclusively for protective extra-low voltage (PELV) operation according to EN 60204-1. Only protective extra-low voltages in accordance with the listed standard may be used for the supply.

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

Only use power supplies that satisfy the requirements of EN 61204-1 and feature safe isolation with PELV in accordance with IEC 61010-2-201 (PELV). They prevent short circuits between the primary and secondary side.

Please also observe the information in [Section "Electrical safety" on page 16](#).



**Select power supplies correctly!**

Refer to the information on selecting the power supply in [Section "Electrical safety" on page 16](#).

Use only power supplies with safe isolation with 24 V DC.



Use a **power supply without fall-back characteristic curve** (see [Section "Sizing of the power supply" on page 61](#)).

**Connection data**

|   |   |
|---|---|
| Designation                             | Axioline F connector  |
| Connection method                       | Push-in connection  |
| Conductor cross-section, rigid/flexible | 0.2 mm <sup>2</sup> ... 1.5 mm <sup>2</sup> / 0.2 mm <sup>2</sup> ... 1.5 mm <sup>2</sup> |
| Conductor cross-section [AWG]           | 24 ... 16   |
| Stripping length                        | 8 mm  |

**Feed-in of the communications voltage U<sub>L</sub>**

|                      |   |
|----------------------|---|
| Supply voltage       | 24 V DC   |
| Supply voltage range | 19.2 V DC ... 30 V DC (including all tolerances, ripple included) |
| Current consumption  | 80 mA, typical<br>Max. 100 mA                                     |



**NOTE: Damage to the electronics**

Provide external protection for the module.

**Protective circuit**

|   |                           |
|---|---------------------------|
| Polarity reversal protection for supply voltage | Polarity protection diode |
| Transient protection                            | Suppressor diode          |

**Ambient conditions**

|  |   |
|--|---|
| Ambient temperature (operation)          | -25°C ... 60°C up to 2,000 m above mean sea level<br>-25°C ... 55°C up to 3,000 m above mean sea level<br>-25°C ... 50°C up to 4,000 m above mean sea level |
| Ambient temperature (storage/transport)  | -40°C ... 85°C  |
| Permissible humidity (operation)         | 5% ... 95% (in accordance with DIN EN 61131-2)  |
| Permissible humidity (storage/transport) | 5% ... 95% (in accordance with 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  |



To ensure correct operation, the AXC F XT SPLC 1000 must be installed in a lockable housing or a lockable control cabinet with a minimum degree of protection of IP54.

|   |  |
|---|--|
| Protection class  | III (IEC 61140, EN 61140, VDE 0140-1)                        |
| Gases that may endanger functions in accordance with DIN 40046-36, DIN 40046-37 | Use of the device in these ambient conditions is prohibited. |
| Vibration resistance (operation/storage/transport)                              | 5g (in accordance with EN 60068-2-6/IEC 60068-2-6)           |
| Shock (operation)   | 30g (in accordance with EN 60068-2-27/IEC 60068-2-27)        |
| Continuous shock  | 10g (in accordance with EN 60068-2-27/IEC 60068-2-27)        |

**Diagnostic and status indicators**

|     |                   |
|-----|-------------------|
| FS  | LED: Red          |
| RUN | LED: Green/orange |
| P   | LED: Green        |
| C   | LED: Green        |

**Safety characteristic data in accordance with EN ISO 13849-1**

|   |                      |
|---|----------------------|
| Performance Level (PL)  | Max. e               |
| Category  | Max. 4               |
| Probability of a dangerous failure per hour (PFH <sub>D</sub> ) | 1 * 10 <sup>-9</sup> |
| Diagnostic coverage (DC <sub>avg</sub> )                        | 99%                  |
| Mean time to dangerous failure (MTTF <sub>D</sub> )             | >80 years            |

**Safety characteristic data for EN 62061**

|   |   |
|---|---|
| Safety Integrity Level Claim Limit (SIL CL)                     | Max. 3  |
| Probability of a dangerous failure per hour (PFH <sub>D</sub> ) | 1 * 10 <sup>-9</sup>  |
| Hardware Fault Tolerance (HFT)                                  | 1   |
| Duration of use (mission time)                                  | 300 months, therefore no restrictions, no maintenance intervals |
| Safe Failure Fraction (SFF) in accordance with DIN EN 62061     | 99%   |

**Safety characteristic data in accordance with IEC 61508 – high demand**

|   |   |
|---|---|
| Safety Integrity Level (SIL)                    | Max. 3  |
| Probability of dangerous failure per hour (PFH) | $1 * 10^{-9}$   |
| Hardware Fault Tolerance (HFT)                  | 1   |
| Duration of use (mission time)                  | 300 months, therefore no restrictions, no maintenance intervals |

**Characteristic data of the SPLC 1000 safety-related controller**

|  |  |
|--|--|
| Programming system   | PLCnext Engineer, IEC 61131              |
| CPU1 (Central Processing Unit 1)                               | ARM® Cortex®-M4, 180 MHz                 |
| CPU2 (Central Processing Unit 2)                               | ARM® Cortex™-M4, 100 MHz                 |
| Shortest cycle time $T_{ZSPLCmin}$                             | 5 ms                                     |
| Program memory (safety program)                                | 64 kB                                    |
| Data storage (addressable area)                                | 8 kB                                     |
| PROFIsafe profile  | V2.6MU1 (also includes support for V2.4) |
| Number of PROFIsafe F-Devices                                  | 32                                       |
| Sum of the safe input data (SI)                                | 512 bytes                                |
| Sum of the safe output data (SQ)                               | 512 bytes                                |
| Sum of the non-safety input data (NSI, inputs exchange area)   | 128 bytes                                |
| Sum of the non-safety output data (NSQ, outputs exchange area) | 128 bytes                                |
| Device diagnostics input data (DI)                             | 128 bytes                                |
| Device diagnostics output data (DQ)                            | 128 bytes                                |
| Function block diagnostics output data (FBQ)                   | 512 bytes                                |
| Number of function-block instances                             | 256                                      |

**Conformance with EMC directive 2014/30/EU**

**Immunity test in accordance with EN 61000-6-2**

|  |  |
|--|--|
| Electrostatic discharge (ESD), EN 61000-4-2/ IEC 61000-4-2 | Criterion A, 8 kV air discharge  |
| Electromagnetic fields EN 61000-4-3/IEC 61000-4-3          | Criterion A, field strength: 10 V/m  |
| Fast transients (burst) EN 61000-4-4/IEC 61000-4-4         | Criterion A, 2 kV  |
| Transient overvoltage (surge) EN 61000-4-5/IEC 61000-4-5   | Criterion A; DC supply lines: $\pm 0.5$ kV/ $\pm 0.5$ kV (symmetrical/ asymmetrical) |
| Conducted disturbance variables EN 61000-4-6/IEC 61000-4-6 | Criterion A, test voltage 10 V   |

**Noise emission test according to EN 61000-6-3** Class B

**Approvals**

For information on the current approvals, visit [phoenixcontact.net/product/1159811](http://phoenixcontact.net/product/1159811).



## A Appendix: Terms for PROFIsafe

Terms that are used in connection with PROFIsafe in this user manual are described below. A definition of PROFIsafe terms is also provided in the PROFIsafe profile.

|   |   |   |  |           |  |       |  |            |  |           |   |
|---|---|---|--|-----------|--|-------|--|------------|--|-----------|---|
| <b>CRC</b>  | <p>Cyclic Redundancy Check</p> <p>A cyclic redundancy check is used to verify the validity of the process data contained in the safety telegram, check whether the assigned address relationships are correct, and verify the safety-related parameters. This value is part of the safety telegram.</p>   |   |  |           |  |       |  |            |  |           |   |
| <b>Consecutive number</b>   | <p>Consecutive number</p> <p>Method for ensuring that the safe data is transmitted completely and in the correct order.</p>   |   |  |           |  |       |  |            |  |           |   |
| <b>Reintegration</b>  | <p>Removal of passivation for the reintegration of previously passivated F-Devices (see also <a href="#">"Passivation"</a>).</p>  |   |  |           |  |       |  |            |  |           |   |
| <b>F-Parameters</b>   | <p>(In accordance with PROFIsafe System Description, version April 2016)</p> <p>F-Parameters contain information for adapting the PROFIsafe layer to specific customer specifications and for checking the parameterization by means of a separate method (diverse). The main F-Parameters are:</p> <table border="0" style="margin-left: 20px;"> <tr> <td style="vertical-align: top;"> <p>F_Source_Address /<br/>F_Destination_Address /<br/>F_Source_Add /<br/>F_Dest_Add (F-Address<br/>for short)</p> </td> <td> <p>Unique address for F-Devices within a PROFIsafe island. The technology part of the F-Device compares the value with the local address switch or with an assigned F-Address in order to check authenticity of the connection.</p> <p>As of PROFIsafe profile V2.6.1, a distinction is made between two address types, which must be specified by the manufacturer in the F-Device-specific user documentation:</p> <p>Address type 1: The F-Device only checks the F_Destination_Address.</p> <p>Address type 2: The F-Device checks the F_Destination_Address and the F_Source_Address.</p> </td> </tr> <tr> <td style="vertical-align: top;">F_WD_Time</td> <td> <p>Specifies the time for the watchdog timer in milliseconds. The timer monitors the time that elapses until the next valid PROFIsafe message is received.</p> </td> </tr> <tr> <td style="vertical-align: top;">F_SIL</td> <td> <p>Indicates the SIL that the user can expect from the relevant F-Device. It is compared with the manufacturer's specification that is stored locally.</p> </td> </tr> <tr> <td style="vertical-align: top;">F_iPar_CRC</td> <td> <p>Checksum that is calculated from all iParameters of the technology-specific part of the F-Device.</p> </td> </tr> <tr> <td style="vertical-align: top;">F_Par_CRC</td> <td> <p>CRC signature that is created across all F-Parameters and ensures error-free transmission of the F-Parameters.</p> </td> </tr> </table> | <p>F_Source_Address /<br/>F_Destination_Address /<br/>F_Source_Add /<br/>F_Dest_Add (F-Address<br/>for short)</p> | <p>Unique address for F-Devices within a PROFIsafe island. The technology part of the F-Device compares the value with the local address switch or with an assigned F-Address in order to check authenticity of the connection.</p> <p>As of PROFIsafe profile V2.6.1, a distinction is made between two address types, which must be specified by the manufacturer in the F-Device-specific user documentation:</p> <p>Address type 1: The F-Device only checks the F_Destination_Address.</p> <p>Address type 2: The F-Device checks the F_Destination_Address and the F_Source_Address.</p> | F_WD_Time | <p>Specifies the time for the watchdog timer in milliseconds. The timer monitors the time that elapses until the next valid PROFIsafe message is received.</p> | F_SIL | <p>Indicates the SIL that the user can expect from the relevant F-Device. It is compared with the manufacturer's specification that is stored locally.</p> | F_iPar_CRC | <p>Checksum that is calculated from all iParameters of the technology-specific part of the F-Device.</p> | F_Par_CRC | <p>CRC signature that is created across all F-Parameters and ensures error-free transmission of the F-Parameters.</p> |
| <p>F_Source_Address /<br/>F_Destination_Address /<br/>F_Source_Add /<br/>F_Dest_Add (F-Address<br/>for short)</p> | <p>Unique address for F-Devices within a PROFIsafe island. The technology part of the F-Device compares the value with the local address switch or with an assigned F-Address in order to check authenticity of the connection.</p> <p>As of PROFIsafe profile V2.6.1, a distinction is made between two address types, which must be specified by the manufacturer in the F-Device-specific user documentation:</p> <p>Address type 1: The F-Device only checks the F_Destination_Address.</p> <p>Address type 2: The F-Device checks the F_Destination_Address and the F_Source_Address.</p>  |   |  |           |  |       |  |            |  |           |   |
| F_WD_Time   | <p>Specifies the time for the watchdog timer in milliseconds. The timer monitors the time that elapses until the next valid PROFIsafe message is received.</p>  |   |  |           |  |       |  |            |  |           |   |
| F_SIL   | <p>Indicates the SIL that the user can expect from the relevant F-Device. It is compared with the manufacturer's specification that is stored locally.</p>  |   |  |           |  |       |  |            |  |           |   |
| F_iPar_CRC  | <p>Checksum that is calculated from all iParameters of the technology-specific part of the F-Device.</p>  |   |  |           |  |       |  |            |  |           |   |
| F_Par_CRC   | <p>CRC signature that is created across all F-Parameters and ensures error-free transmission of the F-Parameters.</p>   |   |  |           |  |       |  |            |  |           |   |
| <b>F_Source_Address</b>   | <p>F-Parameter (F_Source_Add for short);<br/>PROFIsafe source address, address of the safety-related SPNS PROFINET controller (F-Host)</p>  |   |  |           |  |       |  |            |  |           |   |

|                                  |  |
|----------------------------------|--|
| <b>F_Destination_Address</b>     | F-Parameter (F_Dest_Add for short); PROFIsafe destination address; address of the PROFIsafe device (F-Device)  |
| <b>iParameters</b>               | Individual safety parameters of a device   |
| <b>Consecutive number</b>        | See " <a href="#">Consecutive number</a> "   |
| <b>Passivation</b>               | <p>If the safety module detects an error, it switches the affected channel or all channels of the module to the safe state; the channels are then passivated. The detected errors are reported to the safety-related controller.</p> <p>For a safe input module, when passivation is enabled, substitute values (0) are provided for the safety program instead of the process values present at the safe inputs.</p> <p>For a safe output module, when passivation is enabled, substitute values (0) are transferred to the safe outputs instead of the output values provided by the safety program.</p> |
| <b>PROFIsafe</b>                 | Safety-related bus profile based on PROFIBUS DP or PROFINET. It defines the communication between a safety program and the safe I/O devices in a safe system.  |
| <b>PROFIsafe address</b>         | Each safe module has a PROFIsafe address. This address must be set on the safety module via DIP switches, for example, and then configured in the configuration tool for the safety-related controller used.   |
| <b>PROFIsafe monitoring time</b> | <p>Monitoring time for safety-related communication between the S PLC 1000 and the safe I/O devices.</p> <p>This time is parameterized in the F_WD_Time F-Parameter.</p>   |

## B Appendix: Checklists


**NOTE: Observe supporting checklists**

The checklists listed in this section provide support during planning, assembly, and electrical installation, commissioning, parameterization, and validation of the SPLC 1000 and the PROFIsafe system.



These checklists may be used as additional planning documentation and/or as additional verification to ensure the steps in the specified phase are carried out carefully.

The checklists do not claim to be complete.

Observe the applicable standards for your application and, based on these, create individual specific checklists for your system/machine.

Archive the completed checklists to use as reference for recurring tests.

The checklists do not replace validation, initial startup, as well as regular testing performed by qualified personnel.

The following section of a checklist shows an example of a filled in checklist.

| Checklist . . .                             |  |                                |            |
|---|--|--------------------------------|------------|
| <b>Device type/equipment identification</b> |  | AXC F XT S PLC 1000 / BK15NA11 |            |
| <b>Version:</b>                             | ≥ 01/01.00.0000  | <b>Date</b>                    | 2021-02-18 |
| <b>Editor</b>                               | John Smith   | <b>Test engineer</b>           | Jane Brown |
| <b>Comment</b>                              | System XXX has been checked for engine hood production |                                |            |
| No.   | Requirement  | Yes                            | Comment    |
| X   | ...  | <input type="checkbox"/>       |            |

Key:

**Device type/equipment identification** Enter the device type and/or the equipment identification for the relevant device.

**Version:**  
**HW/FW** Enter the hardware and firmware version of the device (see revision specification on the label, item 4 in [Figure 3-15 on page 46](#)).

**Date** Enter the date on which you began to fill in this checklist.

**Editor** Enter the name of the editor.

**Test engineer** Enter the name of the test engineer.

**Comment** Where necessary, enter a comment.

**Requirement (mandatory)** These requirements must be met for a safety application, in order to complete the relevant phase using the checklist.

**Requirement (optional)** These requirements are optional. For points that are not met (No), please enter an appropriate remark in the relevant field.

## B 1 System-specific checklists

This section contains checklists that relate to the phases of life of the PROFIsafe system.

### B 1.1 Planning

| Checklist for planning the use of the PROFIsafe system |   |                          |         |
|--|---|--------------------------|---------|
| Equipment identification                               |   |                          |         |
|  |   | Date                     |         |
| Editor   |   | Test engineer            |         |
| Comment  |   |                          |         |
| No.  | Requirement   | Yes                      | Comment |
| 1  | Have the applicable standards for the system/machine been selected and are the resulting requirements known for each safety function and phase of life of the system/machine?   | <input type="checkbox"/> |         |
| 2  | Has risk assessment for the system/machine been carried out?  | <input type="checkbox"/> |         |
| 3  | Has the corresponding safety category/safety integrity level been derived from risk assessment?   | <input type="checkbox"/> |         |
| 4  | Have the individual safety functions been fully defined/specified?  | <input type="checkbox"/> |         |
| 5  | Does the planned PROFIsafe system meet the required safety integrity for all defined safety functions?  | <input type="checkbox"/> |         |
| 6  | Has the power supply been planned in accordance with the specifications on protective extra-low voltage (PELV) in accordance with EN 60204-1 (including safe isolation with PELV in accordance with IEC 61010-2-201)? | <input type="checkbox"/> |         |
| 7  | Has the maximum permissible response time (SFRT) for each individual safety function within the PROFIsafe system in your system/machine been determined and documented?   | <input type="checkbox"/> |         |
| 8  | Can the planned system/machine be implemented when the determined SFRT is observed with the specified PROFINET infrastructure?  | <input type="checkbox"/> |         |
| 9  | Can the planned application be realized with the programming capacities (for example by using function blocks) and has a specification of the safety-related application program been created?                        | <input type="checkbox"/> |         |
| 10   | Have the user rights for the safety-related application program been specified in the PLCnext Engineer software?  | <input type="checkbox"/> |         |
| 11   | Has a project password been provided?   | <input type="checkbox"/> |         |
| 12   | Who is authorized to “develop” the safety-related application program?  | <input type="checkbox"/> | Names:  |
| 13   | Has a SafePLC password been provided?   | <input type="checkbox"/> |         |
| 14   | Were the settings for user authentication defined in the web-based management system of the PLCnext Control used?   | <input type="checkbox"/> | Names:  |
| 15   | Has the location where the software is to be installed (e.g., on the system PC) been specified?   | <input type="checkbox"/> |         |



**System-specific checklists**

| No. | Requirement  | Yes                      | Comment                   |
|-----|--|--------------------------|---------------------------|
| 16  | Are measures planned which prevent unintentional, automatic restart with hazardous states?   | <input type="checkbox"/> |                           |
| 17  | Are measures planned to ensure unique F-Addresses throughout the network (F-Source Addresses of PROFIsafe devices and F-Destination Addresses of safety-related PROFINET controllers (SPLC 1000))? | <input type="checkbox"/> |                           |
| 18  | Does the planned use correspond to the intended use of the system?   | <input type="checkbox"/> |                           |
| 19  | Has the technical data of the PROFIsafe system been observed?  | <input type="checkbox"/> |                           |
| 20  | Have the requirements of the PROFINET Assembling Guideline been observed and met during planning?  | <input type="checkbox"/> |                           |
| 21  | Have the accessories to be used been planned (e.g., cables, connectors)?   | <input type="checkbox"/> |                           |
| 22  | Are the period of use / proof test intervals and maintenance intervals of the PROFIsafe devices used known and documented?   | <input type="checkbox"/> |                           |
| 23  | Is the assignment of responsibility for subsequent phases of life specified (e.g., for assembly/installation/programming/startup/validation, etc.)?  | <input type="checkbox"/> | Name/company:             |
| 24  | Are measures planned against unauthorized network access?  | <input type="checkbox"/> |                           |
|     |  | Date                     | Signature (editor)        |
|     |  | Date                     | Signature (test engineer) |

**B 1.2 Programming**

| Checklist for programming the PROFIsafe system |   |  |                           |
|--|---|--|---------------------------|
| <b>Equipment identification</b>                |   |  |                           |
|  |   | <b>Date</b>  |                           |
| <b>Editor</b>                                  |   | <b>Test engineer</b>                                     |                           |
| <b>Comment</b>                                 |   |  |                           |
| No.  | Requirement   | Yes  |                           |
| 1  | Have the requirements from the applicable standards for the system/machine been observed and met in the programming phase?  | <input type="checkbox"/>                                 |                           |
| 2  | Have the user rights for the safety-related application program been created in the PLCnext Engineer software?  | <input type="checkbox"/>                                 |                           |
| 3  | Has the safety-related application program been created entirely in PLCnext Engineer?   | <input type="checkbox"/>                                 |                           |
| 4  | Have additional application-specific programming guidelines been created and observed within the program specification for the planning phase?  | <input type="checkbox"/>                                 |                           |
| 5  | Are standard input signals exclusively used to program standard operations (e.g., for the enable principle using the EN_OUT block or for acknowledgment)?   | <input type="checkbox"/>                                 |                           |
| 6  | Are the parameterized F-Addresses (F-Source Addresses of PROFIsafe controllers and F-Destination Addresses of PROFIsafe devices) unique throughout the network?   | <input type="checkbox"/>                                 |                           |
| 7  | Is the F_WD_Time calculated for each F-Device parameterized in the "Safety Parameters" editor in PLCnext Engineer?  | <input type="checkbox"/>                                 |                           |
| 8  | Has a project password been defined?  | <input type="checkbox"/>                                 |                           |
| 9  | Who is authorized to "develop" the safety-related application program?  | <input type="checkbox"/>                                 | Names:                    |
| 10   | Has a SafePLC password been defined?  | <input type="checkbox"/>                                 |                           |
| 11   | Has project information been entered in the "Description" field in the "Properties" editor in the "Project" editor group?   | <input type="checkbox"/>                                 | Type:<br>Location:        |
| 12   | Are possible reciprocal effects due to exchange variables between the programming of the standard controller (PLCnext Control) and the SPLC 1000 taken into consideration and clear?  | <input type="checkbox"/>                                 |                           |
| 13   | Has the following been observed when programming/configuring your safety logic? <ul style="list-style-type: none"> <li>- Switching from the safe state (substitute value = 0) to the operating state can generate an edge change (zero/one edge).</li> <li>- In the safety logic, take measures to prevent this edge change resulting in unexpected machine/system startup or restart.</li> </ul> | <input type="checkbox"/><br><br><input type="checkbox"/> |                           |
|  |   | Date   | Signature (editor)        |
|  |   | Date   | Signature (test engineer) |


**B 1.3 Commissioning**

| Checklist for commissioning the PROFIsafe system |   |                           |         |
|--|---|---------------------------|---------|
| <b>Equipment identification</b>                  |   |                           |         |
|  |   | <b>Date</b>               |         |
| <b>Editor</b>                                    |   | <b>Test engineer</b>      |         |
| <b>Comment</b>                                   |   |                           |         |
| No.  | Requirement   | Yes                       | Comment |
| 1  | Have the requirements from the applicable standards for the system/machine been observed and met in the commissioning phase?  | <input type="checkbox"/>  |         |
| 2  | Is safety ensured during the commissioning phase by means of additional measures and if so what are these measures (see also No. 1)?  |                           |         |
|  | 1 _____   | <input type="checkbox"/>  |         |
|  | 2 _____   | <input type="checkbox"/>  |         |
|  | 3 _____   | <input type="checkbox"/>  |         |
|  | 4 _____   | <input type="checkbox"/>  |         |
|  | 5 _____   | <input type="checkbox"/>  |         |
|  | 6 _____   | <input type="checkbox"/>  |         |
|  | 7 _____   | <input type="checkbox"/>  |         |
|  | 8 _____   | <input type="checkbox"/>  |         |
|  | 9 _____   | <input type="checkbox"/>  |         |
|  | 10 _____  | <input type="checkbox"/>  |         |
|  | Additional requirements in: _____   | <input type="checkbox"/>  |         |
| 3  | Are adjustments to the $F\_WD\_Time_{min}$ required in order to ensure ruggedness of the system and system availability, since the actual SPLC 1000 cycle time may deviate from the SPLC 1000 cycle time estimated during the planning phase? | <input type="checkbox"/>  |         |
|  | <b>NOTE: Do not exceed <math>F\_WD\_Time_{max}</math></b><br>The set $F\_WD\_Time$ must not exceed the $F\_WD\_Time_{max}$ from the defined SFRT. (See also "Validation" checklist)   |                           |         |
| 4  | Are measures implemented against unauthorized network access?   | <input type="checkbox"/>  |         |
| 5  | Are specifications for the commissioning phase applicable and have they been met?   | <input type="checkbox"/>  |         |
|  | Date  | Signature (editor)        |         |
|  | Date  | Signature (test engineer) |         |

**B 1.4 Validation**

| Checklist for validating the PROFIsafe system |   |                          |         |
|---|---|--------------------------|---------|
| <b>Equipment identification</b>               |   |                          |         |
|   |   | <b>Date</b>              |         |
| <b>Editor</b>                                 |   | <b>Test engineer</b>     |         |
| <b>Comment</b>                                |   |                          |         |
| No.   | Requirement   | Yes                      | Comment |
| 1   | Have the requirements from the applicable standards for the system/machine been observed and met for validation?  | <input type="checkbox"/> |         |
| 2   | Have the requirements from the previous planning, programming, and commissioning phases been met?   | <input type="checkbox"/> |         |
| 3   | Has validation of the F-Devices used been carried out and are the results available?  | <input type="checkbox"/> |         |
| 4   | Have safety distances to be observed been calculated and checked according to the implemented response and delay times (response times, SFRT, F_WD_Time <sub>max</sub> )?   | <input type="checkbox"/> |         |
| 5   | Have all the safety functions been checked successfully?  | <input type="checkbox"/> |         |
| 6   | Do the two CRC checksums displayed in the "Safety PLC" editor group in the "Safety Cockpit" editor in the "Overview" view ("Safety PLC project information" and "Engineering project information") match?<br>If you are connected online to the safety-related controller, the checksums are displayed in PLCnext Engineer. | <input type="checkbox"/> |         |
| 7   | Have measures against unauthorized network access been implemented and checked?   | <input type="checkbox"/> |         |

**System-specific checklists**

|           |   |                          |                           |
|-----------|---|--------------------------|---------------------------|
| <b>8</b>  | Are the directives and standards used listed in the declaration of conformity?  | <input type="checkbox"/> |                           |
| <b>9</b>  | Have the programs created in PLCnext Engineer been archived as zip files? Enter the archiving location (e.g., drive or cabinet) in the "Comment" section.   | <input type="checkbox"/> |                           |
| <b>10</b> | Has a complete printout of the safety-related application program programmed in PLCnext Engineer been stored in the system?   | <input type="checkbox"/> |                           |
| <b>11</b> | Have all fully filled in checklists been stored in the system?  | <input type="checkbox"/> |                           |
| <b>12</b> | <p><b>Completion of validation</b></p> <p>Has the latest program version (including the "Project information") been downloaded to the safety-related S PLC 1000 controller on automatic startup?</p> <p>Have organizational or technical measures been introduced for checking the CRC checksum expected for the respective system/machine after a voltage reset or system restart? The CRC checksum is displayed by the CRC element of the S PLC system variable (see <a href="#">Table 8-1 "S PLC system variable and elements of the SPNSV2_TYPE data structure"</a>).</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p> A technical measure for checking the CRC checksum must be implemented in such a way that the check is carried out by a third technical entity beyond the S PLC 1000 and PLCnext Control.</p> </div> | <input type="checkbox"/> |                           |
|           |   | Date                     | Signature (editor)        |
|           |   | Date                     | Signature (test engineer) |

## B 2 Device-specific checklists

This section contains checklists that relate to the phases of life of the SPLC 1000.

### B 2.1 Planning

| Checklist for planning the use of the AXC F XT SPLC 1000 |  |  |                           |
|--|--|--|---------------------------|
| <b>Device type/equipment identification</b>              |  |  |                           |
| <b>Version:<br/>HW/FW</b>                                |  | <b>Date</b>  |                           |
| <b>Editor</b>  |  | <b>Test engineer</b>   |                           |
| <b>Comment</b>   |  |  |                           |
| No.  | Requirement  | Yes  | Comment                   |
| 1  | Has the systematic "Planning" checklist been observed?   | <input type="checkbox"/>   |                           |
| 2  | Are all measures that are based on applicable standards and the PROFINET Assembling Guideline planned?   | <input type="checkbox"/>   |                           |
| 3  | Has the current AXC F XT SPLC 1000 user manual been used as the basis for planning?  | <input type="checkbox"/>   |                           |
| 4  | Have the power supply for the device and direct I/Os been planned as per the specifications for protective extra-low voltage (PELV) in accordance with EN 60204-1 (including safe isolation with PELV in accordance with IEC 61010-2-201)? | <input type="checkbox"/>   |                           |
| 5  | Are measures planned to prevent simple tampering? If so, what are they?<br>1 _____<br>2 _____<br>3 _____<br>4 _____<br>5 _____   | <input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/><br><input type="checkbox"/> |                           |
| 6  | Does the planned use correspond to the intended use?   | <input type="checkbox"/>   |                           |
| 7  | Have the ambient conditions according to the technical data been observed?   | <input type="checkbox"/>   |                           |
| 8  | Has the degree of protection been observed?  | <input type="checkbox"/>   |                           |
| 9  | Have the accessories to be used been planned in accordance with the ordering data in this user manual (cables, plugs)?   | <input type="checkbox"/>   |                           |
| 10   | Have specifications for assembly and electrical installation been defined (e.g., EPLAN) and communicated to the relevant personnel?  | <input type="checkbox"/>   |                           |
| 11   | Have specifications for parameterization been defined and communicated to the relevant personnel?  | <input type="checkbox"/>   |                           |
| 12   | Have specifications for startup been defined and communicated to the relevant personnel?   | <input type="checkbox"/>   |                           |
| 13   | Has the technical data of the interfaces been observed?  | <input type="checkbox"/>   |                           |
|  |  | Date   | Signature (editor)        |
|  |  | Date   | Signature (test engineer) |

**B 2.2 Assembly and electrical installation**

| Checklist for assembly and electrical installation of the AXC F XT S PLC 1000 |  |                          |                           |
|---|--|--------------------------|---------------------------|
| <b>Device type/equipment identification</b>                                   |  |                          |                           |
| <b>Version:<br/>HW/FW</b>   |  | <b>Date</b>              |                           |
| <b>Editor</b>   |  | <b>Test engineer</b>     |                           |
| <b>Comment</b>  |  |                          |                           |
| No.   | Requirement  | Yes                      | Comment                   |
| 1   | Has assembly and electrical installation been carried out according to the specifications of the planning phase?   | <input type="checkbox"/> |                           |
| 2   | Has assembly and electrical installation been carried out according to the specifications in the user manual for the AXC F XT S PLC 1000?  | <input type="checkbox"/> |                           |
| 3   | Has assembly and electrical installation been carried out according to the specifications of the applicable standards and the PROFINET Assembling Guideline?   | <input type="checkbox"/> |                           |
| 4   | Have the power supply for the device and direct I/Os been installed as per the specifications for protective extra-low voltage (PELV) in accordance with EN 60204-1 (including safe isolation with PELV in accordance with IEC 61010-2-201)? | <input type="checkbox"/> |                           |
| 5   | Have measures been taken to prevent simple tampering (e.g., control cabinet can be locked, PLCnext Engineer access rights (user authorization), etc.)? If so, what are they?   |                          |                           |
|   | 1 _____  | <input type="checkbox"/> |                           |
|   | 2 _____  | <input type="checkbox"/> |                           |
|   | 3 _____  | <input type="checkbox"/> |                           |
|   | 4 _____  | <input type="checkbox"/> |                           |
|   | 5 _____  | <input type="checkbox"/> |                           |
|   | 6 _____  | <input type="checkbox"/> |                           |
|   | 7 _____  | <input type="checkbox"/> |                           |
|   | 8 _____  | <input type="checkbox"/> |                           |
|   | 9 _____  | <input type="checkbox"/> |                           |
|   | 10 _____   | <input type="checkbox"/> |                           |
|   |  | Date                     | Signature (editor)        |
|   |  | Date                     | Signature (test engineer) |

### B 2.3 Commissioning and parameterization



Refer to the online help for the PLCnext Engineer software.

| Checklist for commissioning and parameterization of the AXC F XT S PLC 1000 |  |                          |                           |
|---|--|--------------------------|---------------------------|
| <b>Device type/equipment identification</b>                                 |  |                          |                           |
| <b>Version:<br/>HW/FW</b>   |  | <b>Date</b>              |                           |
| <b>Editor</b>   |  | <b>Test engineer</b>     |                           |
| <b>Comment</b>  |  |                          |                           |
| No.   | Requirement  | Yes                      | Comment                   |
| 1   | Have the systematic "Programming" and "Startup" checklists been observed?  | <input type="checkbox"/> |                           |
| 2   | Was commissioning completed in accordance with the specifications (specifications from the planning phase and/or in accordance with the AXC F XT S PLC 1000 user manual, see <a href="#">Table 6-1 "Steps for initial commissioning of the S PLC 1000"</a> )?            | <input type="checkbox"/> |                           |
| 3   | Is it ensured that when the supply voltage of the AXC F XT S PLC 1000 is switched on, automatic startup does not cause a hazardous movement on the machine/system?   | <input type="checkbox"/> |                           |
|   | <div style="border: 1px solid black; padding: 5px; display: inline-block;"> <b>WARNING: Preventing automatic startup</b><br/>                     Take appropriate measures to ensure that automatic startup of your system/machine is prevented.                 </div> |                          |                           |
|   |  | Date                     | Signature (editor)        |
|   |  | Date                     | Signature (test engineer) |



## B 2.4 “Initial commissioning” and “recommissioning/device replacement” validation

Carry out a validation every time you make a safety-related modification to the PROFIsafe system.



In addition, refer to the online help for the PLCnext Engineer software.

| Checklist for validation on initial commissioning or recommissioning/device replacement of the AXC F XT SPLC 1000 |   |                          |                           |
|---|---|--------------------------|---------------------------|
| <b>Device type/equipment identification</b>   |   |                          |                           |
| <b>Version:<br/>HW/FW</b>   |   | <b>Date</b>              |                           |
| <b>Editor</b>   |   | <b>Test engineer</b>     |                           |
| <b>Comment</b>  |   |                          |                           |
| No.   | Requirement   | Yes                      | Comment                   |
| 1   | Has the systematic “Validation” checklist been observed?  | <input type="checkbox"/> |                           |
| 2   | Have all the requirements of the “Planning” checklist been met?   | <input type="checkbox"/> |                           |
| 3   | Have all the requirements of the “Assembly and electrical installation” checklist been met?   | <input type="checkbox"/> |                           |
| 4   | Have all the requirements of the “Commissioning and parameterization” checklist been met?   | <input type="checkbox"/> |                           |
| 5   |   |                          |                           |
| 5a  | Initial commissioning:<br>Has a function test been performed to check all the safety functions in which the AXC F XT SPLC 1000 is involved?   | <input type="checkbox"/> |                           |
| 5b  | Recommissioning after replacing the AXC F XT SPLC 1000:<br>The CRC checksum of the PLCnext Engineer project corresponds to the version validated and documented for the machine/system under 5a (see also checklist item No. 12 in Section B 1.4 “Validation”). | <input type="checkbox"/> |                           |
| 6   | Does the power supply for the device and direct I/Os comply with the specifications on protective extra-low voltage (PELV) in accordance with EN 60204-1 (including safe isolation with PELV in accordance with IEC 61010-2-201)?                               | <input type="checkbox"/> |                           |
| 7   | Do all cables correspond to the specifications?   | <input type="checkbox"/> |                           |
| 8   | Wiring check:<br>Have all the inputs and outputs of all F-Devices physically present in the network and configured in PLCnext Engineer been wired correctly?  | <input type="checkbox"/> |                           |
| 9   | Have measures been taken to prevent simple tampering?   | <input type="checkbox"/> |                           |
|   |   | Date                     | Signature (editor)        |
|   |   | Date                     | Signature (test engineer) |



## C Appendix for document lists

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## D Appendix: Revision history

| Revision | Date       | Content  |
|----------|------------|--|
| 01       | 2021-11-11 | First publication of the user manual for the AXC F XT SPLC 1000. |



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