



SIMATIC

Automation System S7-300 CPU 317TF-2 DP: Controlling a SINAMICS S120 with Safety Functions

Getting Started

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Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

 DANGER
indicates that death or severe personal injury will result if proper precautions are not taken.
 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.
 CAUTION
with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.
CAUTION
without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.
NOTICE
indicates that an unintended result or situation can occur if the corresponding information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation for the specific task, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

 WARNING
Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be adhered to. The information in the relevant documentation must be observed.

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Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

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Introduction

These instructions provide a practical example guiding you through the commissioning tasks required to create a fully functional application, and showing you how to perform a motion with additional safety functions. It will help you get acquainted with operating CPU 317TF-2 DP and the SINAMICS S120 drive system.

Depending on your level of expertise, working through the sample will take between 4 and 5 hours.

Validity

The manual is valid for the following components:

- CPU 317TF-2 DP as of V2.7/4.1.5
- SINAMICS S120 as of V2.6.2
- S7 Technology as of V4.2
- S7 Distributed Safety as of V5.4 SP5 and S7 F Configuration Pack as of V5.5 SP7

Prerequisites

This document presumes that you have connected a SINAMICS S120 drive system to the DP(DRIVE) interface of the CPU 317TF-2 DP.

We recommend the following manuals as preparation:

- Getting Started "CPU 317T-2 DP: Controlling an SINAMICS S120"
- Getting Started "S7 Distributed Safety"
- System manual "Safety Engineering in SIMATIC S7"

Preparation

2.1 Requirements

Requirements

The following requirements must be fulfilled:

- You have an S7-300 station, consisting of:
 - Power supply (PS), e.g. 6ES7307-1KA00-0AA0
 - CPU 317TF-2 DP with memory card (4 MB or more), 6ES7317-6TF14-0AB0 V2.7/V4.1.5.
 - Digital input module, safety-related (F-DI) with bus connector, for example, 6ES7326-1BK02-0AB0
 - Digital output module, safety-related (F-DO) with bus connector, for example, 6ES7326-2BF10-0AB0
 - Safety protector, 6ES7195-7KF00-0XA0
 - Digital input module (DI) with bus connector, for example, 6ES7321-1BH02-0AA0
 - Digital output module (DO) with bus connector, for example, 6ES7322-1BH01-0AA0
 - Two optional front connectors for the digital modules
- For operating the safety functions, you need:
 - Emergency stop, 2-channel - see the Configurator for pushbuttons and SIRIUS 3SB3/3SF5 indicator lamp in the Internet (<https://mall.automation.siemens.com>)
 - Key switch, 2-channel - see the Configurator for pushbuttons and SIRIUS 3SB3/3SF5 indicator lamp in the Internet (<https://mall.automation.siemens.com>)
 - 2 hinge position switches, 2-channel to monitor the protected zone door - see the Configurator for position switches in the Internet (<https://mall.automation.siemens.com>)

- A PG with MPI interface and properly installed software packages and commissioning tools as listed below:
 - STEP 7 as of V5.4 SP5
 - S7 Technology as of V4.2
 - Distributed Safety as of V5.4 SP5 with F Configuration Pack as of V5.5 SP7
- The PG is connected to the CPU via the MPI/DP interface (transmission rate up to 12 Mbps; default 187.5 kbps):
 - PROFIBUS cable 6ES7901-4BD00-0XA0 (for transmission rates up to 12 Mbps)
- A SINAMICS S120 drive system with the following components is connected to the CPU 317TF-2 DP via the DP(DRIVE) interface:
 - CU320 Control Unit with TB30 Terminal Board (6SL3040-0MA00-0AA1)
 - Smart Line Module 5 kW (6SL3130-6AE15-0AA0)
 - Single/Double Motor Module 3 A (6SL3120-2TE13-0AA3)
 - 1 synchronous motor 1FK7022-5AK71-1AG3 with incremental encoder sin/cos 1 Vpp via sensor module cabinet SMC20 (6SL3055-0AA00-5BA1) - optional
 - 1 synchronous motor 1FK7022-5AK71-1LG3 with DRIVE-CLiQ interface: Absolute encoder EnDat 512 pulses/revolution
 - Reference loops for position monitoring
 - Control box for setpoint/actual-value linkage via terminals
- SINAMICS S120 has the factory settings.

- You know the firmware version of your SINAMICS S120.

If you do not know the firmware version, you can find the version listed in the supplied documents. Alternatively, you can open the "content.txt" file on the CF card. The firmware version is in the "Internal Version" entry. You can find more detailed information on reading the firmware version in the SINAMICS S120 product information.

Note

We have used a SINAMICS S120 training case as an example of a drive for this Getting Started. The training case is available under the following order number:

- Single-axis version with 1FK7 motor
6ZB2480-0AA00
 - 2-axis version with 1FK7 motors
6ZB2480-0BA00
-



- The hardware is completely assembled and wired. For information, refer to *Getting Started CPU 31x: Commissioning*.
- You provided hardware limit switches and EMERGENCY-OFF switches for safe and reliable operation of the system. This EMERGENCY-OFF switch is independent of the emergency stop switch described in the application example.

WARNING
Non-compliance with the regulations can result in serious injuries and damage to machines and equipment.
Operation of an S7-300 as part of plants or systems is subject to special rules and regulations, based on its field of application. Please note the current safety regulations for the prevention of accidents, e.g. IEC 204 (EMERGENCY-OFF equipment).

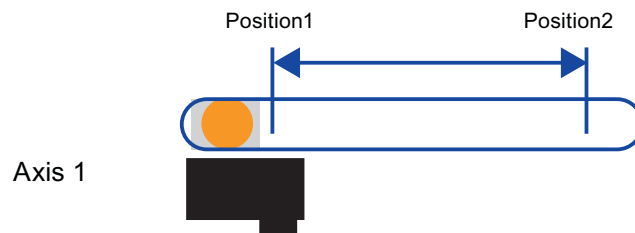
2.2 Task

The example includes a technology task (positioning) with safety functions. The axis moves in a production area with access control.

Technology task

The positioning requests are performed via two inputs:

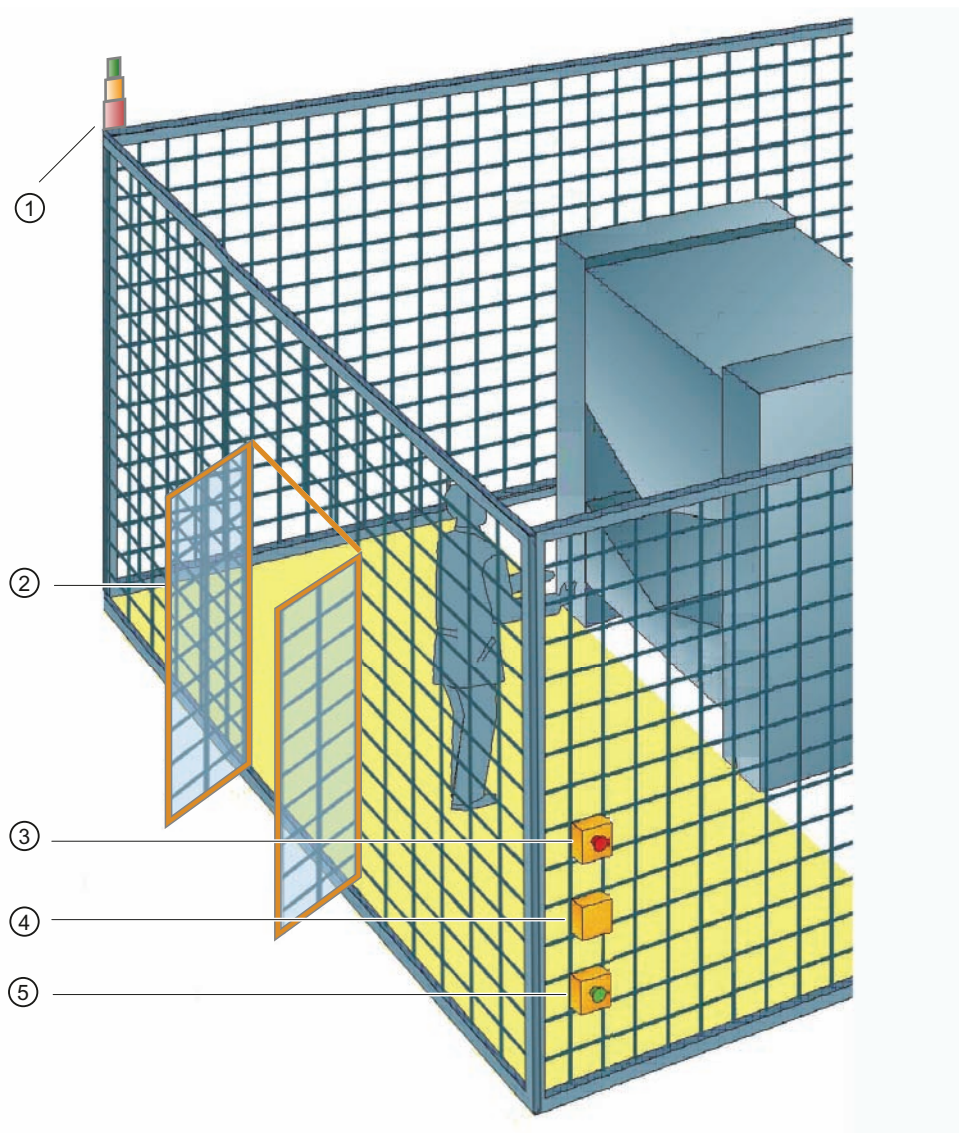
- Start position at position 1 (0 mm)
- Start position at position 2 (5000 mm)



Other inputs are used to start or stop the axis.

Safety elements

The following figure shows the safety elements in the protection zone.

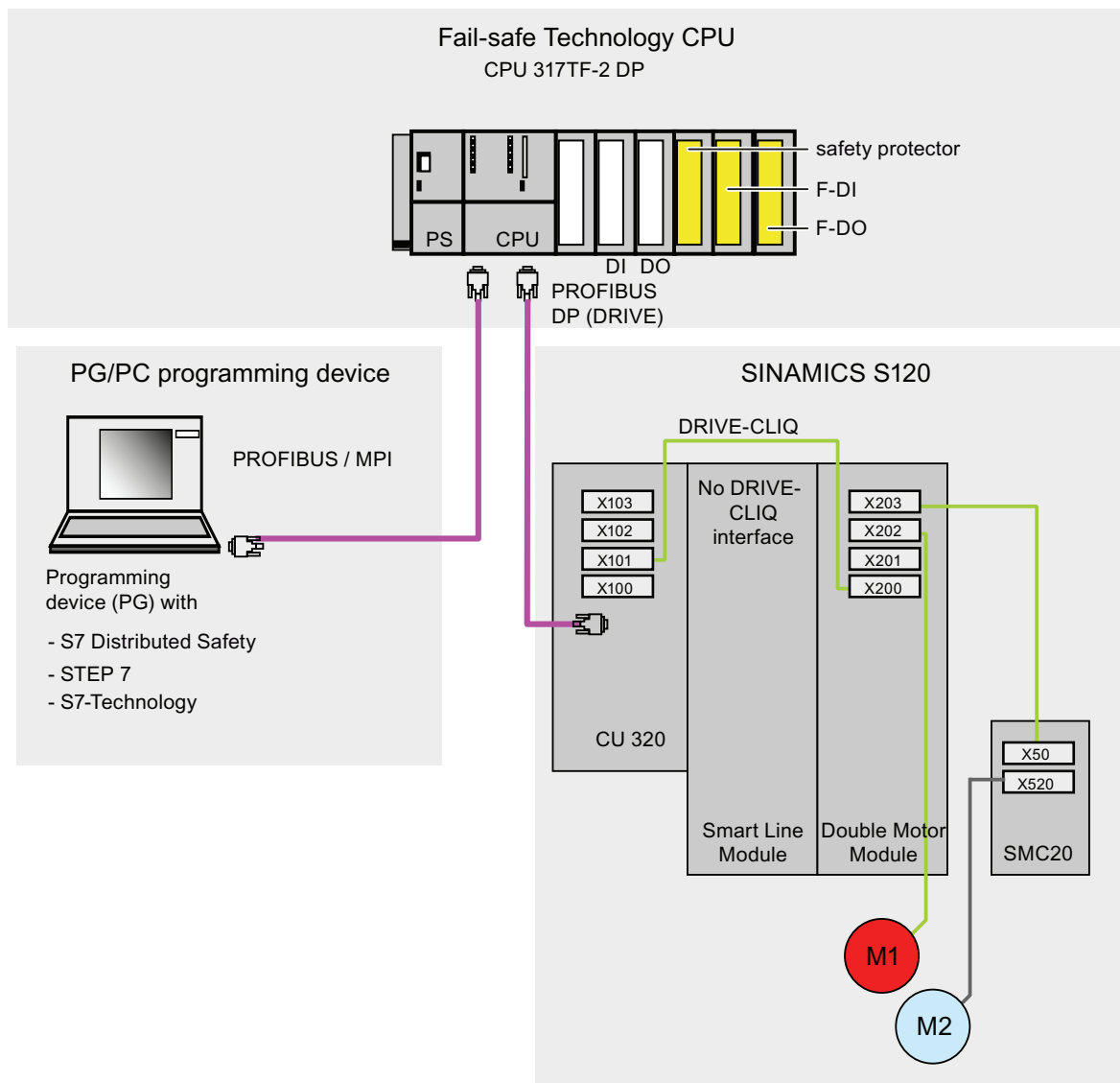


- 1 Signal lamps for indicating the operating status
- 2 Safety door with 2 position switches
- 3 Emergency stop switch
- 4 Key switch for setup mode
- 5 Acknowledgment button for safety-related events and reintegration of the F-I/O

Figure 2-1 Production area with access protection

Safety element	Safety function on the drive
Emergency stop switch	Safe Stop1 (SS1)
Position switch on safety door	Safe Stop2 (SS2)
Key switch	Safe Limiting Speed (SLS)

The tasks in the example result in the following hardware assembly:



Motor M2 is a component of the SINAMICS S120 training case but is not used in the example at hand.

Basic procedure

Configure the TF-CPU, drive and an axis using HW Config and S7T Config. Configure the safety functions on the drive with S7T Config. Then operate the configured axis with the user program. The technology functions are included in the standard component of the user program. The safety functions are controlled by the safety program. The status of the safety functions on the drive is evaluated in the safety program.

The task is divided into the following learning units:

Step	Learning unit	Engineering tool
1	Wiring	
2	Creating a T station	SIMATIC Manager
3	Configuring the F-DI signal module	HW Config
4	Configuring the F-DO signal module	HW Config
5	Configuring the drive	HW Config
6	Assigning the PG/PC interface Downloading the hardware configuration to the target hardware	NetPro HW Config
7	Configuring the drive	S7T Config
8	Message frame configuration	S7T Config
9	Configuring safety-related communication between the TF-CPU and drives with safety functions	HW Config
10	Configuring the properties of the TF-CPU	HW Config
11	Interconnecting the safety data block with SINAMICS parameters	S7T Config
12	Configuring safety functions on the drive	S7T Config
13	Configure axes	S7T Config
14	Creating technology data blocks	Technology Objects Management
15	Creating an S7 user program	STEP 7, S7 Distributed Safety
16	Editing the safety program	STEP 7, S7 Distributed Safety
17	Trial run	

Example program

The program blocks for the described example can be found in STEP 7 in the sample project, PROJECT-CPU317TF. You can open the project in SIMATIC Manager with **File > Open > Sample Projects**, copy the program blocks into your own project and adapt them to your hardware assembly.

! WARNING

Danger from live wires

You may come into contact with live wires. Always switch off power before you start wiring the S7-300.

Procedure

You can find a similar description of the installation and wiring of the CPU 317T(F)-2 DP in the *Getting Started Collection S7-300 PLC: CPU 31x: Commissioning* in the Internet (<http://support.automation.siemens.com/WW/view/en/15390497>).

Setting the PROFIBUS address on the CU320

Set the PROFIBUS address of the SINAMICS to PROFIBUS address 4. You set the PROFIBUS address on the CU320 directly via the hardware DIP switch as follows:

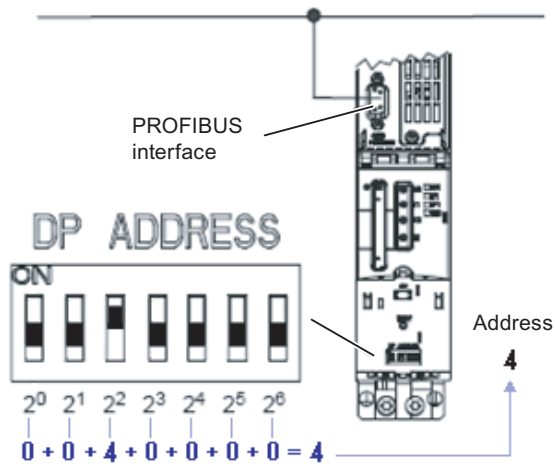
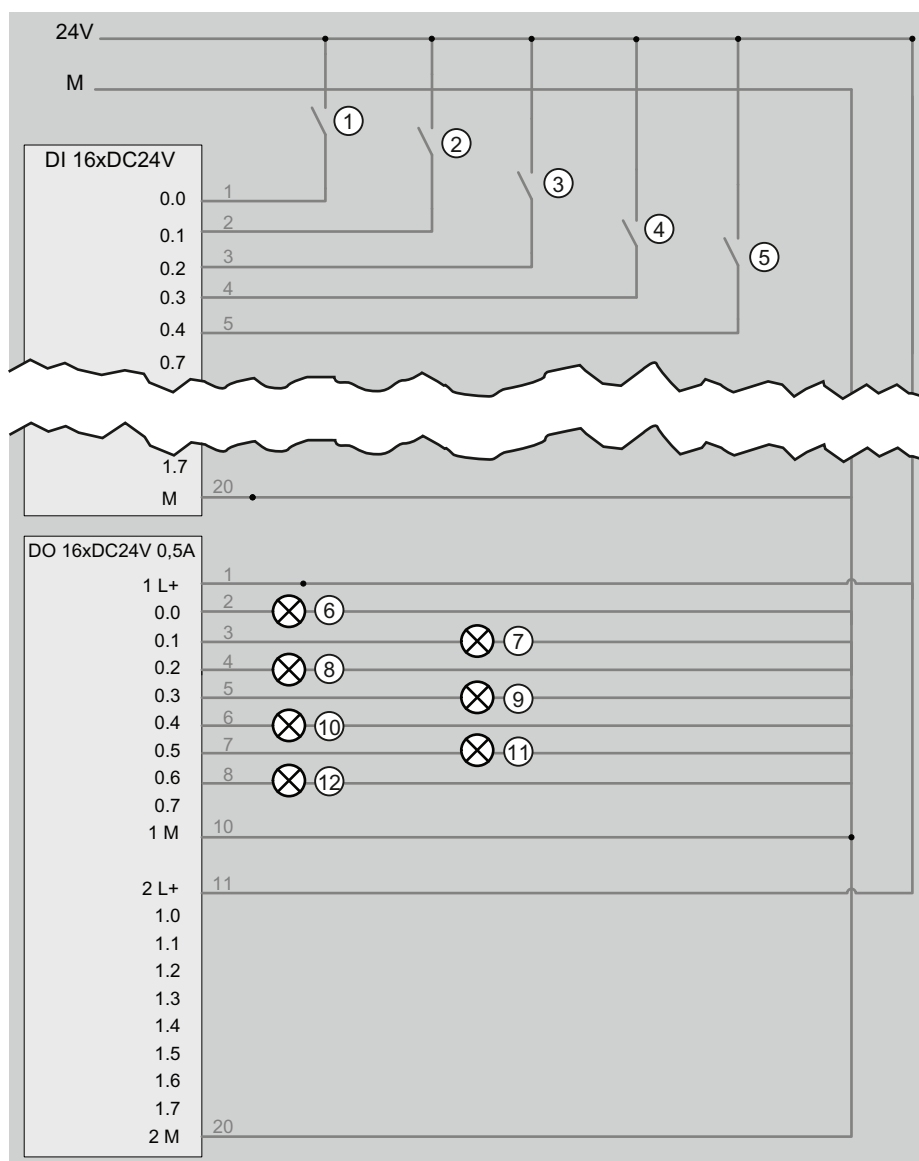


Figure 3-1 Schematic representation of the CU320 control unit

Wiring standard signal modules



Wiring the F-DI signal module

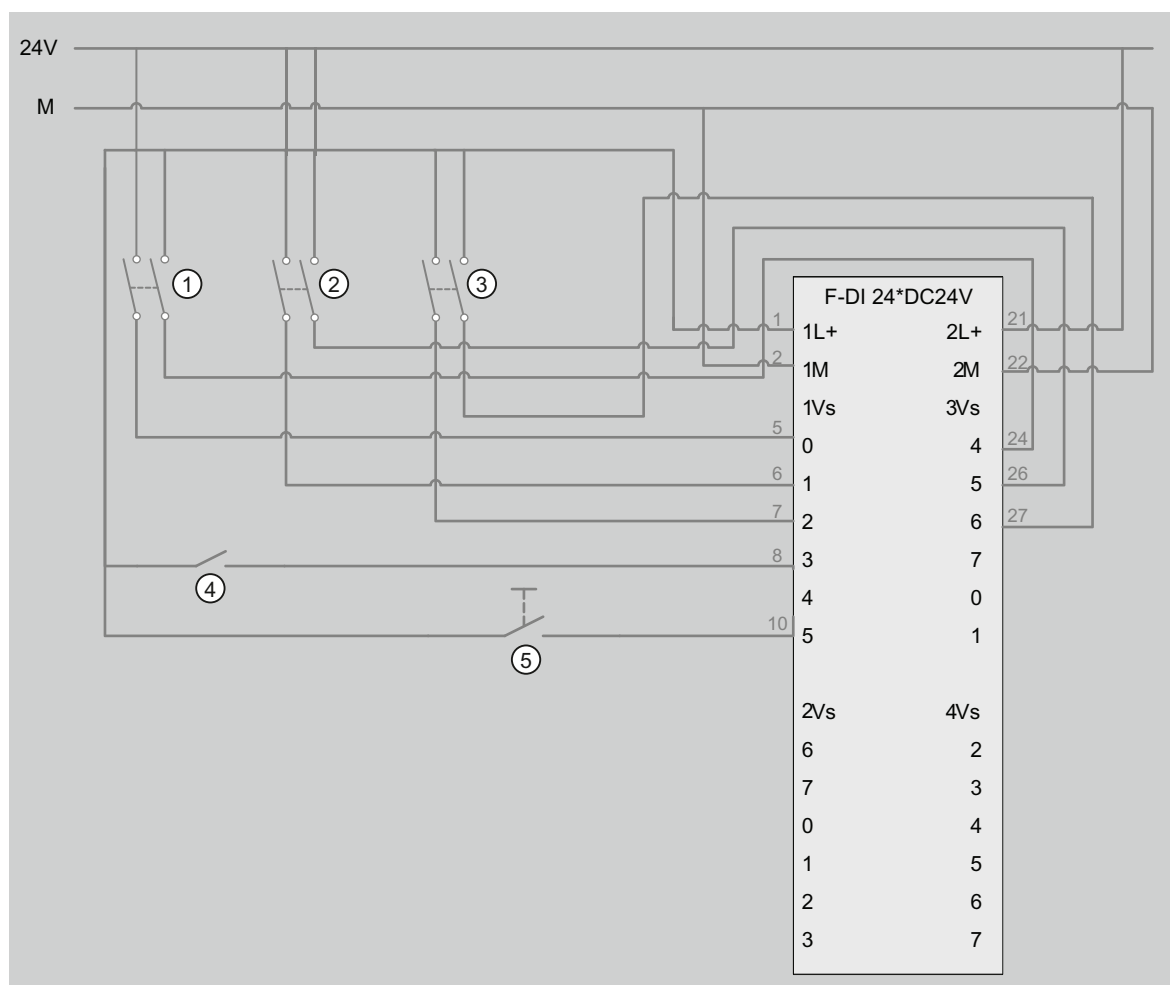


Figure 3-3 Wiring overview for the F-DI signal module

①	Safety door contact top
②	Safety door contact bottom
③	Emergency stop switch
④	Key switch for setup mode
⑤	Safety acknowledgment button

Wiring the F-DO signal module

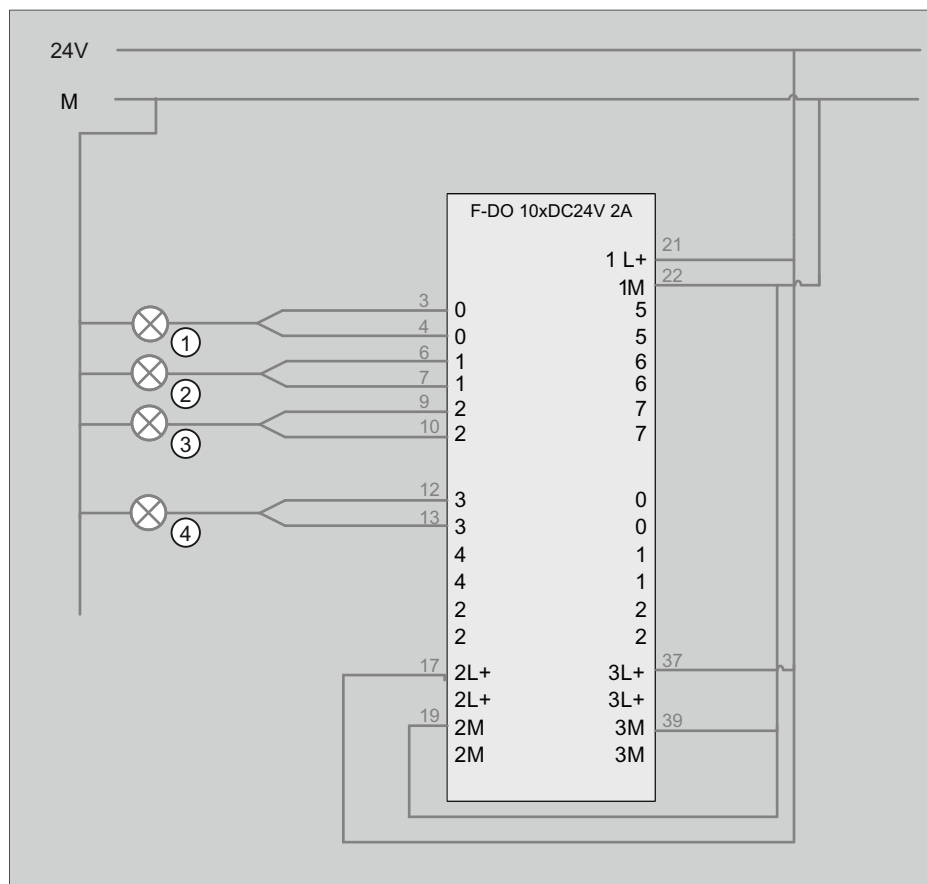


Figure 3-4 Wiring overview for the F-DO signal module

①	Safety disabled
②	Setup mode active
③	Emergency stop active
④	F acknowledgment required

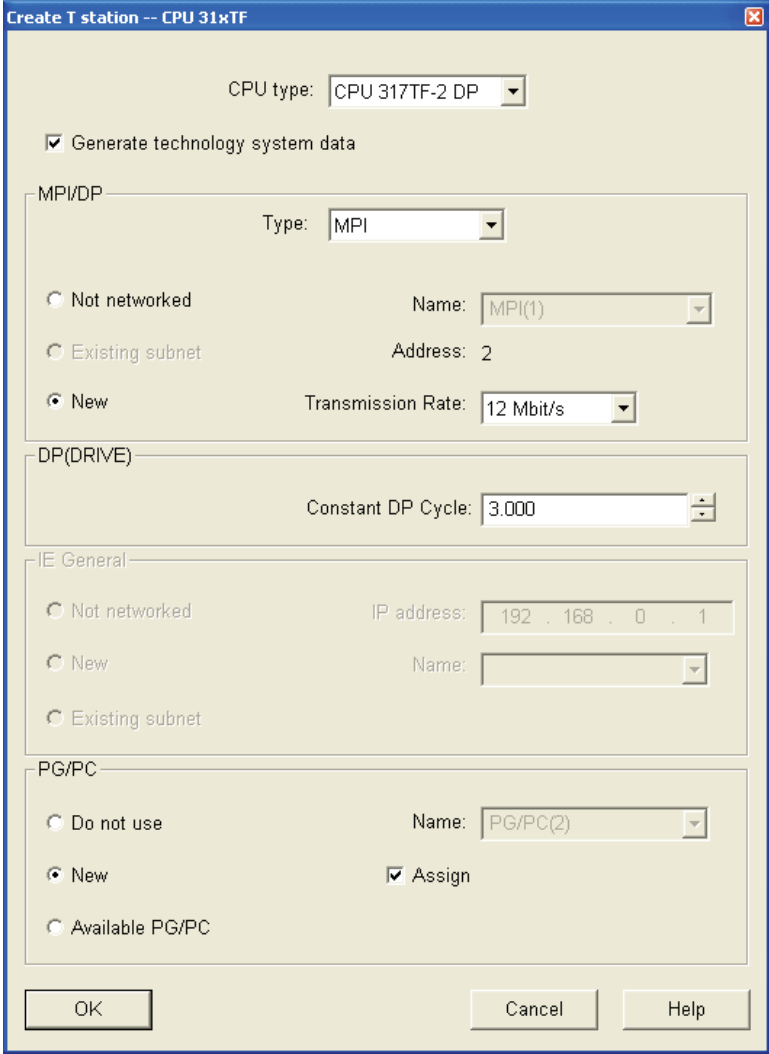
Configuration

4

4.1 Setting up the T station with the help of a wizard

The station wizard helps you to carry out several steps when configuring a CPU 31xT(F) in one work session.

Procedure

Step	Activity
1	Create a new project in the SIMATIC Manager (e.g. "Getting Started CPU 317TF").
2	Select the Insert > Station > SIMATIC T Station menu command.  The "Set up T station" dialog box opens.

Step	Activity
3	Select the following settings in the fields: CPU type: CPU317TF-2 DP "Generate Technology System Data" option activated "MPI/DP": New, type "MPI", transmission rate 1.5 Mbit/s or higher "PG/PC": New, "Assign" option activated If required, press the button "Help" to obtain additional information. Confirm with "OK". Result: A new SIMATIC 300 station is created in the project with a CPU 317TF-2 DP (latest version).
4	Open the hardware configuration and add the following modules, as specified in the section "Requirements (Page 7)": - Digital input module DI16xDC24V, e.g. 6ES7321-1BH02-0AA0 - Digital output module DO16xDC24V/0.5A, e.g. 6ES7322-1BH01-0AA0
5	Save and compile the hardware configuration. The system compiles your project, and adds the "Technology Objects" object to the project window in SIMATIC Manager.
6	Download the hardware configuration to the target system.

4.2 Configuring the F-DI signal module

Use of the fail-safe input channels

Configure a fail-safe F-DI signal module. The following table shows which safety elements need to be connected to the individual channels and how the channels need to be configured.

Note

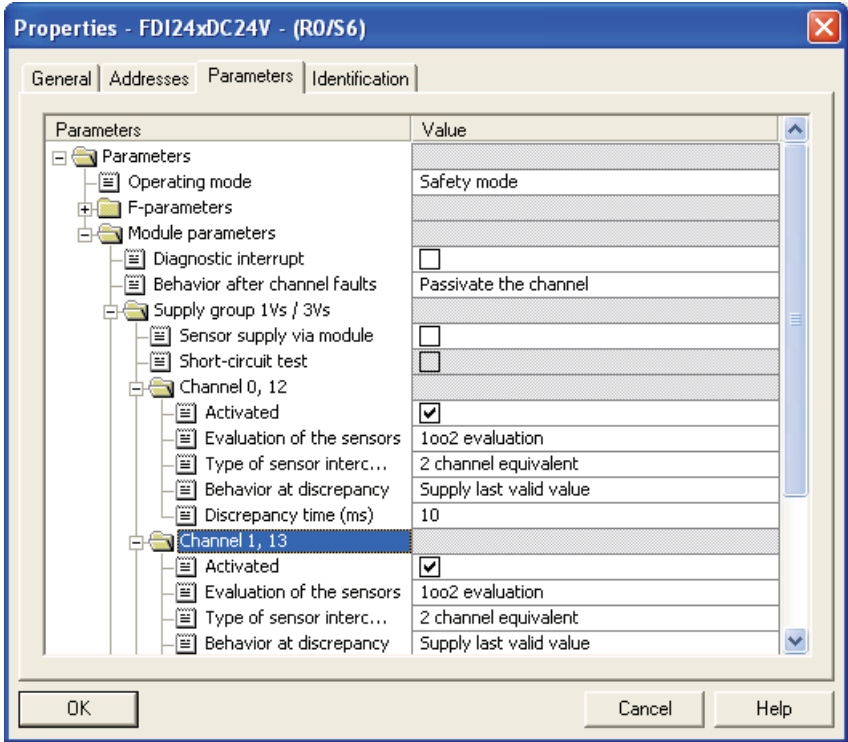
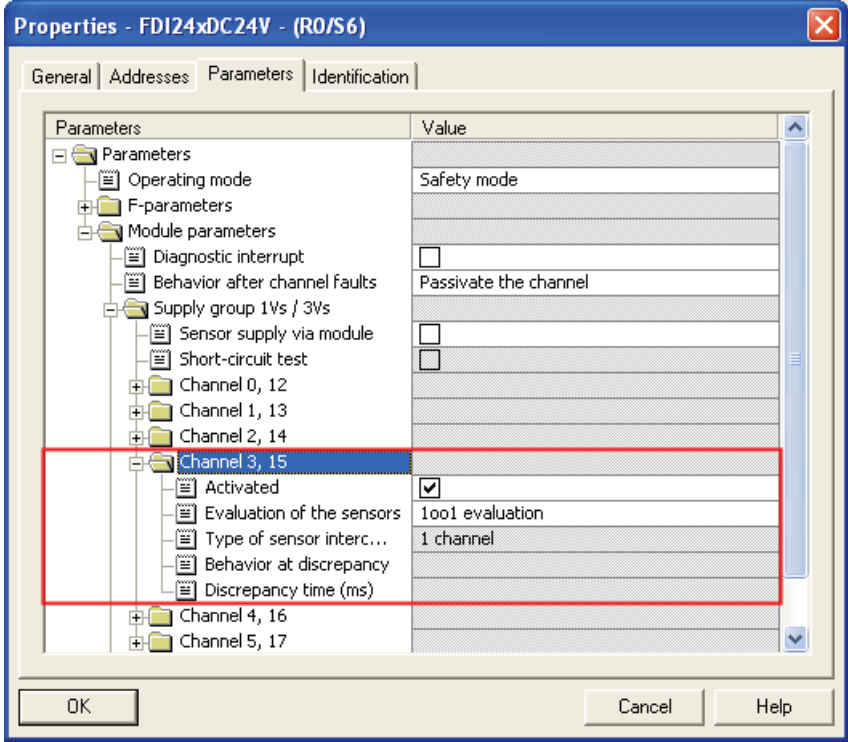
You must set a password to provide access permission for the safety program.

Table 4- 1 Configuration of the input channels, supply group 1Vs / 3Vs

Channel	Use	Parameter	Value
0 and 12	1. of the safety door, 2-channel	Evaluation of encoder	1oo2 evaluation
		Type of encoder interconnection	2-channel equivalent
1 and 13	2. of the safety door, 2-channel	Evaluation of encoder	1oo2 evaluation
		Type of encoder interconnection	2-channel equivalent
2 and 14	Emergency stop switch, 2-channel	Evaluation of encoder	1oo2 evaluation
		Type of encoder interconnection	2-channel equivalent
3	Key switch for setup mode, single-channel	Evaluation of encoder	1oo1 evaluation
		Type of encoder interconnection	Single-channel
5	Acknowledgment button, single-channel	Evaluation of encoder	1oo1 evaluation
		Type of encoder interconnection	Single-channel

Procedure

Step	Activity
1	In slot 6 of the previously created hardware configuration, add an SM 326F DI24xDC24V F-DI signal module (6ES7 326-1BK02-0AB0).
2	Open the "Parameters" tab in properties of the F-DI signal module. There you change the following parameters: - Operating mode - F-Parameters - Module parameters
3	Select "Safety mode".
4	Open the "F-Parameters" folder. Note the DIP switch setting and set the DIP switch of the module to match.
5	Open the "Module parameters" folder. Select "Passivate the channel" as the "Behavior after channel faults".

Step	Activity
6	Assign the parameters of the channels used as shown in the "Configuration of the input channels" table: Keep the default settings for channels 0 and 12, 1 and 13, 2 and 14:  For channels 3 and 15, select the parameters as shown in the following figure: 

Step	Activity
7	Deactivate the remaining channels of the 1Vs / 3VS supply group and all channels of the 2VS / 4VS supply group by clearing the check marks of the "Activated" option. Confirm the entries with OK.
8	Enter a password for the safety program.

Result

The configuration of the F-DI signal module is complete.

4.3 Configuring the F-DO signal module

Use of the fail-safe output channels

Configure a fail-safe F-DO signal module. The table below shows which channels are used and the meaning of the connected lights.

Table 4- 2 Use of the output channels

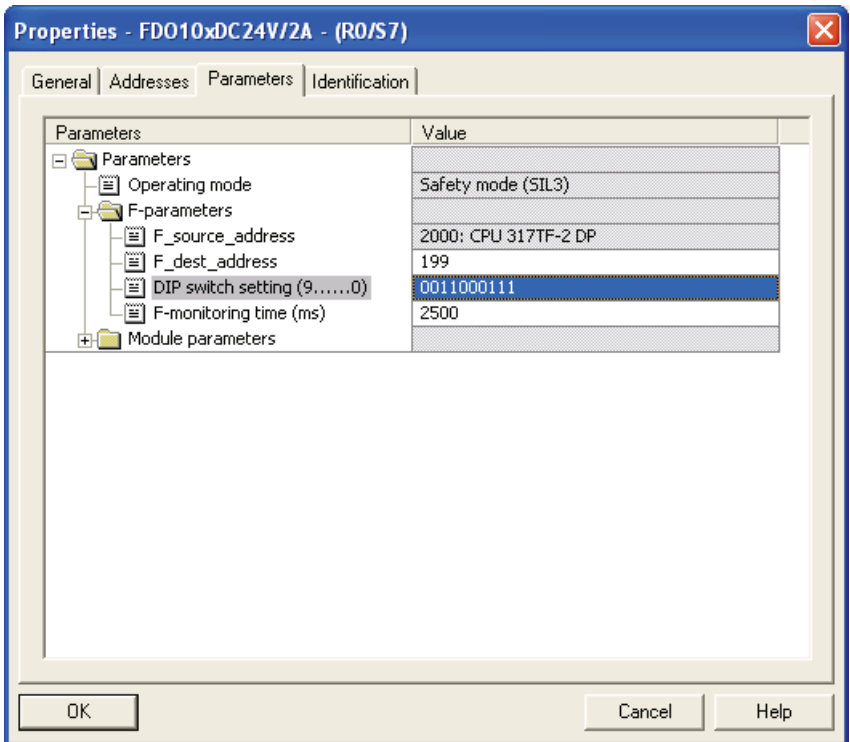
Channel	Use
DO channel 0	Safety mode deactivated
DO channel 1	Setup mode activated (safety door open and key switch on "Setup")
DO channel 2	Emergency off active (emergency stop button is pressed or safety door open without setup mode)
DO channel 3	Acknowledgment required (at least one F-I/O has a fault requiring acknowledgment or needs to be reintegrated)

Note

You have to enter the password for the safety program to configure the fail-safe module.

The names and order of the parameters may differ from the following description if you are using a different fail-safe module. You can find information on the parameters in the online help.

Procedure

Step	Activity
1	In slot 7 of the hardware configuration, add an SM 326F DO10xDC24V F-DO signal module (6ES7 326-2BF10-0AB0).
2	Open the "Parameters" tab in properties of the F-DO signal module. Enter a password for the safety program, if prompted.
3	Select "Safety mode".
4	Open the "F-Parameters" folder.  Note the value of the "DIP switch setting" parameter and set the DIP switch of the module to match this value.
5	Open the "Module parameters" folder. Deactivate the "Diagnostics interrupt" option. Select "Channel passivation" as the "Reaction to channel errors". Activate the used channels 0 to 3 ("Use of the output channels" table). Deactivate all other channels.
6	Confirm the entries with OK.

Result

The configuration of the F-DO signal module is complete.

4.4 Configuring a drive in HW Config

Note

The procedure is described in detail in Step 6 of the Getting Started "CPU 317T-2 DP: Controlling a SINAMICS S120".

Procedure

Step	Activity	Result
1	In the HW catalog, open the tree structure SIMATIC Technology > PROFIBUS DP(DRIVE) > Drives > SINAMICS .	
2	Select the "SINAMICS > SINAMICS S120 CU320" drive component from the tree of the HW catalog.	
3	Drag-and-drop the drive to the DP master system of the DP(DRIVE).	The "Properties – PROFIBUS interface SINAMICS" dialog box opens.
4	Enter PROFIBUS address "4", then confirm with "OK".	The "Properties - SINAMICS" dialog box opens.
5	Select the appropriate device version that is suitable for your SINAMICS, e.g. 2.6.2, and confirm with "OK".	
6	The "DP Slave Properties" dialog box opens. Open the "Isochronous mode" tab.	
7	Set the "Synchronize drive with equidistant DP cycle", then set the time coefficients as shown below.	

DP slave properties

General | Configuration | **Isochronous Operation** | Data Exchange Broadcast - Overview

☒ Synchronize drive to equidistant DP cycle

Network settings in ms

Equidistant bus cycle activated

Equidistant DP cycle: 3.000 Data_Exchange_Time comp. Tdx: 0.179

Master application cycle Tmapc [ms]: 3.000 = Factor 1 x Grid / base time [ms] 3.000

DP cycle Tdp [ms]: 3.000 = Factor 24 x Frame / base time [ms] 0.125

Time Ti [ms] (actual value acquisition): 0.125 = Factor 1 x Grid / base time [ms] 0.125

Time To [ms] (setpoint acceptance): 0.375 = Factor 3 x Grid / base time [ms] 0.125

Align

OK Cancel Help

4.5 Downloading the hardware configuration to the target hardware

Step	Activity	Result
8	Click "Align".	The following components are aligned to the set values: • DP cycle in the DP master system • All drive components of the same family (here SINAMICS)
9	Confirm with "OK".	
10	Finalize your HW configuration by calling the Station > Save and compile command.	Your project will be compiled.

4.5 Downloading the hardware configuration to the target hardware

Requirement

To get online access to the SINAMICS S120 drive from the programming device, you need routing between the X1-MPI/DP interface and the PROFIBUS-DP (DRIVE) through the technology CPU.

Ensure that the appropriate PG/PC assignment has been made. If required, configure a PG/PC assignment in NetPro.

Note

The procedure is described in detail in Step 7 of the Getting Started "CPU 317T-2 DP: Controlling a SINAMICS S120".

Procedure

Step	Activity
1	Download the hardware configuration to the CPU using the menu command PLC > Download to Module .
2	Close HW Config with Station > Exit .

4.6 Configuring a drive in S7T Config

Basic procedure

The drive is configured in two steps:

1. Automatic online configuration of the drive
2. Offline configuration of the drive with full DRIVE-CLIQ technology

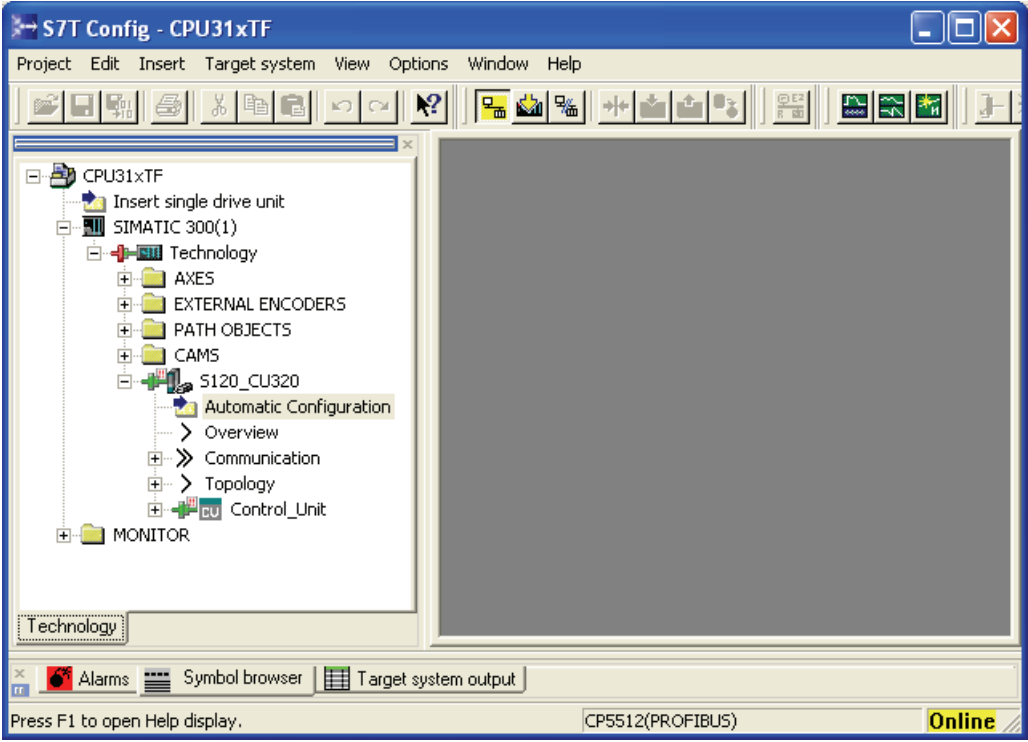
Requirement

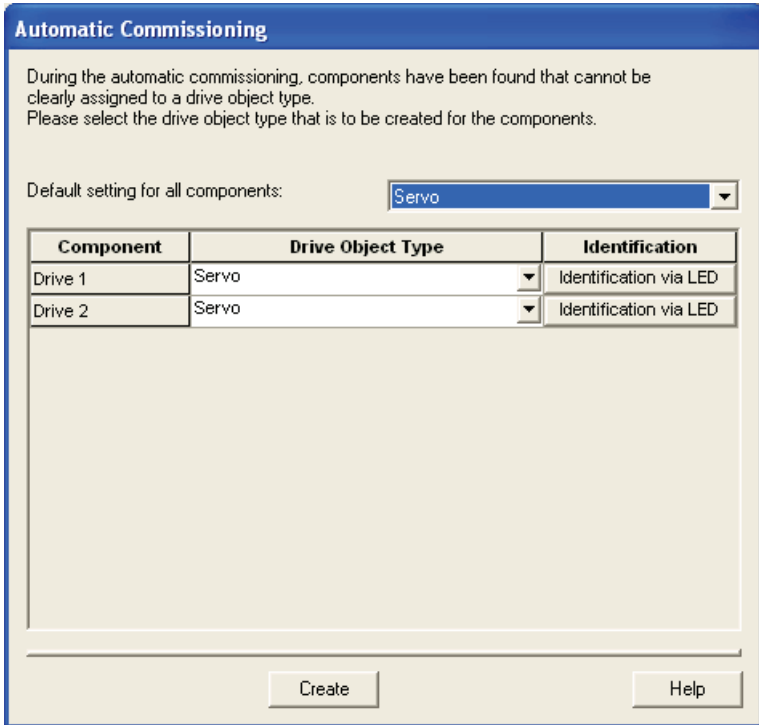
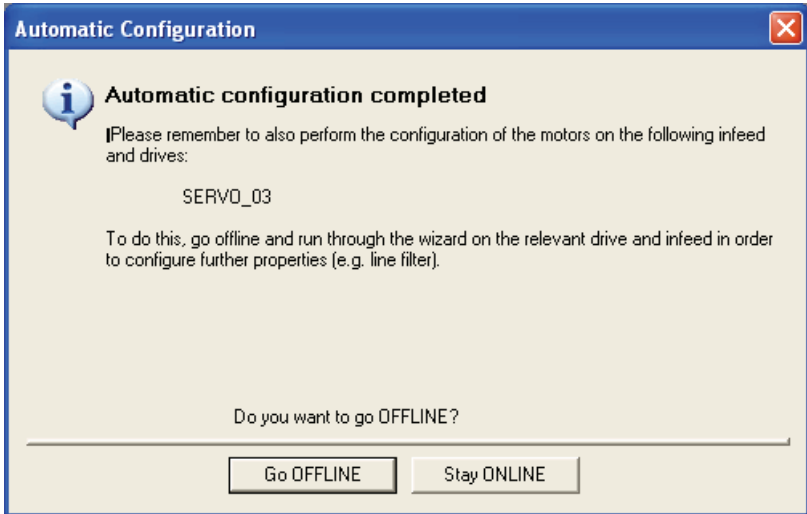
Routing is configured between the X1-MPI/DP interface and the PROFIBUS-DP (DRIVE) through the TF-CPU in NetPro.

The factory settings are set on the drive.

Automatic online configuration of the drive

Step	Activity
1	Open S7T Config. To do this, select "Technological objects" and the Options > Configure technology menu command in the SIMATIC Manager. Result: S7T Config opens.
2	Save the current project data by using the Project > Save and recompile all command.
3	Switch to online mode by selecting the Project > Connect to target system menu command.

Step	Activity
4	Open the SIMATIC 300(1) > Technology > SINAMICS_S120 tree in the project navigator. Double-click "Automatic configuration".  The screenshot shows the 'S7T Config - CPU31xTF' application window. The menu bar includes Project, Edit, Insert, Target system, View, Options, Window, and Help. The toolbar contains various icons for file operations and configuration. The project tree on the left is expanded to show the 'Technology' folder under 'SIMATIC 300(1)'. Within 'Technology', the 'S120_CU320' folder is expanded, and the 'Automatic Configuration' option is selected. Below the tree, there are tabs for 'Technology', 'Alarms', 'Symbol browser', and 'Target system output'. The status bar at the bottom indicates 'Press F1 to open Help display.', 'CP5512(PROFIBUS)', and 'Online'.
5	In the "Automatic configuration" dialog box, click "Configure".

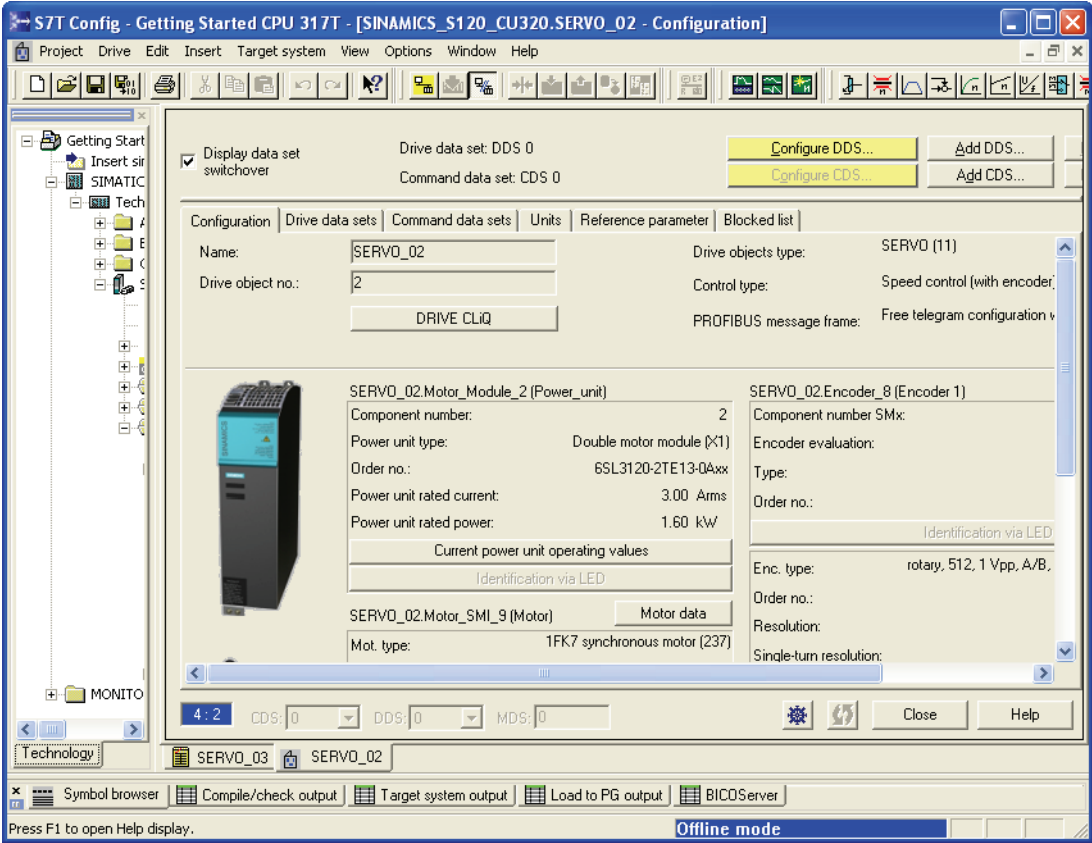
Step	Activity
6	Set the drive object type for both motors to "Servo" and confirm with "Create".  The two drive objects will be created and preconfigured automatically. The configuration data will be loaded to the programming device. Note: The SINAMICS training case on which this document is based has two different motor types. One of the two motor types uses DRIVE-CLiQ technology. The second encoder is connected via SMC20, which is why DRIVE-CLiQ recognizes that a second encoder is present and creates it. However, the second motor cannot be configured automatically.
7	Click "Go OFFLINE" to change to offline mode. 

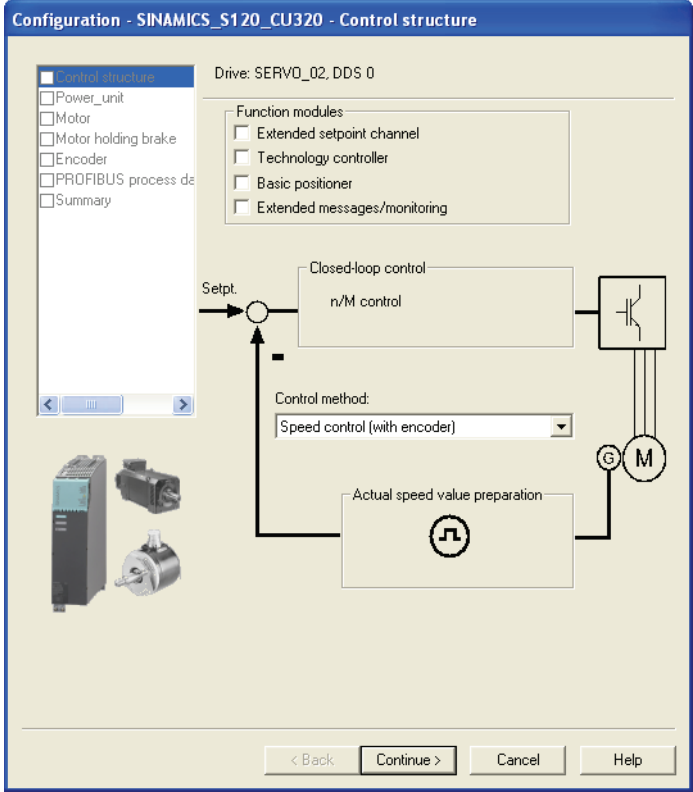
Note

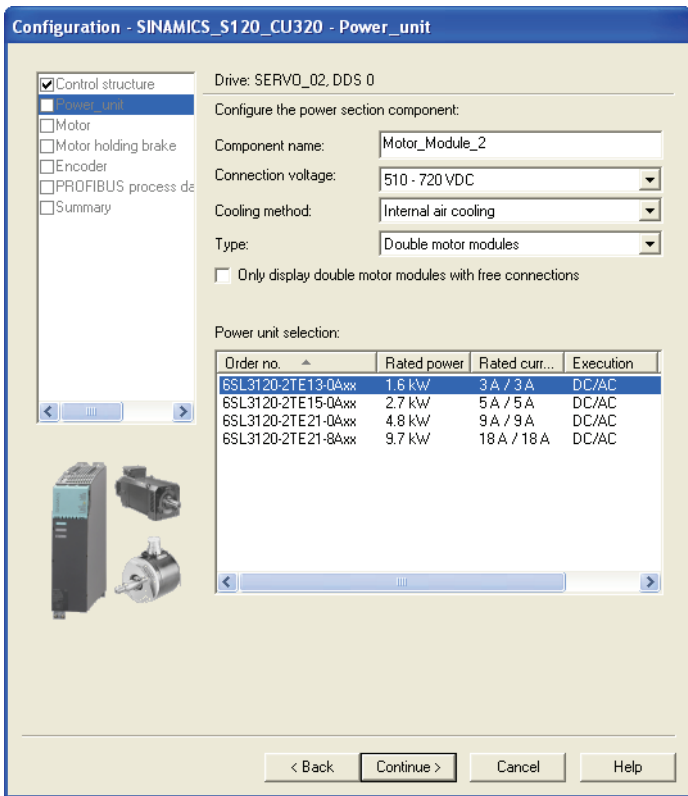
For the application example, you only need the "Servo_02" drive with full DRIVE CLIQ technology. "Servo_03" drive is configured automatically, but it is not necessary.

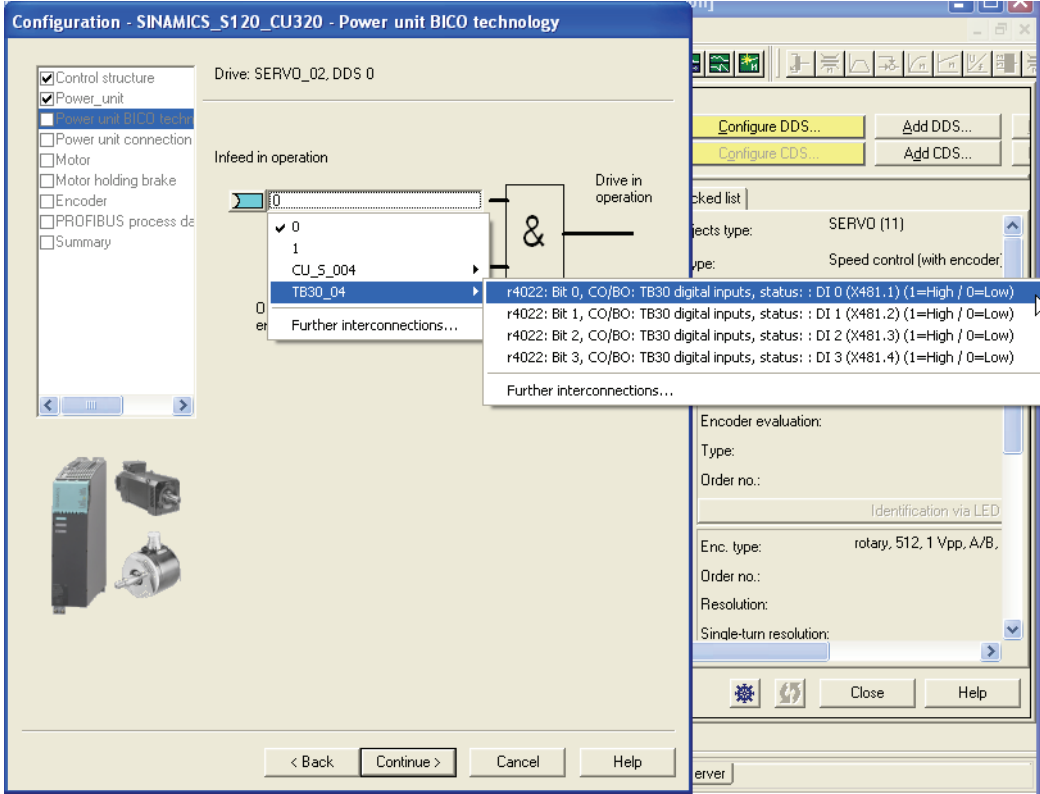
Offline configuration of the drive with full DRIVE-CLIQ technology

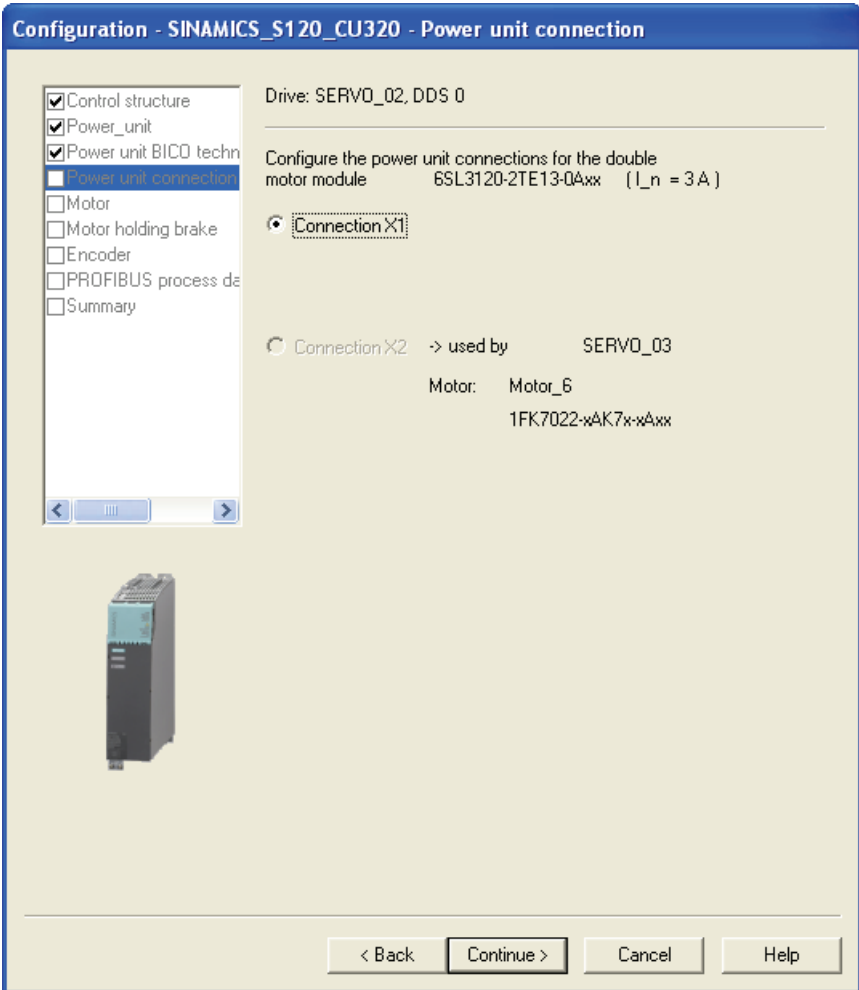
Configure the drive "Servo_02".

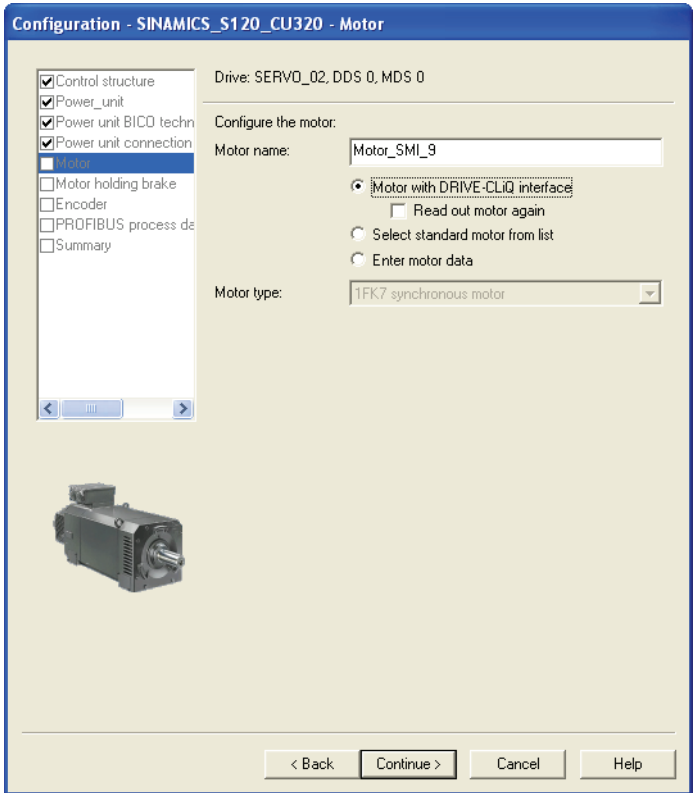
Step	Activity
1	In the project navigator, open the tree SIMATIC 300(1) > Technology > S120_CU320 > Drives > Servo_02 > and double-click "Configuration" to open the offline drive configuration.
2	Click "Configure DDS..." to start the configuration.  The motor module features full DRIVE-CLIQ technology and has already been preconfigured correctly. The correct motor and encoder have already been set.

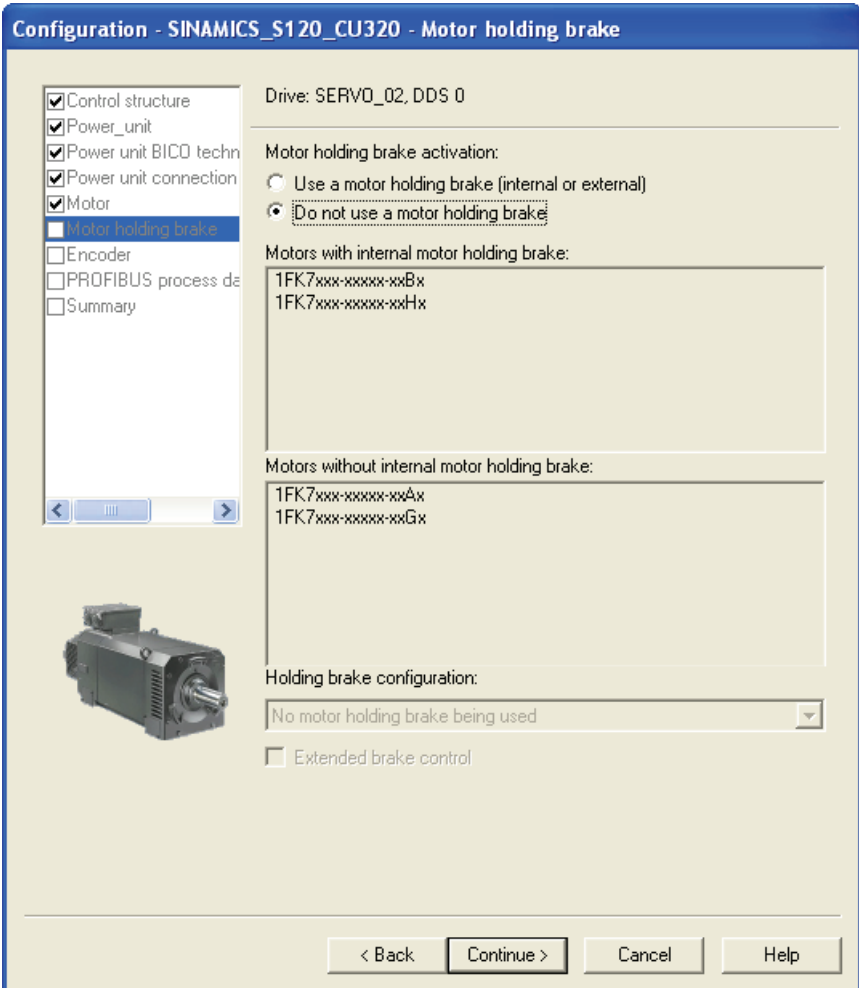
Step	Activity
3	Accept the default settings and click "Next >". 

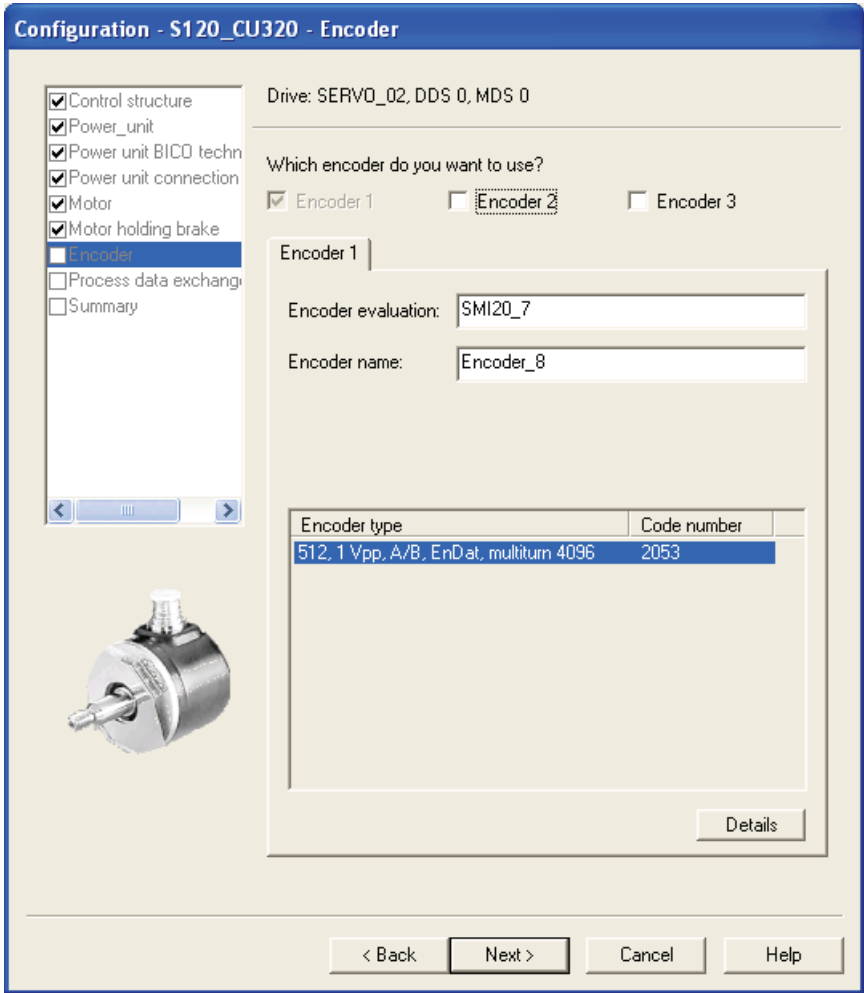
Step	Activity																				
4	The motor module has DRIVE-CLIQ technology and has already been configured correctly. Check the order number and click "Next >".  Configuration - SINAMICS_S120_CU320 - Power_unit Drive: SERV0_02, DDS 0 Configure the power section component: Component name: Motor_Module_2 Connection voltage: 510 - 720 VDC Cooling method: Internal air cooling Type: Double motor modules ☐ Only display double motor modules with free connections Power unit selection: <table><thead><tr><th>Order no.</th><th>Rated power</th><th>Rated curr...</th><th>Execution</th></tr></thead><tbody><tr><td>6SL3120-2TE13-0Axx</td><td>1.6 kW</td><td>3 A / 3 A</td><td>DC/AC</td></tr><tr><td>6SL3120-2TE15-0Axx</td><td>2.7 kW</td><td>5 A / 5 A</td><td>DC/AC</td></tr><tr><td>6SL3120-2TE21-0Axx</td><td>4.8 kW</td><td>9 A / 9 A</td><td>DC/AC</td></tr><tr><td>6SL3120-2TE21-8Axx</td><td>9.7 kW</td><td>18 A / 18 A</td><td>DC/AC</td></tr></tbody></table> < Back Continue > Cancel Help	Order no.	Rated power	Rated curr...	Execution	6SL3120-2TE13-0Axx	1.6 kW	3 A / 3 A	DC/AC	6SL3120-2TE15-0Axx	2.7 kW	5 A / 5 A	DC/AC	6SL3120-2TE21-0Axx	4.8 kW	9 A / 9 A	DC/AC	6SL3120-2TE21-8Axx	9.7 kW	18 A / 18 A	DC/AC
Order no.	Rated power	Rated curr...	Execution																		
6SL3120-2TE13-0Axx	1.6 kW	3 A / 3 A	DC/AC																		
6SL3120-2TE15-0Axx	2.7 kW	5 A / 5 A	DC/AC																		
6SL3120-2TE21-0Axx	4.8 kW	9 A / 9 A	DC/AC																		
6SL3120-2TE21-8Axx	9.7 kW	18 A / 18 A	DC/AC																		
5	The SINAMICS training case on which this document is based does not have an active infeed module. Confirm the warning about wiring of the operating signal with "Close".																				

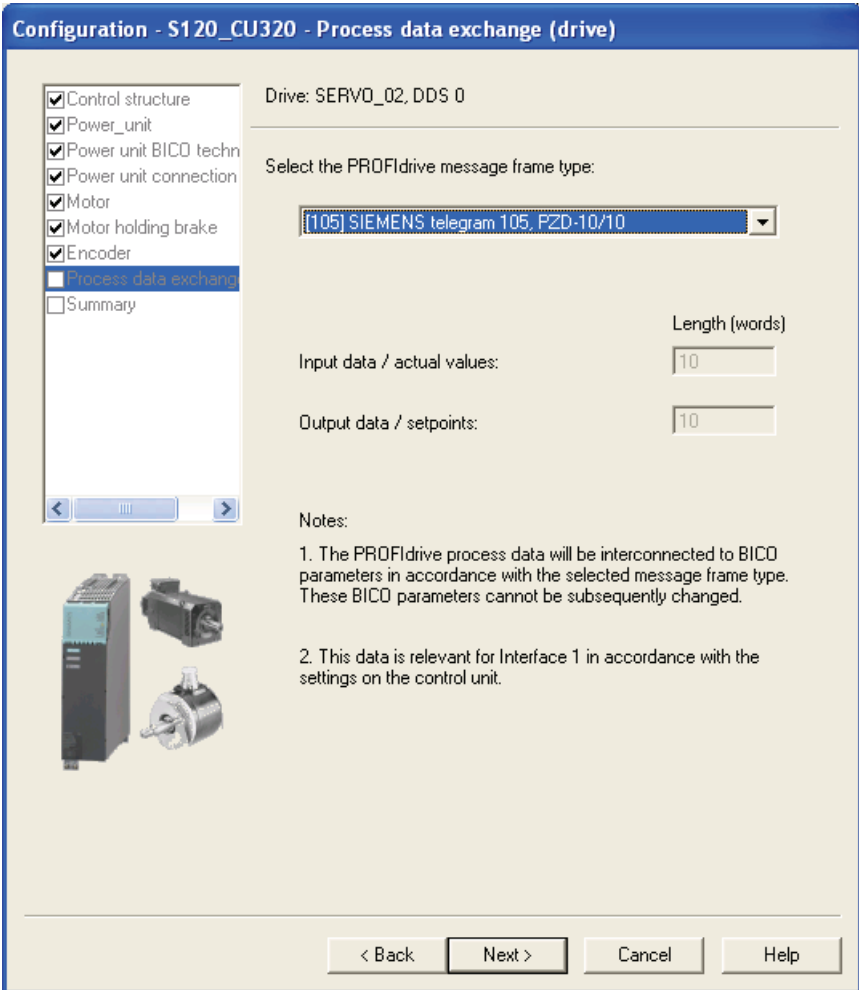
Step	Activity
6	Click the blue button and in the TB30_04 context menu, select digital input 0, which corresponds to parameter r4022, bit 0. Then click "Next >". 

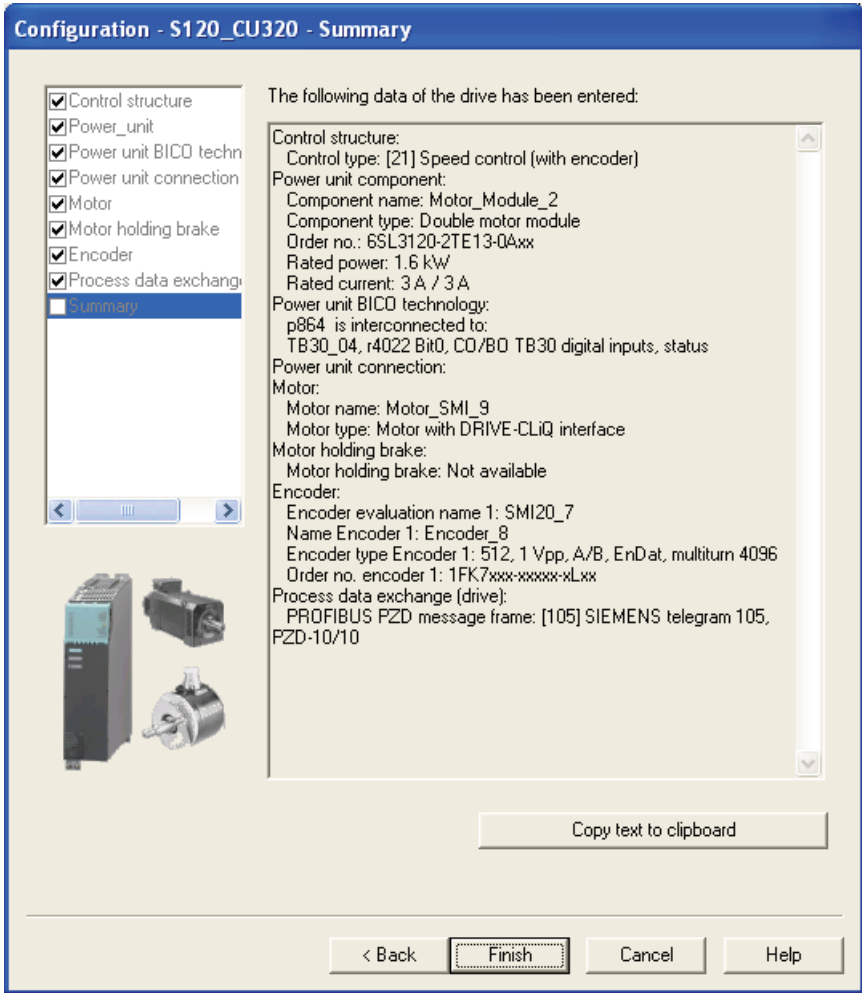
Step	Activity
7	The motor with full DRIVE-CLIQ technology is connected to the X1 terminal of the motor module. Click "Next >". 

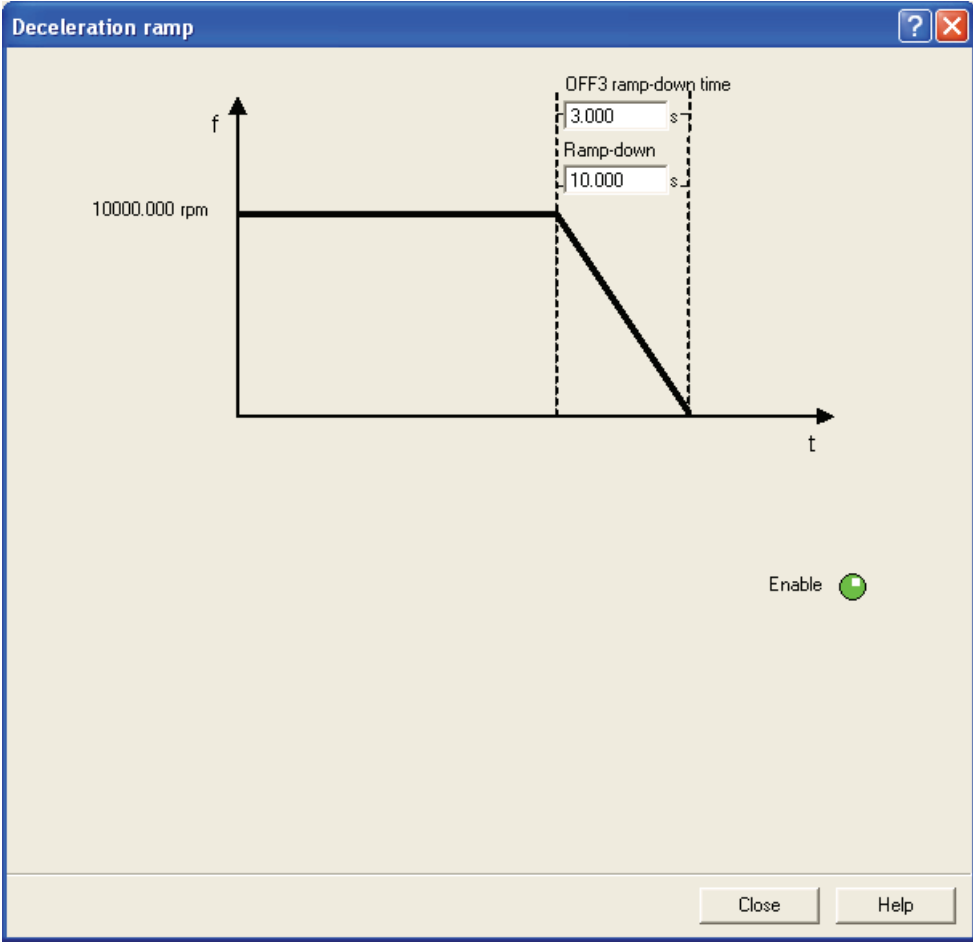
Step	Activity
8	The motor with complete DRIVE-CLIQ technology has already been correctly configured. Click "Next >". 

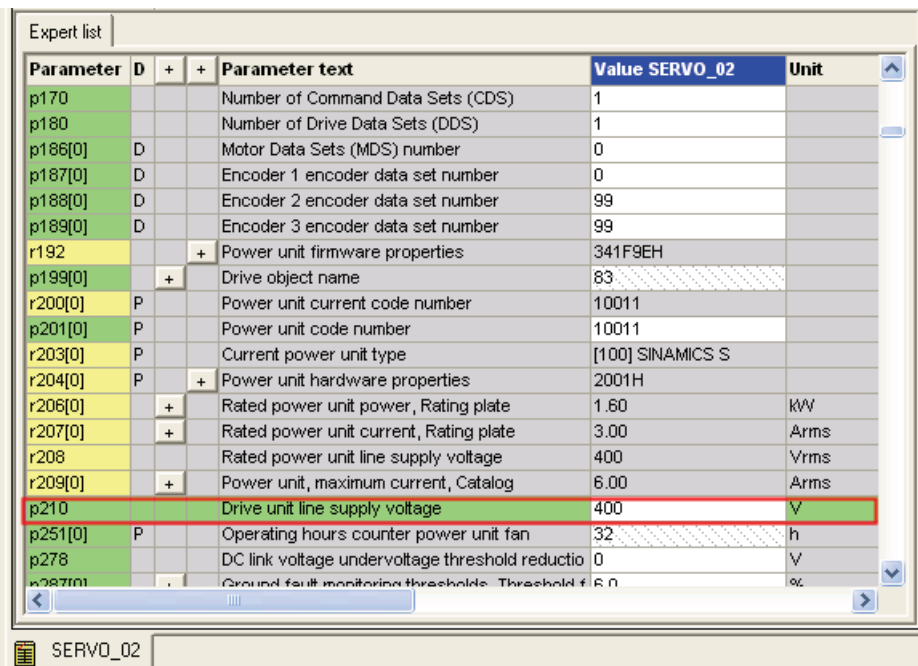
Step	Activity
9	Select "No motor holding brake..." and click "Next >". 

Step	Activity
10	The correct encoder has already been correctly configured by means of DRIVE-CLIQ technology. Click "Next >". 

Step	Activity
11	Set the PROFIdrive message frame type to "SIEMENS telegram 105" and click "Next >". 

Step	Activity
12	Click the "Finish" button to exit the offline configuration of the drive.  The offline configuration of the drive is complete. Close the dialog box with "Close".

Step	Activity
13	Open the drive object in the project navigator: SIMATIC 300(1) > Technology > SINAMICS_S120 > Drives > Servo_02. Select Open-loop/closed-loop control > Setpoint addition and click "Deceleration ramp".  Enter 3 s in the "OFF3 ramp-down time" box and close the dialog box with "Close".

Step	Activity
14	In the project navigator, open the tree structure SIMATIC 300(1) > Technology > SINAMICS_S120 > Drives > Servo_02. Select the Expert > Expert list command from the shortcut menu.
15	Select parameter "p210" and enter "400".  The Smart Line Module and the Motor Module of the SINAMICS S120 training case have been especially equipped for operation on a 230 V system. For this reason, "Parameter p210" of the connected drives must be set to the following value, which differs from the factory settings: p210 = 400 V device connection voltage SERVO/VECTOR The setting of "parameter p210 = 400V" cannot be calculated by the SINAMICS operating system and is preset for a 230 V power supply for the error-free operation of the SINAMICS S120 training case. Select the "p1248" parameter (DC link voltage threshold, lower) and enter "244" V.

Result

This completes the configuration of the drive in S7T Config.

You now can configure the PROFIdrive message frames of the drive.

4.7 Message frame configuration of the drive

A PROFIsafe message frame (30) is required in addition to the standard PROFIdrive message frame for communication between the drive and the TF-CPU.

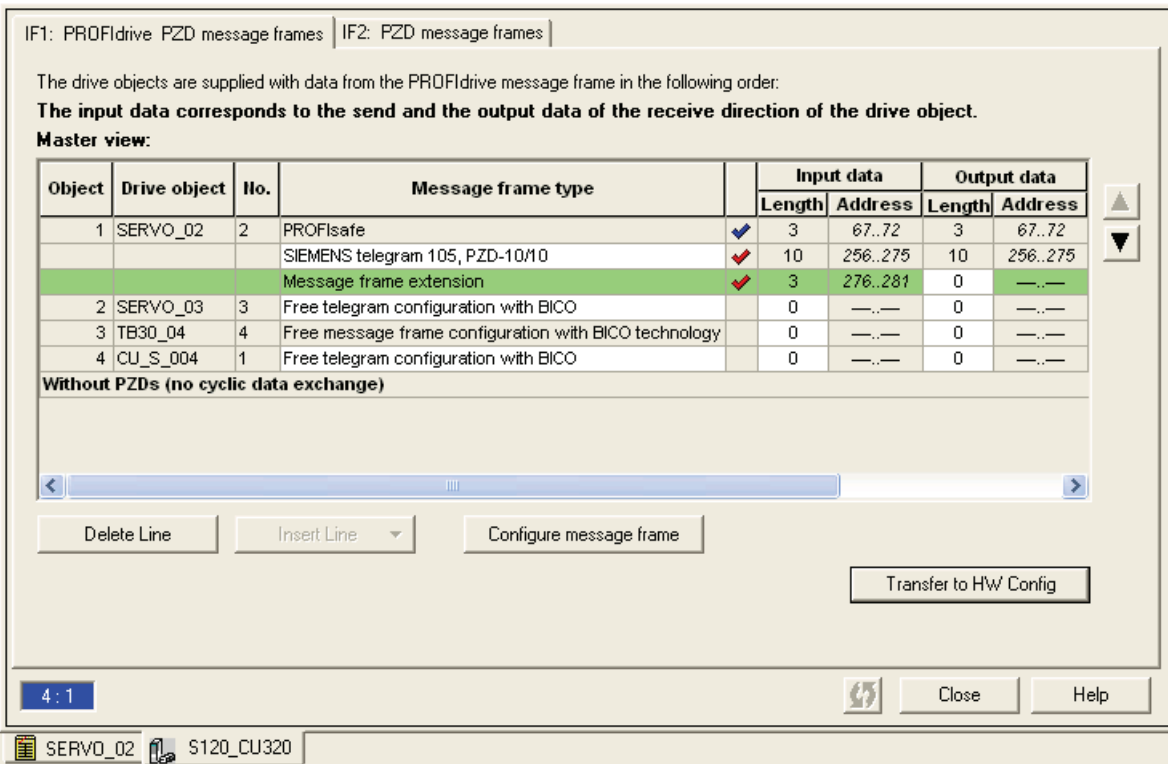
In addition, the PROFIdrive standard actual value message frame must be extended by a safety data block (3 words). This enables display of status information and messages about the safety functions of the drive in the TO DB of the axis.

Requirement

The offline configuration of the drive is complete.

Procedure

Step	Activity
1	In the project navigator, open the tree structure SIMATIC 300(1) > Technology > S120_CU320 > Communication . Double-click "Message frame configuration".
2	In the "Message frame configuration" dialog box, verify that the message frame type for the drive is set to "SIEMENS message frame 105".
3	Select the "Servo_02" line and click "Insert line > PROFIsafe". Result: A new line for a PROFIsafe message frame (30) is inserted before the standard message frame 105.
4	Select standard message frame 105 and add an additional message frame extension for the safety data block: 3 words of input data, 0 words of output data (from master view).

Step	Activity
5	Click "Transfer to HW Config" to have the message frame address set in the "Input data" and "Output data" columns. The message frame configuration should then appear as follows: 
6	Check whether valid addresses are entered for all message frames and close the dialog box.
7	Select the Project > Save and recompile all menu command to save and compile the entire technology project.
8	Select the Project > Connect to target system menu command to switch to online mode.
9	The desired configuration is on the PG/PC. In the project navigator, select the tree SIMATIC 300(1) > Technology > S120_CU320 and select the Target system > Download menu command to transfer the configuration to the drive. If necessary, click "<== Download" in the "Online / Offline comparison" dialog box to transfer the configuration.
10	At the security prompt for the download, select the "After loading, copy RAM to ROM" option and click "Yes".
11	Close the dialog box with "Close".
12	In the S7T Config select the Project > Disconnect from target system menu command to switch to offline mode.

4.8 Configuring safety-related communication between the TF-CPU and drives with safety functions

To access a drive with safety functions from the F-program via PROFIsafe, you need to configure a master-slave coupling in HW Config.

Requirement

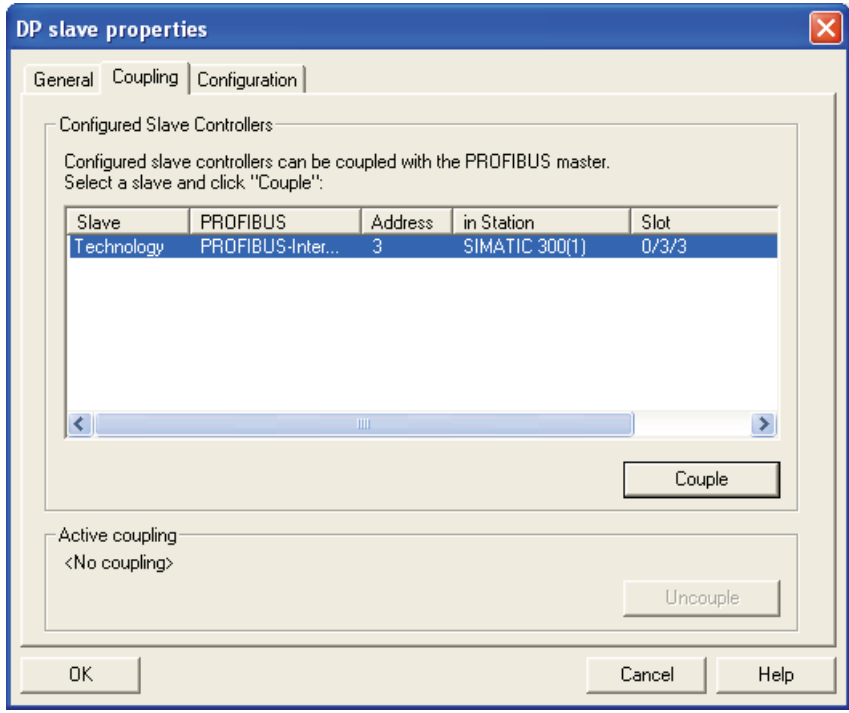
- The TF-CPU is configured in HW Config.
- The drives with safety functions are configured on the DP (DRIVE).

Note

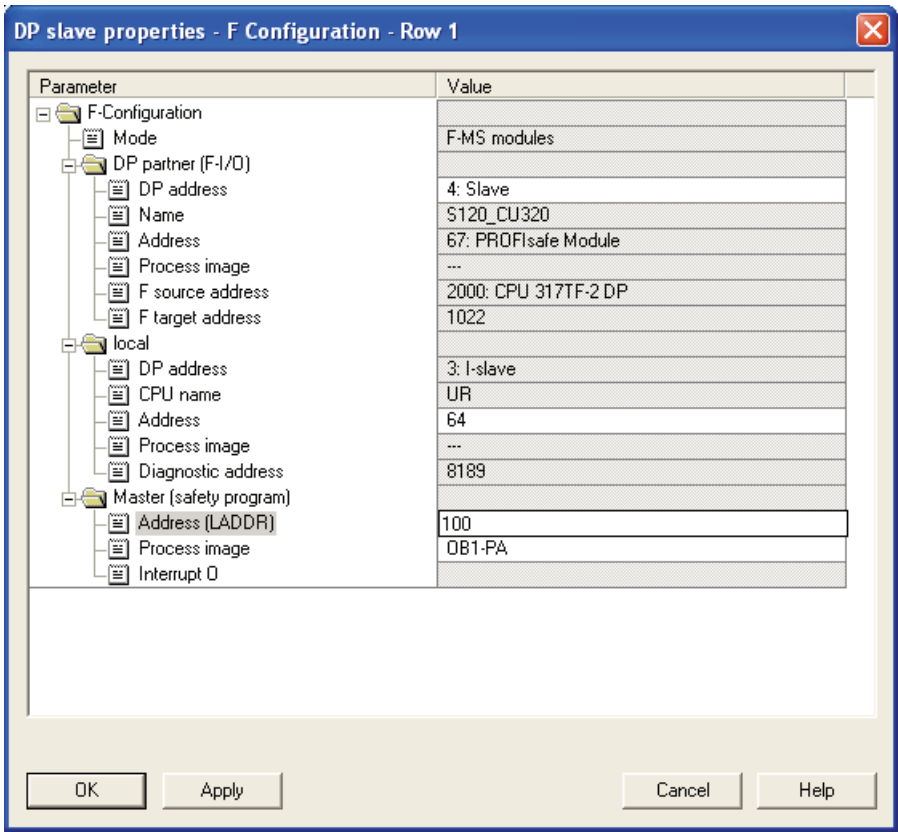
Any changes to the hardware configuration at a later time require a new configuration of the drive in S7T Config.

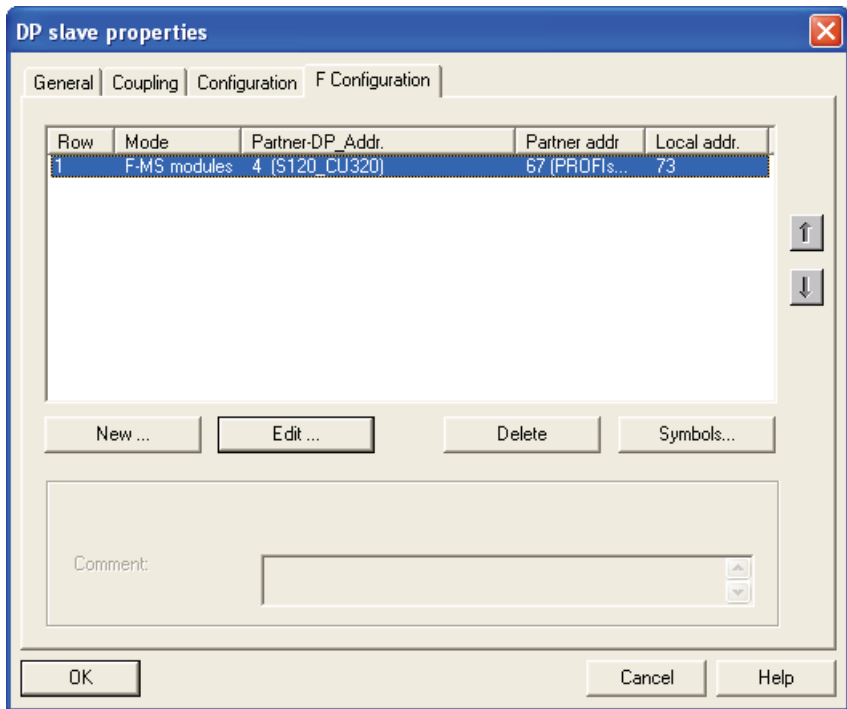
Procedure

To configure the master-slave coupling in HW Config, proceed as follows:

Step	Description
1.	In HW Config, double-click the technology (slot 3), and then select the "F-Configuration" tab. Click "Configure". The "Properties - DP Slave" dialog box opens. 
2.	Select the "Technology" line in the "Coupling" tab and click "Connect". The ID of the technology as an internal DP slave appears in the "Active Connection" box. Confirm with "OK".

4.8 Configuring safety-related communication between the TF-CPU and drives with safety functions

Step	Description
3.	Click "Configure" again. The "F-Configuration" tab is now visible in the "Properties - DP Slave" dialog box.
4	Open the "F-Configuration" tab and click "New" to configure a safety-related communication link between the TF-CPU and a drive, PROFIsafe module on the DP (DRIVE).
5	 In the "DP Slave - F-Configuration" properties dialog: - The "F target address" start address of the drive is displayed in the "DP partner (F-I/O)" folder. IMPORTANT: Note the fail-safe target address, because you will need it for the safety configuration of the drive in S7T Config. - In the "Local" folder: Keep the suggested local start address in the I-slave or enter a free address > 63. - In the "Master (Safety Program)" folder, enter the start address "Address (LADDR)" through which the drive should be accessed from the safety program of the F-CPU of the DP master. The address must be within the process image, for example, 100.

Step	Description
6	Follow the instructions in the online help if necessary. Confirm the entries with OK. Result The configured safety-related communication link between Integrated Technology (I-slave) and the drive (PROFIsafe module) is now displayed. 
7	Click OK to close all dialogs.

4.9 Configuring the properties of the TF-CPU

Procedure

Step	Activity
1	Open the properties of the CPU 317TF-2 DP in HW Config.
2	Make the following settings in the "Protection level" section of the "Protection" tab: Select the "Can be bypassed with password" option under "1: Access protection for F-CPU". In the "Password" box, enter a password for the F-CPU (max. 8 characters) and repeat your entry in the "Enter again" box. Select the "CPU contains safety program" option.
3	Confirm the entries with OK.
4	Save and compile the hardware configuration.
5	Download the hardware configuration to the CPU using the menu command PLC > Download to Module .

4.10 Interconnecting the safety data block with SINAMICS parameters

Structure of the safety data block

The safety data block is used to extend the TO DB, through which the drive can send process data (PCD) to the technology CPU.

The individual bits of the safety data block contain the status of the safety functions and need to be interconnected with the following drive parameters:

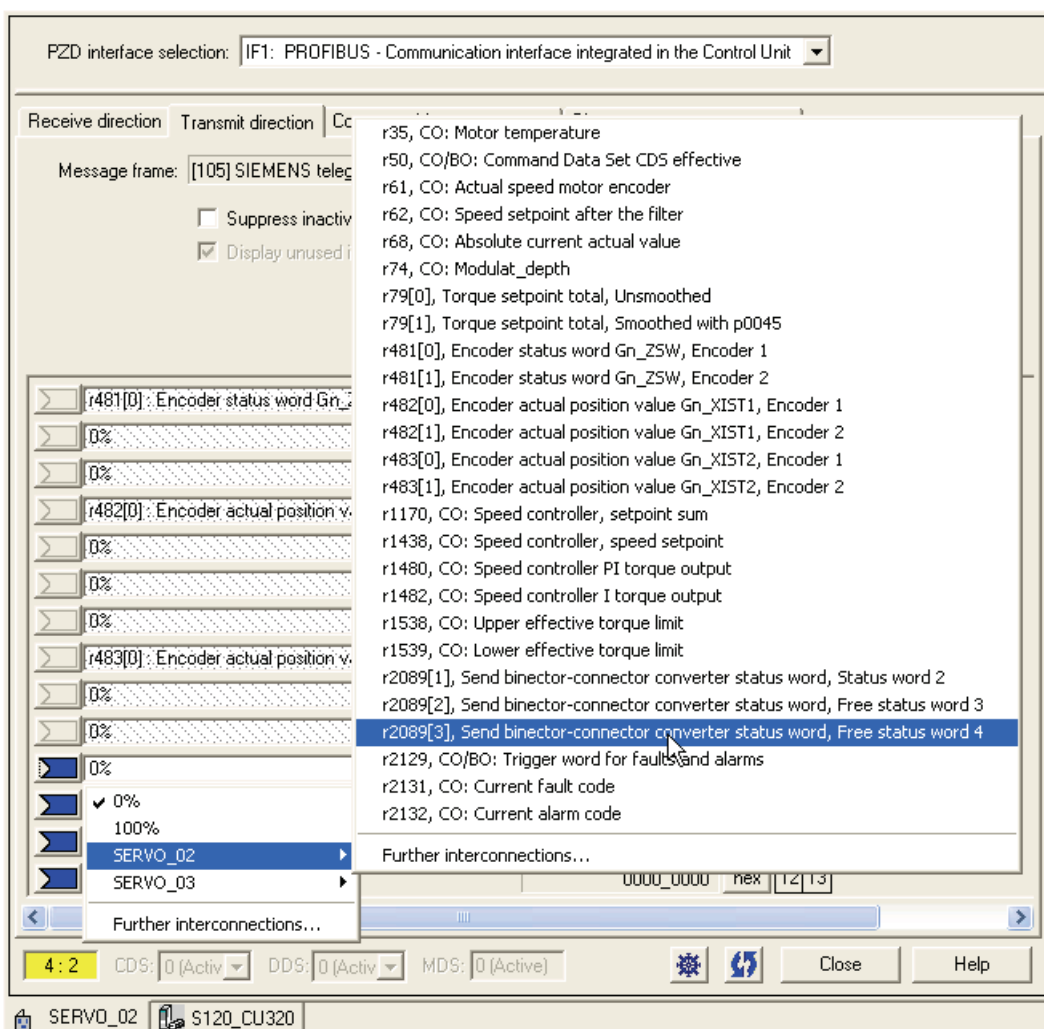
Table 4- 3 Interconnection of the safety data block

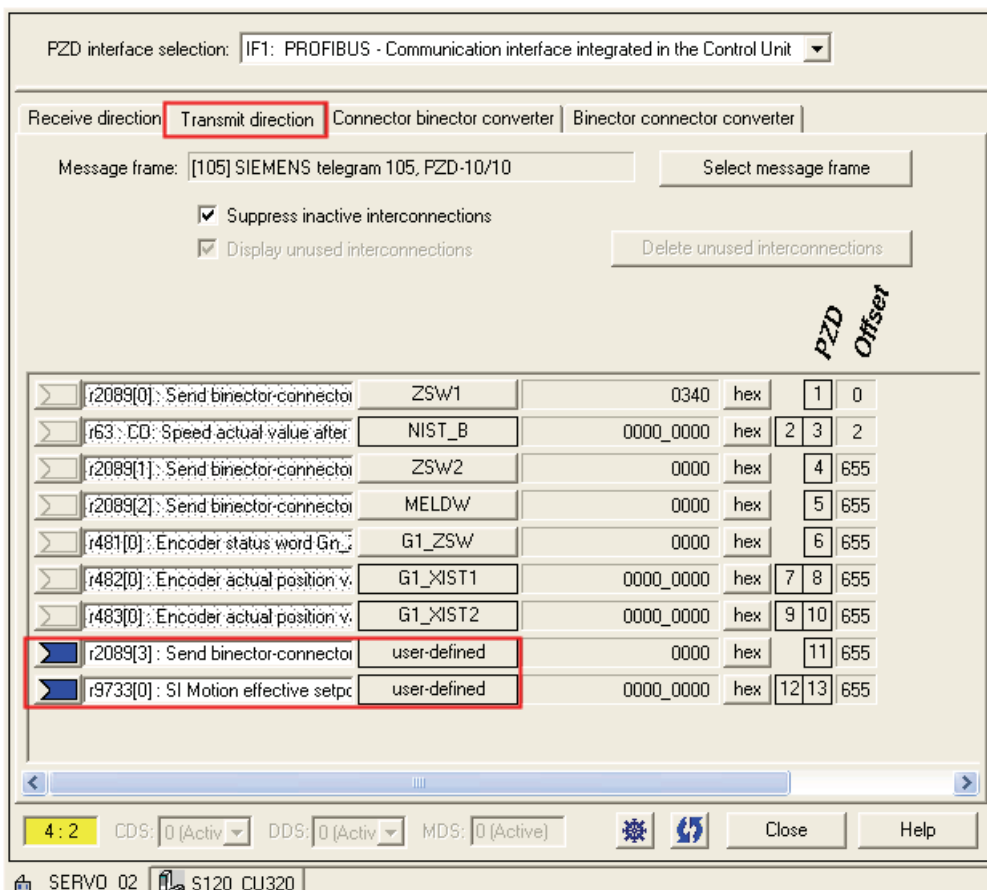
Bit	Meaning	Parameter
0	STO is active	r9722.0
1	SS1 is active	r9722.1
2	SS2 is active	r9722.2
3	SOS is selected.	r9722.11
4	SLS is deselected (0 active)	r9720.4
5	Reserved	
6	Reserved	
7	SSM (speed n is below limit)	r9722.15
8	Reserved	
9	Reserved	
10	Reserved	
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	At least one safety message pending	r2139.5

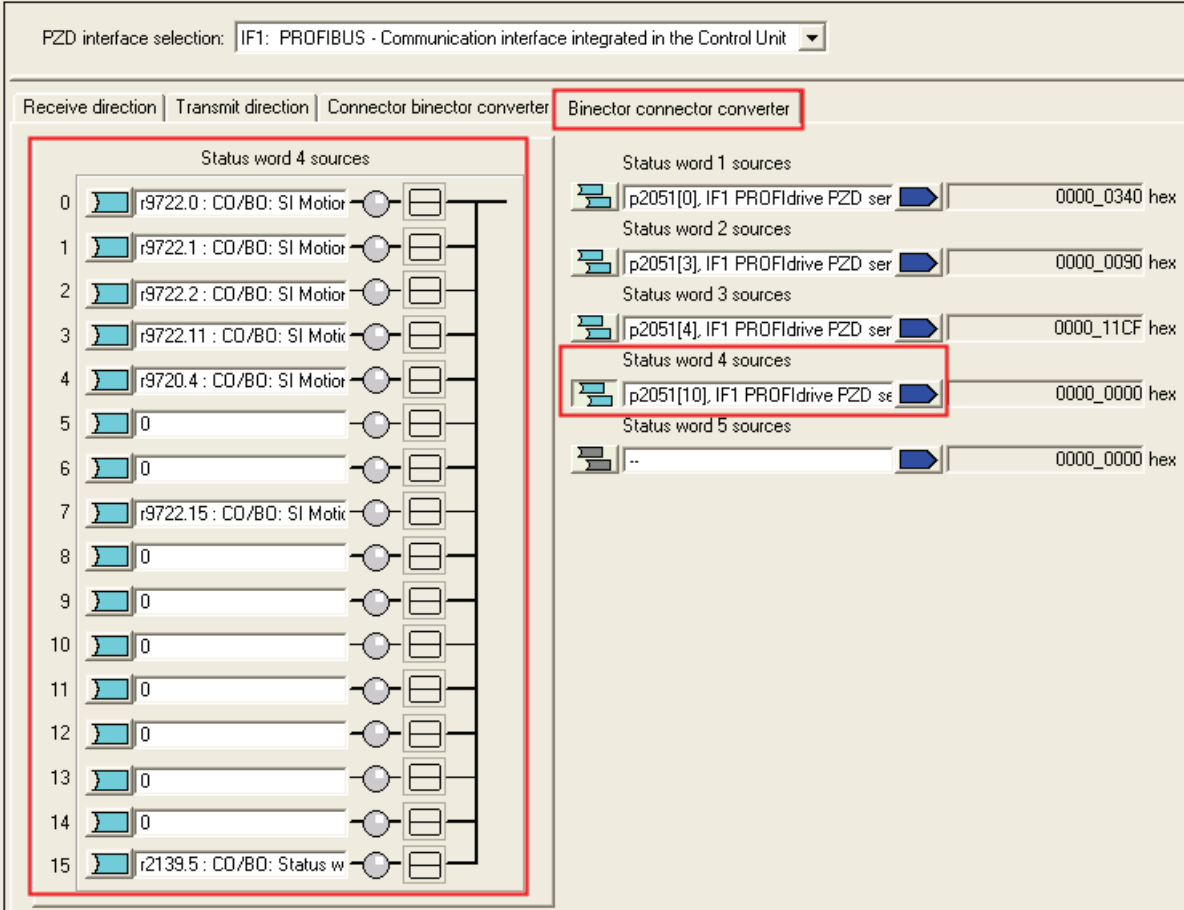
Interconnect the individual bits of the safety data block in the message frame configuration of the drive using a binector connector converter.

Procedure

Step	Activity
1	In S7T Config, open the message frame configuration of the drive.
2	Select the created message frame extension and click "Configure message frame".
3	In the "Transmit direction" tab, disable the "Suppress inactive interconnections" option so that the free interconnections will be displayed.
4	In the "Transmit direction" tab, assign the interconnected binector connector converter and the r9733 parameter to the message frame extension. In the PCD 11 line, click the left blue box to create the interconnection with r2089[3].



Step	Activity
5	In the PCD 12/13 line, click the left blue box to create the interconnection with r9733[0]. Select the "Suppress inactive interconnections" option. The interconnection then appears as follows: 

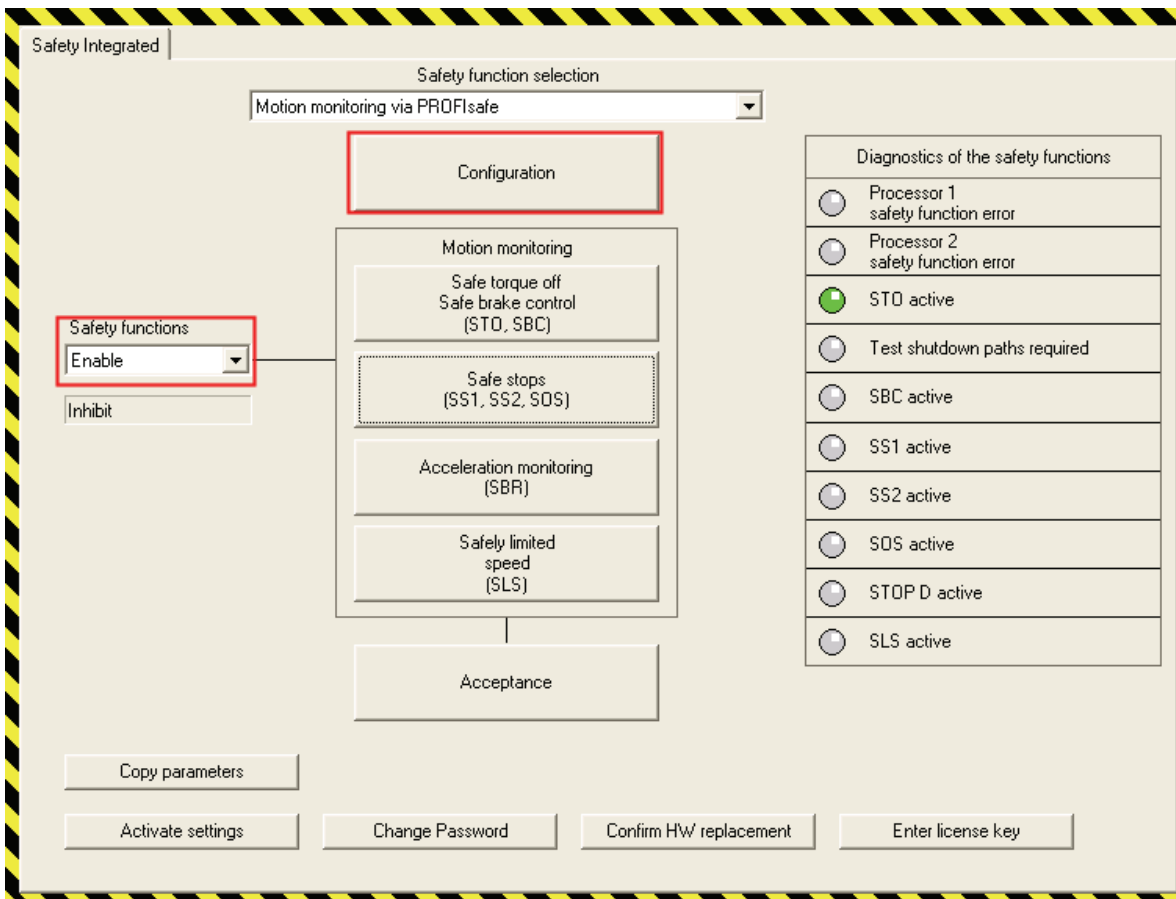
Step	Activity
6	Open the "Binector connector converter" tab. Make sure that the p2051[10] parameter is interconnected in "Status word 4 sources". Make the required interconnections according to "Interconnection of the safety data block" table, as shown in the figure below.  The status word is then available at parameter r2089[3].
7	Select the Project > Save and compile all menu command to save and compile the entire technology project.
8	Switch to online mode by selecting the Project > Connect to target system menu command.
9	Select SIMATIC 300(1) > Technology > S120_CU320 in the project navigator and select the Target system > Download menu command to transfer the configuration to the drive.
10	At the security prompt for the download, select the "After loading, copy RAM to ROM" option and click "Yes".

4.11 Configuring safety functions on the drive

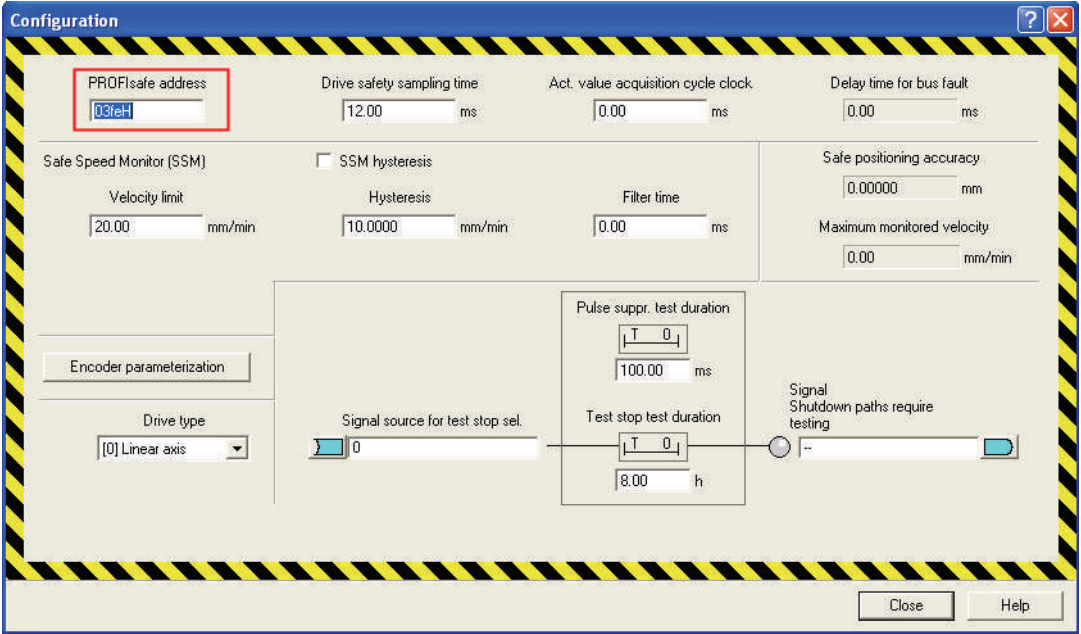
Requirement

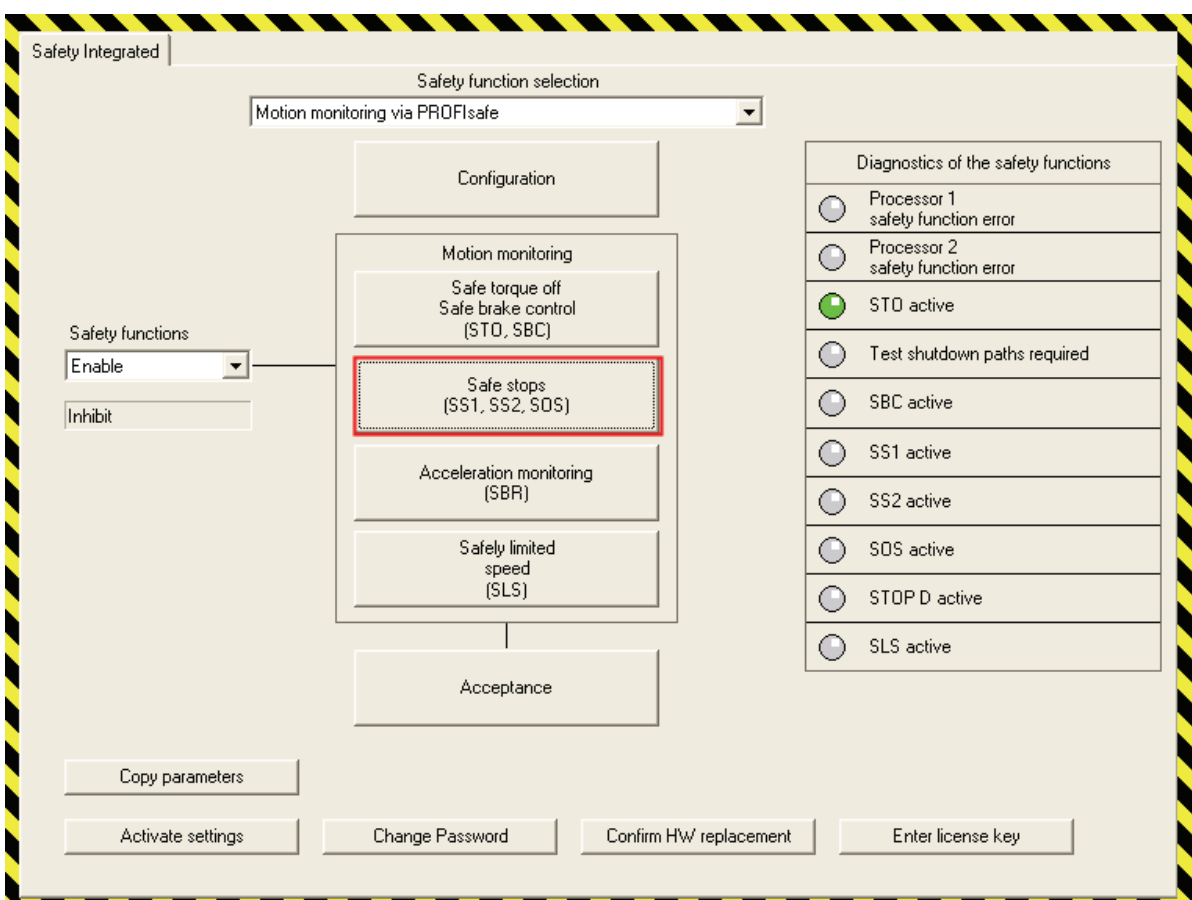
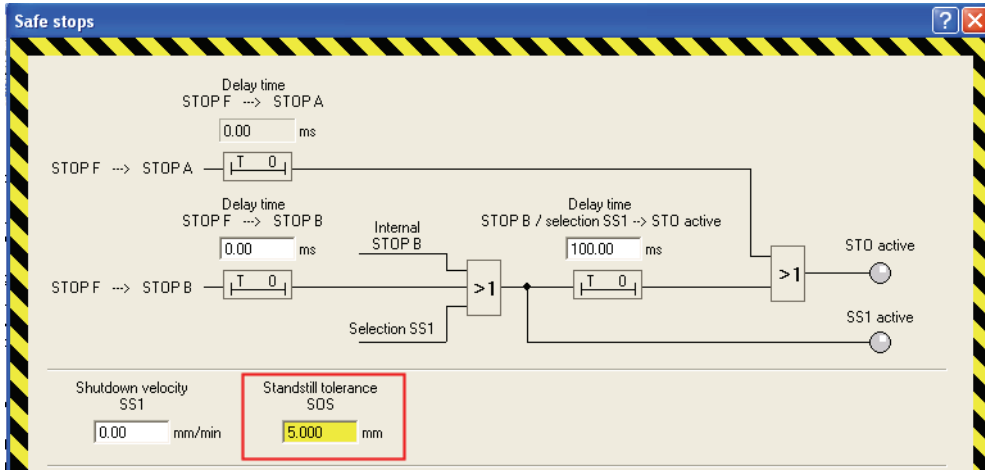
S7T Config is in online mode.

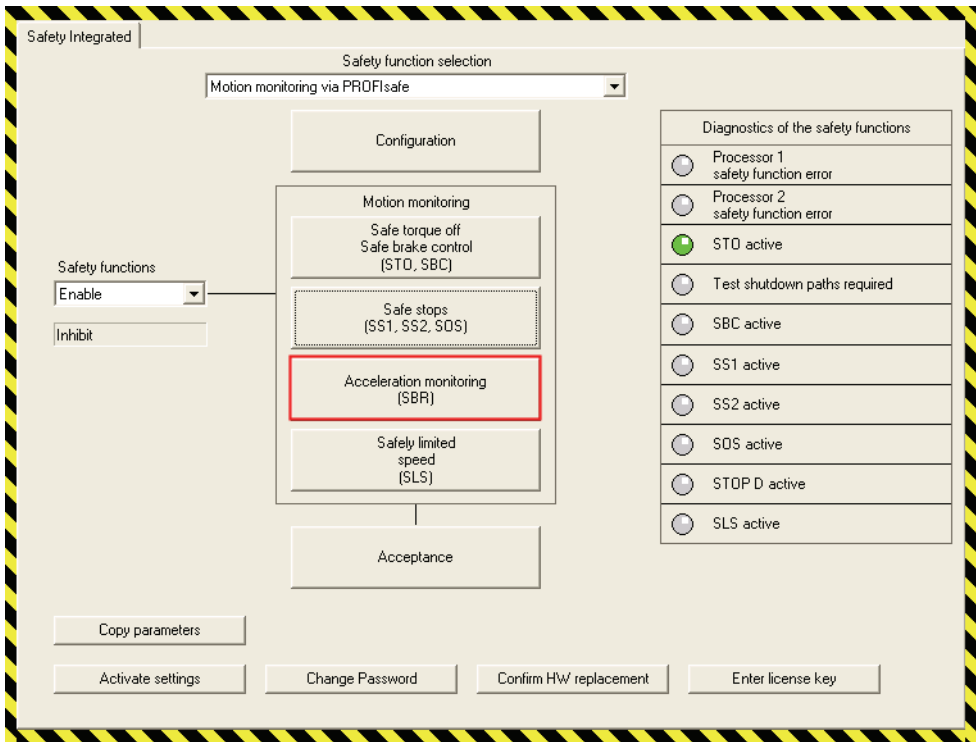
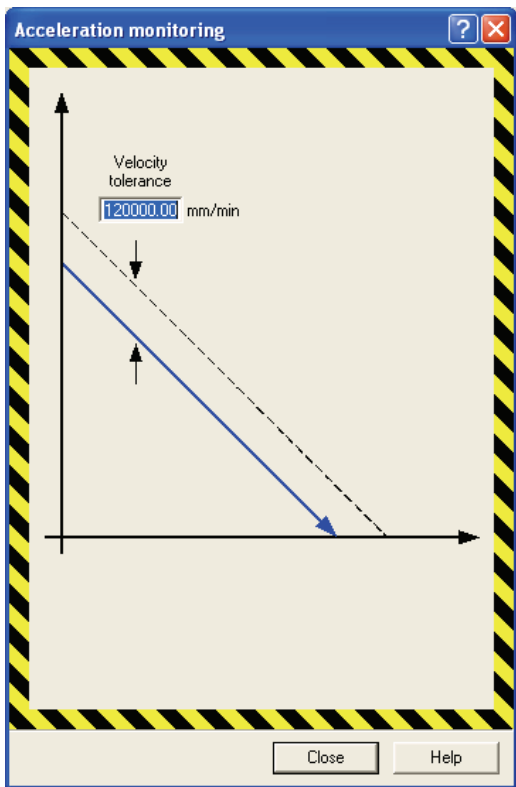
Procedure

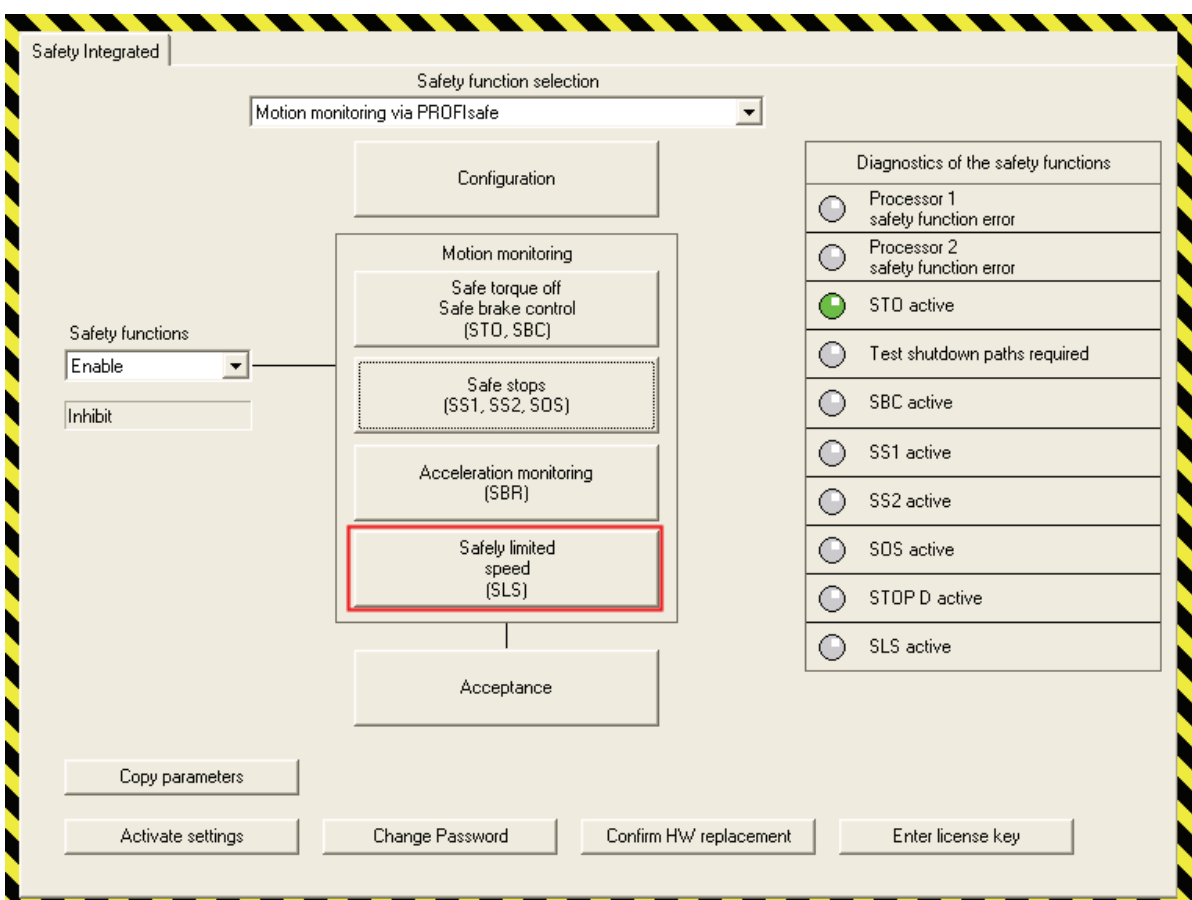
Step	Activity
1	Select "Functions > Safety Integrated" under your drive in the project navigator. Click "Change settings" in the "Safety integrated" dialog.
2	Select "Motion monitoring using PROFISafe" in the "Selection safety function" box.
3	 Select "Safety functions > Enable". Click "Configuration".

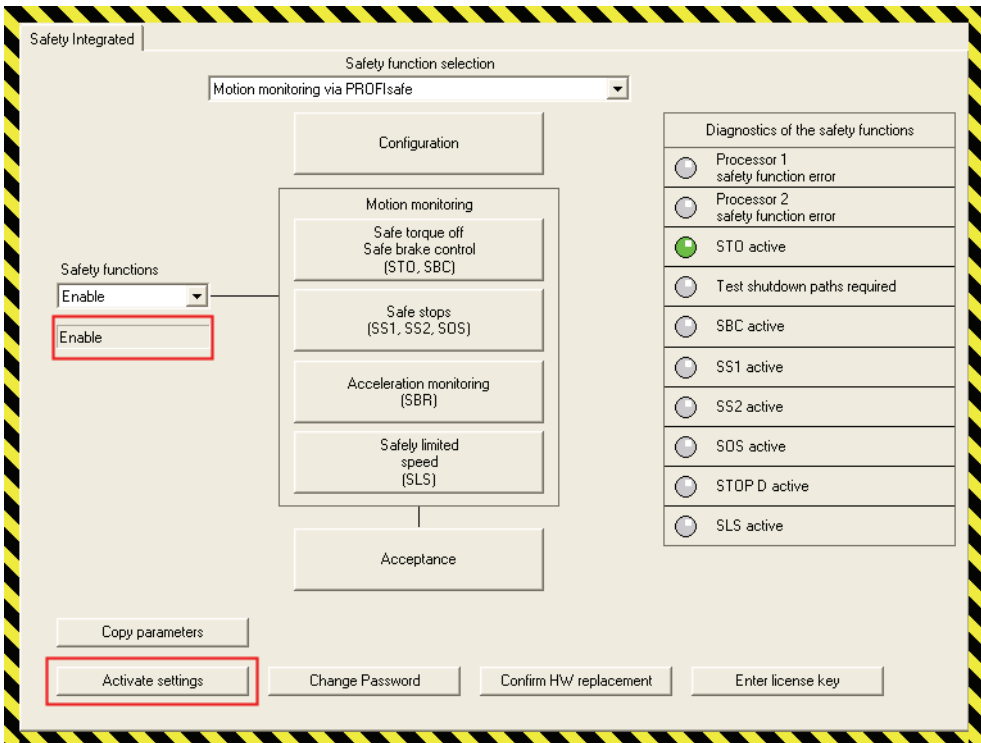
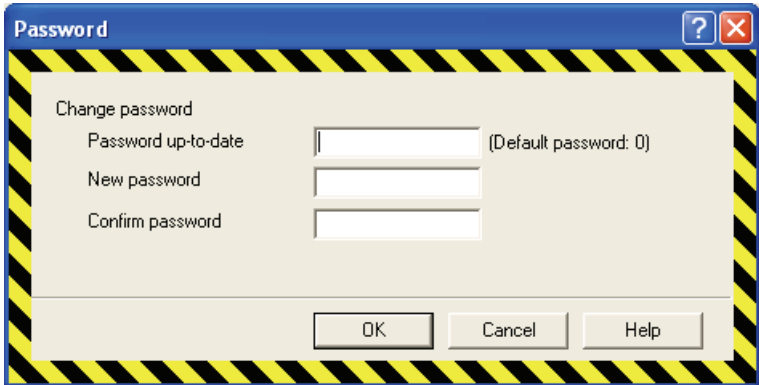
4.11 Configuring safety functions on the drive

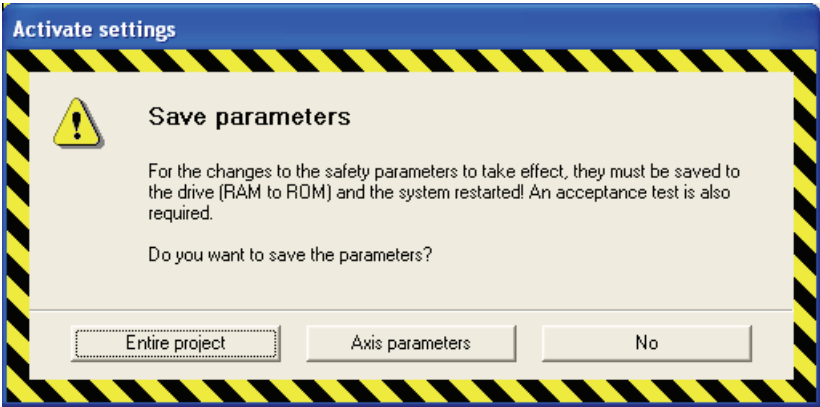
Step	Activity
4	In the "PROFIsafe address" dialog box, enter the hexadecimal value of the "F target address" of the master-slave coupling for the drive from HW Config. In this case, the address 1022 (3FE hex) was automatically assigned in HW Config. 
5	Click "Close" to confirm the entries and close the "Configuration" dialog.

Step	Activity
6	 Click on "Safe stops". Enter 5 mm in the "Standstill tolerance SOS" dialog box.  Click "Close" to confirm the entries and close the "Configuration" dialog.

Step	Activity
7	Click "Acceleration monitoring".  Enter 120,000.0 mm/min in the "Velocity tolerance" dialog box.  Click "Close" to confirm the entries and close the "Configuration" dialog.

Step	Activity
8	 Click "Safely limited speed (SLS)".

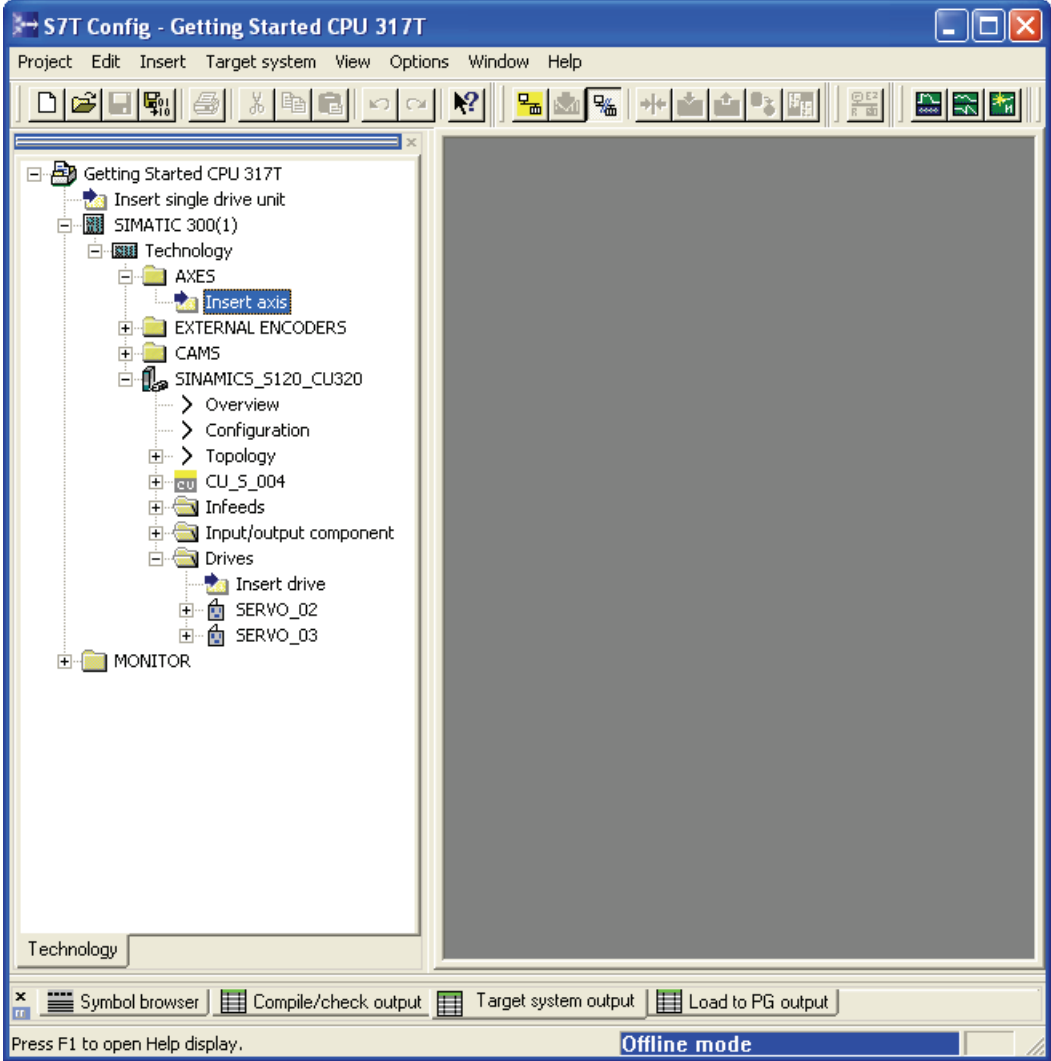
Step	Activity
11	 Click "Activate settings". You are prompted to change the safety password for the drive.  Enter a safety password for the drive.

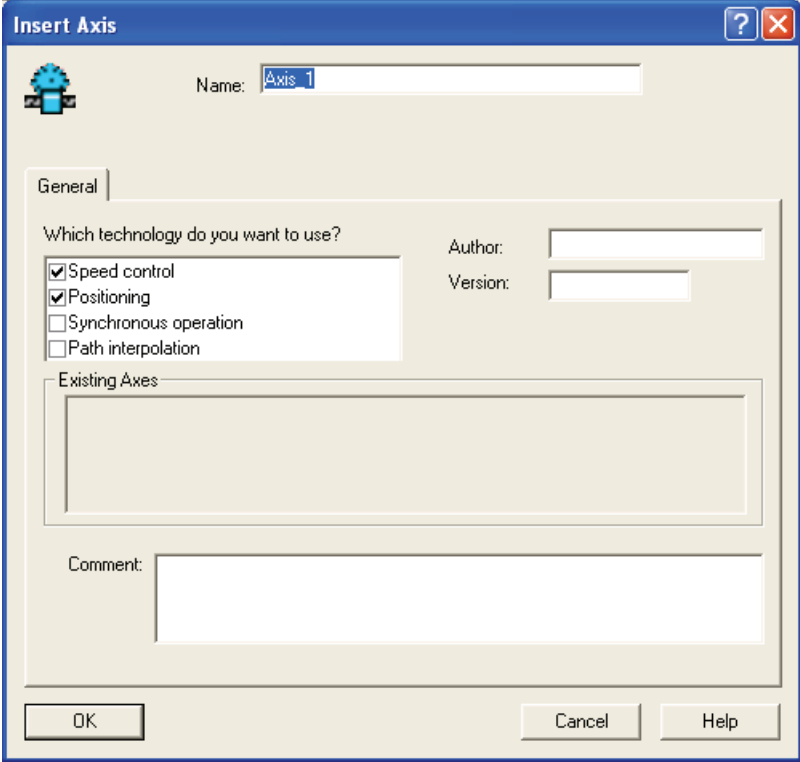
Step	Activity
12	You are prompted to save the safety parameters in the ROM.  Click "Entire project".
13	Switch to offline mode in S7T Config by selecting the Project > Disconnect from target system menu command.
14	Switch off the SINAMICS S120 drive system (de-energize) and switch it on again.
15	Once the device has started up, switch to online mode in S7T Config by selecting the Project > Connect to target system menu command.
16	Select "Technology > S120" in the project navigation and select the Load to PG command from the shortcut menu. Confirm the security prompt with "Yes".
17	Save the project in S7T Config.
18	Switch to offline mode by selecting the Project > Disconnect from target system menu command.

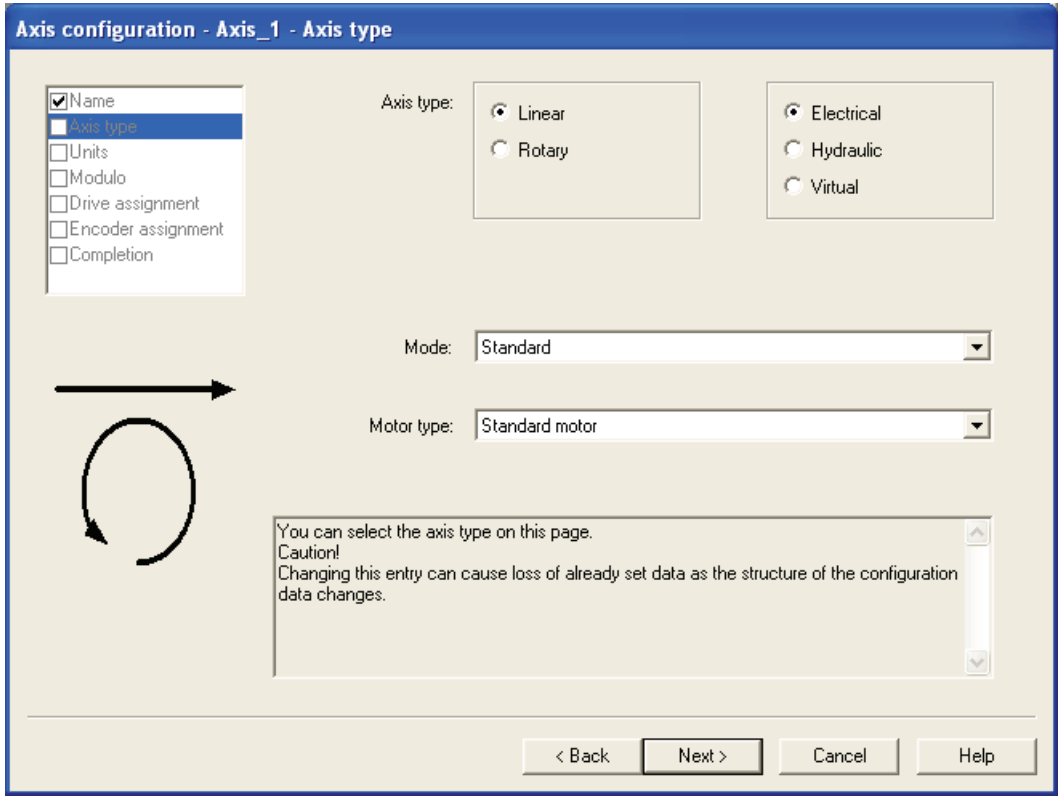
4.12 Configuring axes in S7T Config

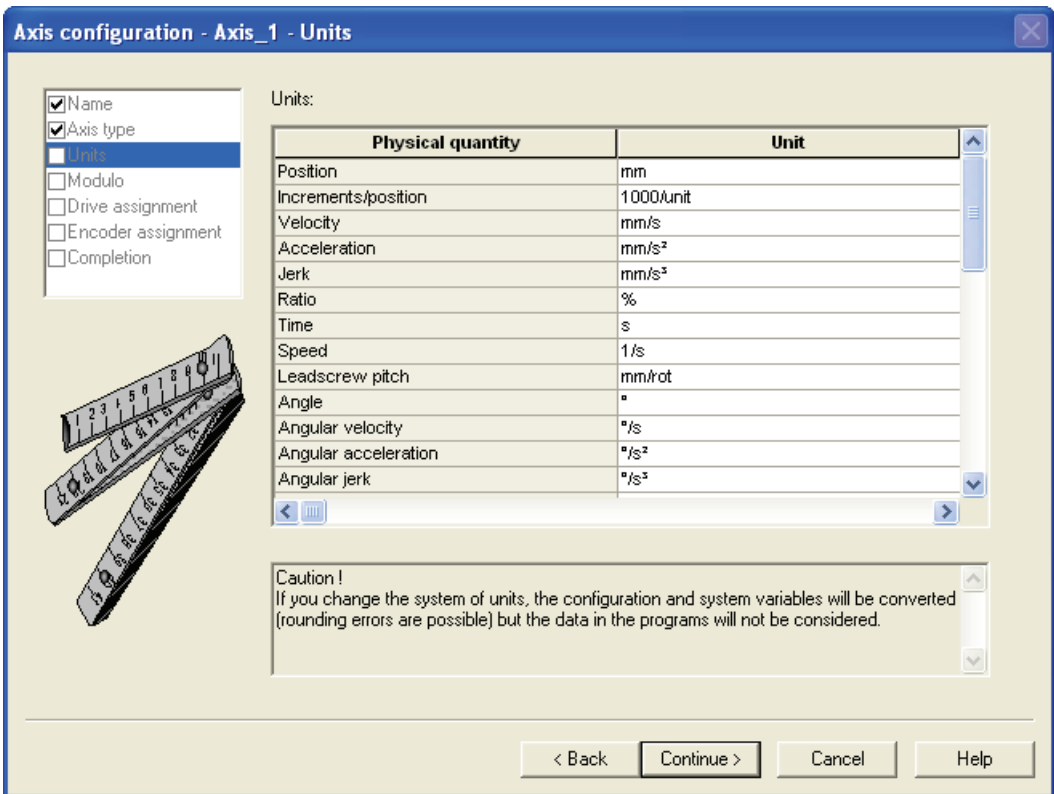
Creating and configuring an axis technology object using S7T Config

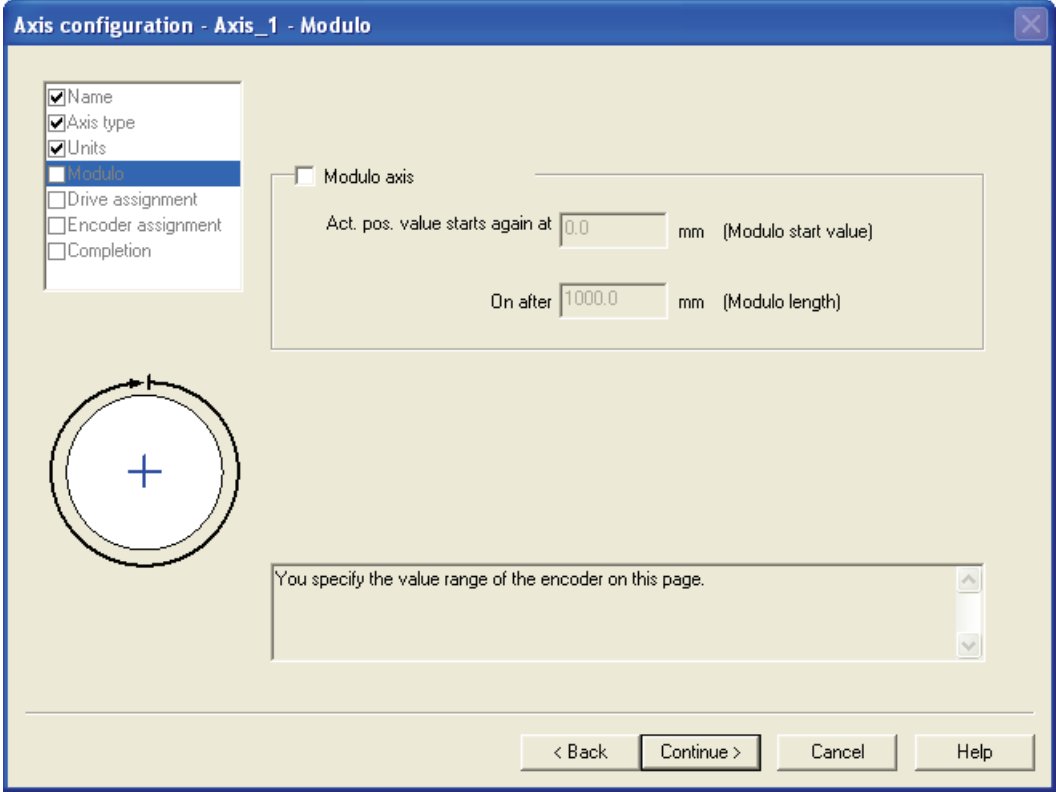
Procedure

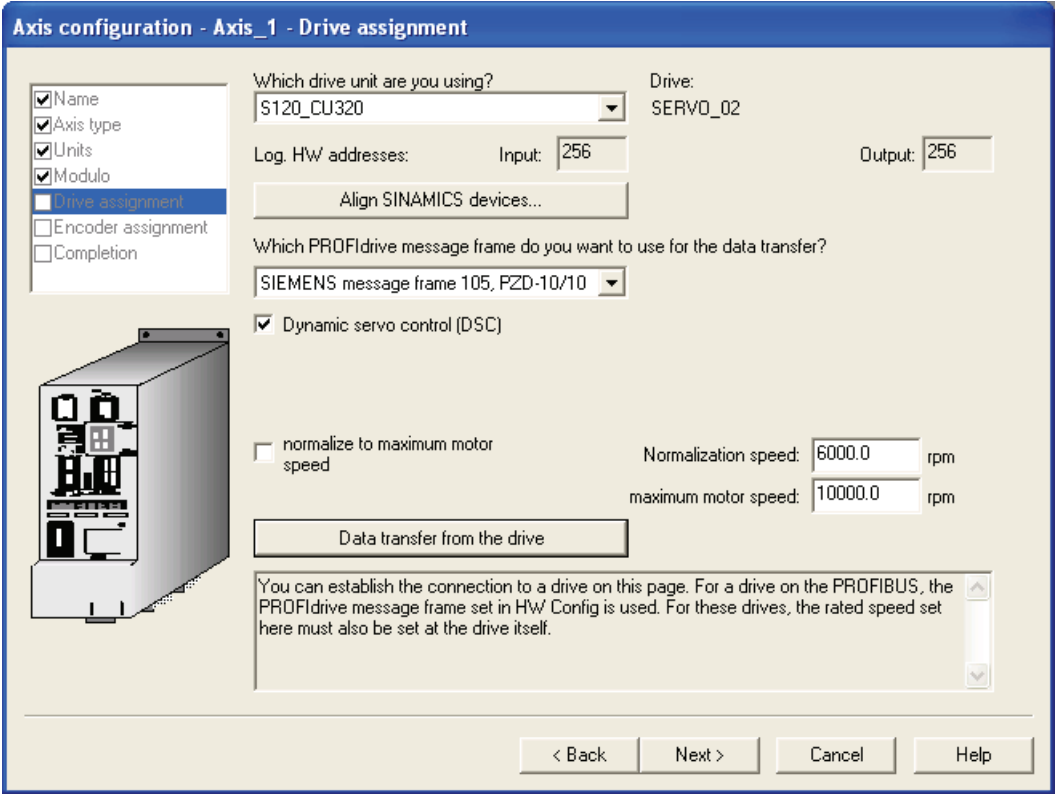
Step	Activity	Result
1	In the project navigator, open the tree structure SIMATIC 300(1) > Technology > AXES. Double-click "Insert axis" to start the axis wizard: 	Result: The "Insert Axis" dialog box opens.

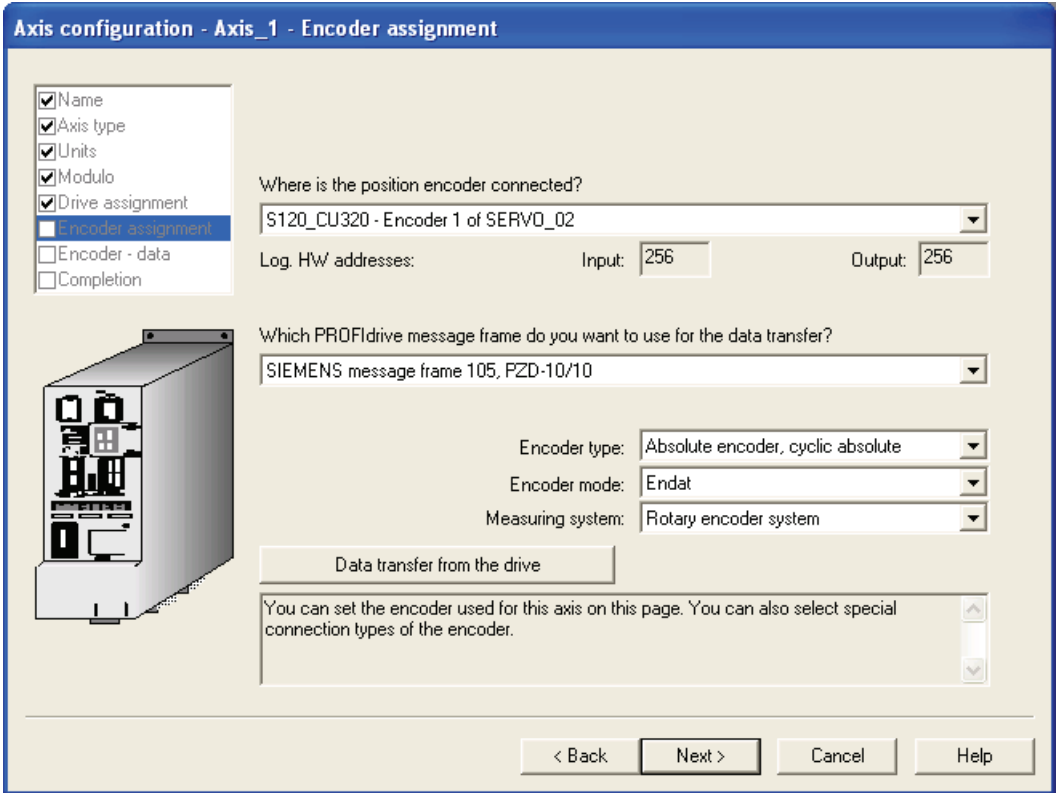
Step	Activity	Result
2	Confirm the default technology selection (speed control, positioning) with "OK". 	Result: The "Axis Configuration - Axis_1 – Axis Type" dialog box opens.

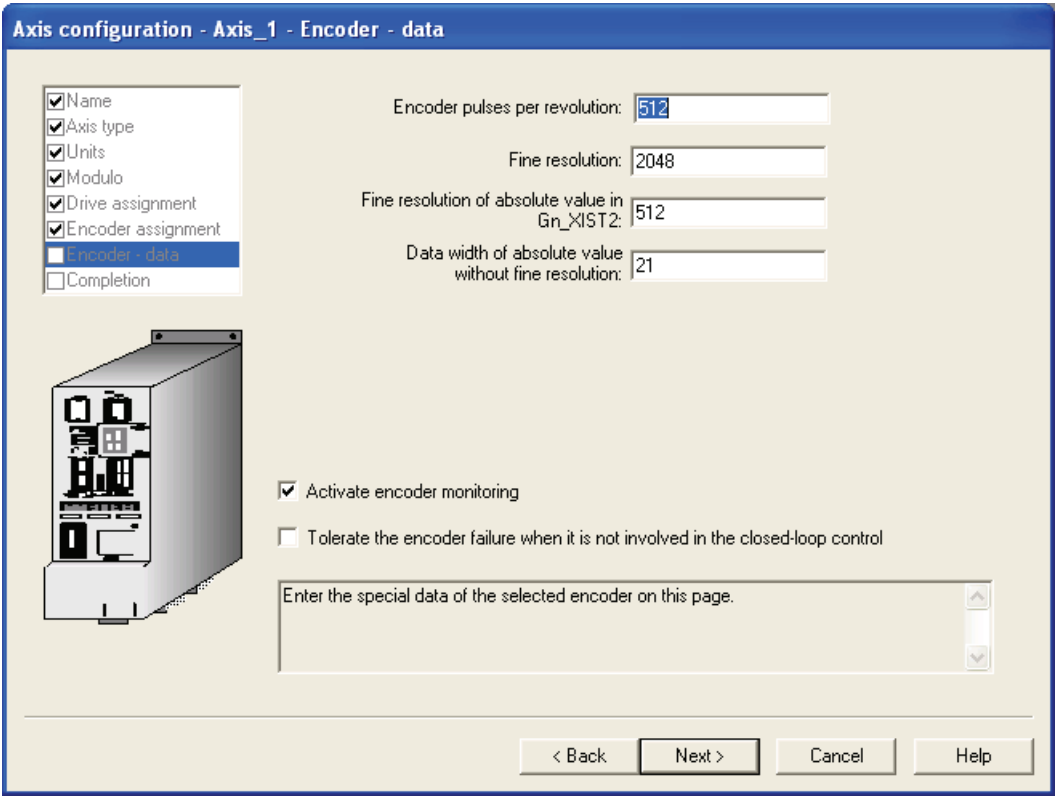
Step	Activity	Result
3	Accept the "Axis type: Linear, electrical" and "Motor type: standard motor". Confirm with "Continue". 	Result: The "Axis configuration - Axis_1 - Units" dialog box opens.

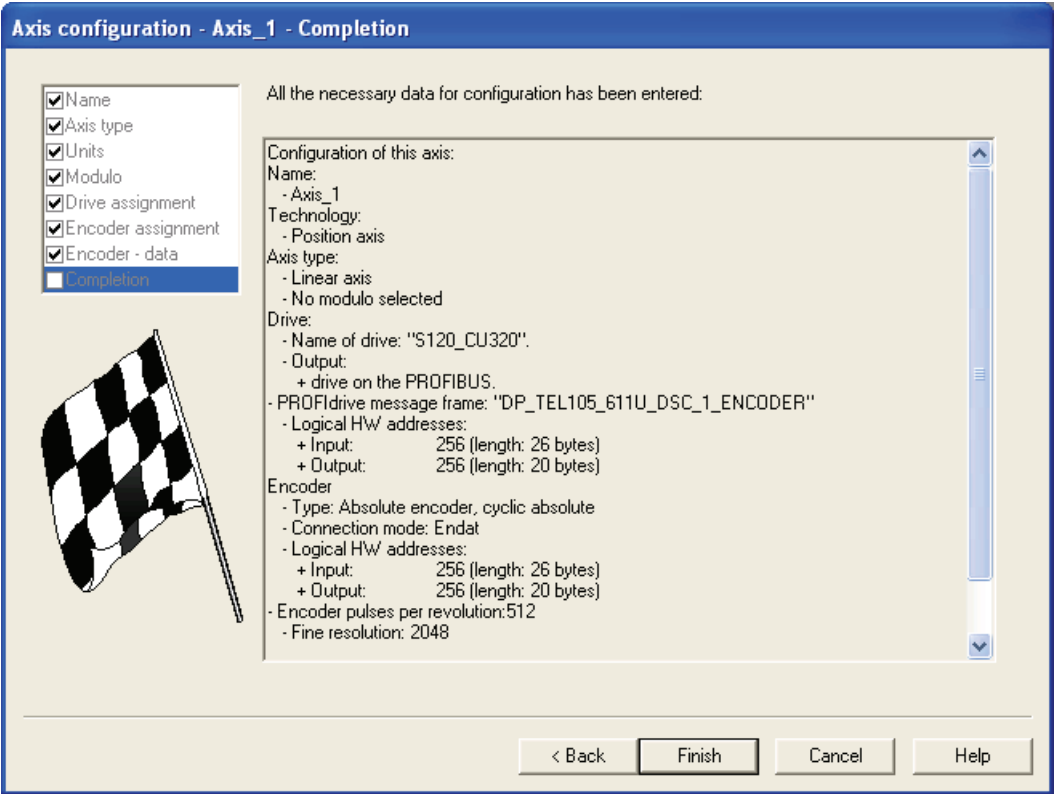
Step	Activity	Result																												
4	Confirm with "Continue".  Axis configuration - Axis_1 - Units Units: <table border="1"> <thead> <tr> <th>Physical quantity</th><th>Unit</th></tr> </thead> <tbody> <tr><td>Position</td><td>mm</td></tr> <tr><td>Increments/position</td><td>1000/unit</td></tr> <tr><td>Velocity</td><td>mm/s</td></tr> <tr><td>Acceleration</td><td>mm/s²</td></tr> <tr><td>Jerk</td><td>mm/s³</td></tr> <tr><td>Ratio</td><td>%</td></tr> <tr><td>Time</td><td>s</td></tr> <tr><td>Speed</td><td>1/s</td></tr> <tr><td>Leadscrew pitch</td><td>mm/rot</td></tr> <tr><td>Angle</td><td>°</td></tr> <tr><td>Angular velocity</td><td>°/s</td></tr> <tr><td>Angular acceleration</td><td>°/s²</td></tr> <tr><td>Angular jerk</td><td>°/s³</td></tr> </tbody> </table> Caution! If you change the system of units, the configuration and system variables will be converted (rounding errors are possible) but the data in the programs will not be considered. < Back Continue > Cancel Help	Physical quantity	Unit	Position	mm	Increments/position	1000/unit	Velocity	mm/s	Acceleration	mm/s ²	Jerk	mm/s ³	Ratio	%	Time	s	Speed	1/s	Leadscrew pitch	mm/rot	Angle	°	Angular velocity	°/s	Angular acceleration	°/s ²	Angular jerk	°/s ³	Result: The "Axis configuration Axis_1 - Modulo" dialog box opens.
Physical quantity	Unit																													
Position	mm																													
Increments/position	1000/unit																													
Velocity	mm/s																													
Acceleration	mm/s ²																													
Jerk	mm/s ³																													
Ratio	%																													
Time	s																													
Speed	1/s																													
Leadscrew pitch	mm/rot																													
Angle	°																													
Angular velocity	°/s																													
Angular acceleration	°/s ²																													
Angular jerk	°/s ³																													

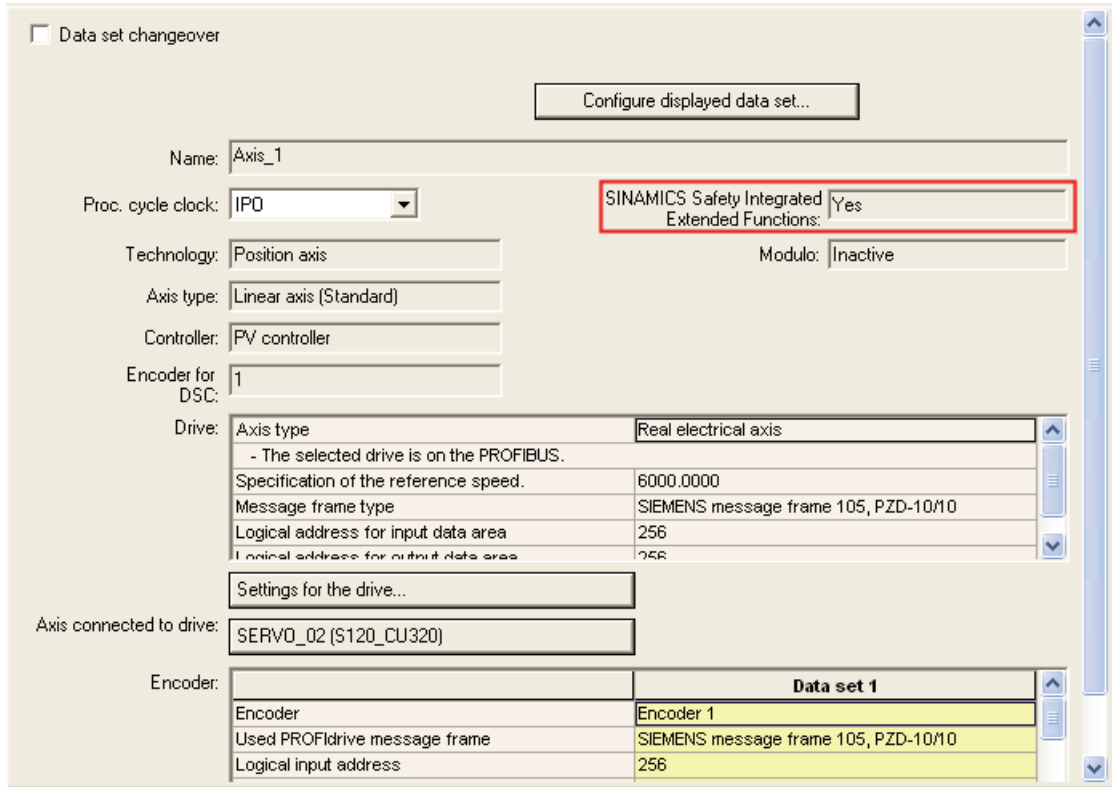
Step	Activity	Result
5	Confirm with "Continue". 	Result: The "Axis Configuration - Axis_1 Drive Assignment" dialog box opens.

Step	Activity	Result
6	The drive configuration, consisting of the drive and message frame, can be taken from the configuration of the drive and only has to be confirmed in this dialog box. Click "Data transfer from the drive" and apply the settings with "Next". 	Result: The "Axis configuration - Axis_1 - Encoder assignment" dialog box opens.

Step	Activity	Result
7	You can take the encoder assignment from the configuration of the drive. Click "Data transfer from the drive" and apply the settings with "Next". 	Result: The "Axis Configuration - Axis_1 - Encoder - Data" dialog box opens.

Step	Activity	Result
8	Enter the resolution specified on your motor rating plate as well as the number of data bits. In our example, the number of encoder pulses is "512" and the number of data bits is "21".  Accept the settings with "Continue". If you use another encoder type, you can find appropriate examples for the encoder configuration in the online help of S7T Config. Result: The "Axis Configuration - Axis_1 - Completion" dialog box opens, showing the data you configured.	

Step	Activity	Result
9	 Axis configuration - Axis_1 - Completion All the necessary data for configuration has been entered: Configuration of this axis: Name: - Axis_1 Technology: - Position axis Axis type: - Linear axis - No modulo selected Drive: - Name of drive: "S120_CU320". - Output: + drive on the PROFIBUS. - PROFIdrive message frame: "DP_TEL105_611U_DSC_1_ENCODER" - Logical HW addresses: + Input: 256 (length: 26 bytes) + Output: 256 (length: 20 bytes) Encoder: - Type: Absolute encoder, cyclic absolute - Connection mode: Endat - Logical HW addresses: + Input: 256 (length: 26 bytes) + Output: 256 (length: 20 bytes) - Encoder pulses per revolution: 512 - Fine resolution: 2048 < Back Finish Cancel Help	
	Complete the axis configuration with "Finish".	
10	Close the message box with "OK".	You completed the axis configuration in S7T Config.

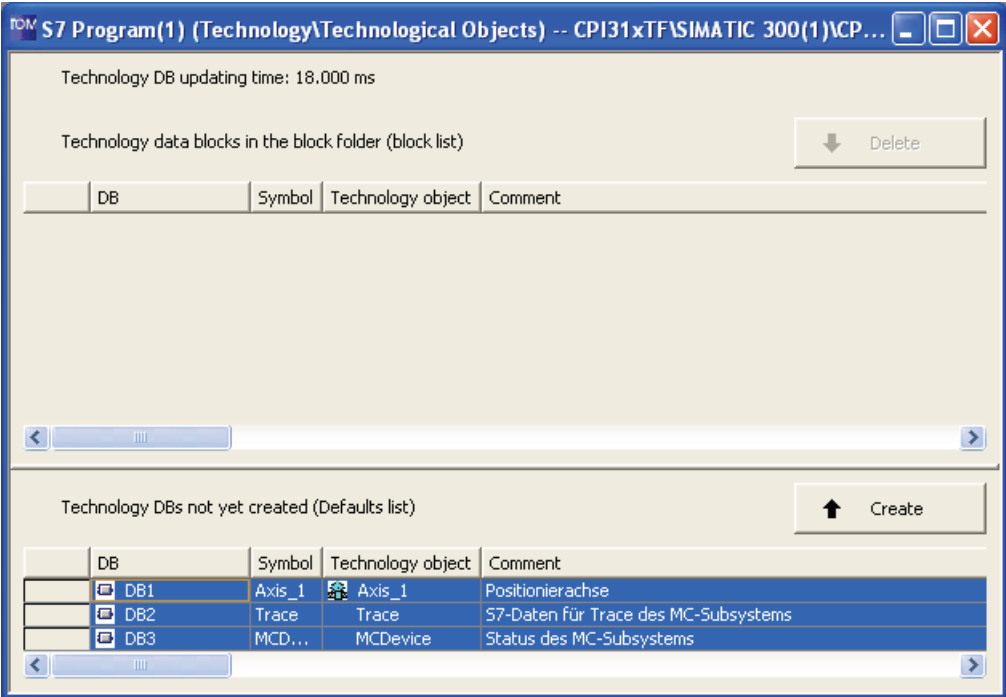
Step	Activity	Result
11	In the project navigator, open the tree SIMATIC 300(1) > Technology > AXES > Axis_1 > Configuration.  "Yes" is shown in the "SINAMICS Safety Integrated Extended Functions" box.	
12	Select Project > Save and recompile all to save the configuration in S7T Config.	The axis configuration will be stored and compiled.

Programming

5.1 Creating technology data blocks

Use "Technology Objects Management" to generate a technology DB for each TO. Do not copy the technology DBs in order to ensure a defined assignment between the technology DB and its TO.

Procedure

Step	Activity	Result
1	Change to "Technology Objects Management". Confirm the first message box with "OK", and the second with "Yes". If you are not running the "Technological Objects Management" application yet, you can open it by double-clicking "Technological Objects" in the "Technology" folder in SIMATIC Manager (see also step: "Configuring the axes with S7T Config"). Result: The "Technological Objects Management" opens.  Edit the DB numbers as shown in the figure in order to adapt these for use in our example.	
2	Create the technology DBs listed below by clicking "Create": • Axis_1 • Axis_2 (if this exists) • Trace • MCDdevice	The system generates the technology data blocks DB1, DB2, DB3 or DB4.

Step	Activity	Result
3	Close the "Technological Objects Management" via the Technological objects > Exit menu command.	
4	Select Station > Save and compile menu command in HW Config.	The configuration data will be saved and compiled.
5	Download the hardware configuration to the TF-CPU using the menu command PLC > Download to Module .	The configuration data will be downloaded to the TF-CPU.
6	In the SIMATIC Manager select the block folder of the station and select the menu command PLC > Download .	All blocks will be downloaded to the TF-CPU.

5.2 Creating an S7 user program

Procedure

Step	Activity	Result
1	In SIMATIC Manager, open the sample project " <code>\\Examples\\PROJECT-CPU317TF</code> ". Copy the all blocks and symbols to your project: Confirm the message "The object "xy" already exists. Do you want to overwrite it?" with "Yes". Important: The sample program does not contain DB 1 to DB 4! Create these technology DBs in STEP 7 (see the step "Creating the technology DBs"), in order to maintain consistency between the user program and the technology objects.	The sample program is copied to the project.
2	Double-click FB 100 if you want to edit the example program.	The LAD/STL/FBD editor opens.
3	Select these settings: - View > LAD, - View > Overviews, and - View > Details.	You have now opened an extended and clear view for editing the STEP 7 user program.
4	Double-click FB 101 if you want to edit the safety program.	The LAD/STL/FBD editor opens.

Function block FB 100

The axis is enabled and pending errors are acknowledged in this block. Depending on the selected Safety Function, you will be able to start and stop the axis motions to positions 1 and 2 at standard speed or reduced speed.

Function block FB 101

This block processes the signals of the emergency stop switch, the key switch and the door contact switch securely with safety blocks. Signals for activation of the safety functions at the drive will be written to the I/O area. This block also serves to reintegrate the drive after passivation.

The function block is protected with the password "safety".

Advanced procedure

You create and generate the blocks of the safety program.

CAUTION
For more detailed information on creating the safety program, refer to the manual "S7 Distributed Safety - Configuring and Programming".

5.3 Editing the safety program

Requirement

The hardware configuration is complete, saved and compiled.

A fail-safe data block of type F-Global DB with the symbolic name F_GLOBDB is available in the block folder of the S7 program. The F-Global DB is automatically inserted in HW Config during saving and compiling of the hardware configuration when the "CPU contains safety program" option is enabled in the properties of the CPU.

A fail-safe module of the type F_CALL is in the block folder of the S7 program.

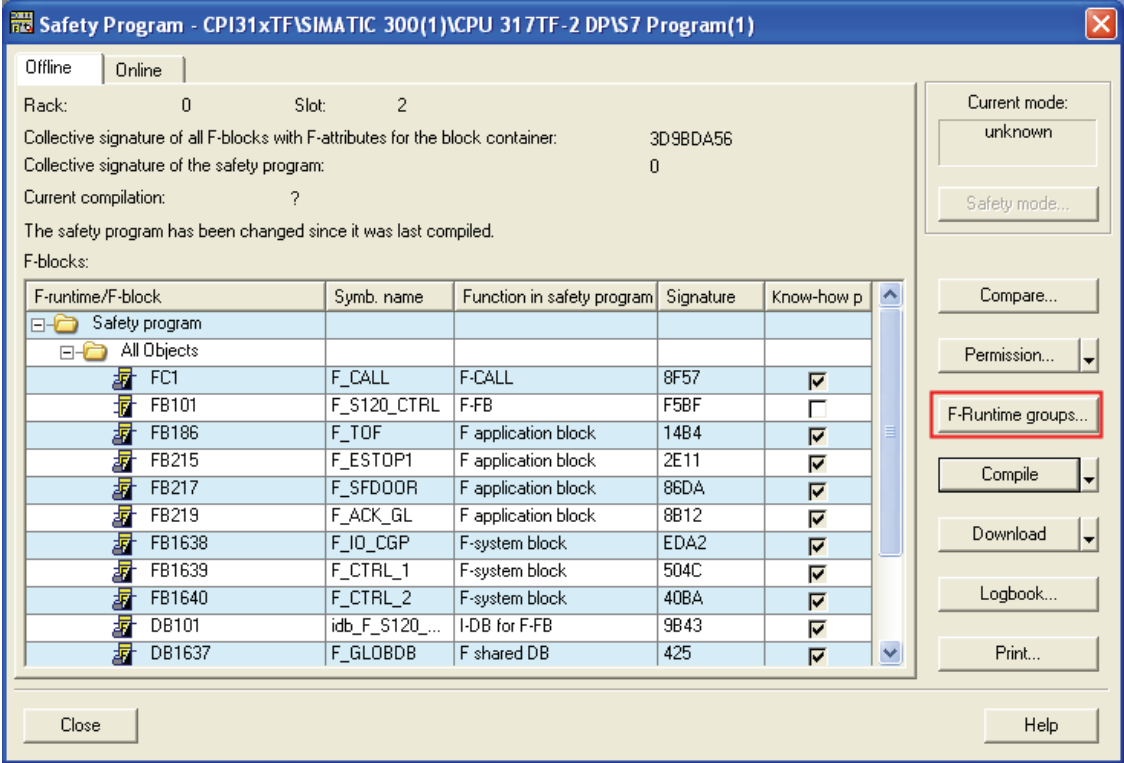
Note

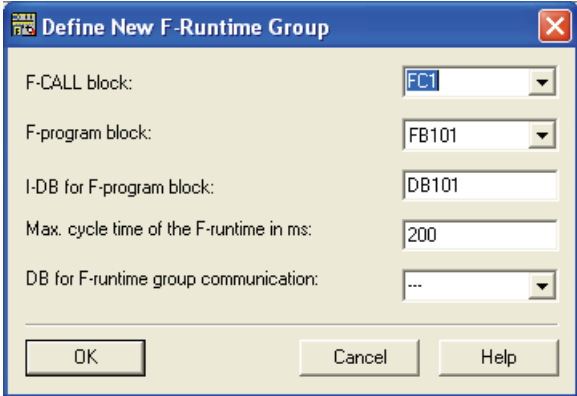
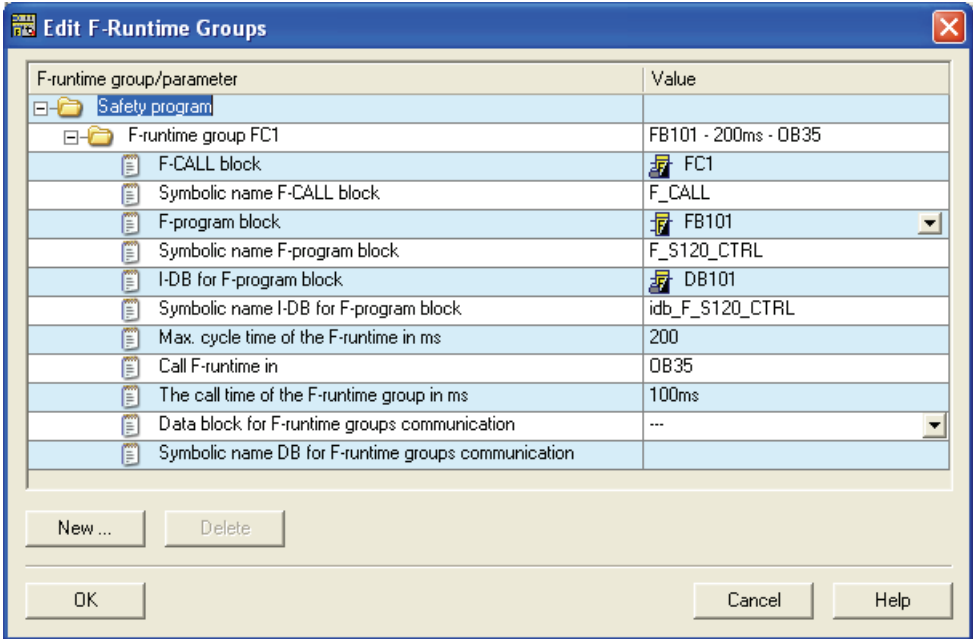
The "PROJECT_CPU317TF" sample project contains an FC1 block of the type F_CALL.

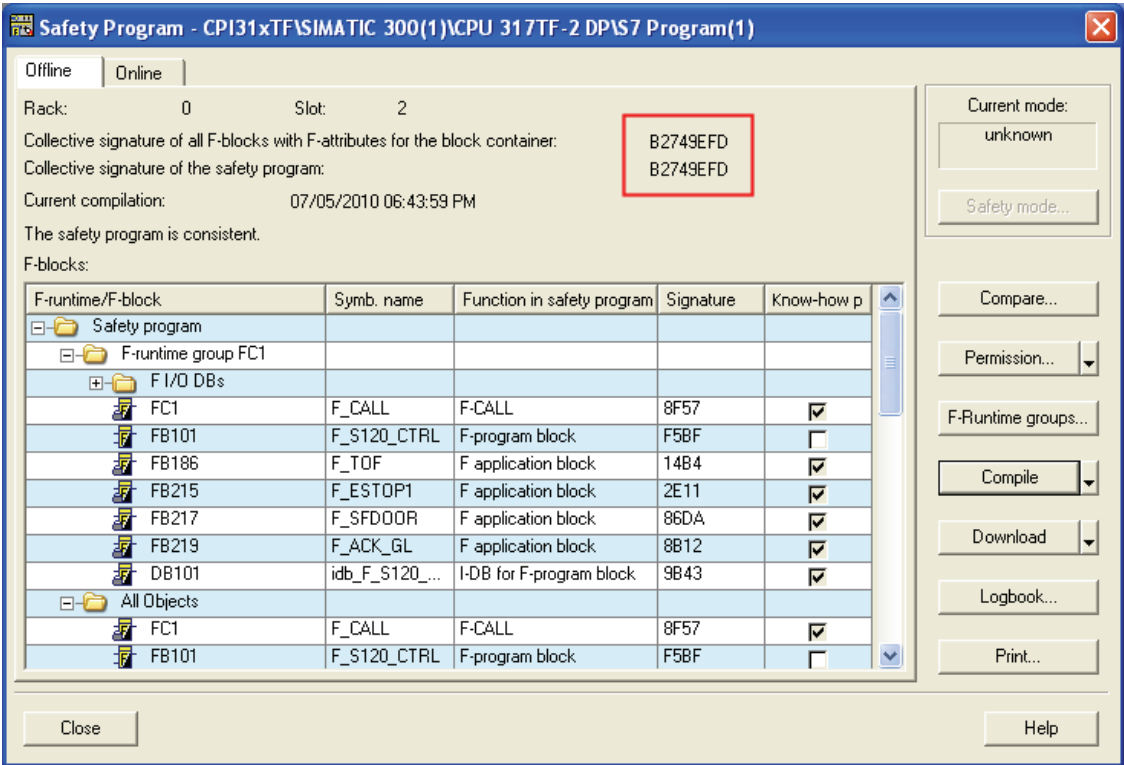
Note

When the hardware configuration is compiled, S7 Distributed Safety automatically creates fail-safe blocks that are required in the safety program. These blocks may not be deleted and not be changed.

Procedure

Step	Activity	Result
1	Select CPU 317TF-2 DP in SIMATIC Manager and then select the Options > Customize safety program menu command.	The "Safety program" dialog box appears.
2	 Click "F-runtime groups" to create a fail-safe runtime group.	
3	Click "New" to create a new fail-safe runtime group.	The "Define new F-runtime group" dialog box appears.

Step	Activity	Result
4	Keep the default settings if you have copied the blocks of the example program into the project.  If you have programmed your own blocks, select them from the drop-down lists. Confirm the entries with "OK".	You return to the "Edit fail-safe runtime groups" dialog box.
5	 If the specified blocks do not yet exist, they will be created after confirmation of the entries. Therefore, confirm any questions with "Yes".	
6	In the SIMATIC Manager, open OB 1 and check whether the call of FB100 (F_SimplePositioning) is consistent (it is not red).	
7	Open OB 35 and check whether the call of FC 1 (F_CALL) is consistent (it is not red).	
8	In the "Safety program" dialog box, click "Generate".	The safety program is compiled and the results will be displayed in a separate window.

Step	Activity	Result
	Note Because the automatically created blocks have no fixed numbers, errors may occur during compilation of the safety program. In this case, you need to check the addresses of the accesses to the F-I/O in the function blocks of the program and adapt them if necessary. Then compile the safety program again.	
9	When compiling is completed without error, there is always a consistent safety program in the block container, consisting of all F-blocks with an F-attribute.  The collective signature of all F-blocks with the F-attribute in the block container and the collective signature of the safety program are identical (as highlighted in the picture). In other words, there is now a consistent safety program ready for an acceptance procedure.	
10	Click "Download" to load the safety program to the CPU. A prompt appears offering you the option of downloading the standard user program along with the safety program.	
11	Confirm with "Yes". Note: If you only download the F-blocks, the block in which the F-CALL block is called (cyclic interrupt OB 35 in the example here) will not be loaded. You will then have to download the OB separately as in the standard. Note: You can only download the complete safety program in STOP mode.	

Step	Activity	Result
12	In the "Safety program" dialog box, open the "Offline" and "Online" tabs one after the other and verify that the collective signatures of all F-blocks with the F-attribute in the block container match online and offline.	If they match, then the download has been successful. If they do not match, repeat the download process.
13	Perform a STOP/RUN transition of the TF-CPU to activate safety mode. Note: After creating a safety program, you need to perform a complete functional test based on your automation task (see the manual, S7 Distributed Safety, Configuring and Programming).	

Result

You have now fully created the safety program to meet the stated objective of the example.

Trial run

NOTICE

You start the drive with the next steps.

To stop the drive again:

- Set input I0.2 (Stop) to "1"
- Switch the CPU to STOP.
- Operating the emergency stop switch

The following is a description of trial runs for the control of safety functions on the SINAMICS drive.

Note

The trial run for the technology task without safety functionality is described in detail in the Getting Started "CPU 317T-2 DP: Controlling a SINAMICS S120".

Safe Stop 1 (SS1) trial run

If the emergency stop switch is operated during operation, then the drive will brake autonomously at the OFF3 ramp until standstill (SS1). Once standstill has been reached or if the emergency stop switch is operated in standstill, the drive is set to zero torque (Safe Torque Off = STO).

	Action	Reaction	Explanation
1	Power On (ramp-up completed)	Q24.2 = TRUE (emergency stop/safety door active)	
2	Close safety door I8.0 = TRUE (SafetyDoor1) I8.1 = TRUE (SafetyDoor2) Trigger emergency stop I8.2 = TRUE (emergency off)	Q24.3 = TRUE (safety acknowledgment required)	Acknowledgment for reintegration required
3	Acknowledge and reintegrate fail-safe I/Os I8.5 = TRUE (trigger edge) > FALSE	Q24.2 = FALSE Q24.3 = FALSE	No safety event pending
4	Acknowledge technology I0.1 = TRUE (trigger edge) > FALSE	Q4.1 = TRUE (reset done)	No technology alarms pending
5	Activate position control I0.0 = TRUE	Q4.0 = TRUE (position control active)	Drive enters position control
6	Start positioning at 5000.0 I0.4 = TRUE (trigger edge) > FALSE	Drive moves in positive direction	

	Action	Reaction	Explanation
7	Emergency stop actuated while positioning is running. I8.2 = FALSE (emergency stop)	Drive is slowed to a standstill according to OFF3 ramp and the drive is set to zero torque. Q24.2 = TRUE (emergency stop/safety door active)	SS1 and STO will become active
8	Trigger emergency stop I8.2 = TRUE (emergency off)	Q24.3 = TRUE (safety acknowledgment required)	Acknowledgment of emergency stop required
9	Acknowledge and reintegrate fail-safe I/Os I8.5 = TRUE (trigger edge) > FALSE	Q24.2 = FALSE Q24.3 = FALSE	No safety event pending
10	Acknowledge technology I0.1 = TRUE (trigger edge) > FALSE	Q4.1 = TRUE (reset done)	No technology alarms pending

Safe Stop 2 (SS2) trial run

If you open the safety door during operation without actuation of the commissioning key switch, the drive will brake autonomously on the OFF3 ramp until standstill (SS2) and will change into a securely monitored position-controlled operation (Safe Operating Stop = SOS) after reaching standstill. The drive may be in position control, but a motion out of a specified monitoring window would result in a safe reaction of the drive.

	Action	Reaction	Explanation
1	Activate position control I0.0 = TRUE	Q4.0 = TRUE (position control active)	Drive enters position control
2	Start positioning at 0.0 I0.3 = TRUE (trigger edge) > FALSE	Drive moves in negative direction	
3	Safety door open I8.0 = FALSE (SafetyDoor1) I8.2 = FALSE (SafetyDoor2)	Drive is slowed to a standstill according to OFF3 and the drive remains under control. Q24.2 = TRUE (emergency stop/safety door active)	SS2 and SOS are active
4	Close safety door I8.0 = TRUE (SafetyDoor1) I8.2 = TRUE (SafetyDoor2)	Q24.3 = TRUE (safety acknowledgment required)	Acknowledgment of safety door required
5	Acknowledge and reintegrate fail-safe I/Os I8.5 = TRUE (trigger edge) > FALSE	Q24.2 = FALSE Q24.3 = FALSE	No safety event pending
6	Acknowledge technology I0.1 = TRUE (trigger edge) > FALSE	Q4.1 = TRUE (reset done)	No technology alarms pending

Safely-Limited Speed (SLS) trial run

If you operate the commissioning key switch and then open the safety door, then the drive will only travel at a safety-limited speed. If you exceed the speed, then the drive will switch to a safe operating mode. If you open the safety door during travel with actuated commissioning key switch, then the speed will be reduced automatically to a safe speed in this sample program.

	Action	Reaction	Explanation
1	Start positioning at 5000.0 I0.4 = TRUE (trigger edge) > FALSE	Drive moves in positive direction	
2	Set key switch to commissioning I8.3 = TRUE (commissioning key switch)	No further reaction	
3	Safety door open I8.0 = FALSE (SafetyDoor1) I8.2 = FALSE (SafetyDoor2)	Drive travels further in the positive direction, but speed is reduced to safely limited speed. Q24.1 = TRUE (commissioning mode active) Q24.2 = TRUE (emergency stop/safety door active)	SLS active
4	Close safety door I8.0 = TRUE (SafetyDoor1) I8.2 = TRUE (SafetyDoor2)	Q24.3 = TRUE (safety acknowledgment required)	Acknowledgment of safety door required
5	Acknowledge and reintegrate fail-safe I/Os I8.5 = TRUE (trigger edge) > FALSE	Drive travels further in positive direction and increases its velocity to original value. Q24.2 = FALSE Q24.3 = FALSE	No safety event pending
7	After reaching position 5000.0	Q4.4=TRUE (position 5000.0 reached) (Q4.6=TRUE if the same position is reached while the speed is still reduced).	

Diagnostics / correction of errors

Incorrect operator input, faulty wiring or inconsistent configuration data may lead to errors. For information on how to analyze such errors and messages, refer to the *S7-Technology* manual.

Further Information

Service and support on the Internet

In addition to our documentation, we offer a comprehensive knowledge base on the Internet (<http://support.automation.siemens.com>). There you will find:

- The newsletter that provides you with latest information relating to your product
- Your appropriate documentation, using our Service & Support search engine
- A bulletin board in which users and specialists worldwide exchange their know-how
- Your local Siemens partner for Automation & Drives in our Partner database
- Information about local service, repairs, and spare parts. You will find much more under "Services".

