

The background image shows a man in a light blue shirt from the side, looking at a tablet. He is in a factory or industrial setting with various machines and equipment visible in the background. Overlaid on the image are several digital graphics: a '24/7' icon with a circular arrow, a 'NEWS' icon with a person silhouette, a 'Home' icon, and a large 'Industry Online Support' text. There are also binary code (0s and 1s) and network-like icons scattered throughout the digital overlay.

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Integration of a SINAMICS G120 (F variant) with PROFINET in SIMATIC PCS 7

SIMATIC PCS 7 / F Systems / SINAMICS G120 /
PROFIsafe

<https://support.industry.siemens.com/cs/ww/en/view/35928862>

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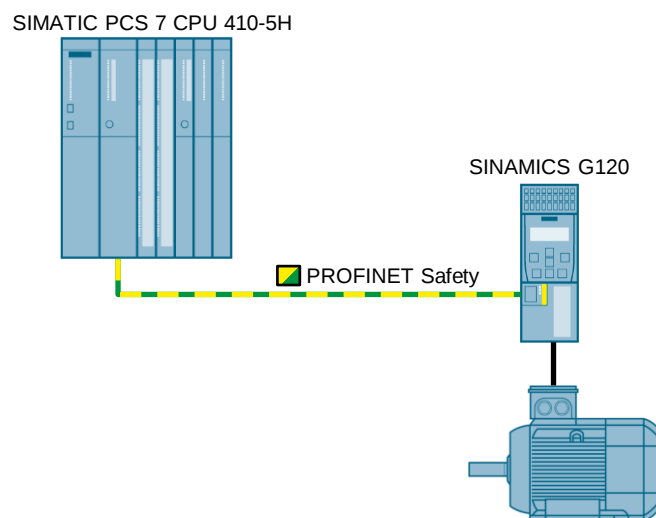
1 Introduction

1.1 Overview

Objective of the application

This application example describes the integration of a SINAMICS G120 F frequency inverter in SIMATIC PCS 7 with SIMATIC S7 F Systems. Special attention is paid to the parameterization of the PROFINET and PROFIsafe settings.

Figure 1-1 Overview of components



Key contents

- Integration of the GSDML file (device master data) and the SINAMICS G120 (F variant) in PCS 7
- Hardware configuration
- Installation using the “SINAMICS MICROMASTER STARTER” editor
- Settings of the PROFINET and PROFIsafe parameters
- Parameterization of the “Safety Integrated Function” and acknowledgements

1.2 Components Used

The application example has been created with the following hardware and software components:

Table 1-1 Software components

Components	Note
SIMATIC PCS 7 V9.0 SP2 UC01	
SINAMICS MICROMASTER STARTER V5.1.1.2	Parameterization of the Frequency Inverter <u>Download:</u> https://support.industry.siemens.com/cs/ww/en/view/26233208
SIMATIC S7 F Systems V6.2 Upd 1	
GSDML file	G120_GSDML_CU240E-2_PN_V4_7_9.zip <u>Download:</u> https://support.industry.siemens.com/cs/en/en/view/26641490
S7 F Systems Library V1.3 SP2	

Table 1-2 Hardware components

Components	Item number
SIMATIC PCS 7 CPU 410-5H E	6ES7410-5HM08-0AB0
SINAMICS G120 CU240E-2 PN-F, FW V4.7	6SL3244-0BB13-1FA0

Delimitation

The manual covers the integration via PROFINET with PROFIsafe. If you use PROFIBUS, refer to the document: "Integration of a SINAMICS G120 (F variant) with PROFIBUS in SIMATIC PCS 7"

The following points are not discussed in detail:

- Integration of the safety functions, which are performed directly via secure inputs on the device
- Wiring and assembly of the individual components
- Fundamentals of the integration of frequency-controlled drives in PCS 7

Basic knowledge of PCS 7 engineering, PROFINET, PROFIsafe, and Safety is assumed.

Note

You can find the configuration of SINAMICS and MICROMASTER drives with Drive ES in PCS 7 in the following application example:

<https://support.industry.siemens.com/cs/ww/en/view/58007228>

You can find configuration of frequency inverters with the APL channel block "FbDrive" in SIMATIC PCS 7 in the following application example:

<https://support.industry.siemens.com/cs/ww/en/view/64181993>

2 Configuration

2.1 Requirements

A prepared PCS 7 project is required, where at least a CPU with F-parameters, a PROFINET string, and all communication paths are configured.

The initial commissioning of the frequency inverter and its PROFINET communication parameters must already have been performed.

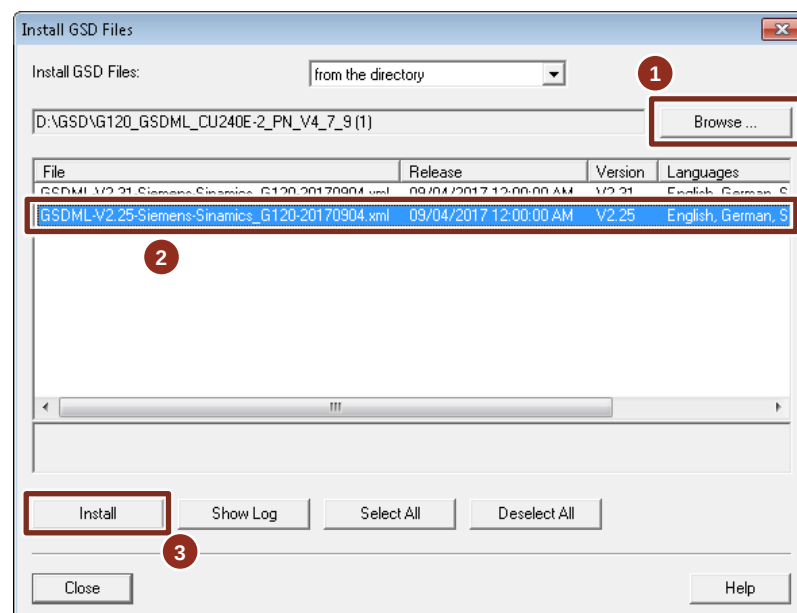
2.2 GSD File Import

Open the hardware configuration and install the corresponding GSDML file in the preferred language. Make sure you have the correct firmware version.

Procedure

1. Options > Install GSD file
2. Browse... > Select storage directory for the GSDML
3. Select desired GSDML > Install

Figure 2-1



2.3 Hardware Configuration

The PROFINET communication between the CPU and the SINAMICS G120 (F variant) consists of two components that must be configured in slots 1 and 2.

- PROFIsafe telegram for the safety functions (slot 1)
- Telegram for the control of the SINAMICS (slot 2)

Note

As an alternative to the PROFIsafe Telegram 30, the PROFIsafe Telegram 900 is available. Depending on the safety functions used, the corresponding PROFIsafe Telegram must be selected by the user.

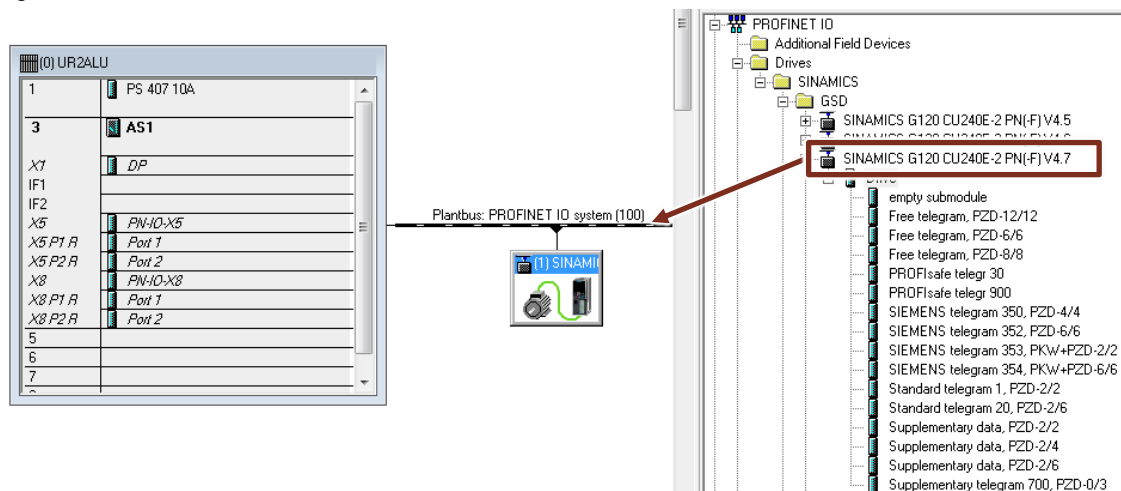
You can find an overview of the PROFIsafe Telegrams and their structure in the following manual:

<https://support.industry.siemens.com/cs/en/en/view/109757227>

Procedure

1. Open the HW configuration.
2. Switch to the catalog's default profile.
3. Insert the SINAMICS from the hardware catalog into the desired PROFINET IO system.
"PROFINET IO > Drives > GSD > SINAMICS G120 CU240x-2PN(-F) V4.7"

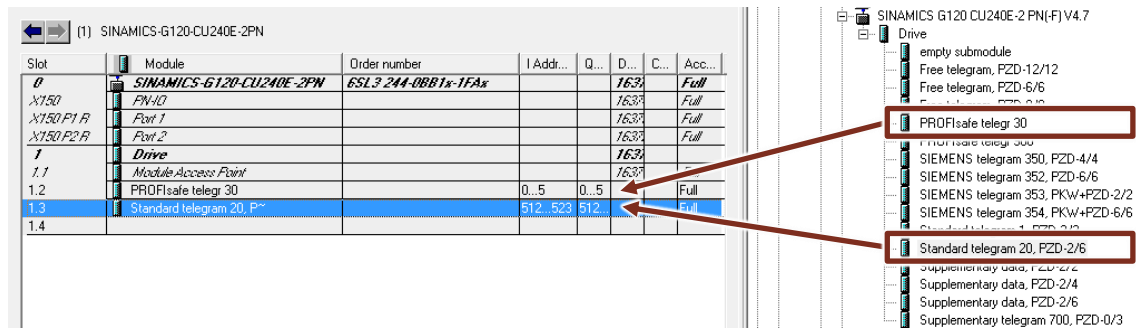
Figure 2-2



2 Configuration

4. Then insert the Telegrams relevant for the communication:
 - PROFIsafe Telegram 30 in Slot 1
 - Standard Telegram 20 in Slot 2

Figure 2-3



5. Assign the PROFINET device name, the PROFINET device number, and the IP address of the frequency inverter.

2.3.1 PROFIsafe Telegram

The PROFIsafe Telegram is used to implement PROFINET communication of the SINAMICS G120 (F variant) safety functions.

- The value “F_Dest_Add” is the PROFIsafe address of SINAMICS and is specified by the HW configuration. It is used for unique identification of source and target and must be entered later in SINAMICS in parameter p9810.
- The “F_WD_Time” parameter is the PROFIsafe monitoring time. A valid current safety message frame must come from the F CPU within this monitoring time period. This ensures that failures and errors are detected and appropriate reactions triggered.

Procedure

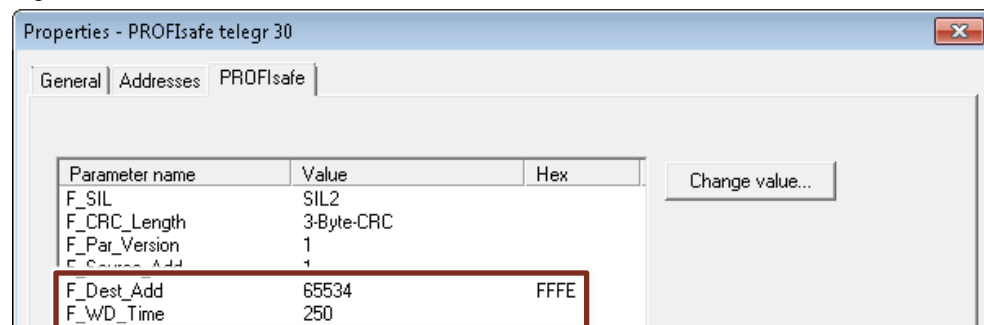
1. Double-click on the PROFIsafe Telegram to open its properties and select the “PROFIsafe” tab.
2. Assign the PROFIsafe address and the PROFIsafe monitoring time and confirm with “Ok”. (In this application example, the default value was used.)

Note

The necessary monitoring times can be calculated with the table “s7ftime.xlsm”:

<https://support.industry.siemens.com/cs/ww/en/view/22557362>

Figure 2-4



2.3.2 Telegram for Control

This Telegram is used to communicate all non-safety-relevant process and control values such as control signals, status commands, the frequency set point, and the actual frequency value. Therefore, always select your Telegram in accordance with the requirements.

Note

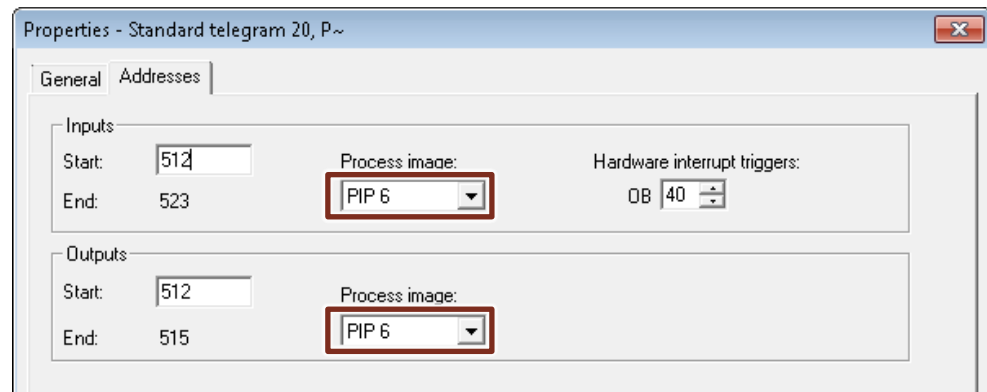
You can find an overview of the available standard and SIEMENS Telegrams, as well as their structure and content, in the CU240 E Operating Manual:

<https://support.industry.siemens.com/cs/ww/en/view/109478828>

Procedure

1. Set a process image for your Telegram for Control and then configure it in the CPU.

Figure 2-5



2. Load this configuration into the AS.

2.4 Symbol Editor

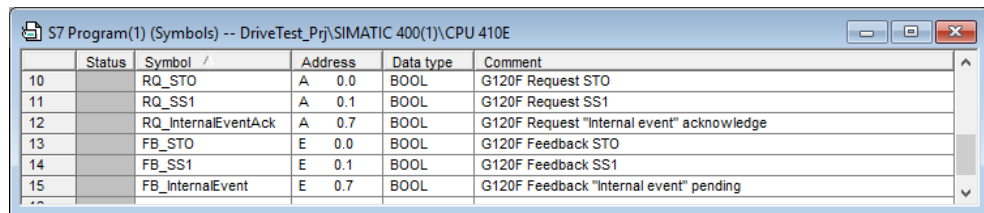
Each drive with a configured PROFIsafe Telegram represents an F Device with PROFIsafe communication to the F Host. A separate PROFIsafe Telegram is selected for each drive. In this example, Telegram 30 is used.

This Telegram contains 6 bytes of input data and 6 bytes output data. The first two bytes (PZD1) each contain the Safety user data. The remaining bytes are required for safe PROFIsafe communication.

Procedure

1. For the fail-safe inputs and outputs of the PROFIsafe Telegram, create the symbols for "STO", "SS1", and "InternalEvent" in the symbol editor.
 - The outputs actively control the safe states. Here, the value "zero" is the safe state, i.e. when a fail-safe "high signal" is sent, permission is granted.
 - The inputs transmit the current state of SINAMICS with regard to fail-safe shutdown.

Figure 2-6



	Status	Symbol /	Address	Data type	Comment
10		RQ_STO	A 0.0	BOOL	G120F Request STO
11		RQ_SS1	A 0.1	BOOL	G120F Request SS1
12		RQ_InternalEventAck	A 0.7	BOOL	G120F Request "Internal event" acknowledge
13		FB_STO	E 0.0	BOOL	G120F Feedback STO
14		FB_SS1	E 0.1	BOOL	G120F Feedback SS1
15		FB_InternalEvent	E 0.7	BOOL	G120F Feedback "Internal event" pending

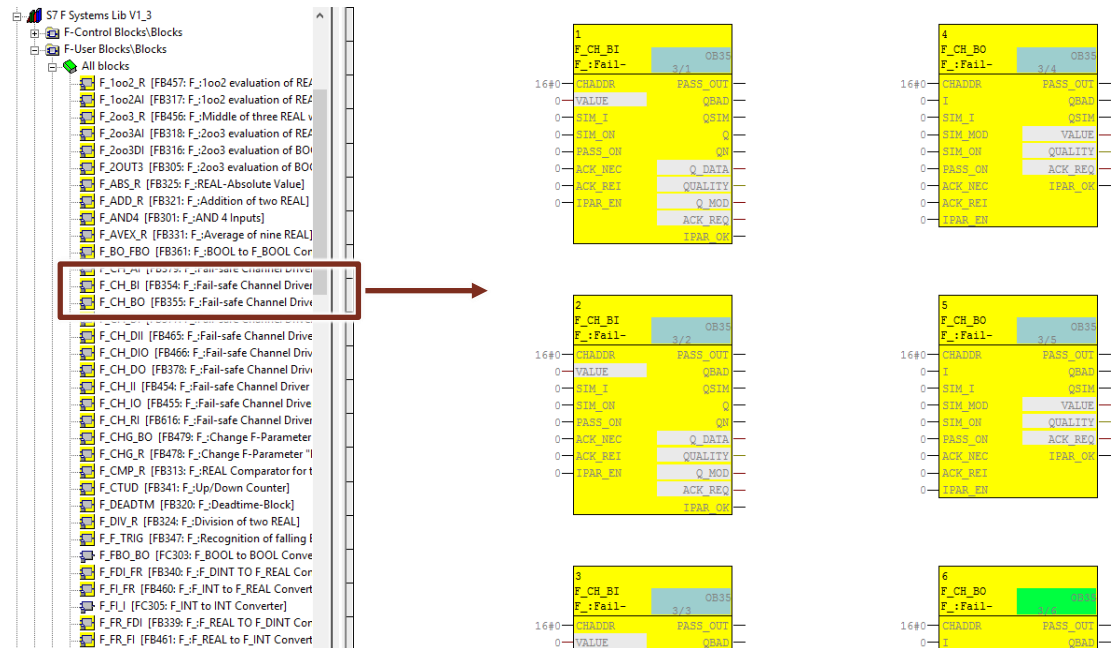
2. Create appropriate symbols in the symbol editor for the input and output addresses of the standard Telegram 20.

2 Configuration

Configuration of the F-plan

1. Insert a new CFC plan in the desired hierarchy folder and open it.
2. Place the fail-safe channel drivers "F_CH_BI" for reading the feedback signals and "F_CH_BO" for the output of the request signals. You can find this in the library "S7 F Systems Lib V1_3".

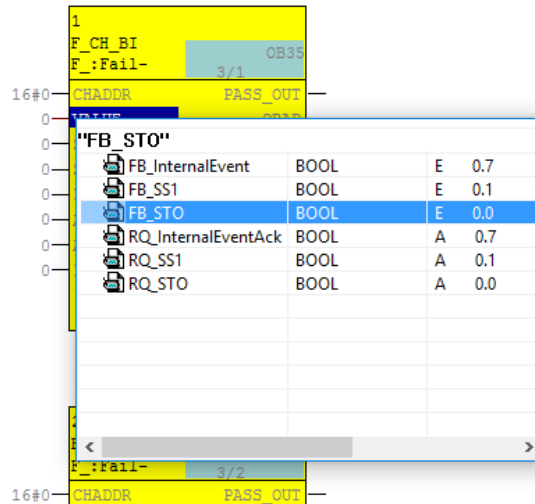
Figure 2-8



2 Configuration

3. Connect the channel drivers to the respective input and output symbols:
 - "F_CH_BI" with the feedback signals "FB_xxx"
 - "F_CH_BO" with the outputs "RQ_xxx"

Figure 2-9



4. Connect the inputs and outputs with your fail-safe program.
5. Compile the S7 program and download it to the AS. Acknowledge the channel drivers to obtain the current process values.

3 Parameterization of the Frequency Inverter

The following section describes how to configure the SINAMICS G120 (F variant) if it has not yet been configured for PROFINET operation.

The following steps in the project are only necessary to configure the SINAMICS using the “STARTER” editor.

3.1 Integration into the User Project

The following steps in the project are only necessary to configure the SINAMICS using the “STARTER” editor. If you want to configure the frequency inverter via another interface (e.g. USB adapter), this step can be omitted.

Note The following steps are only possible if the initial commissioning of the frequency inverter has already been performed and the PROFINET parameters have been set.

Note The PCS 7 driver generator does not work with the OM version, so it cannot be used in the initial configuration.

Procedure

1. Copy your created subproject with the “Save as” function. This project only serves to configure the SINAMICS via “STARTER”. Save it in a temporary path outside your multi-project and open it.
2. Open the hardware configuration of your AS and delete the inserted SINAMICS, because the GSDML file does not allow dataset routes.

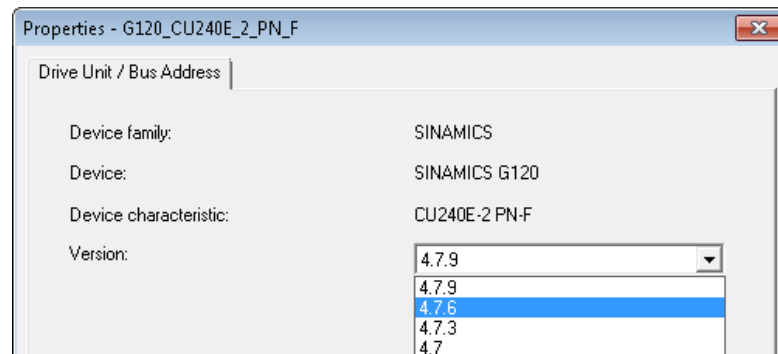
Note Inserting the SINAMICS G120 as the Object Manager (OM) version would cause an address and name conflict, so you must delete the existing SINAMICS.

3. Insert the SINAMICS G120 (F variant) from the hardware catalog again. Do not use the GSDML version. Use instead the OM version, which can be found under the following path:
“PROFINET IO > Drives > SINAMICS > SINAMICS G120”

3 Parameterization of the Frequency Inverter

4. When inserting the SINAMICS, assign the same PROFINET name, the same IP address, and the firmware of the previously deleted device.

Figure 3-1



Note

You can find out which further requirements are necessary for dataset routing in the following FAQ:

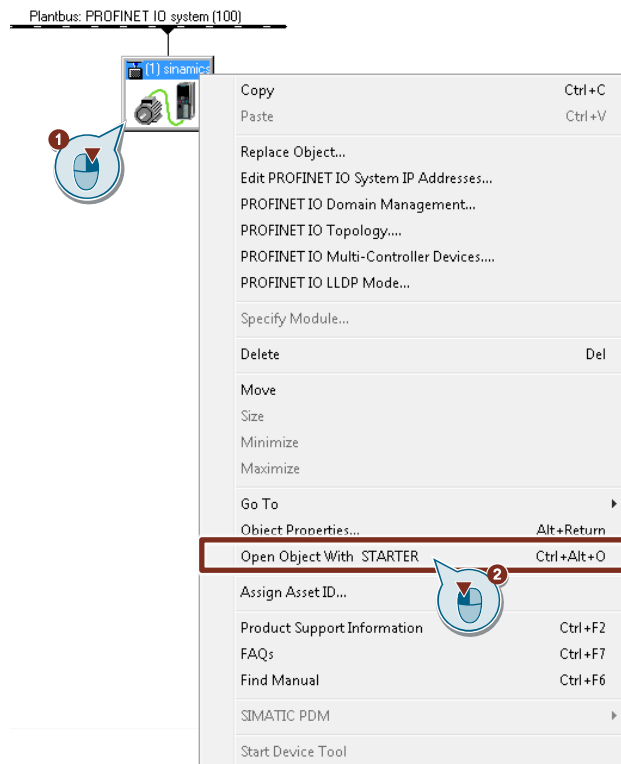
<https://support.industry.siemens.com/cs/at/en/view/7808062>

3.2 Parameterization in SINAMICS STARTER

Procedure

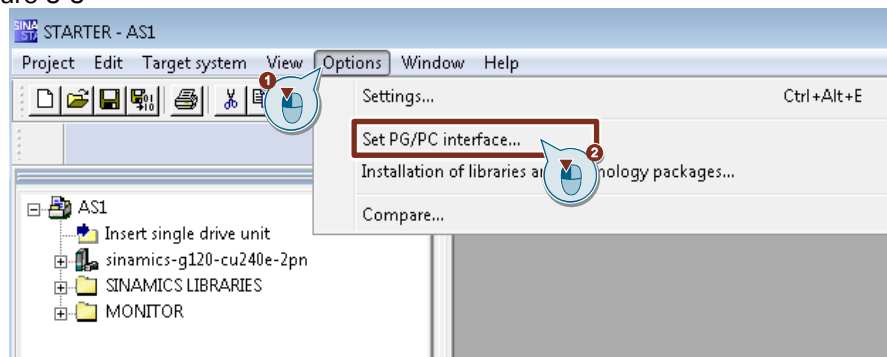
1. To configure SINAMICS, open the “STARTER” configuration tool via the SINAMICS context menu and select “Open object with STARTER”.

Figure 3-2



2. Set your PG/PC interface under “Options” with the selection “Set PG/PC interface...”.

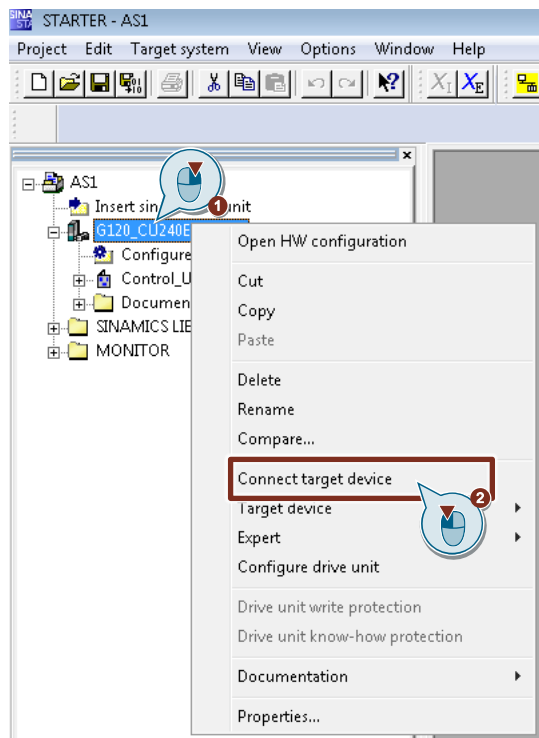
Figure 3-3



3 Parameterization of the Frequency Inverter

3. Select SINAMICS and choose “Connect to target system” from the menu bar.

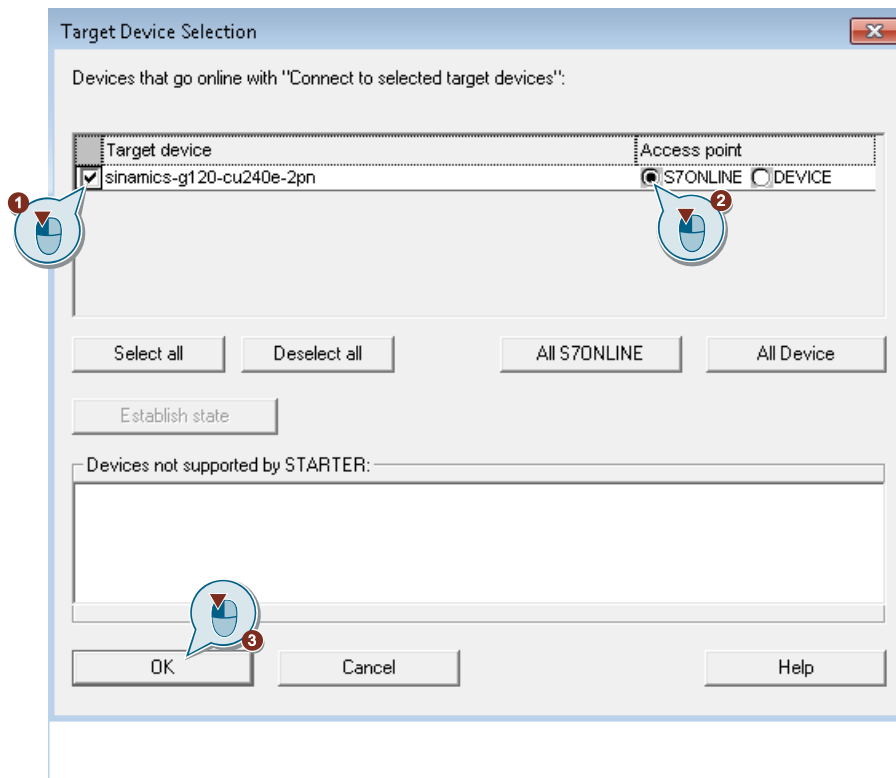
Figure 3-4



3 Parameterization of the Frequency Inverter

4. Before the connection is established, you are asked via which path the connection is to be established.
 - Set the check mark at the frequency inverter.
 - In this application example, the connection is established via dataset routing via the CPU. Select "S7Online" at the access point.
 - Confirm with "Ok"

Figure 3-5



Note If you want to connect directly to the frequency inverter via USB adapter, select "Device".

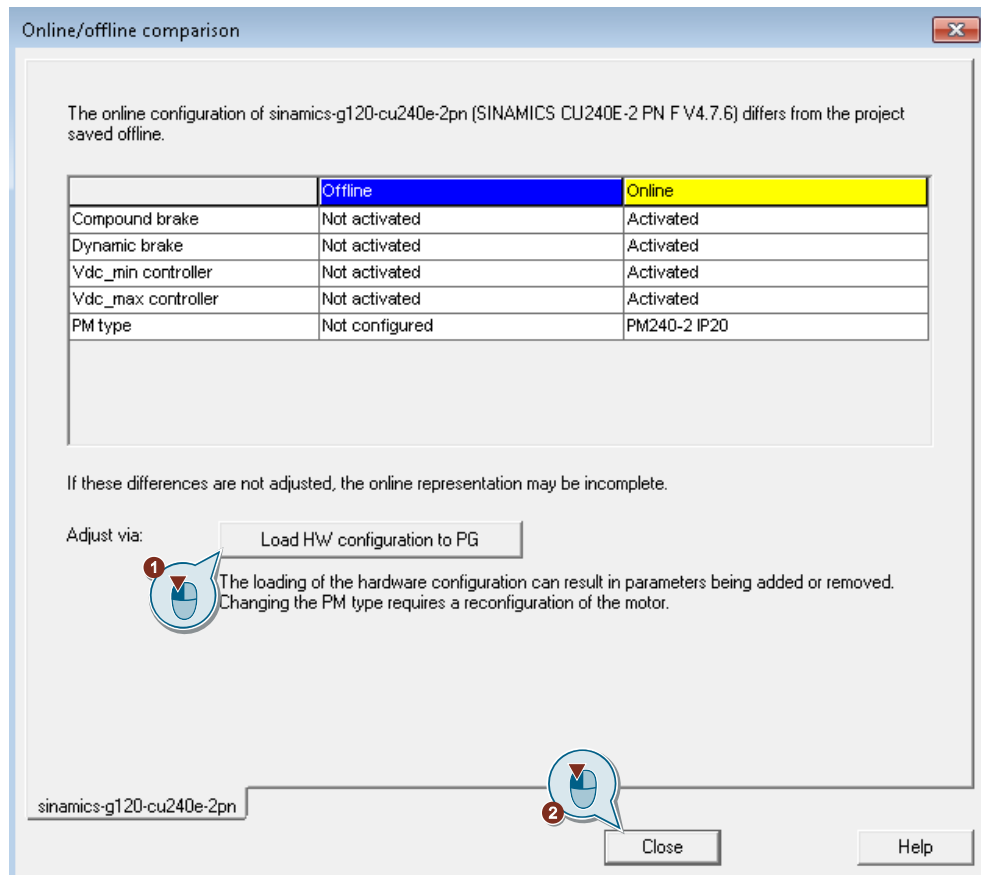
3 Parameterization of the Frequency Inverter

5. Load the current configuration by pressing the “Load HW configuration to PG” button and close the dialog box afterwards.

Note

When connecting to the device for the first time, the “STARTER” will detect a difference in configuration between the inserted device and the one actually present.

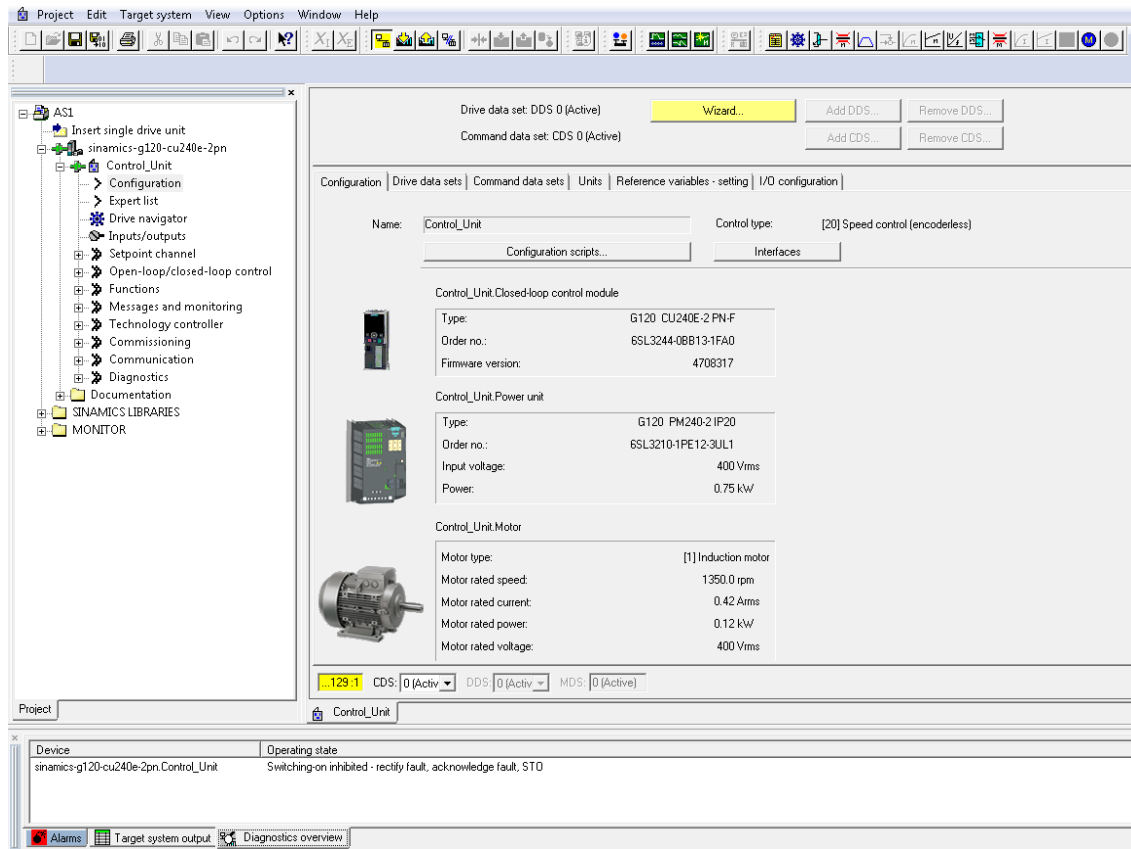
Figure 3-6



3 Parameterization of the Frequency Inverter

The SINAMICS STARTER is now connected to the frequency inverter. By clicking “Configuration”, you can access the following view:

Figure 3-7



6. Configure your motor or the frequency inverter.

Note

You can use the wizard to fundamentally configure the frequency inverter. You can find more information in the G120 manual for the respective Control Unit:

<https://support.industry.siemens.com/cs/en/en/view/31657012>

3.3 PROFINET Settings of the Frequency Inverter

So that the frequency inverter can process the PROFINET Telegrams, the frequency inverter must be configured accordingly.

Procedure

1. Check the settings of your frequency inverter's PROFINET Telegram by clicking:
"Communication > Fieldbus"
2. For transmission and reception, set the Telegram 30 for PROFIsafe and the standard Telegram 20 so that they match the hardware configuration.

Figure 3-8

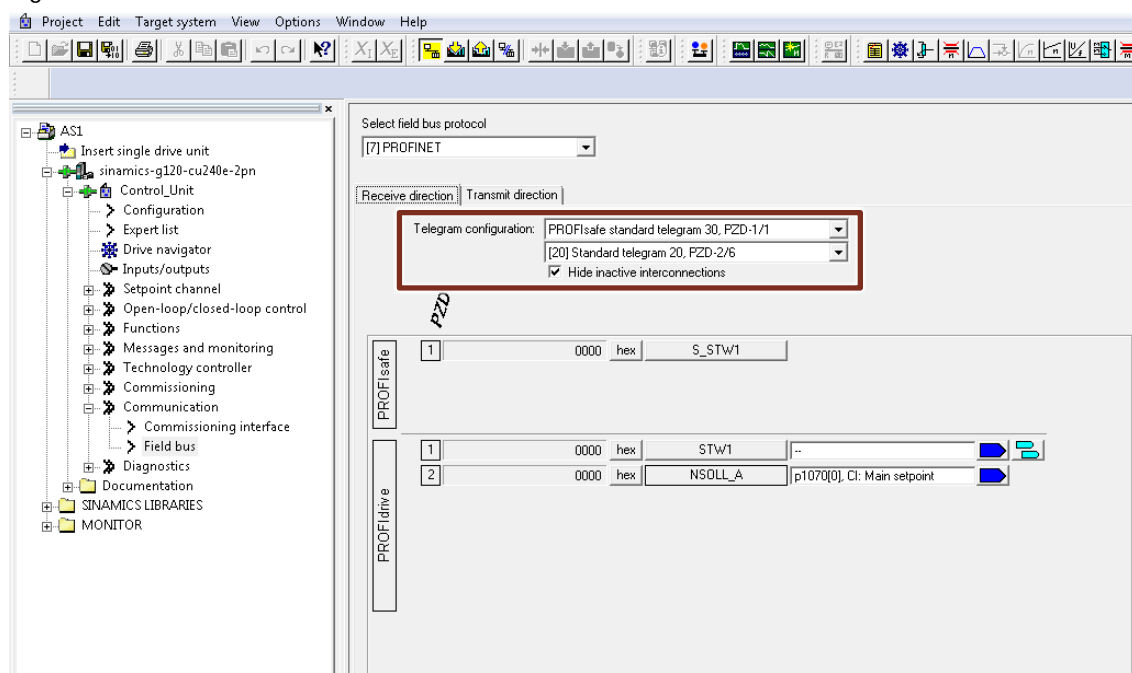


Table 3-1

Parameter	Value
P810	PROFIsafe address
P9761 (also r9760)	Safety password (Standard 12345)

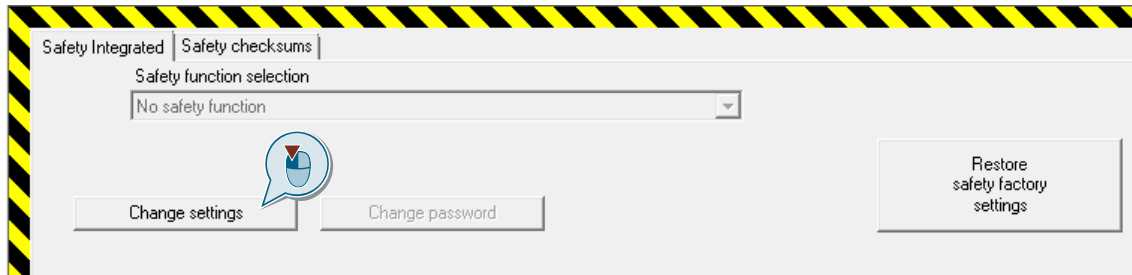
3.4 PROFIsafe Settings

The following section describes how to activate the frequency inverter's PROFIsafe functions.

Procedure

1. Switch the overview to Safety Integrated:
"Functions > Safety Integrated"
2. Click "Change settings"

Figure 3-9



3. Select the "Extended Function via PROFIsafe".

Figure 3-10

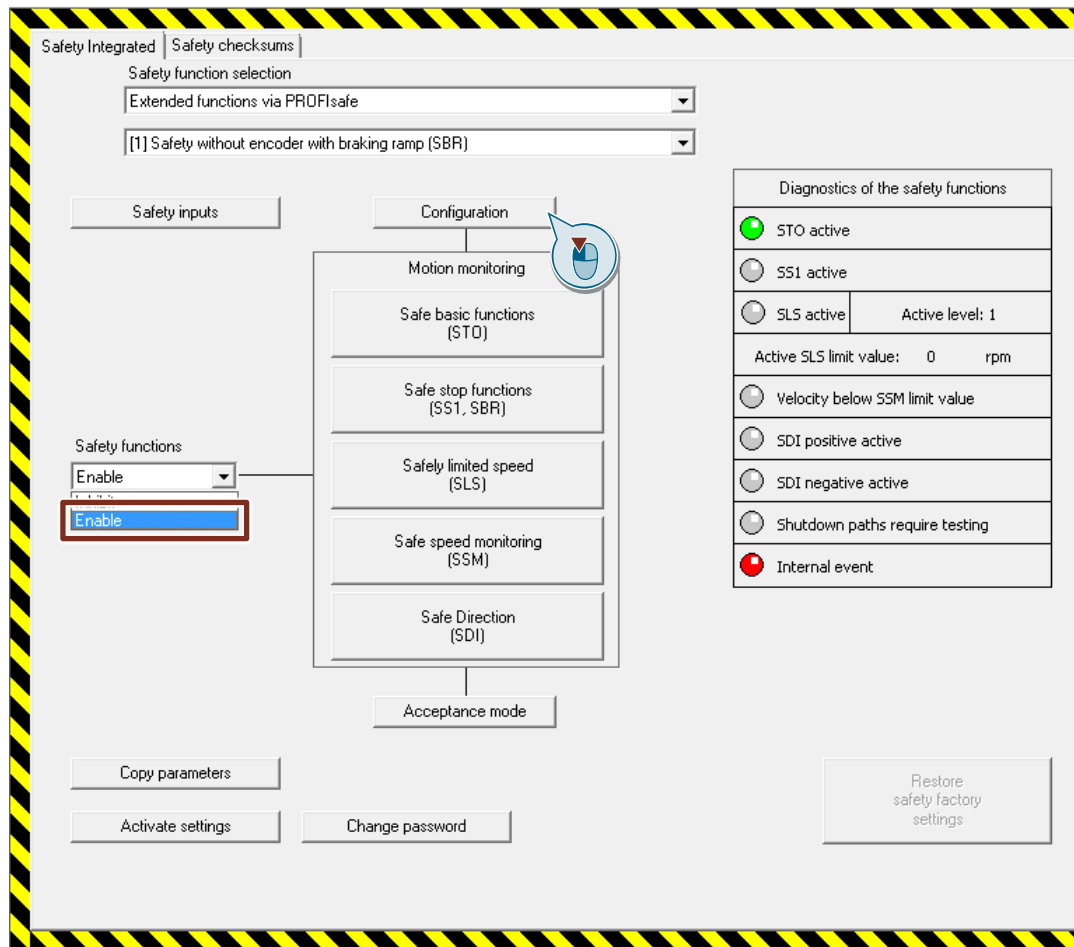


4. Activate the safety functions

3 Parameterization of the Frequency Inverter

5. Open the “Configuration” submenu.

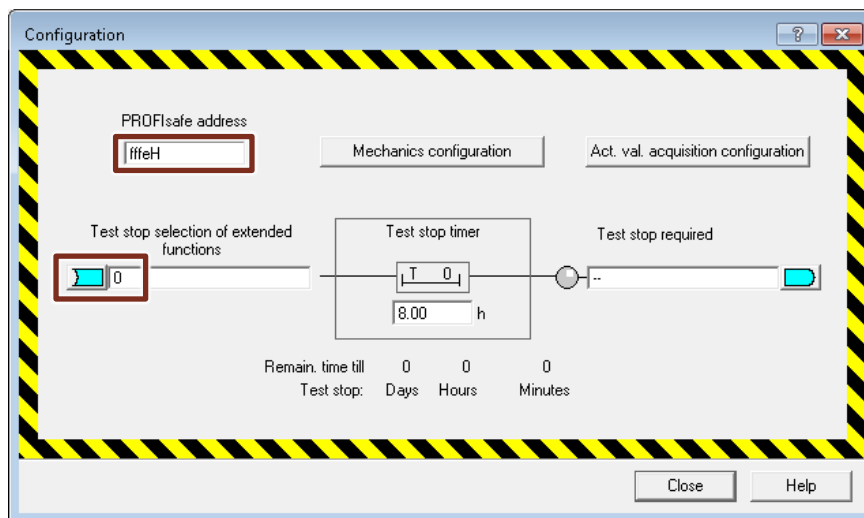
Figure 3-11



6. Enter the value from “HW-Config > SIMANICS G120 > Telegram 30 > Properties > F_Dest_Add_in SINAMICS STARTER > Function > Safety Integrated” > Configuration > “PROFIsafe Address” and close the configuration window again.

3 Parameterization of the Frequency Inverter

Figure 3-12



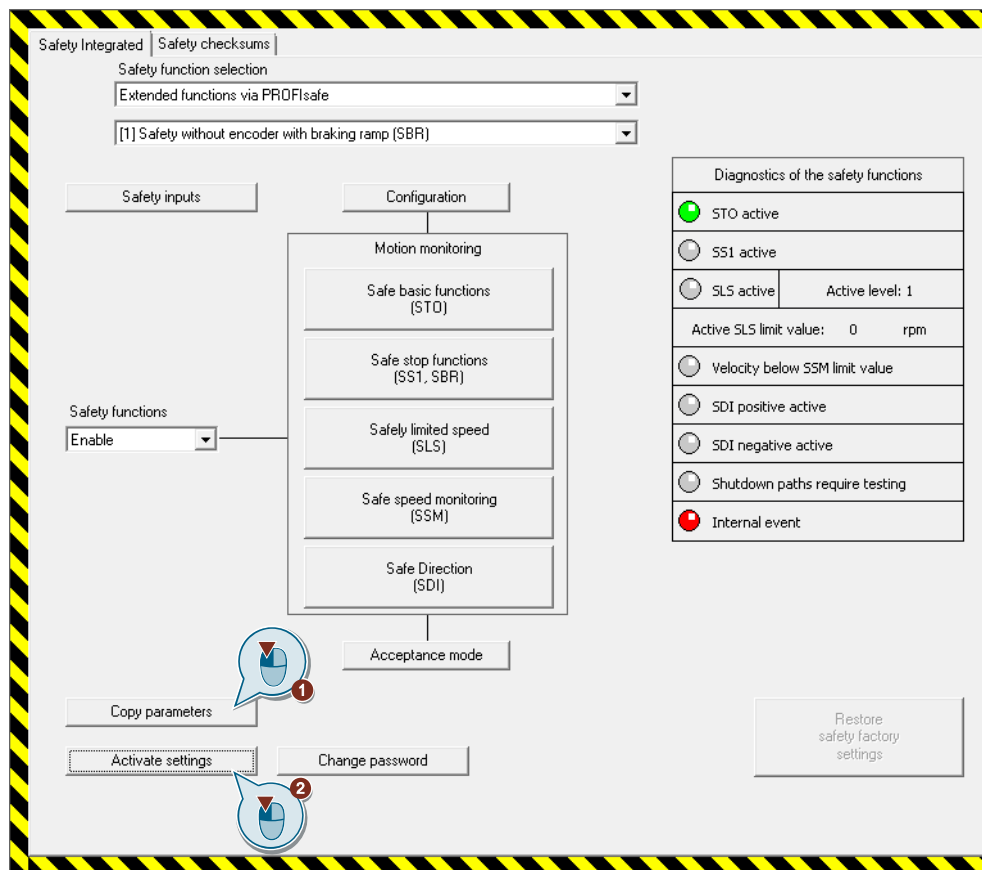
Note If necessary, parameterize the “Test Stop” function in the Safety Integrated configuration by connecting it to a terminal.

7. Transfer the set values with “Copy parameters”.
8. Click “Activate settings” to activate the settings and enter the password in the subsequent prompt.

When you are asked whether the parameters are to be copied from RAM to ROM, confirm with “Yes” so that the values are permanently stored in SINAMICS.

3 Parameterization of the Frequency Inverter

Figure 3-13



3.5 Settings of the Safety Integrated Functions

In the Safety Integrated function overview in STARTER, you can configure various shutdown behaviors with the “Extended functions via PROFIsafe” option set.

Figure 3-14

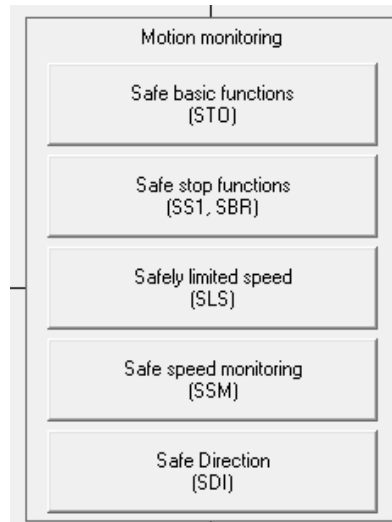


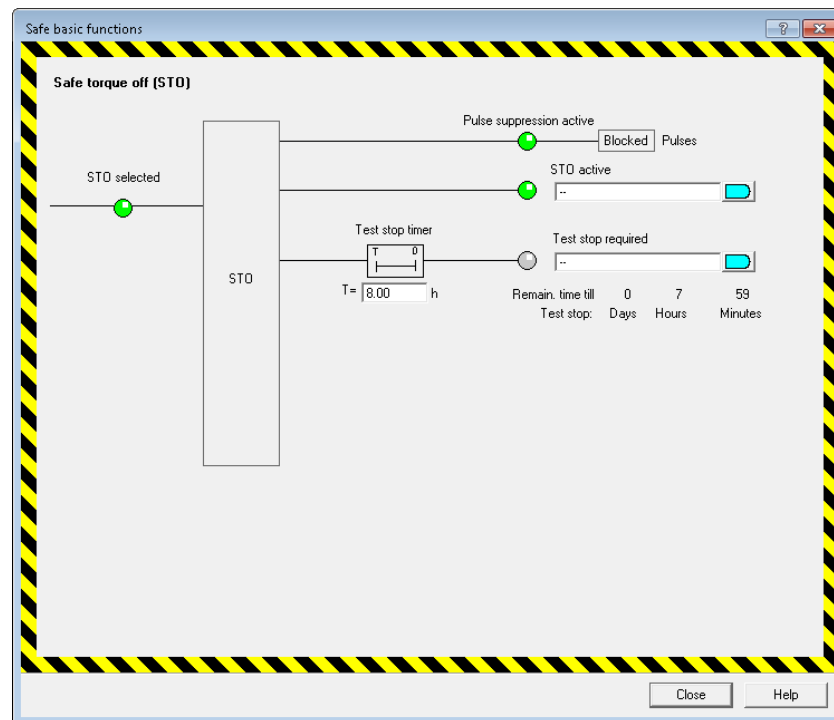
Table 3-2

Parameter	Abbreviation	Description
Safe Torque Off	STO	Safe disconnection of the electrical power supply to the motor. (Category 0 stop function according to EN 60204-1)
Safe Stop 1/ Safe braking ramp	SS1 / SBR	Fast and safely monitored stopping of the drive via a ramp function after an adjustable delay time or when the switch-off speed is reached after STO. (Category 1 stop function according to EN 60204-1)
Safety-limited speed	SLS	The drive speed is monitored to ensure safety. Parameterizable switch-off reaction at limit violation.
Reliable indication of undershooting	SSM	Safe monitoring of the direction of movement (positive and negative direction). Parameterizable switch-off reaction when moving in direction that is not enabled
Safe Direction	SDI	Safe monitoring of the direction of movement (positive and negative direction). Parameterizable switch-off reaction when moving in direction that is not enabled

3 Parameterization of the Frequency Inverter

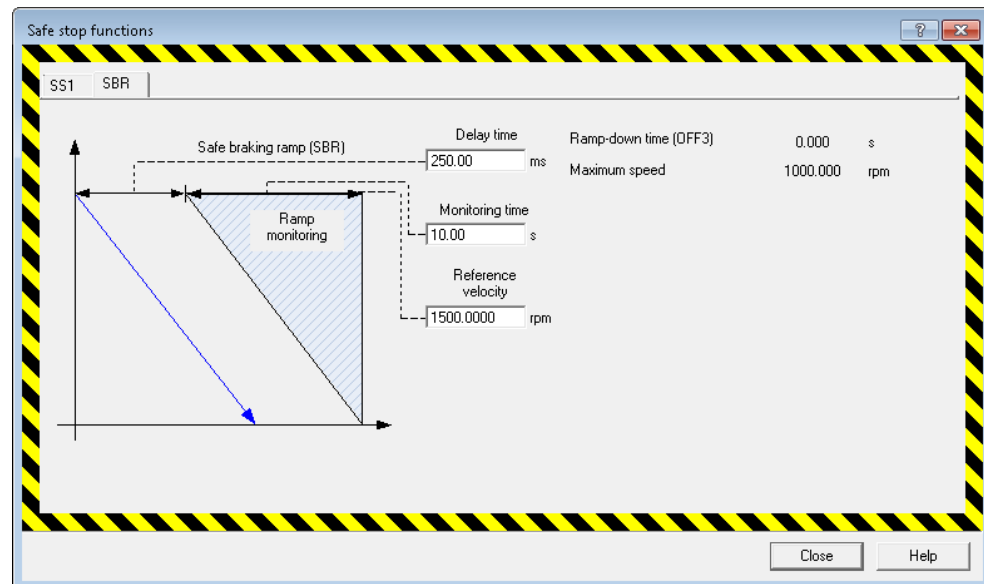
STO parameter

Figure 3-15 Safe Torque Off



SS1/SBR parameter

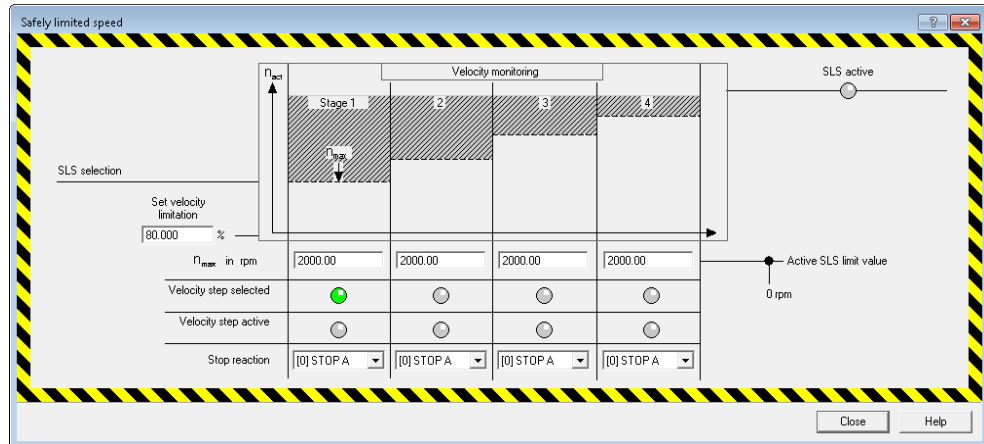
Figure 3-16 Safe Stop 1/Safe braking ramp



3 Parameterization of the Frequency Inverter

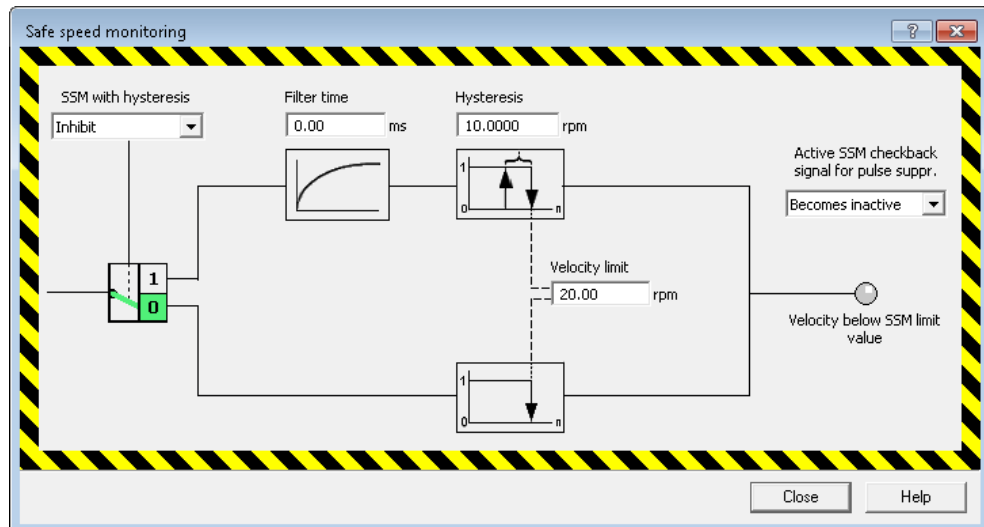
SLS parameter

Figure 3-17 Safety-limited speed



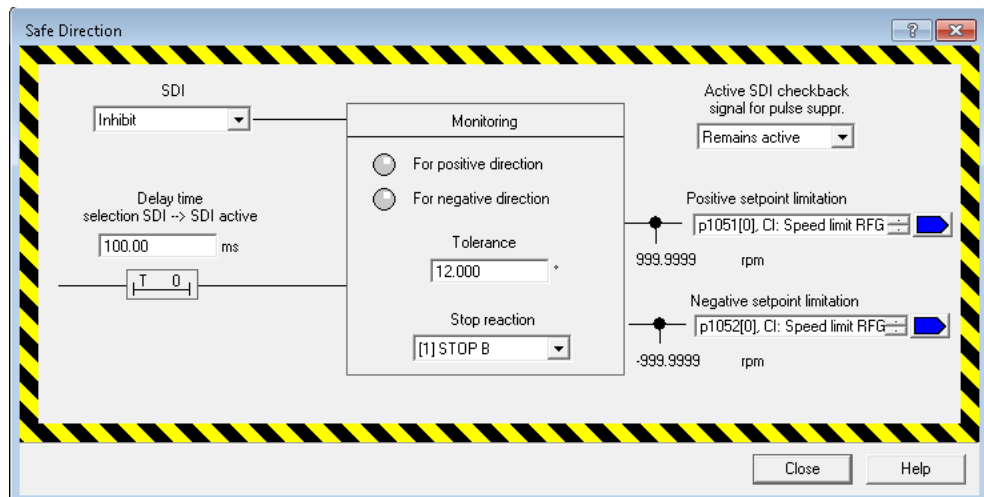
SSM parameter

Figure 3-18 Reliable display of undershooting



SDI parameter

Figure 3-19 Safe Direction



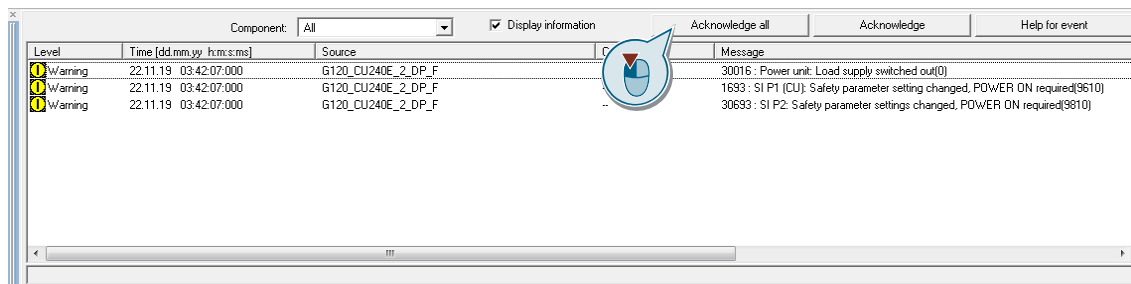
3.6 Acknowledge the PROFIsafe Errors in SINAMICS with STARTER

The alarm history is displayed in the lower part of the Starter and is divided into several sections.

Procedure

1. For this purpose, change to the alarm view in the STARTER, which is located under “Diagnosis > Alarm History”.
2. Switch to the “Alarms” tab and acknowledge all alarms by clicking the corresponding “Acknowledge All” button.

Figure 3-20



3.7 Accessing the Expert List

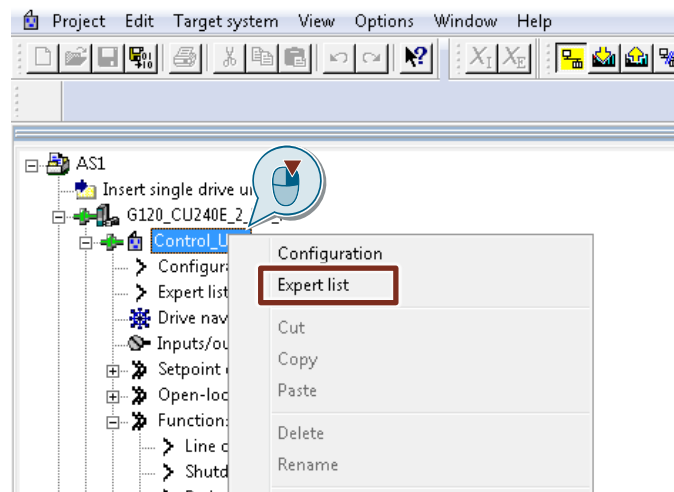
In “STARTER”, it is possible to call up all parameters in table form online via the Expert List and change them there. You can access this list via the context menu “Control Unit > Expert List”.

Note

You can find an overview of the parameters of the SINAMICS G120 CU240E-2 Expert List in the List Manual:

<https://support.industry.siemens.com/cs/en/en/view/109751314>

Figure 3-21



3 Parameterization of the Frequency Inverter

Figure 3-22

Expert list						
Param...	Data	Parameter text	Online value	Control_Unit	Unit	Modifiable to
All	All					Access level
1	r2	Drive operating display	[45] Switching-on inhibited ...		All	2
2	p3	Access level	[3] Expert		Operation	1
3	p10	Drive commissioning parameter filter	[0] Ready		Ready to run	1
4	p14	Buffer memory mode	[0] Save in a non-volatile fa...		Operation	3
5	p15	Macro drive unit	7.) Fieldbus with data set c...		Commissionin...	1
6	r18	Control Unit firmware version	4708304			3
7	r20	Speed setpoint smoothed	0.0		rpm	2
8	r21	CO: Actual speed smoothed	0.0		rpm	2
9	r22	Speed actual value rpm smoothed	0.0		rpm	3
10	r24	Output frequency smoothed	0.0		Hz	3
11	r25	CO: Output voltage smoothed	0.0		Vrms	2
12	r26	CO: DC link voltage smoothed	0.0		V	2
13	r27	CO: Absolute actual current smoothed	0.00		Arms	2
14	r31	Actual torque smoothed	0.00		Nm	2
15	r32	CO: Active power actual value smoothed	0.00		kW	2
16	r35	CO: Motor temperature	20.0		°C	2
17	r36	CO: Power unit overload I2t	0.0		%	3
18	p39[0]	CO: Energy display, Energy balance (sum)	0.00		kWh	2
19	p40	Reset energy consumption display	0			Operation 3
20	r41	Energy consumption saved	10.70		kWh	2
21	p42[0]	CO: Process energy display, Energy balance (sum)	0		kWh	2
22	p43	BT Enable energy usage display	0			Operation 2
23	p45	Display values smoothing time constant	4.00		ms	Operation 3
24	p46	CO/BO: Missing enable sig	40021 COFH			1
25	r47	Motor data identification and speed controller optimization	[0] No measurement			1
26	p50	CO/BO: Command Data Set CDS effective	0H			3
27	p51	CO/BO: Drive Data Set DDS effective	0H			2
28	p52	CO/BO: Status word 1	EBC8H			2
29	p53	CO/BO: Status word 2	2E0H			2
30	p54	CO/BO: Control word 1	0H			2
31	p55	CO/BO: Supplementary control word	2000H			3
32	p56	CO/BO: Status word, closed-loop control	3H			3
33	r60	CO: Speed setpoint before the setpoint filter	0.00		rpm	3
34	r62	CO: Speed setpoint after the filter	0.00		rpm	3
35	p63[0]	CO: Speed actual value, Unsmoothed	0.00		rpm	3
36	r64	CO: Speed controller system deviation	0.00		rpm	3
37	r65	Slip frequency	0.00		Hz	3
38	r66	CO: Output frequency	0.00		Hz	3

4 Appendix

4.1 Service and support

Industry Online Support

Do you have any questions or need assistance?

Siemens Industry Online Support offers round the clock access to our entire service and support know-how and portfolio.

The Industry Online Support is the central address for information about our products, solutions and services.

Product information, manuals, downloads, FAQs, application examples and videos – all information is accessible with just a few mouse clicks:

support.industry.siemens.com

Technical Support

The Technical Support of Siemens Industry provides you fast and competent support regarding all technical queries with numerous tailor-made offers – ranging from basic support to individual support contracts. Please send queries to Technical Support via Web form:

www.siemens.com/industry/supportrequest

SITRAIN – Training for Industry

We support you with our globally available training courses for industry with practical experience, innovative learning methods and a concept that's tailored to the customer's specific needs.

For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page:

www.siemens.com/sitrain

Service offer

Our range of services includes the following:

- Plant data services
- Spare parts services
- Repair services
- On-site and maintenance services
- Retrofitting and modernization services
- Service programs and contracts

You can find detailed information on our range of services in the service catalog web page:

support.industry.siemens.com/cs/sc

Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for iOS and Android:

support.industry.siemens.com/cs/ww/en/sc/2067

4.2 Links and literature

Table 4-1

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to the entry page of this application example https://support.industry.siemens.com/cs/ww/en/view/35928862
\3\	SINAMICS G: Speed control of a G120 with S7-300/400 (STEP 7 V5) via PROFIBUS in STEP 7 with Safety Integrated (via PROFIsafe) https://support.industry.siemens.com/cs/ww/en/view/24093625
\4\	SINAMICS G: Speed control of a G120 with S7-300/400 (STEP 7 V5) via PROFIBUS with Safety Integrated (via terminal, sensorless) https://support.industry.siemens.com/cs/ww/en/view/24230051
\5\	SINAMICS G: Speed control of a G120 with S7-300/400 (STEP 7 V5) via PROFINET in STEP 7 with Safety Integrated (via PROFIsafe) https://support.industry.siemens.com/cs/ww/en/view/29585944
\6\	SINAMICS G: Speed control of a G120D with S7-300/400 (STEP 7 V5) via PROFIBUS with Safety Integrated (via PROFIsafe, sensorless) https://support.industry.siemens.com/cs/ww/en/view/26494756
\7\	SINAMICS G: Speed control of a G120D with S7-300/400 (STEP 7 V5) via PROFINET with Safety Integrated (via PROFIsafe, sensorless) https://support.industry.siemens.com/cs/ww/en/view/28899367
\8\	SINAMICS G: Example for calculating the limit values for SS1 and SLS https://support.industry.siemens.com/cs/ww/en/view/24488874
\9\	The configuration of frequency inverters with the APL channel block "FbDrive" in SIMATIC PCS 7 is described in the following application example: https://support.industry.siemens.com/cs/ww/en/view/64181993

4.3 Change documentation

Table 4-2

Version	Date	Modifications
V1.0	03/2020	First version