

SIEMENS

Startdrive

SINAMICS Getting Started - SINAMICS Startdrive


Getting Started


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 DANGER
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 WARNING
indicates that death or severe personal injury may result if proper precautions are not taken.

 CAUTION
indicates that minor personal injury can result if proper precautions are not taken.

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indicates that property damage can result if proper precautions are not taken.


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Introduction

1.1 SINAMICS Startdrive - Drive commissioning

SINAMICS Startdrive tutorial



This tutorial will provide you with a brief overview of working with Startdrive. The different steps for creating a project, and the commissioning and diagnostics tools are shown briefly using a typical example.

Note

The tutorial is indicative only and makes no claim to be technically complete. For commissioning you require the online help of SINAMICS Startdrive and the drive documentation.

Connecting the drive unit to the PC

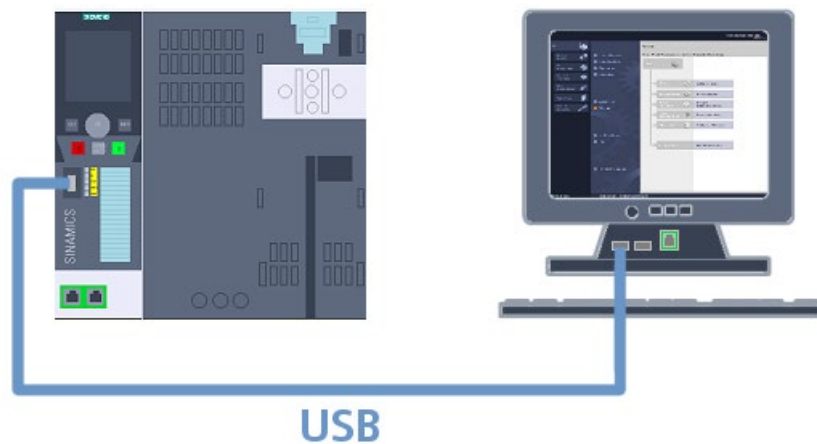
2.1 USB wiring

Wiring via USB

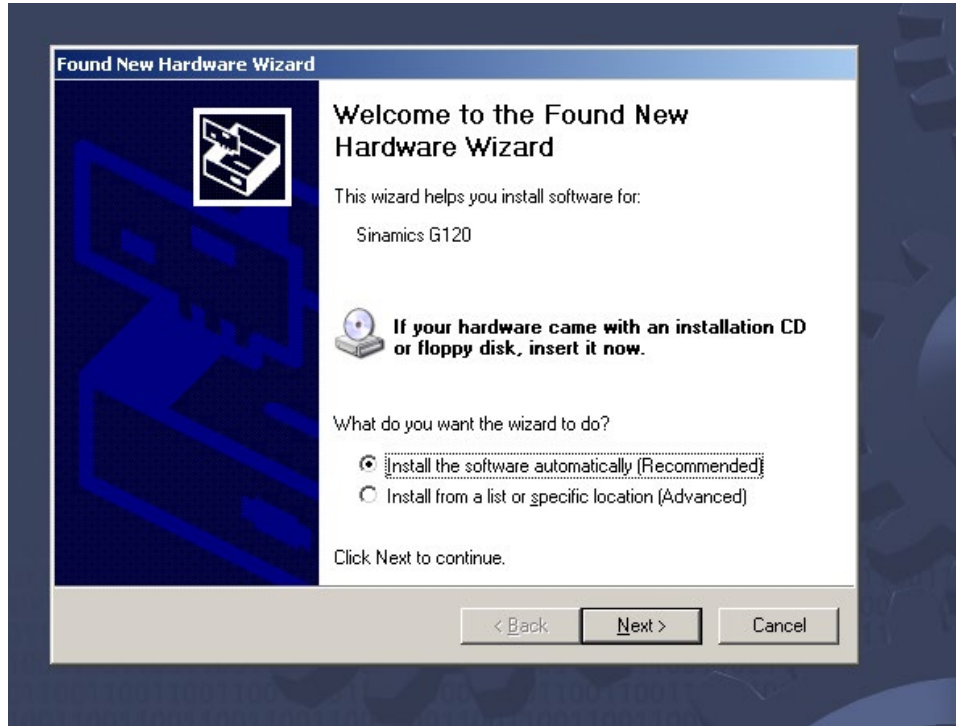
The drive unit must be wired to the PC in order for the commissioning to be performed. Depending on the connection options you can connect the drive unit to the PC via PROFINET or PROFIBUS DP and via USB for all drive units.

How to connect the drive to the PC:

1. Switch the drive on and wait until ramp-up has completed.
2. Plug the micro USB connector into the corresponding socket on the front of the drive and the USB connector into a USB port on the PC.



Windows detects the USB device with the initial connection and automatically installs the driver. Note the procedure in the installation wizard. Windows XP is used as an example here. The driver is installed automatically under Windows 7.



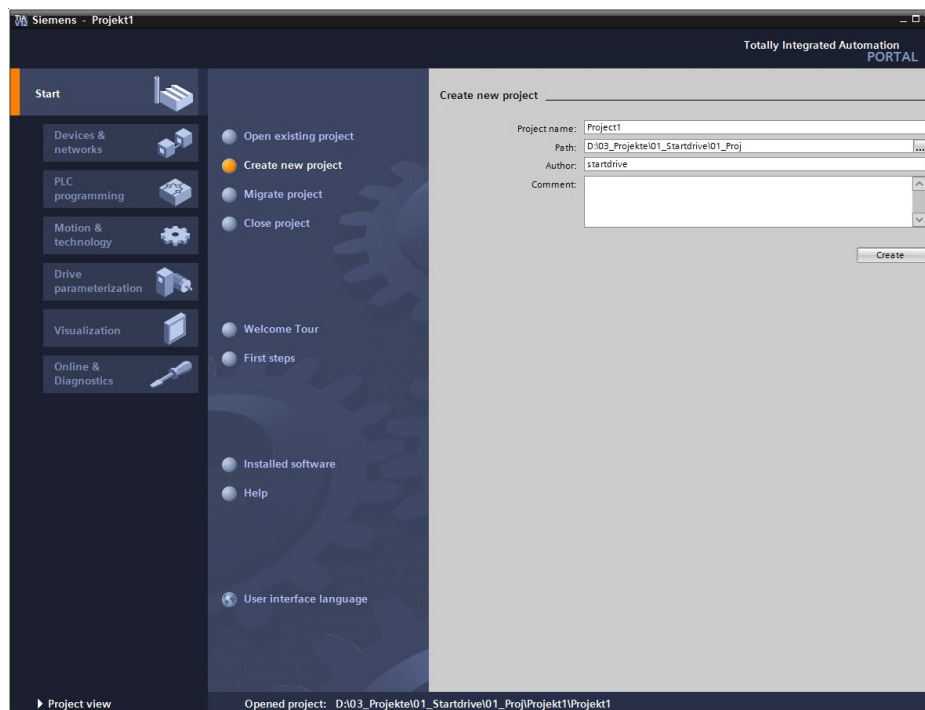
Once the driver is installed you can create a new project and go online on the drive.

Creating a project

3.1 Creating project portal view

Portal view

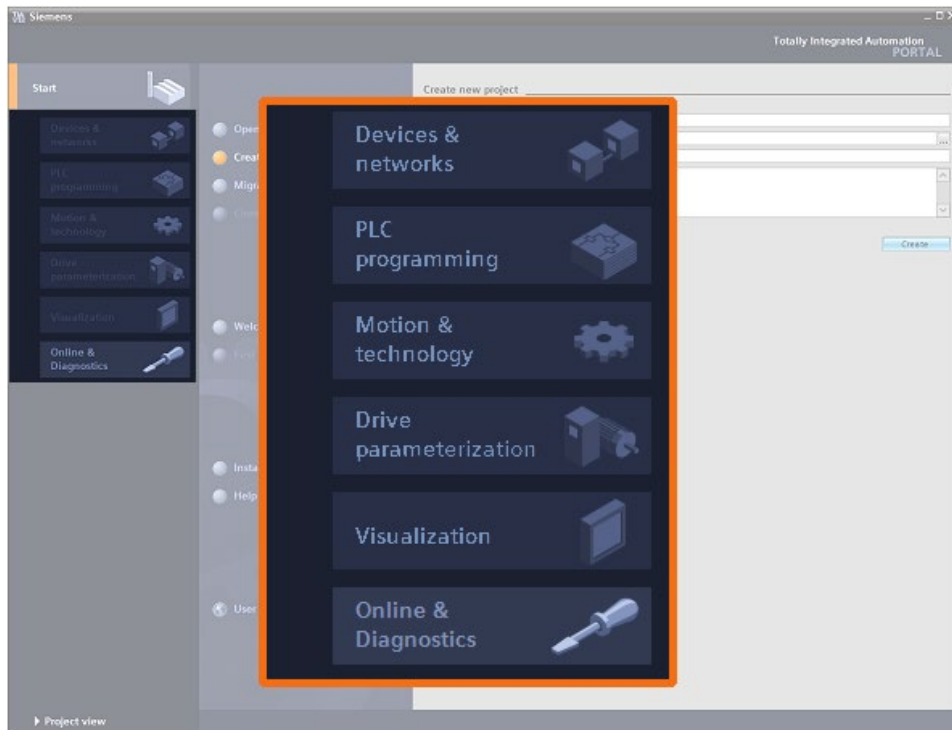
Upon opening Startdrive you will find yourself in the so-called portal view of the new TIA Portal.



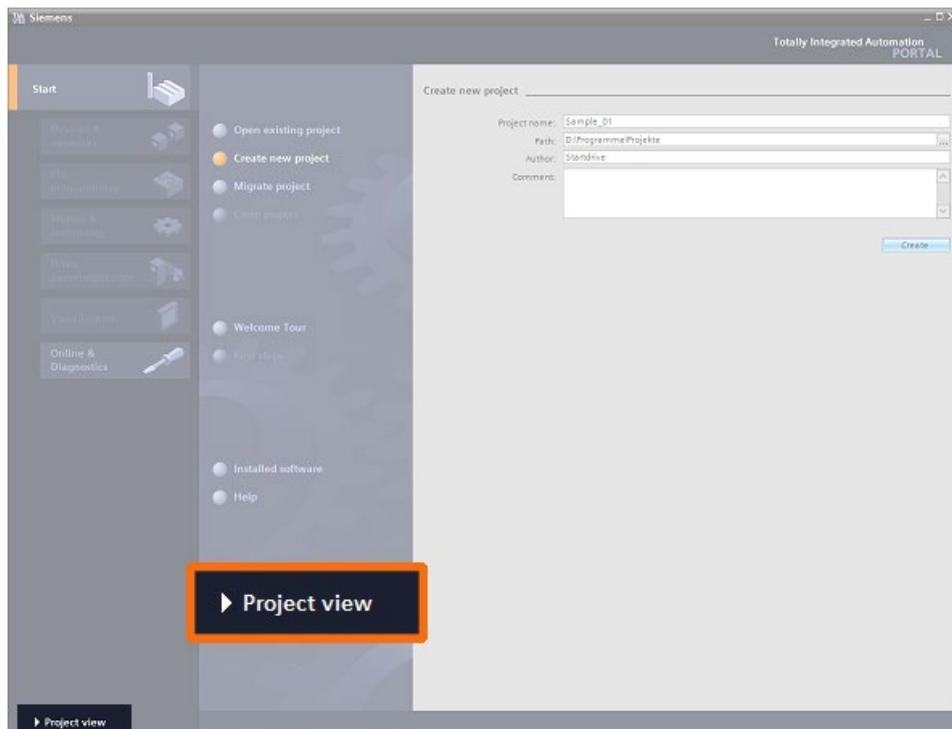
The portal view offers a task-oriented view of the tools and provides the basic functions for the individual task areas, e.g. project management and diagnostics.

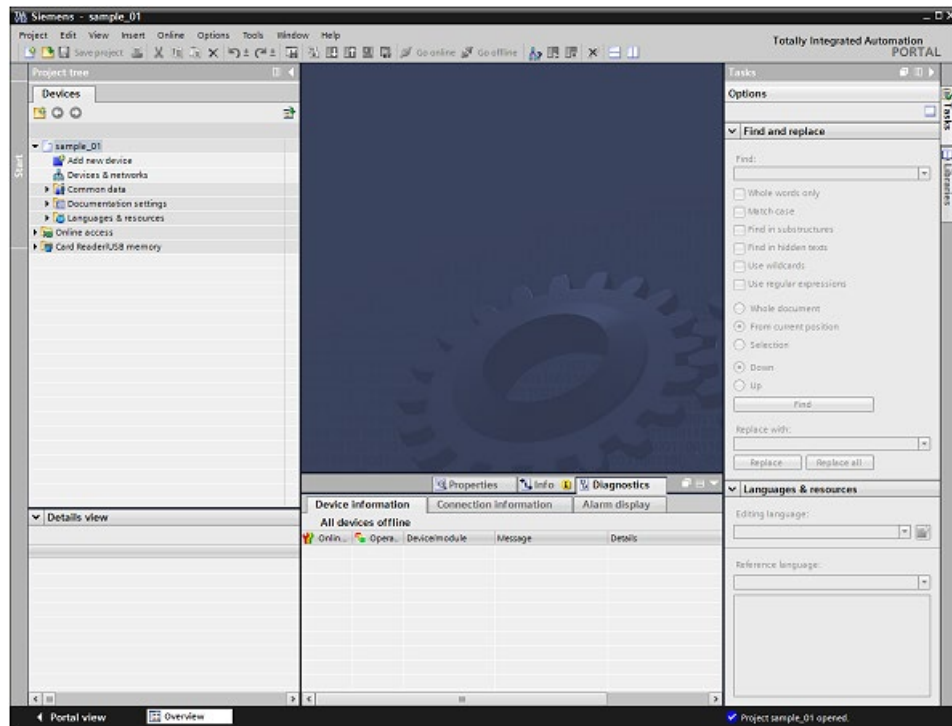
Creating a project

3.1 Creating project portal view



The TIA Portal also continues to provide the project view for the classic display. You can switch to this view easily via the relevant button.



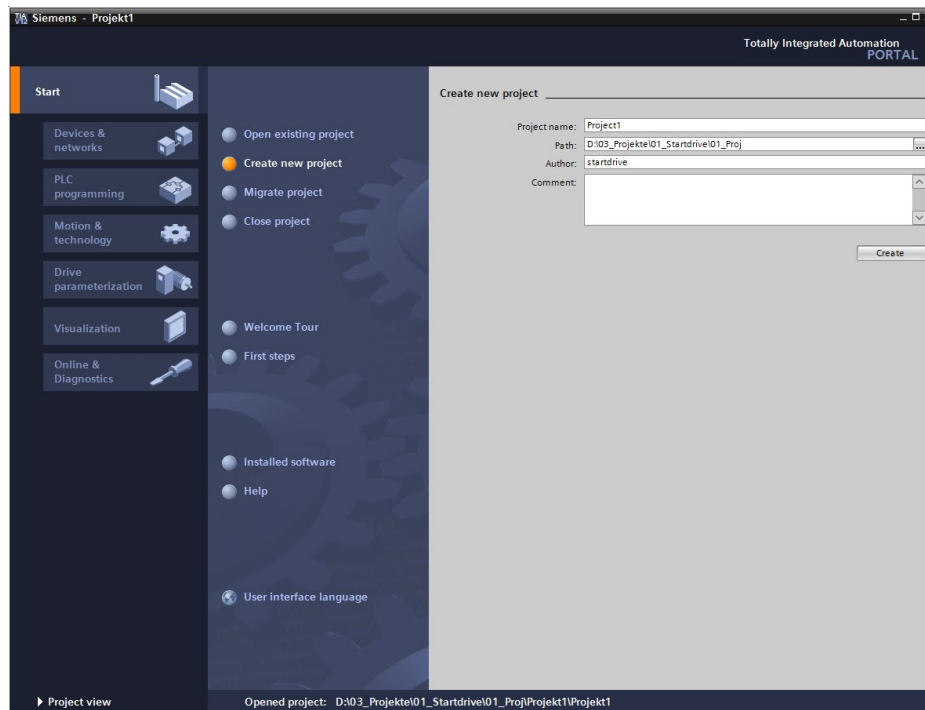


The portal view is the important view first of all in the tutorial. You will create a new project from this view in the next step.

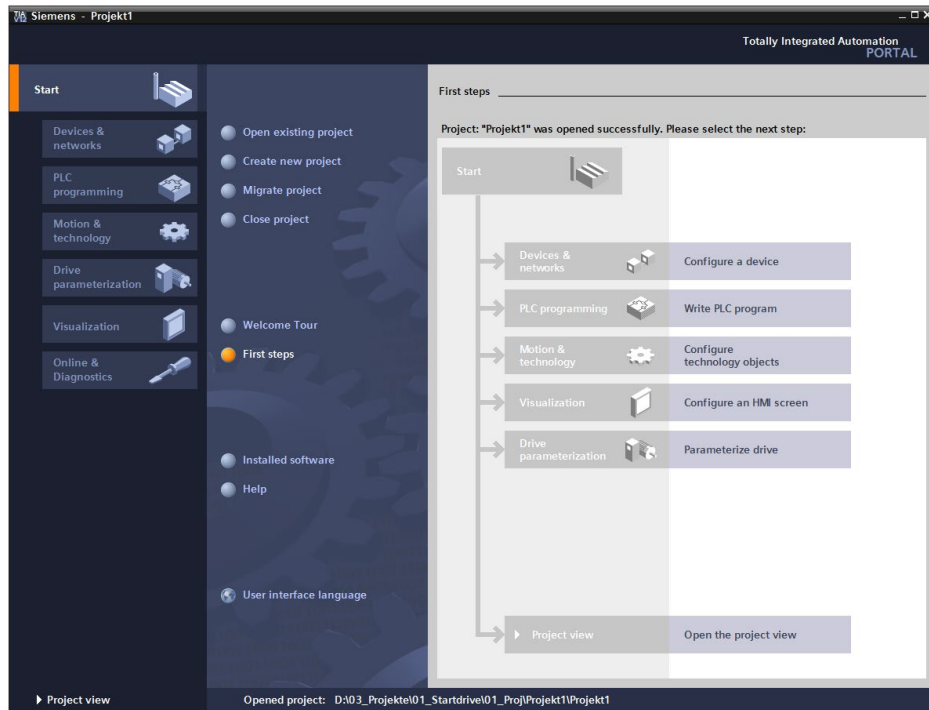
3.2 Creating a new project

How to create a new project

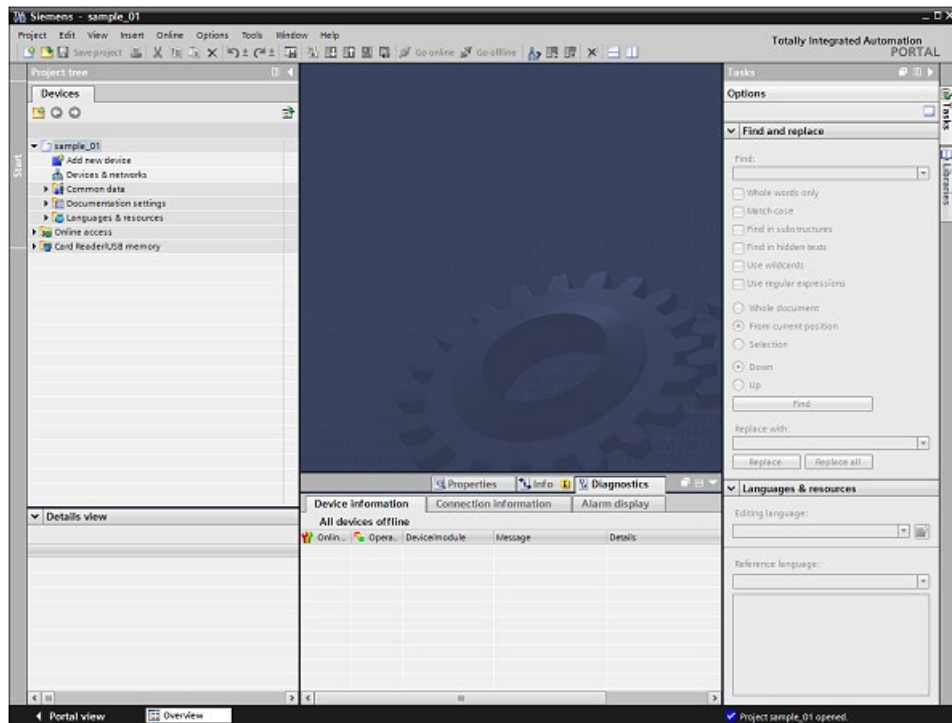
1. Click "Create new project" in the portal view.
2. Enter a name under "Project name" and select the pathway for saving the project.



3. Confirm with "Create". The project is created.



4. Switch to project view for the next steps, e.g. going online.



Going online and incorporating devices

4.1 Online mode and connected devices

Online mode



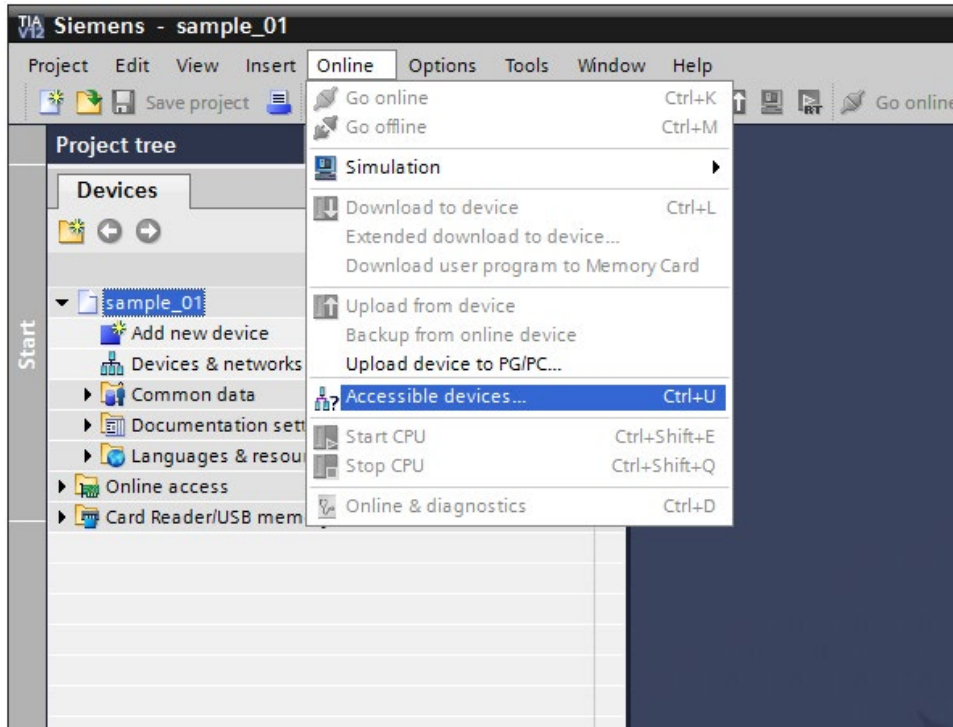
The Startdrive provides the option of going to the drive online via the "Accessible devices" function. For this the drive unit can be connected to the PC via USB, PROFIBUS DP, or PROFINET. This depends on the relevant version of the drive unit.

You will now learn how to identify connected drive units via Accessible devices and incorporate these into the existing project.

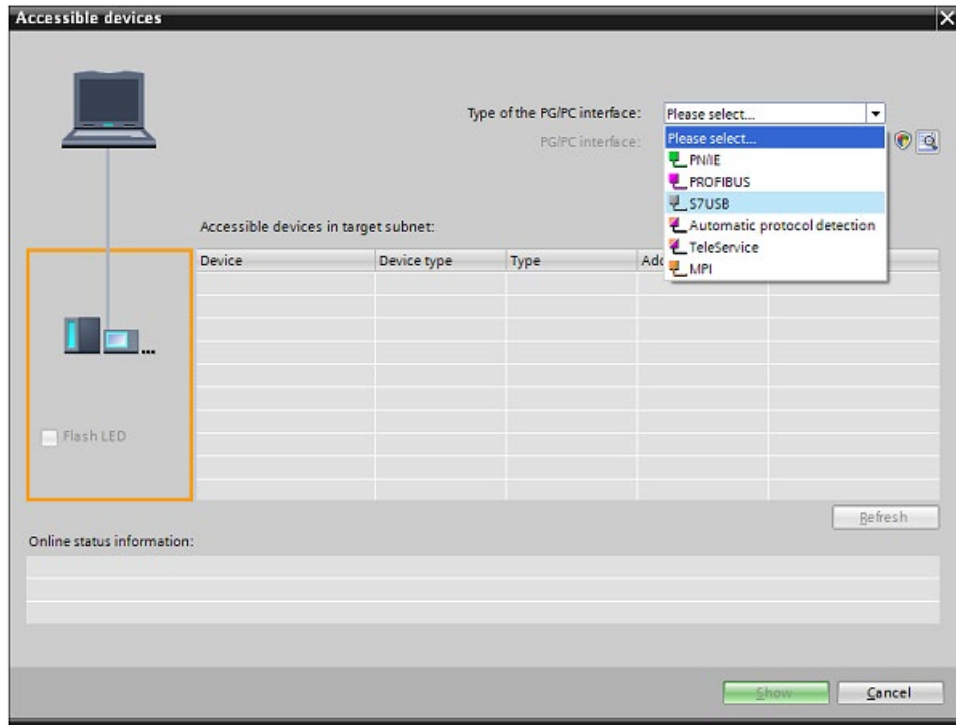
4.2 Finding the drive unit via USB with Accessible devices

How to find connected drive units with Accessible devices

1. Select "Accessible devices" in the "Online" menu.

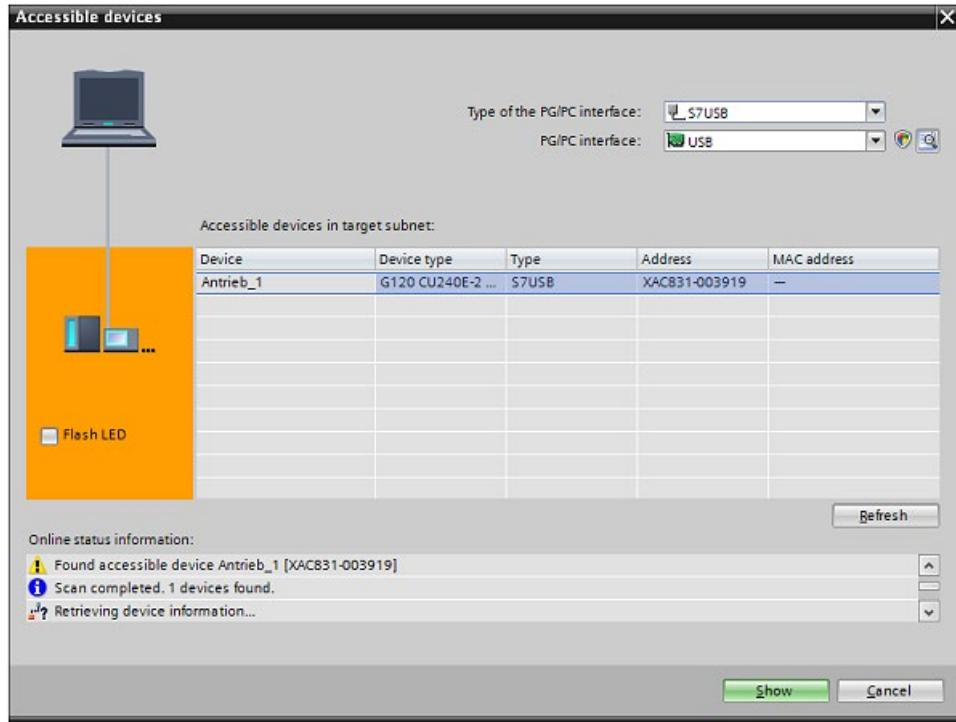


- In the "Accessible devices" window select "S7USB" as the "PG/PC interface type" and click "Update"



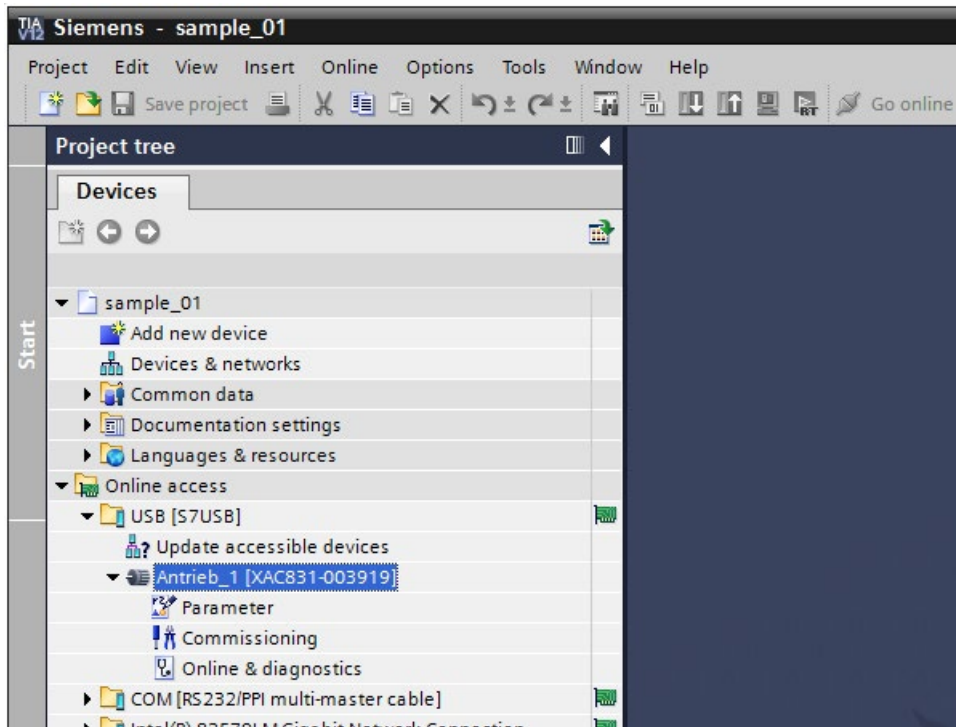
Startdrive automatically scans the selected interface and displays the drive units found.

- Select the drive unit found and click "Display."



4.3 Integrating the drive unit into the project

The drive unit is displayed under "Online access" in the project navigator.



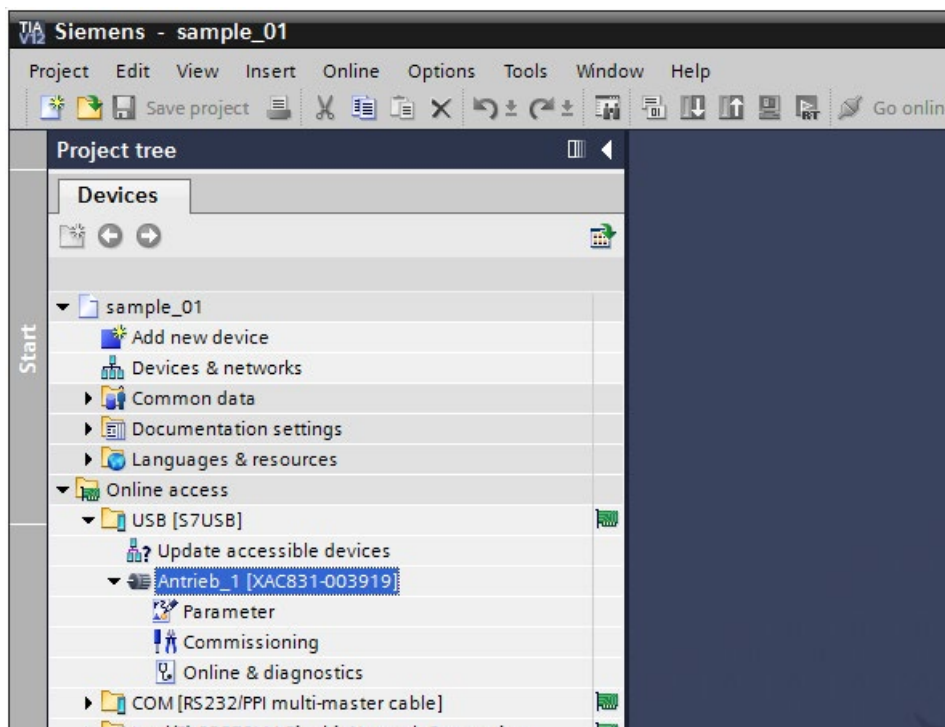
4.3 Integrating the drive unit into the project

Integrating the drive unit

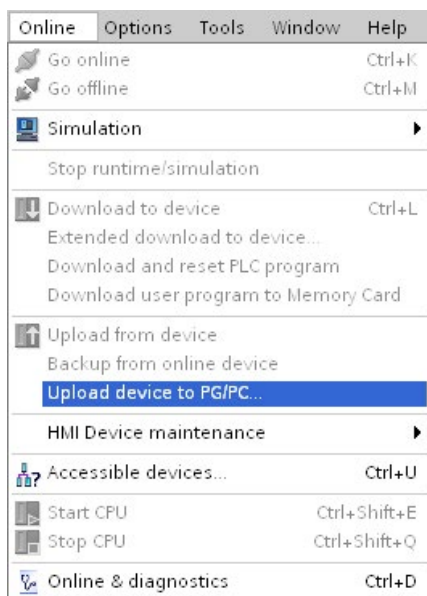
You can access the drive unit from Startdrive via Accessible nodes. You can now integrate the drive unit into the project.

How to integrate drive units into the project online

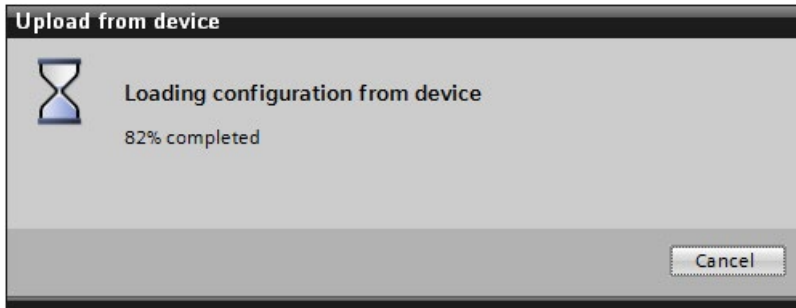
1. Select the drive unit under "Online access" in the project navigator.



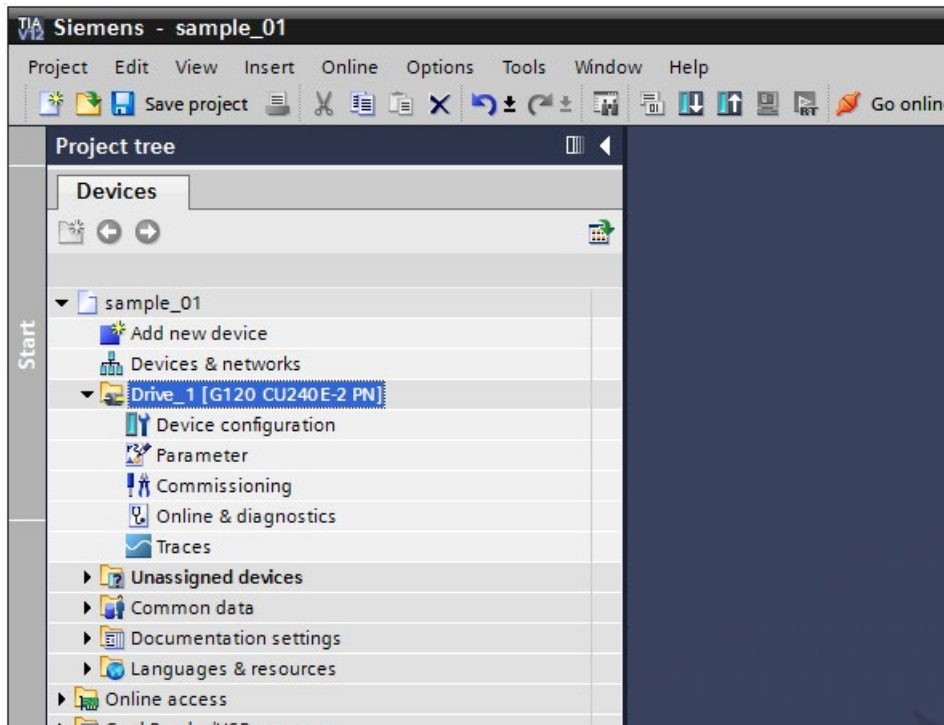
2. Select "Upload device to PG/PC" in the online menu.



The data is loaded to the PG/PC.



The drive unit is integrated into the project and is displayed in the project navigator.



Commissioning the drive

5.1 Commissioning with Startdrive

Commissioning with Startdrive



You can complete the commissioning in a short space of time with the Startdrive Commissioning wizard. For this Startdrive supports offline commissioning in the project or online directly on the drive unit. After offline commissioning you load the configuration from the PG/PC into the device, with online commissioning you load the configuration from the drive unit into your project.

Online commissioning will be introduced to you in the next step.

5.2 Going online and starting the wizard

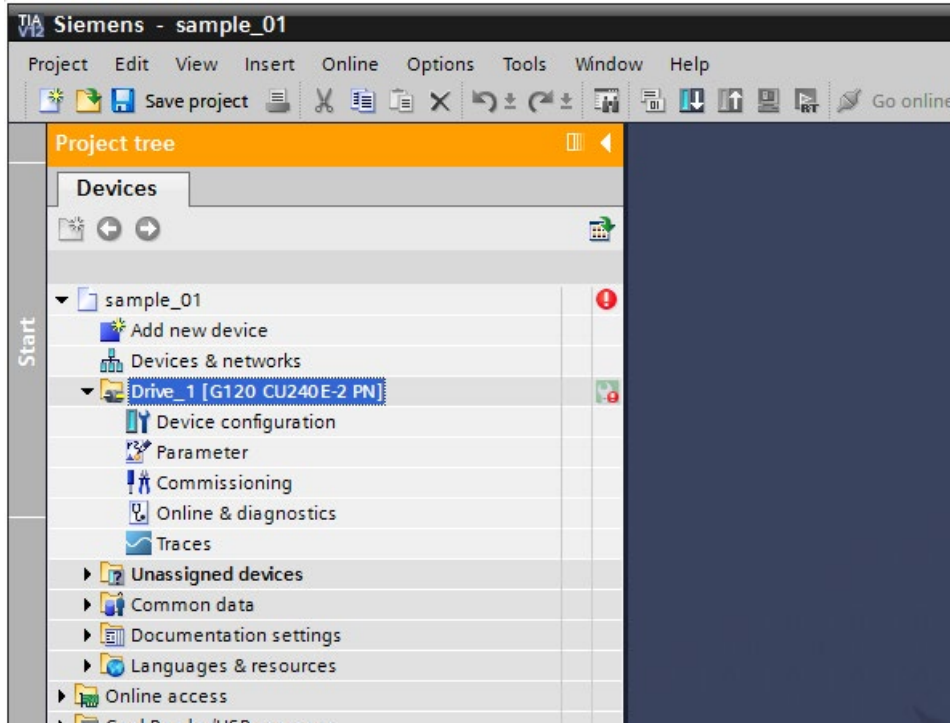
Basic commissioning online

You must connect Startdrive Online with the drive unit before commissioning.

How to go online and start the commissioning

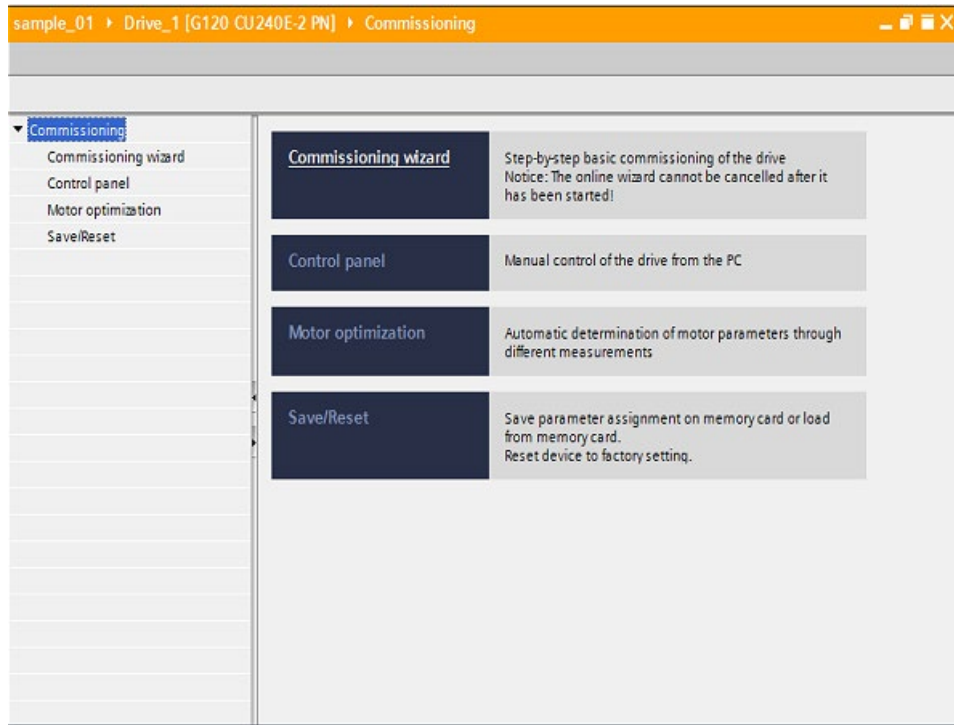
1. Select the drive unit in the project navigator and then select "Connect online" from the shortcut menu.

A typical icon is displayed next to the drive unit once the connection has been established. In the example, this is the icon for maintenance required because the drive still has to be commissioned.



2. Double-click "Commissioning" in the project navigator. A window is shown in the working area.

3. Double-click "Commissioning wizard" in the working area. The wizard will start.



You will complete the commissioning in the next step.

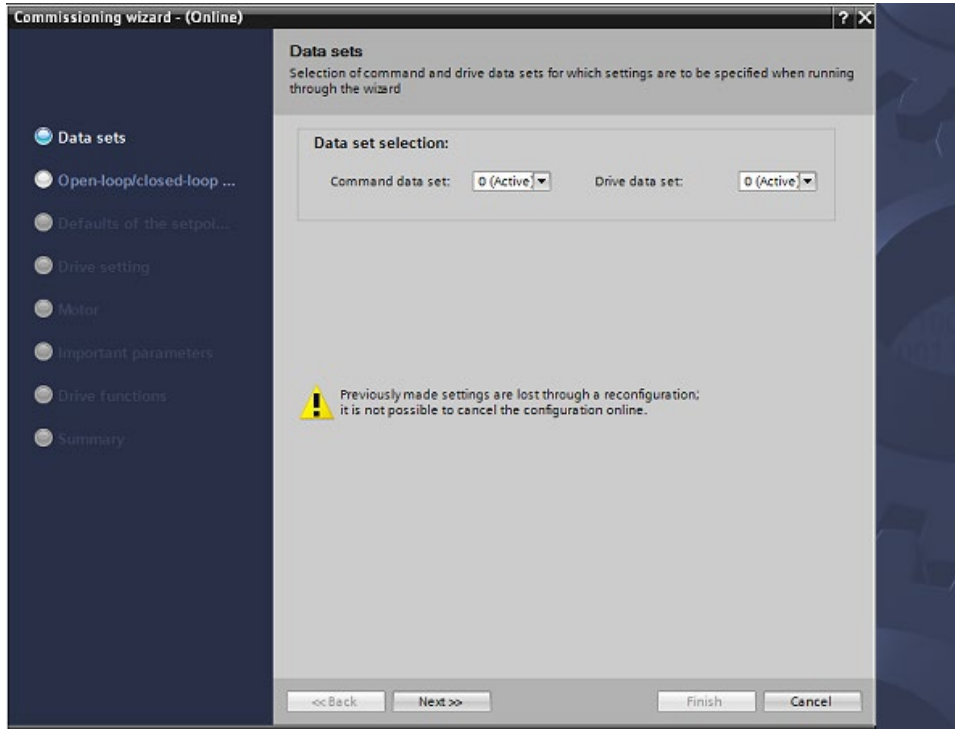
5.3 Basic commissioning with the wizard

Basic commissioning online with the wizard

Select the relevant parameters in the wizard for basic commissioning of the drive. Startdrive is already online with the drive unit connected and the Commissioning wizard is open in the working area.

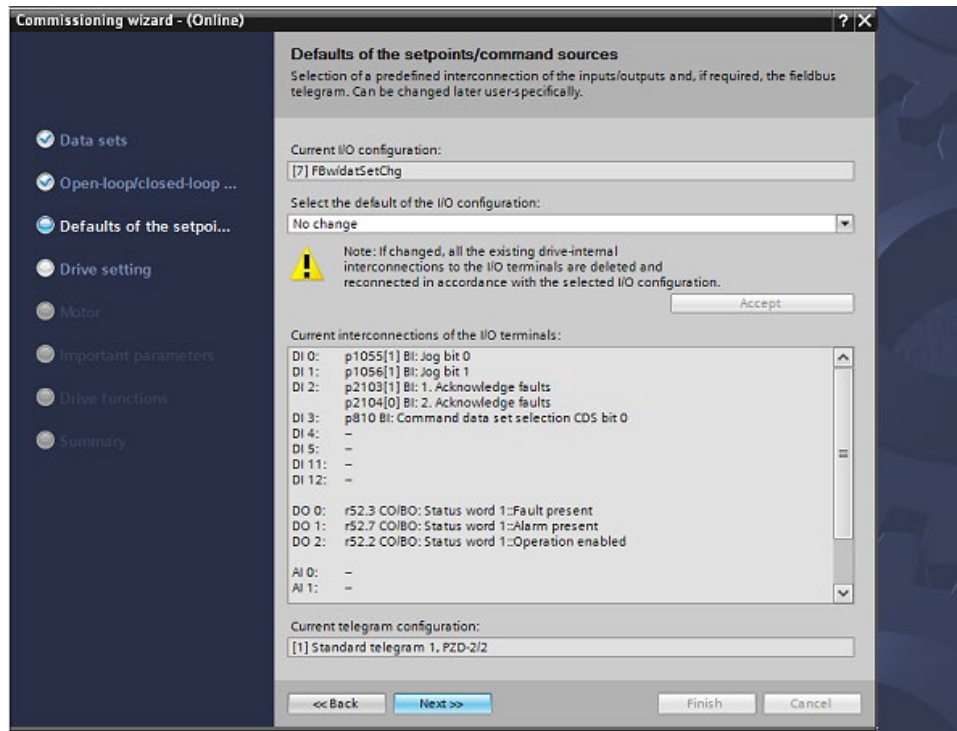
How to perform basic commissioning

1. You configure the open-loop/closed-loop control type, determine the drive settings and select the motor in the open wizard.

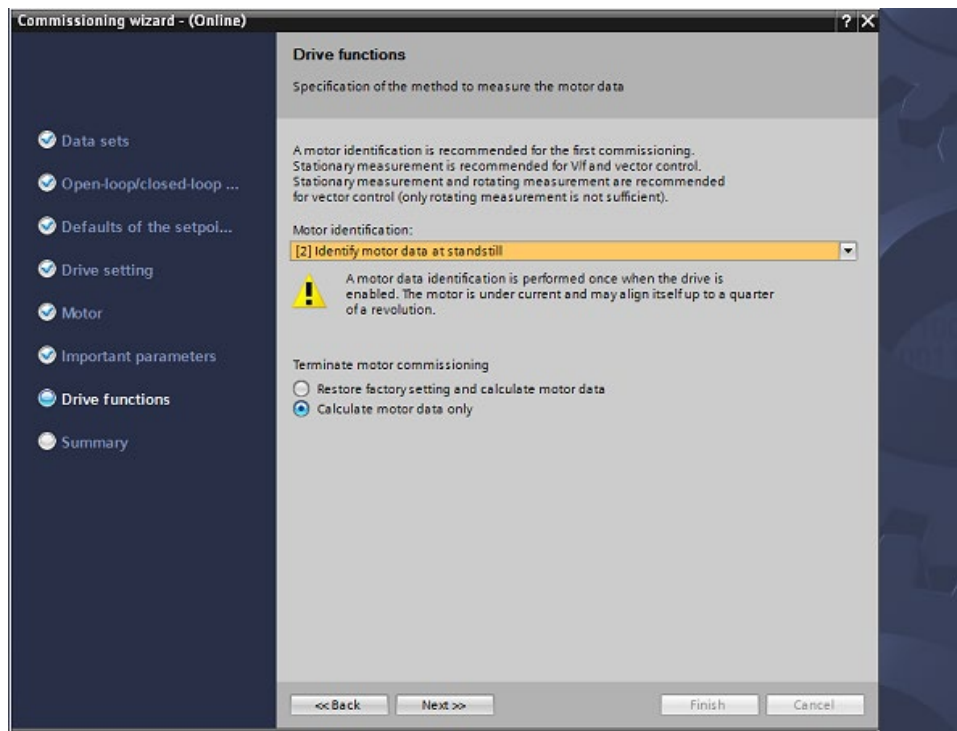


2. Run through the Commissioning wizard. You move to the next step in each case by clicking "Next".

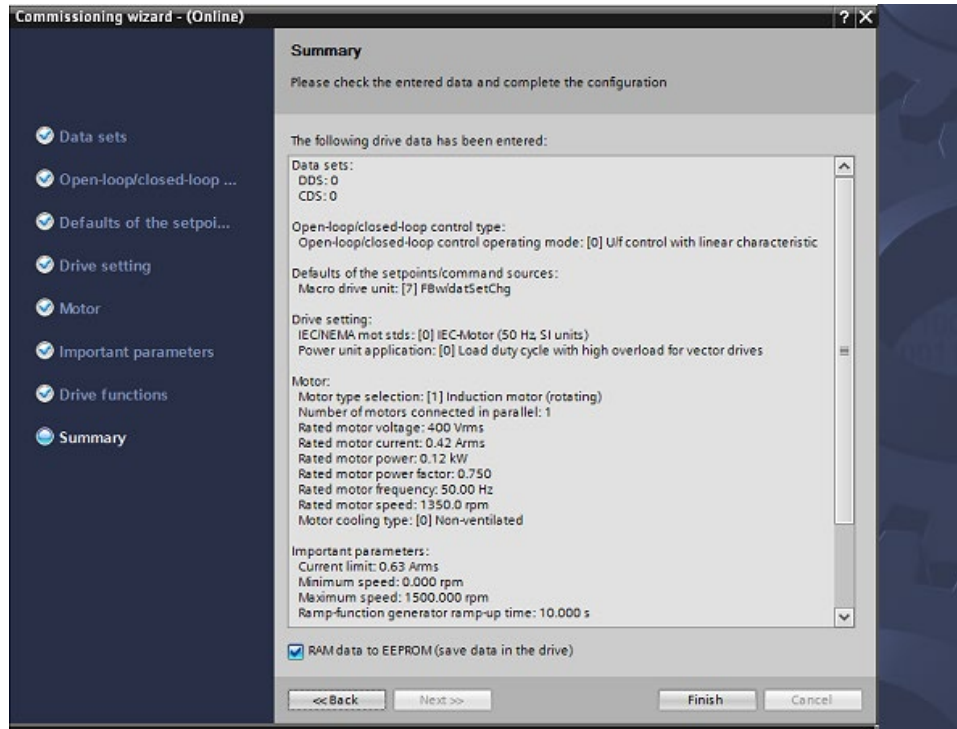
3. Use standard telegram 1 as telegram. This is preset through the selection of the macro.



4. Carry out the motor data identification when the motor is at standstill is recommended for the first commissioning. This is performed with the first ON command, e.g. when testing the drive with the control panel.



- 5. All parameters are displayed in the Summary at the end of the wizard. You can check the values entered once again here and make any changes by clicking "Back."



- 6. Click "Finish".
This completes the basic commissioning.

Testing and optimizing the drive

6.1 Testing and optimizing drives

Testing and optimizing



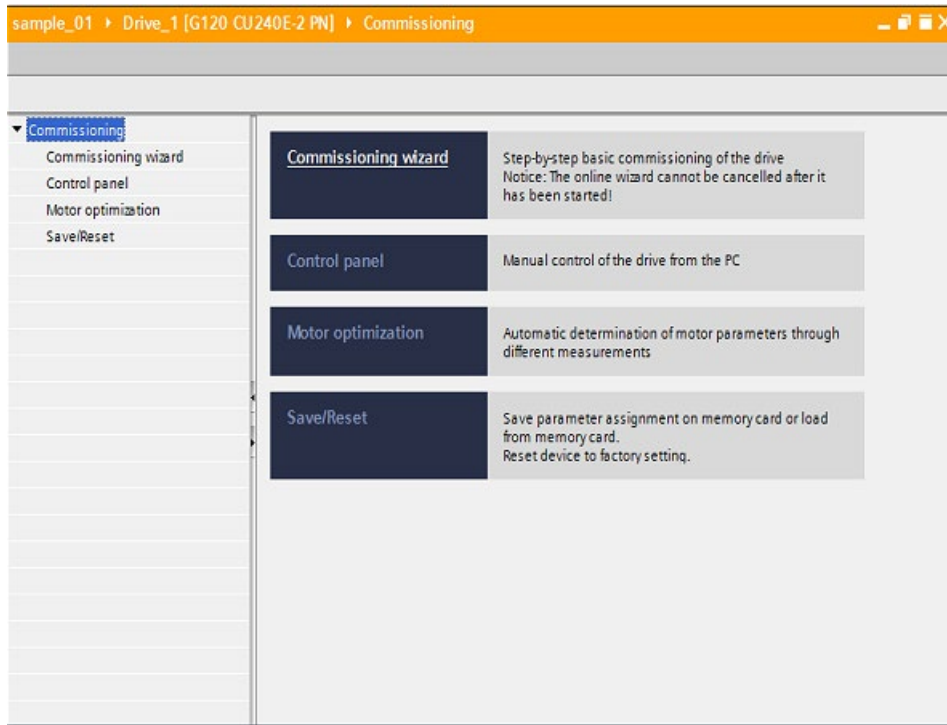
Startdrive offers a number of options for testing and optimizing the drive. For the first function test, you can operate the drive by using the drive control panel. Error conditions can be recorded and eliminated via the online and diagnostics screen forms with all the alarm and fault messages. The motor optimization helps you to improve the control properties of the motor

The drive control panel will be introduced to you initially in step one.

6.2 Testing using the drive control panel

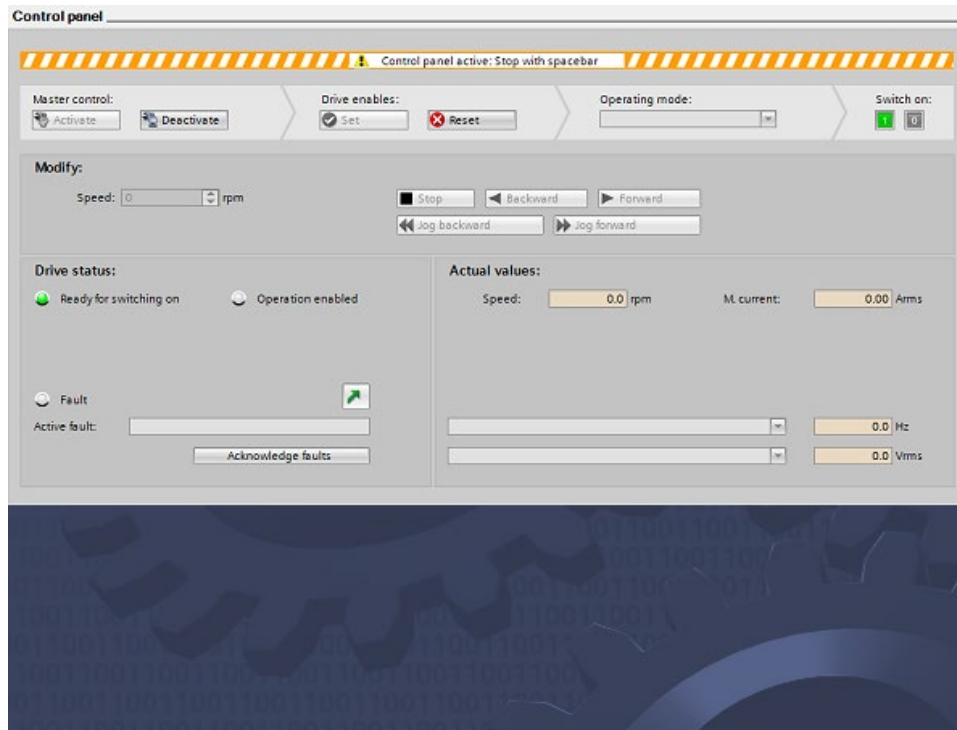
Rotating the motor using the drive control panel

You can carry out an initial function test of the drive by using the drive control panel. The Startdrive must be connected to the drive online and Commissioning must be open in the working area.

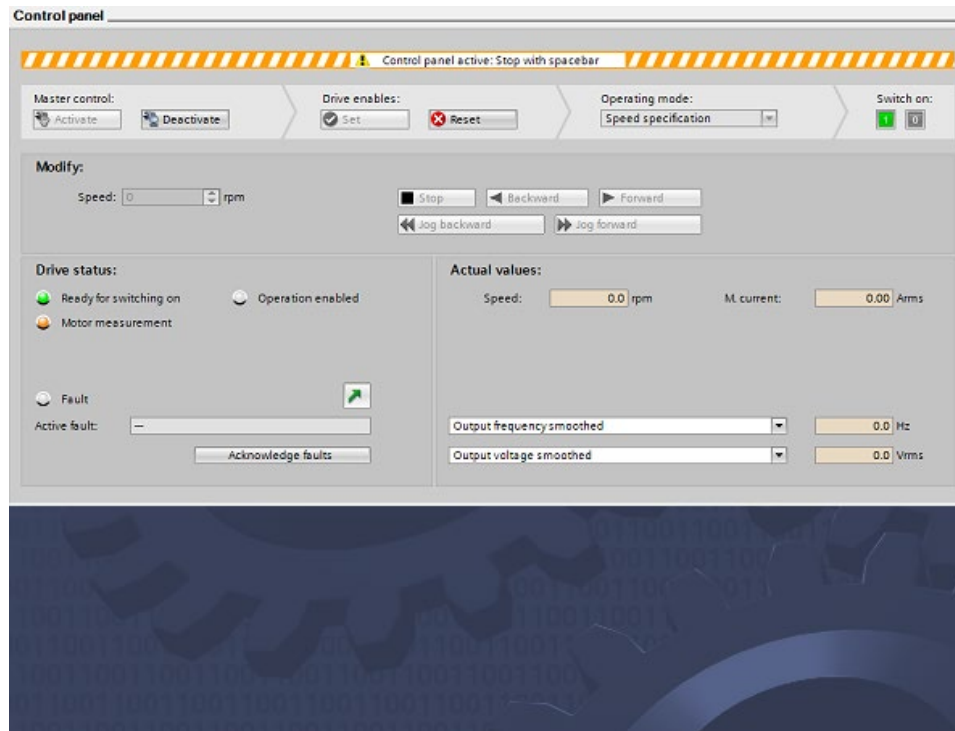



How to carry out a test using the drive control panel

1. Double-click "Control panel"
2. Activate "Master control" and set the drive enables and the operating mode on the control panel. The motor is then ready to be switched on.



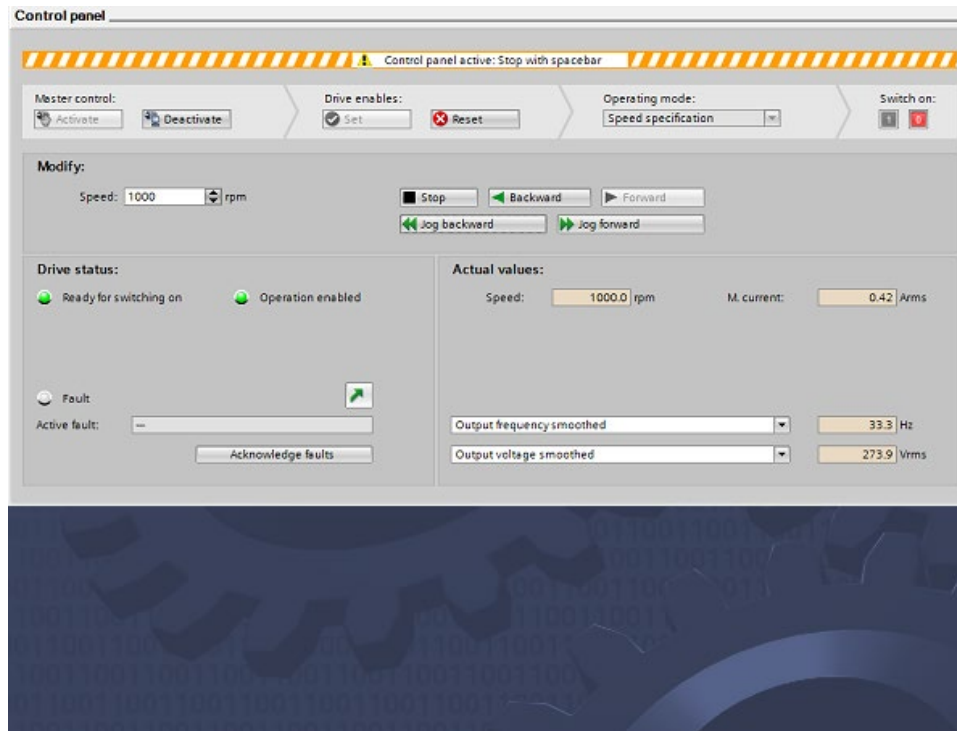
- 3. Motor measurement is performed once at the first ON command of the drive after commissioning. Start the drive and wait until the measurement is completed.



 CAUTION
Rotating the drive
Observe the safety instructions in the manual before you make the motor rotate.

- 4. Enter a "speed."

5. You can make the drive rotate by clicking the "Forward" or "Backward" buttons. The drive accelerates to the specified speed. The actual values are displayed.



6. Click "Stop" to stop the drive, switch off the motor, reset the drive enables and give up master control.

Parameterizing the drive

7.1 Function and parameter views

Functions and parameters



A parameterization editor with three tabs is available to parameterize the drive. In one tab, you perform the basic commissioning with the wizard. The two other tabs contain a function view and a parameter view. They are described in more detail in this section.

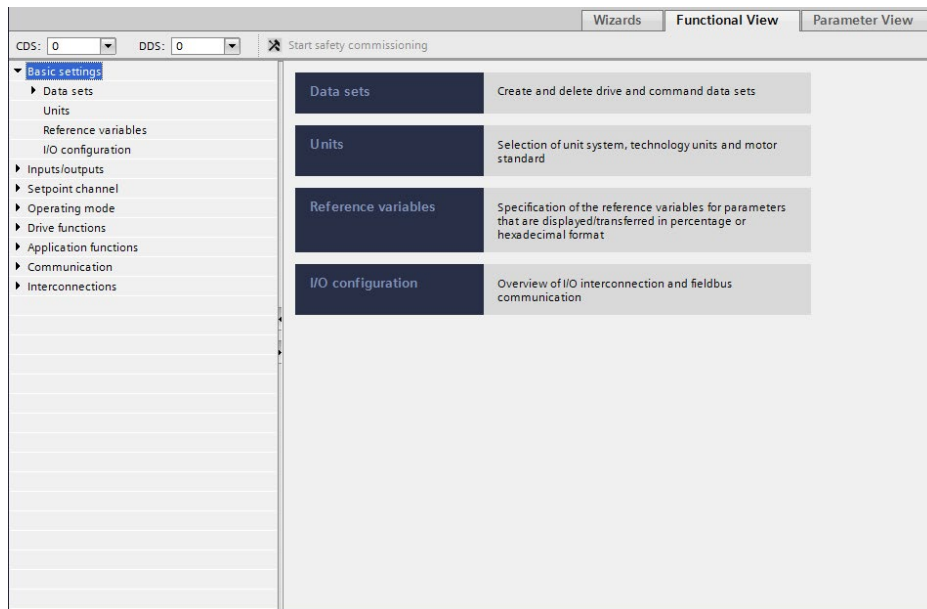
7.2 Displaying the function view

Function view

You parameterize the drive using screen forms with a graphical user interface in the function view.

How to open the function view:

1. Double-click "Parameters" below the drive in the project navigator.
2. Click the "Function View" tab in the working area.
3. The secondary navigation for calling the function-oriented screen forms is in the left-hand area of the function view.

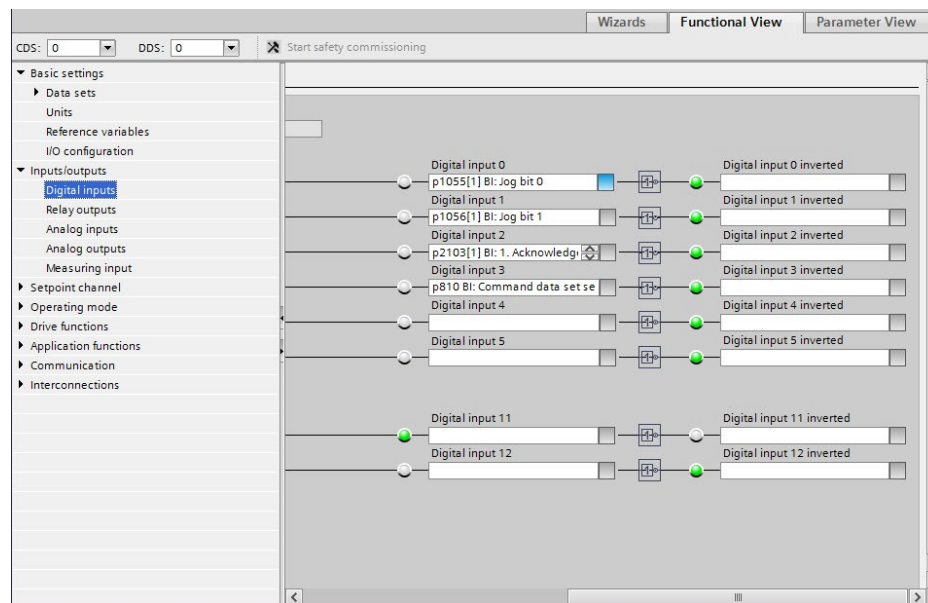


The next step shows how the parameterization is performed in the function view.

7.3 Assigning parameters in the function view

Assigning parameters in the function view

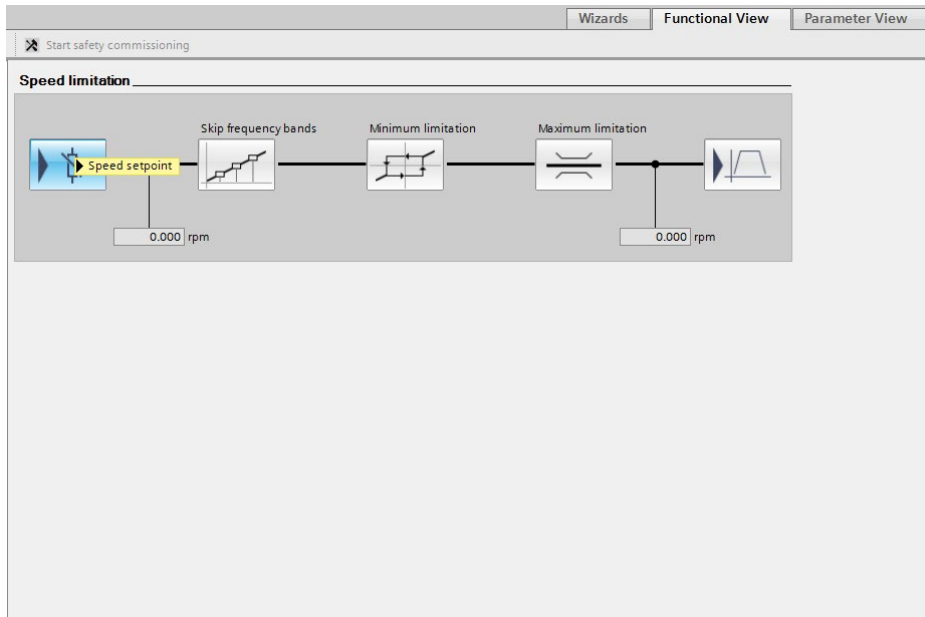
You edit the most important parameters in a clearly organized, graphical user interface in the function view. The screen forms are based on function diagrams that map the functions in signal flow diagrams. The signal flow is from left to right.



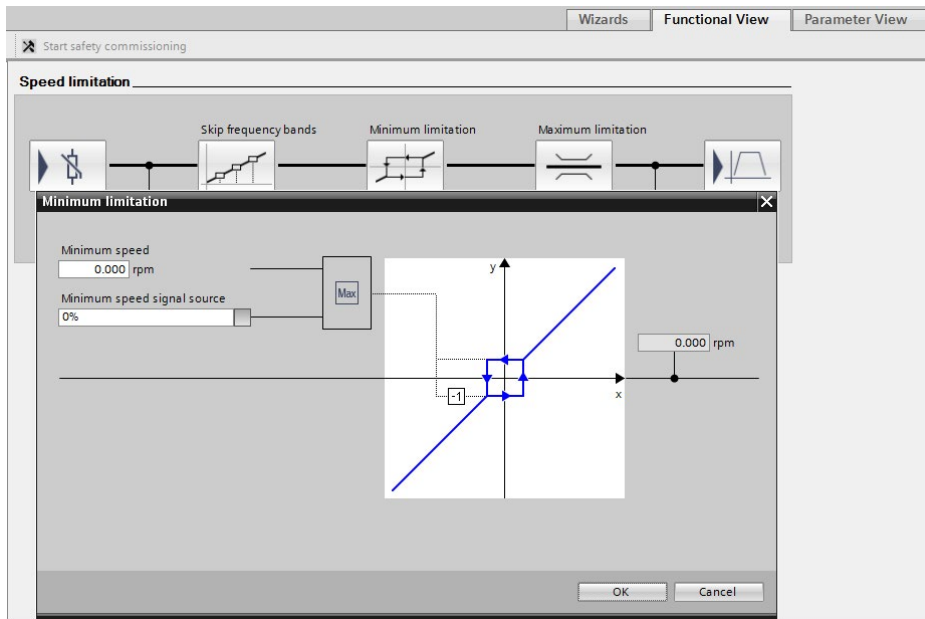
How to work with the function view:

1. You can assign the signals for the inputs/outputs similar to the real terminal connections. Simply select the terminal signal from the displayed list.

- 2. You can parameterize the functions in the screen forms with the aid of a graphical support.



- 3. In addition to the secondary navigation, you can toggle between the individual screen forms of the function view with the buttons.
- 4. You are supported by help screens when entering values.



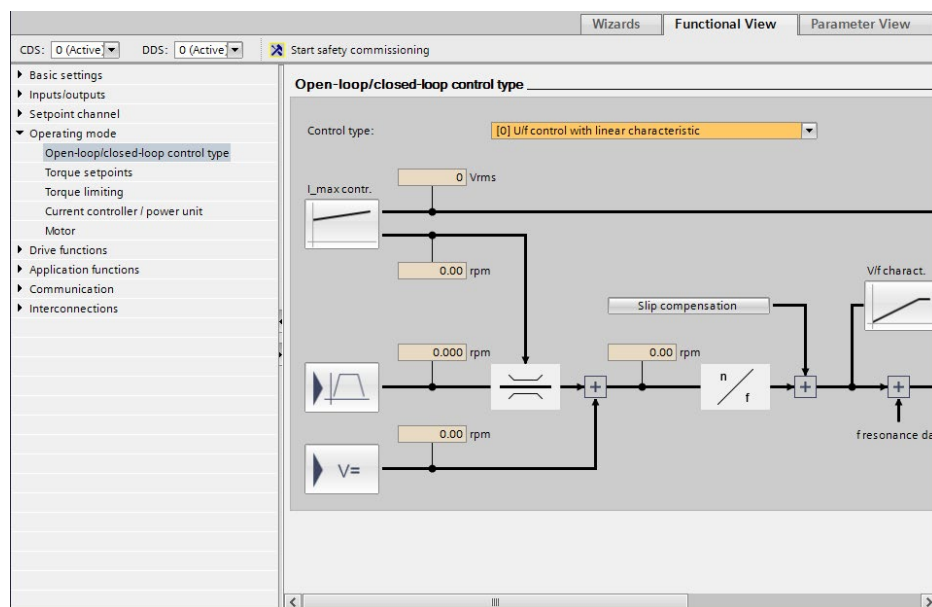
7.4 Online function view

Working online with the function view

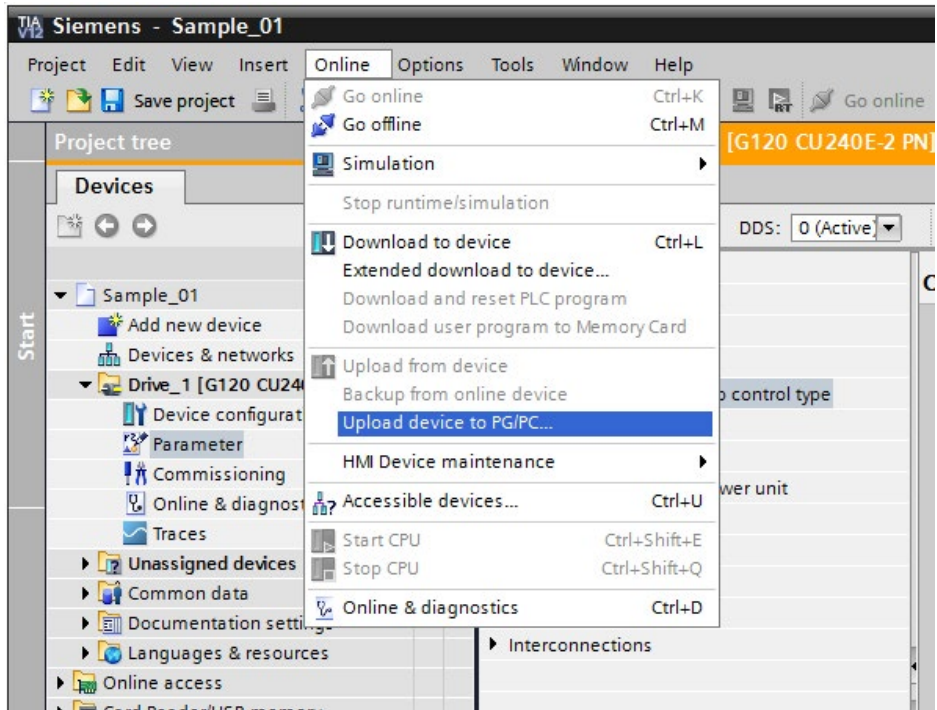
In the function view, you can change the parameter values directly in the drive when you are connected online to the drive. The input fields of the parameters that you can change online are displayed in orange.

To go online with the function view:

1. Connect Startdrive online with the drive ( Go online). The input fields that can be changed are displayed in orange.



- 2. Parameter changes in the online view only affect the drive. If you want to take the changes into the offline project, you must perform an upload to the project.



7.5 Displaying the parameter view

Parameter view

The parameter list provides a clearly organized display of the parameters available for the device. To facilitate the locating of parameters, they are sorted according to topic.

How to open the parameter view:

- 1. Click the "Parameter View" tab in the working area.

2. The secondary navigation for calling the parameter groups sorted according to topic is in the left-hand area.

Number	Parameter text	Value	Unit
<All>	<All>	<All>	<All>
r2	Drive operating display	[42] Switching on inhibited - set "OCIOFF2" = "1" (p08...	
p10	Drive commissioning parameter filter	[0] Ready	
p15	Macro drive unit	[7] FBw/dtSetChg	
r18	Control Unit firmware version	4503001	
r20	Speed setpoint smoothed	0.0	rpm
r21	Actual speed smoothed	0.0	rpm
r25	Output voltage smoothed	0.0	Vrms
r26	DC link voltage smoothed	630.4	V
r27	Absolute actual current smoothed	0.00	Arms
r31	Actual torque smoothed	0.00	Nm
r32	Active power actual value smoothed	0.00	kW
r34	Motor utilization	-200	%
r35	Motor temperature	20.0	°C
r39[0]	Energy display, Energy balance (sum)	0.02	kWh
r41	Energy consumption saved	5.48	kWh
r46	Missing enable sig	40001COFH	
r47	Motor data identification and speed controller..	[0] No measurement	
r51	Drive Data Set DDS effective		OH
r52	Status word 1		EBCOH
r53	Status word 2		2EOH
r54	Control word 1		OH
p100	IEC/NEMA mot stds	[0] IEC-Motor (50 Hz S1 units)	
p170	Number of Command Data Sets (CDS)	2	
p205	Power unit application	[0] Load duty cycle with high overload for vector drives	
r206[0]	Rated power unit power, Rated value	0.37	kW
r208	Rated power unit line supply voltage	400	Vrms
p230	Drive filter type, motor side	[0] No filter	
p233	Power unit motor reactor	[0] No filter	0.000 mH
p234	Power unit sine-wave filter capacitance	[0] No filter	0.000 µF
p300[0]	Motor type selection	[1] Induction motor (rotating)	
p301[0]	Motor code number selection	0	
p304[0]	Rated motor voltage	400	Vrms
p305[0]	Rated motor current	0.42	Arms
p306[0]	Number of motors connected in parallel	1	

3. You can either display all parameters or select special groups.

Number	Parameter text	Value	Unit
<All>	<All>	<All>	<All>
p10	Drive commissioning parameter filter	[0] Ready	
p15	Macro drive unit	[7] FBw/dtSetChg	
r47	Motor data identification and speed controller..	[0] No measurement	
p205	Power unit application	[0] Load duty cycle with high overload for vector drives	
p230	Drive filter type, motor side	[0] No filter	
p304[0]	Rated motor voltage	400	Vrms
p305[0]	Rated motor current	0.42	Arms
p307[0]	Rated motor power	0.12	kW
p308[0]	Rated motor power factor	0.750	
p309[0]	Rated motor efficiency	0.0	%
p310[0]	Rated motor frequency	50.00	Hz
p311[0]	Rated motor speed	1350.0	rpm
p322[0]	Maximum motor speed	0.0	rpm
p323[0]	Maximum motor current	0.00	Arms
p340[0]	Automatic calculation, motor/control parame...	[0] No calculation	
p500	Technology application	[0] Standard drive	
p922	PROFIdrive telegram selection	[1] Standard telegram 1, PZD-2/2	
p1000[0]	Speed setpoint selection	[6] Fieldbus	
p1470[0]	Speed controller encoderless operation P-gain	3.000	
p1472[0]	Speed controller encoderless operation integr...	144.0	ms
p1900	Motor data identification and rotating measur...	[0] Inhibited	
p3900	Completion of quick commissioning	[0] No quick parameterization	

7.6 Working with the parameter view

Working with the parameter view

The parameters are displayed with number, text, value and unit in the parameter list. Parameters that can be changed have a light gray background.

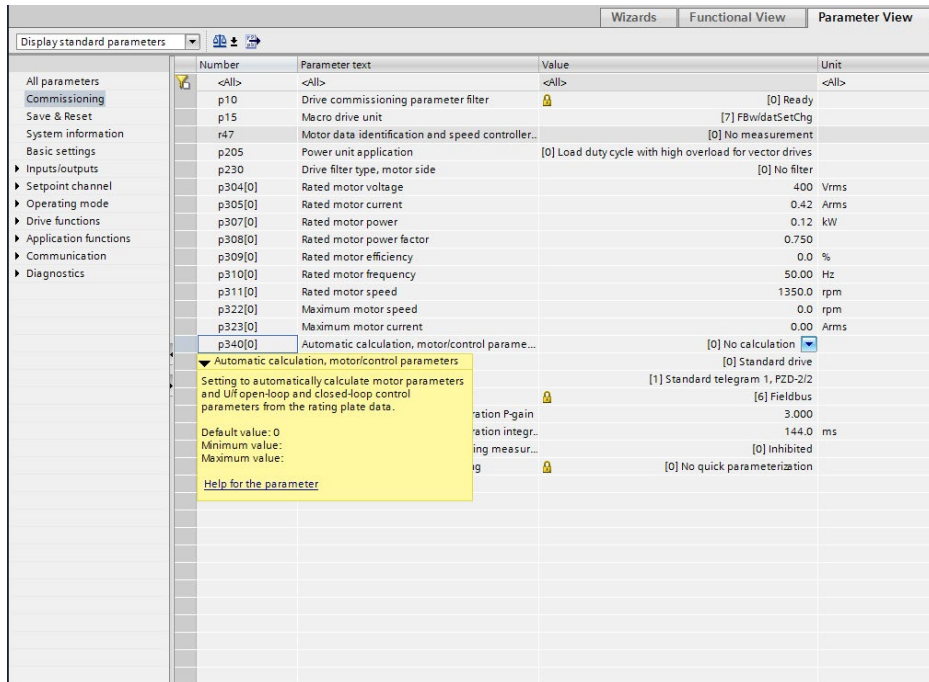
How to work with the parameter list:

1. Click the parameter in the "Value" column that is to be changed.

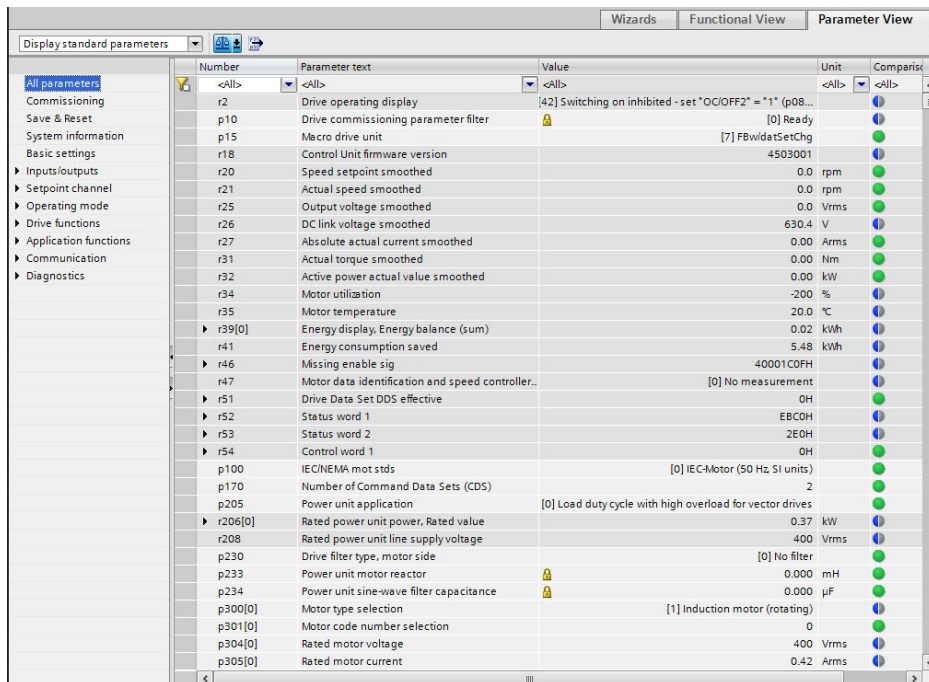
Number	Parameter text	Value	Unit
<All>	<All>	<All>	<All>
p10	Drive commissioning parameter filter	[0] Ready	
p15	Macro drive unit	[7] FBW/datSetChg	
r47	Motor data identification and speed controller...	[0] No measurement	
p205	Power unit application	[0] Load duty cycle with high overload for vector drives	
p230	Drive filter type, motor side	[0] No filter	
p304[0]	Rated motor voltage	400	Vrms
p305[0]	Rated motor current	0.42	Arms
p307[0]	Rated motor power	0.12	kW
p308[0]	Rated motor power factor	0.750	
p309[0]	Rated motor efficiency	0.0	%
p310[0]	Rated motor frequency	50.00	Hz
p311[0]	Rated motor speed	1350.0	rpm
p322[0]	Maximum motor speed	0.0	rpm
p323[0]	Maximum motor current	0.00	Arms
p340[0]	Automatic calculation, motor/control parameter...	[0] No calculation	
p500	Technology application	[0] Standard drive	
p922	PROFIdrive telegram selection	[1] Standard telegram 1, PZD-2/2	
p1000[0]	Speed setpoint selection	[6] Fieldbus	
p1470[0]	Speed controller encoderless operation Pgain	3.000	
p1472[0]	Speed controller encoderless operation integr...	144.0	ms
p1900	Motor data identification and rotating measur...	[0] Inhibited	
p3900	Completion of quick commissioning	[0] No quick parameterization	

2. Select a value from the list or enter a value and confirm it with the ENTER key.

- To display the online help, click the parameter and open the online help for the parameter via the displayed tooltip.



- You can compare the current values of the parameters with the factory settings.
- The differences are displayed with icons in the Comparison column.



7.7 Online parameter view

Working online with the parameter view

In the parameter view, you can change the parameter values directly in the drive when you are connected online to the drive.

To go online with the parameter view:

1. Switch to online mode in the parameter view. The input fields that can be changed are displayed in orange.

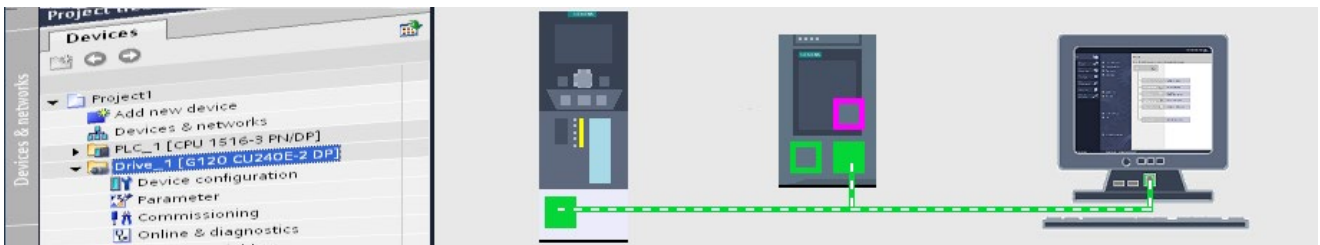
Number	Parameter text	Value	Unit
r2	Drive operating display	42] Switching on inhibited - set "OC/OFF2" = "1" (p08...	
p10	Drive commissioning parameter filter	[0] Ready	
p15	Macro drive unit	[7] FBwidatSetChg	
r18	Control Unit firmware version	4503001	
r20	Speed setpoint smoothed	0.0	rpm
r21	Actual speed smoothed	0.0	rpm
r25	Output voltage smoothed	0.0	Vrms
r26	DC link voltage smoothed	631.0	V
r27	Absolute actual current smoothed	0.00	Arms
r31	Actual torque smoothed	0.00	Nm
r32	Active power actual value smoothed	0.00	kW
r34	Motor utilization	-200	%
r35	Motor temperature	20.0	°C
r39[0]	Energy display, Energy balance (sum)	0.02	kWh
r41	Energy consumption saved	5.48	kWh
r46	Missing enable sig	40001COFH	
r47	Motor data identification and speed controller...	[0] No measurement	
r51	Drive Data Set DDS effective	0H	
r52	Status word 1	EBCOH	
r53	Status word 2	2EOH	
r54	Control word 1	0H	
p100	IEC/NEMA mot stds	[0] IEC-Motor (50 Hz SI units)	
p170	Number of Command Data Sets (CDS)	2	
p205	Power unit application	[0] Load duty cycle with high overload for vector d...	
r206[0]	Rated power unit power, Rated value	0.37	kW
r208	Rated power unit line supply voltage	400	Vrms
p230	Drive filter type, motor side	[0] No filter	
p233	Power unit motor reactor	0.000	mH
p234	Power unit sine-wave filter capacitance	0.000	µF
p300[0]	Motor type selection	[1] Induction motor (rotating)	
p301[0]	Motor code number selection	0	
p304[0]	Rated motor voltage	400	Vrms
p305[0]	Rated motor current	0.42	Arms
p306[0]	Number of motors connected in parallel	1	

2. Parameter changes in the online view only affect the drive. If you want to take the changes into the offline project, you must perform an upload to the project.

Drive with control via PROFINET

8.1 Higher-level control and drive

Controller and drive unit



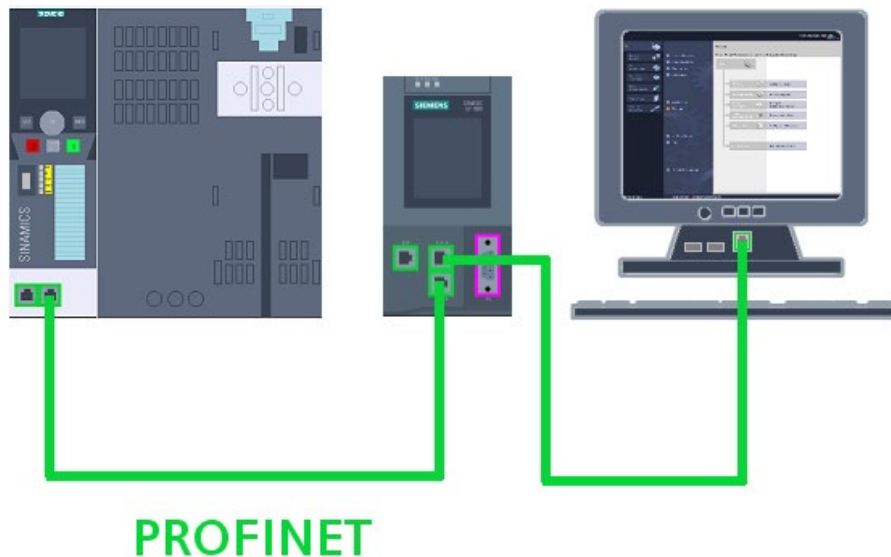
With the Startdrive integrated in the TIA Portal you can easily configure a drive unit with a higher-level controller. We will briefly show you the configuration process using a SIMATIC S7-1500 and a SINAMICS G120 with CU240E-2 PN as an example. For this the drive and controller are connected and configured via PROFINET.

8.2 Connecting the drive, controller, and PC

Establishing the PROFINET connection

The drive, controller, and PC must be connected with each other before starting the configuration.

1. Connect the PC's Ethernet port with PN interface X1 P1 on the SIMATIC S7-1500 via a PROFINET cable. The X1 interface has two ports.
2. Connect the second PN port X1 P2 on the SIMATIC S7-1500 with the PN interface X1 on the SINAMICS G120 drive unit.



3. Switch the devices on and wait until ramp-up has completed.

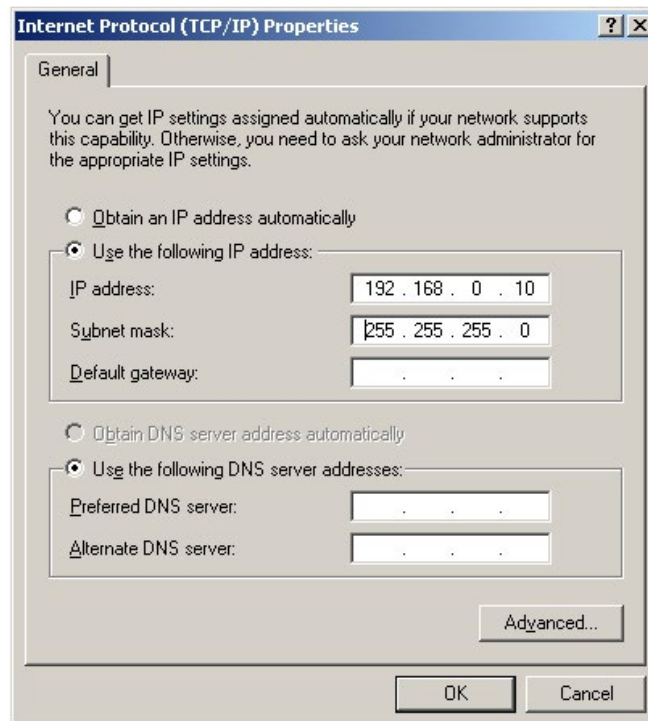
You will then be able to identify the devices with the TIA Portal via "Accessible devices"

8.3 Identifying devices via Accessible devices

Identifying devices via Accessible nodes

You can access the connected devices via "Accessible nodes" in the project navigator. The TIA Portal must be open for this.

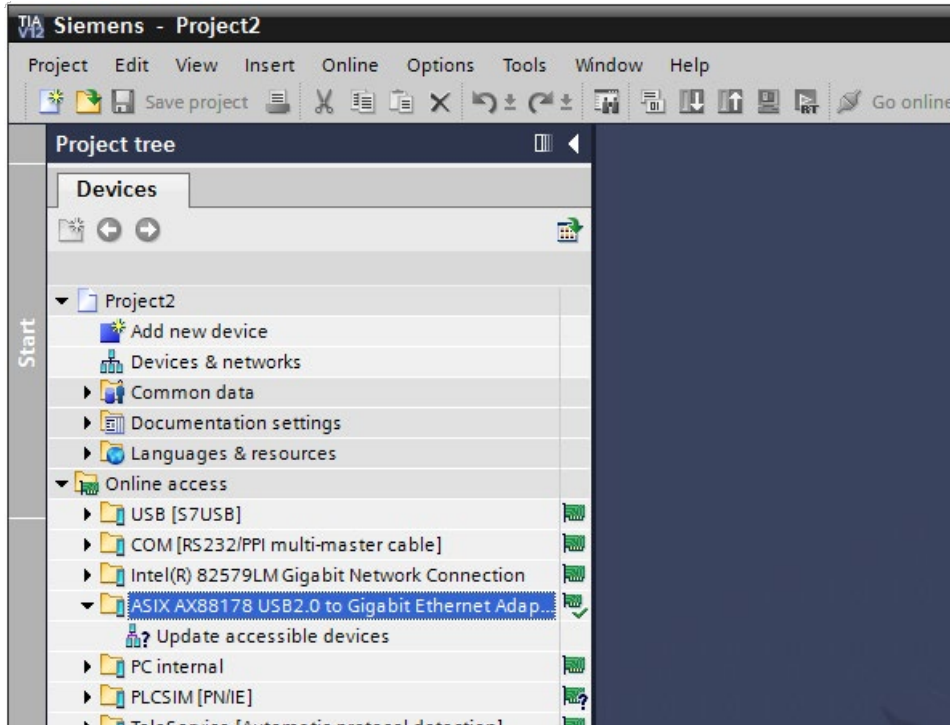
1. First of all check the TCP/IP properties of the PC's Ethernet interface in MS Windows and enter a unique IP address and the subnet mask. The subnet mask is identical for all nodes (PC, controller, drive).



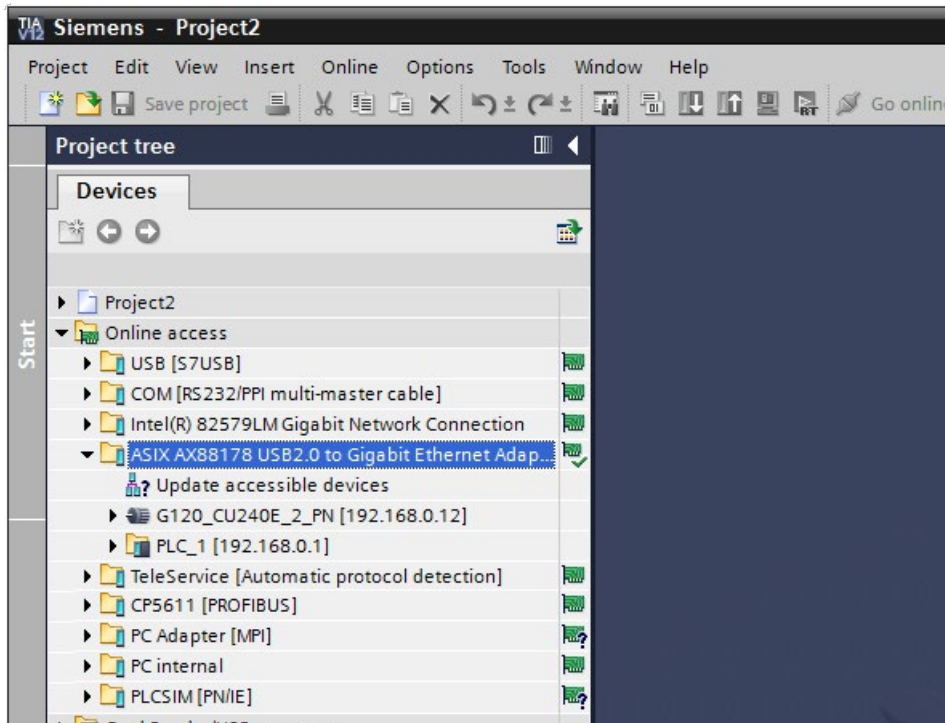
2. Switch to the TIA Portal. You have already created a new project there.

8.3 Identifying devices via Accessible devices

3. Open "Online access" in the project navigator. All usable interfaces for the PC are automatically displayed under Online access.
4. Click "Update accessible nodes" under the PC's Ethernet interface.



All devices found after scanning the interface are then displayed in the project navigator.



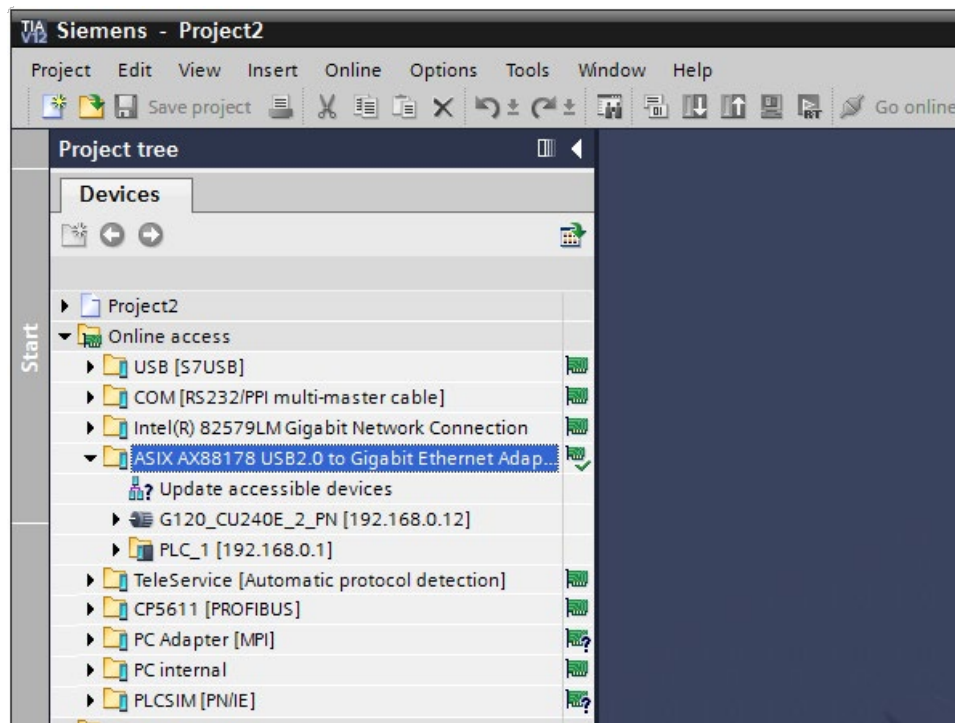
8.4 Checking the IP and names of the devices via Accessible nodes

IP address and name of the node

The nodes must have a unique IP address and a PROFINET device name for PROFINET communication.

How to display the current IP and name of the nodes

1. The current IP addresses can be read next to the device with Online access. You will then use this IP later when configuring the hardware.



Next we will show you how to change the IP and the name.

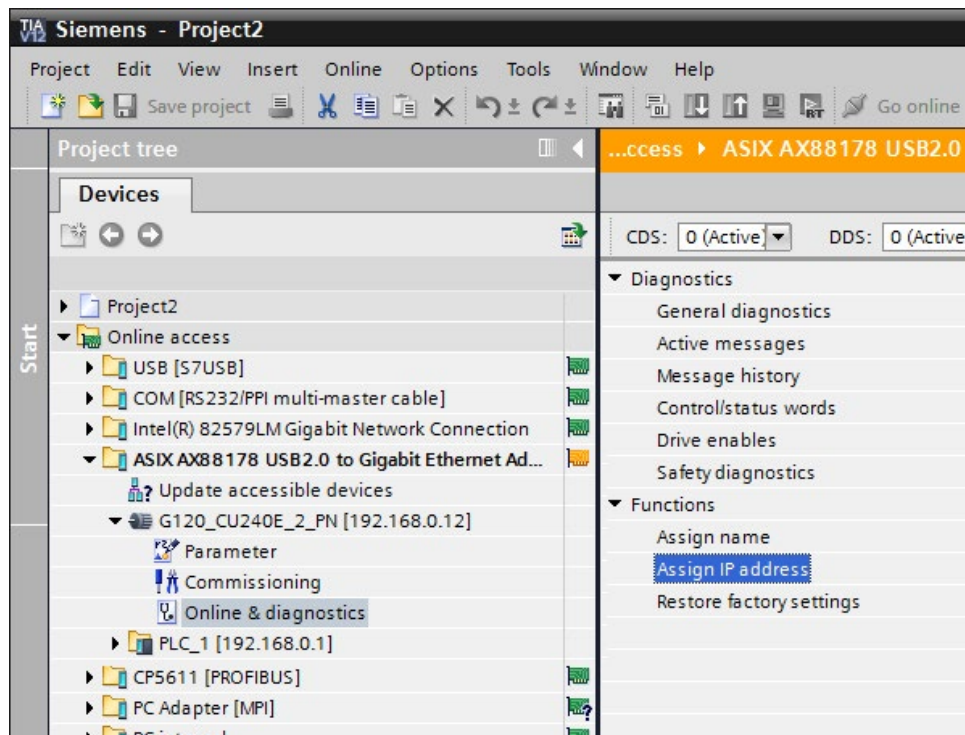
8.5 Changing the IP and name via Accessible nodes

Changing the IP address and name

You can change the IP and the name under "Online & diagnostics". We demonstrate this below using a drive as an example. The procedure for the controller is identical.

How to change the IP and/or the name

1. Open "Online & diagnostics" on the drive or the controller.



2. Select "Assign IP address." Enter the IP address and subnet into the window shown and you can assign these to the drive via the "Assign IP" button.

Note

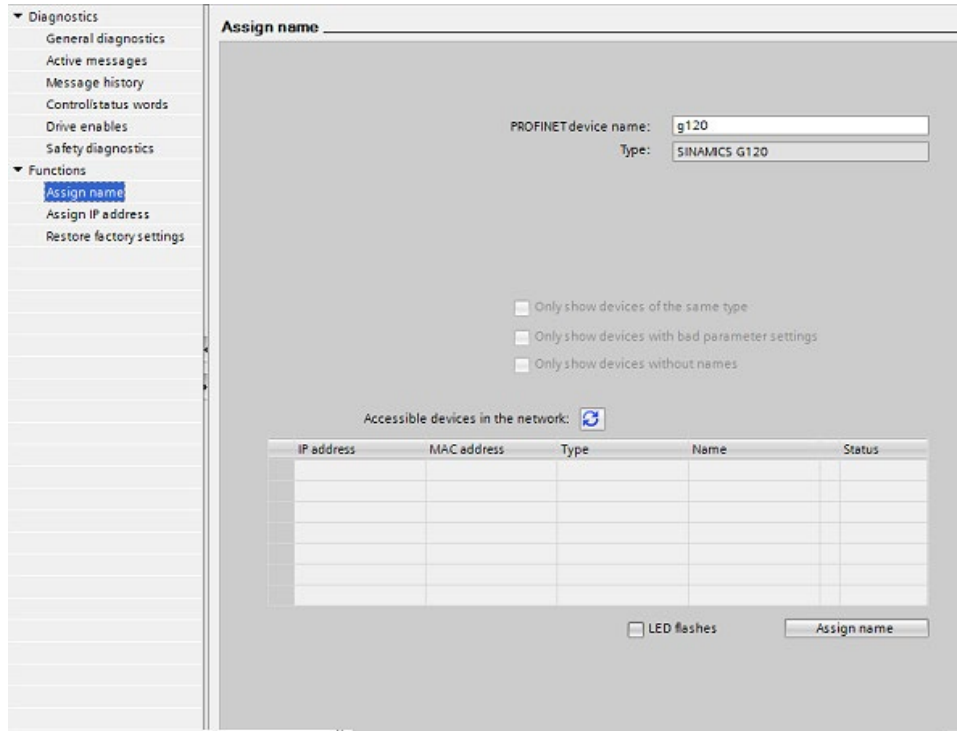
The new IP address for the controller only takes effect after the control unit has been restarted.

The screenshot shows a software interface with a left-hand navigation menu and a main configuration window. The navigation menu is expanded to show the 'Functions' section, where 'Assign IP address' is highlighted. The main window is titled 'Assign IP address' and contains the following fields and controls:

- MAC address: 00 - 1B - 1B - 00 - 3C - 02 (with an 'Accessible devices' button to its right)
- IP address: 192 . 168 . 0 . 12
- Subnet mask: 255 . 255 . 255 . 0
- Use router
- Router address: 192 . 168 . 0 . 12
- Assign IP address button

At the bottom of the interface, there are navigation arrows and a status indicator.

- 3. You can assign a new PROFINET device name to the drive via the "Assign name" function.

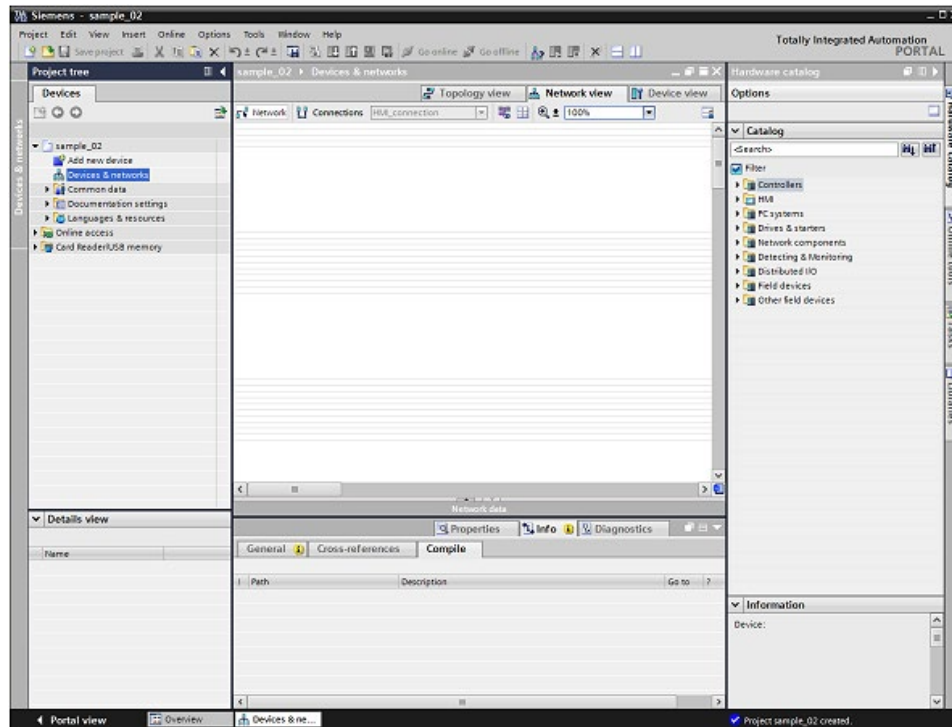


You will use the assigned IP addresses and names later when configuring the hardware. You will configure these in the next step.

8.6 Inserting devices into the project

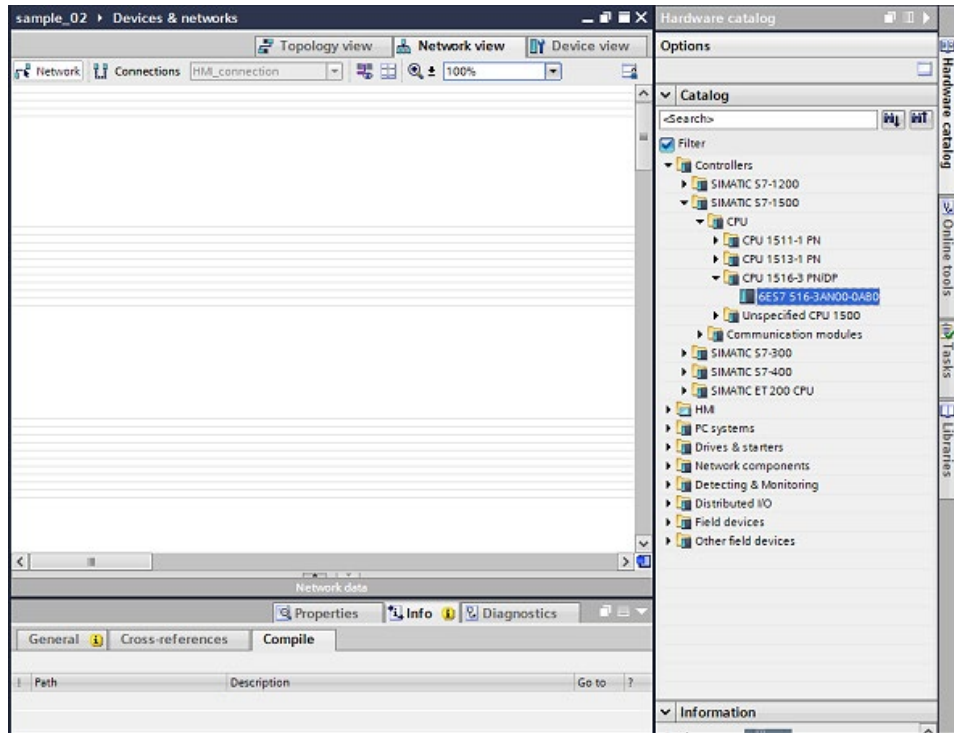
Inserting devices

In the TIA Portal you can insert the hardware into the project via the Insert dialog or via the hardware catalog. You will use the hardware catalog in the example. You must create the project and select "Devices & networks" in the project navigator before starting.

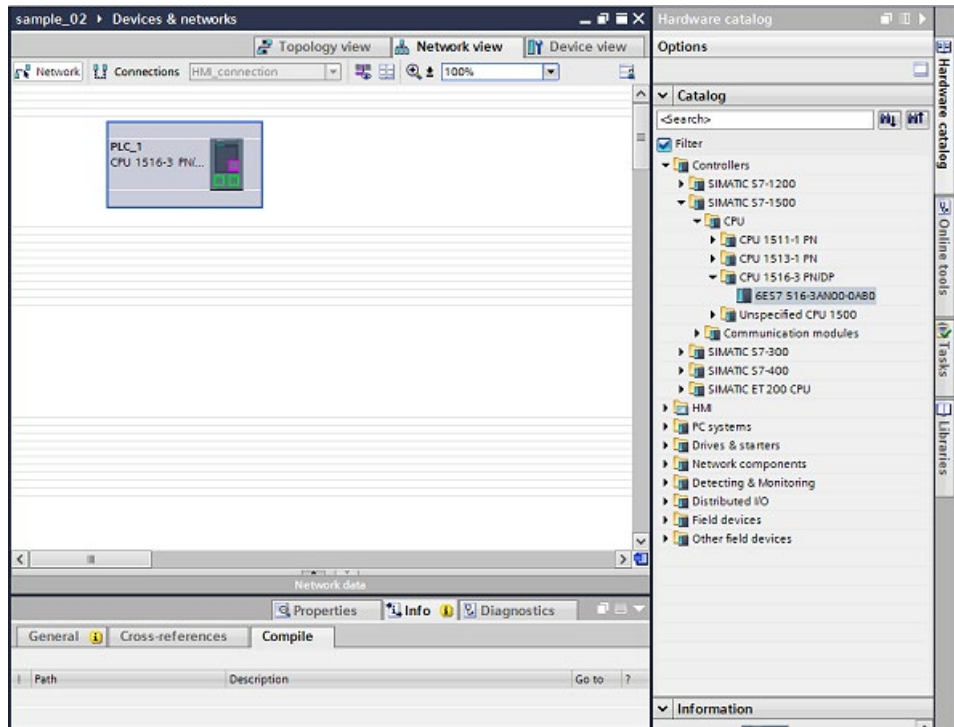


How to insert the devices into the project

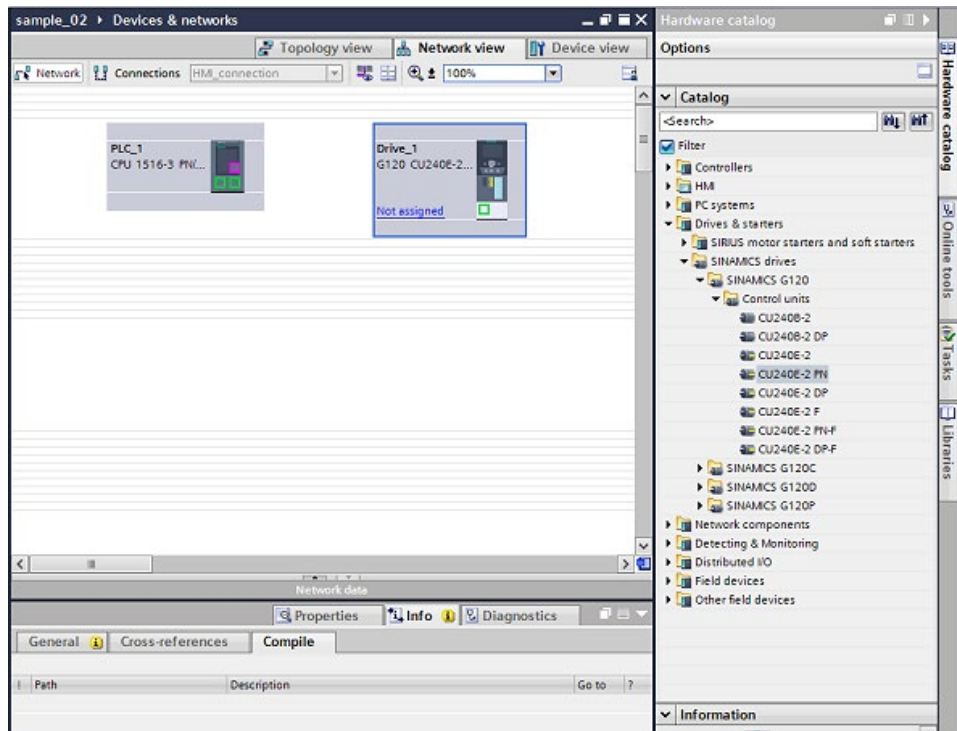
1. In the hardware catalog navigate to the entry for the controller being used. This is a CPU 1516-3 PN/DP in the example.



2. Drag the controller to the network view using Drag&Drop.

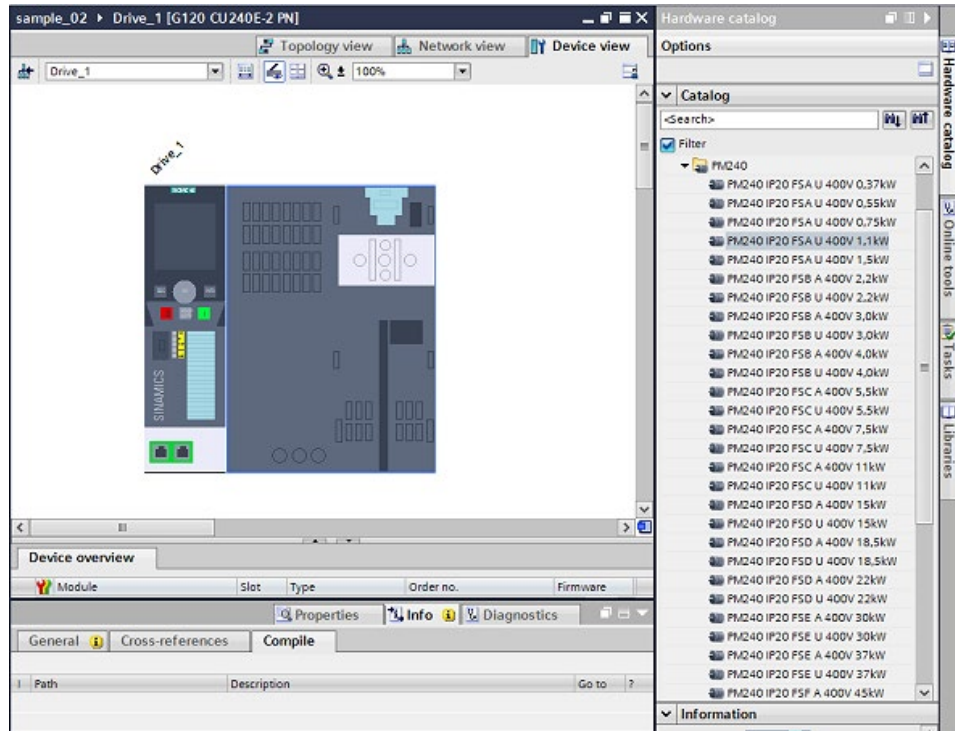


3. Now insert the drive, a CU240E-2 PN in the example, into the project using Drag&Drop.

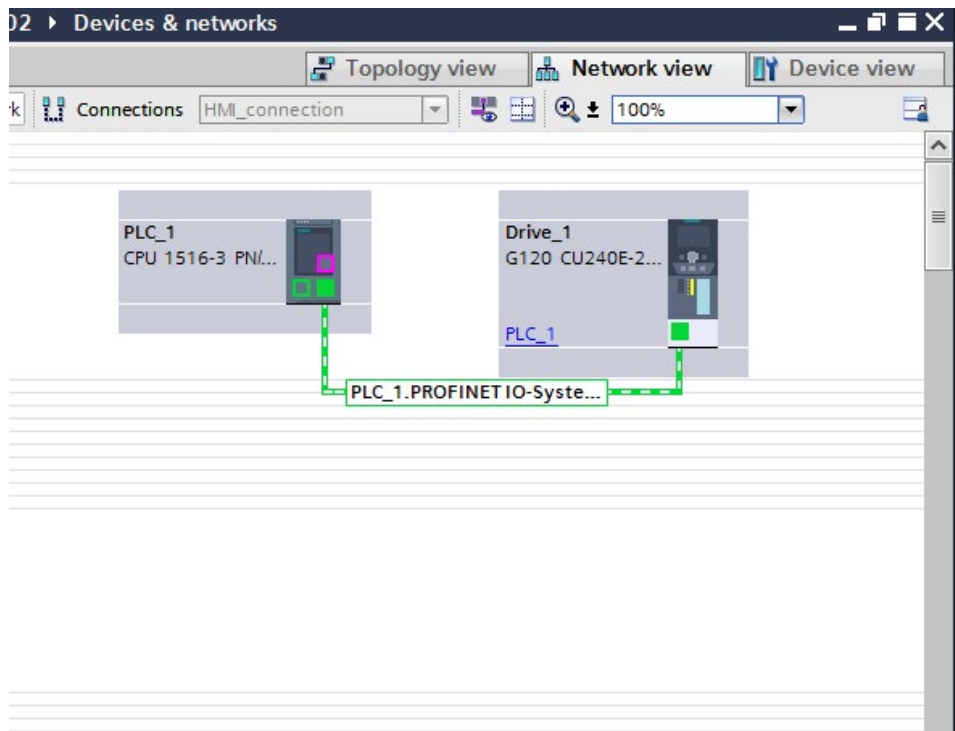


4. Select the drive in the "Network view" and switch to the "Device view" tab.

5. Drag the power unit for the device to the free space using Drag&Drop.



6. Switch back to the "Network view" and, with the left mouse button pressed, drag a connection from the drive's X1 interface to the controller's X1 interface. A PROFINET IO system is created automatically.



This completes the process for inserting the hardware.

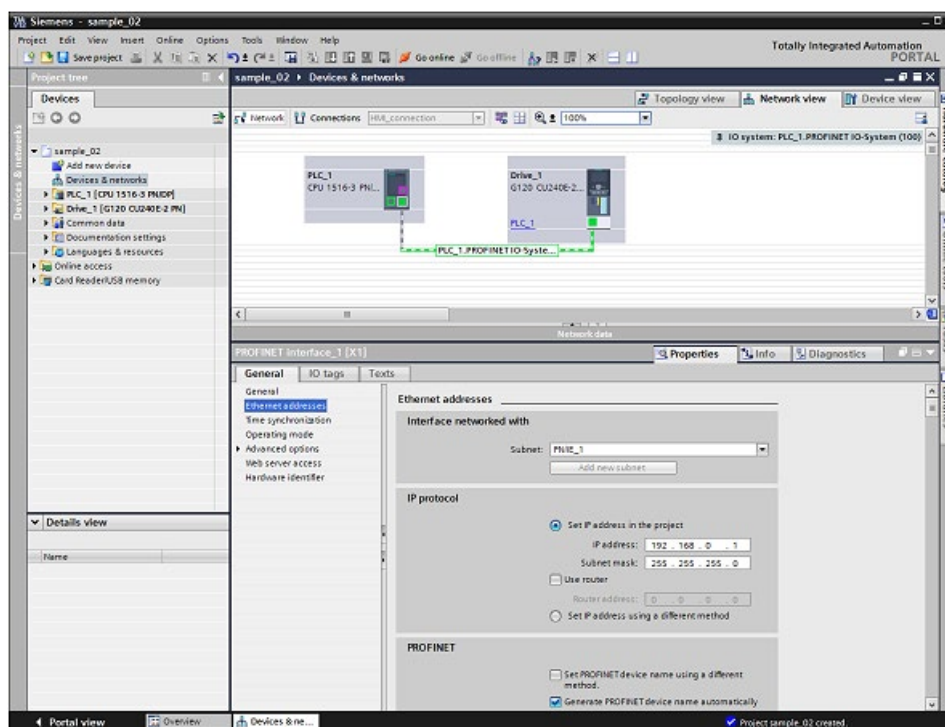
8.7 Adapting the IP and name in the project

IP address and name

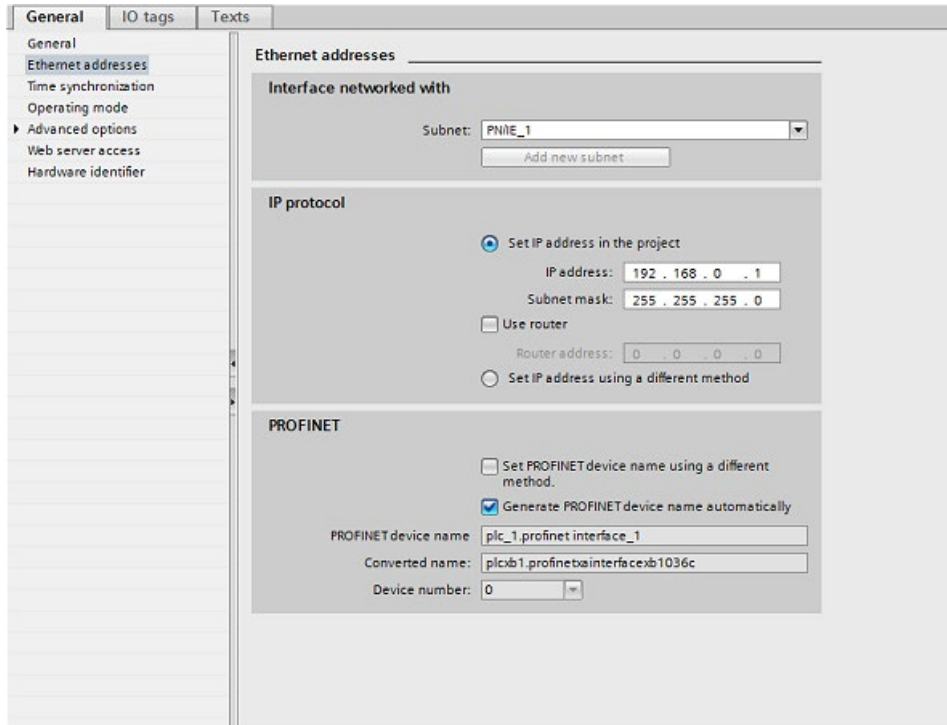
The IP addresses in the project and in the target hardware must match for PROFINET communication. You have already checked the IP and the name of the target hardware via Accessible nodes. These must now be entered in the project. Upon download the name in the target hardware is overwritten by the name from the project and does not therefore have to be adapted.

How to display the IP address and name

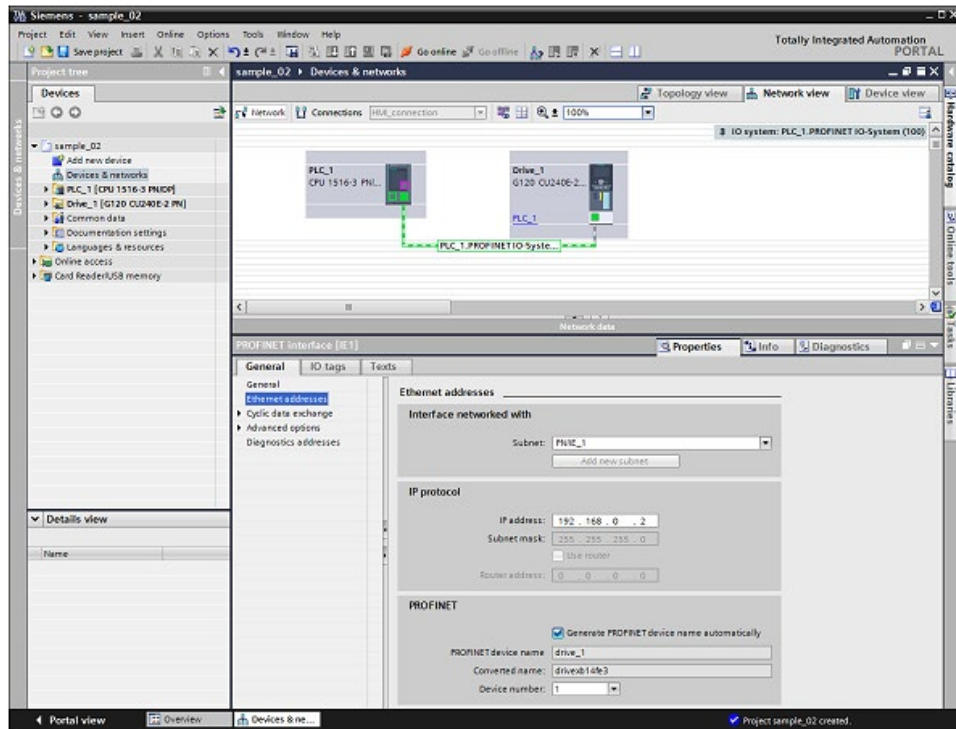
1. In the "Network view", click the Ethernet port used for the controller. Additional information is displayed in the "Properties" tab of the inspector window.



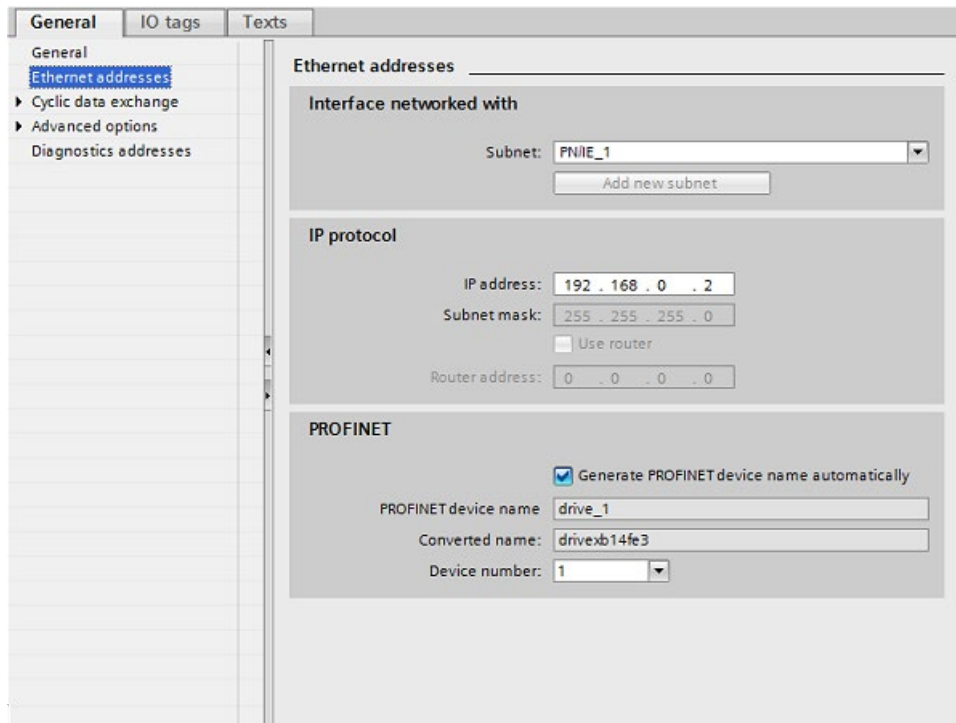
2. Enter the IP address, the subnet mask, and where applicable the name under "Ethernet addresses". You can have the name generated automatically or enter a new one.



3. Click also on the Ethernet port used for the drive.



4. Enter the Ethernet address and where applicable the name.



The hardware configuration is complete. You can load the project into the target system following the commissioning.

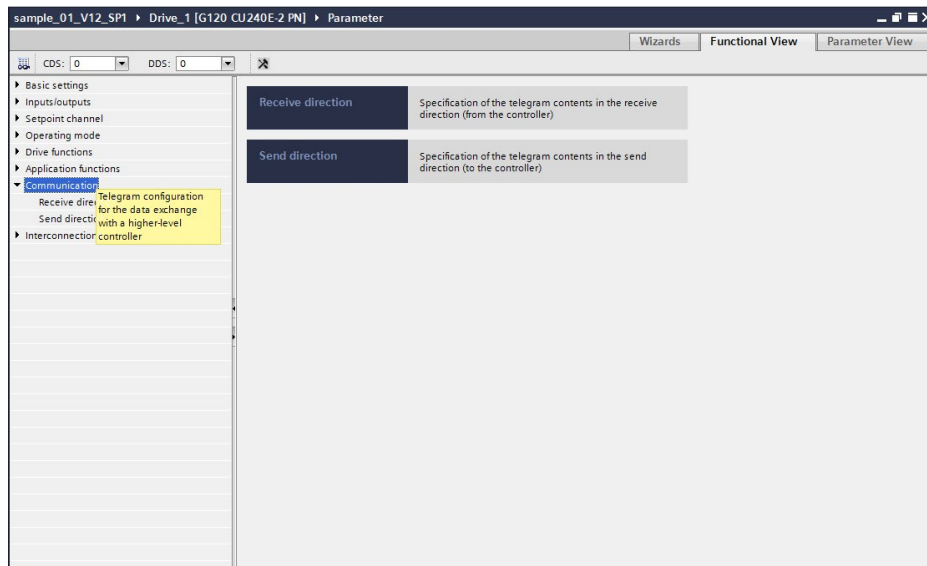
8.8 Configuring a telegram

Telegram configuration

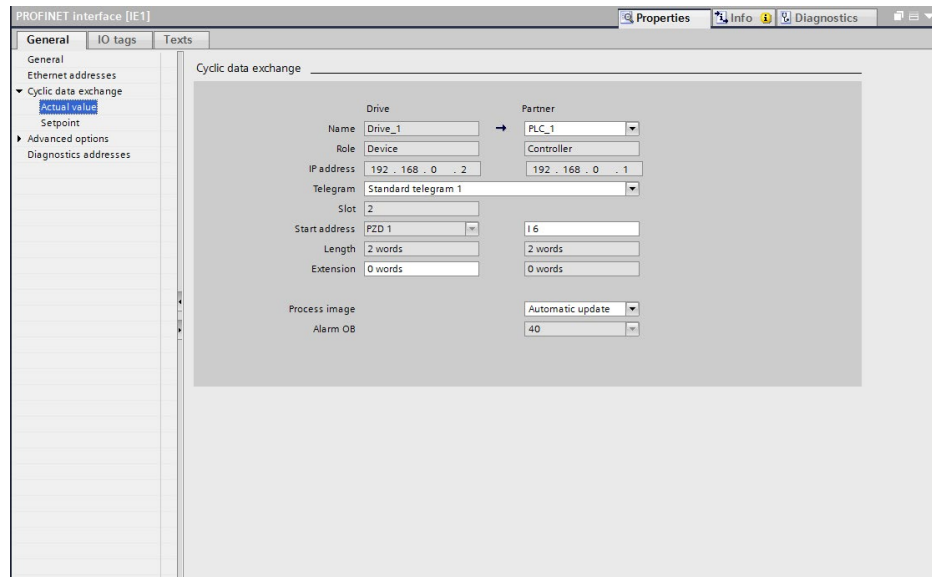
A telegram must be configured for the cyclic communication between the drive and the controller. You have already selected a telegram in the wizard during the commissioning of the drive. Telegram 1 was used in the example. You can configure and also change the telegram subsequently.

Proceed as follows:

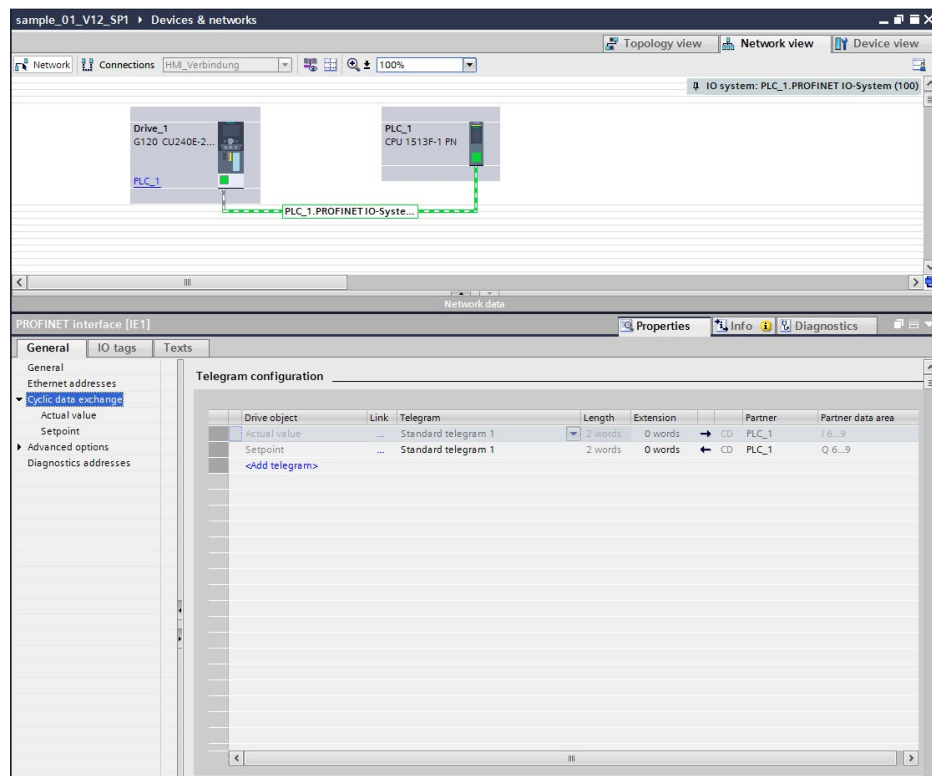
1. In the parameter view of the drive, you can display and configure the address ranges of the telegram in the "Communications" screen form. This is separated according to receive and send direction. It is recommended that you use the default settings.



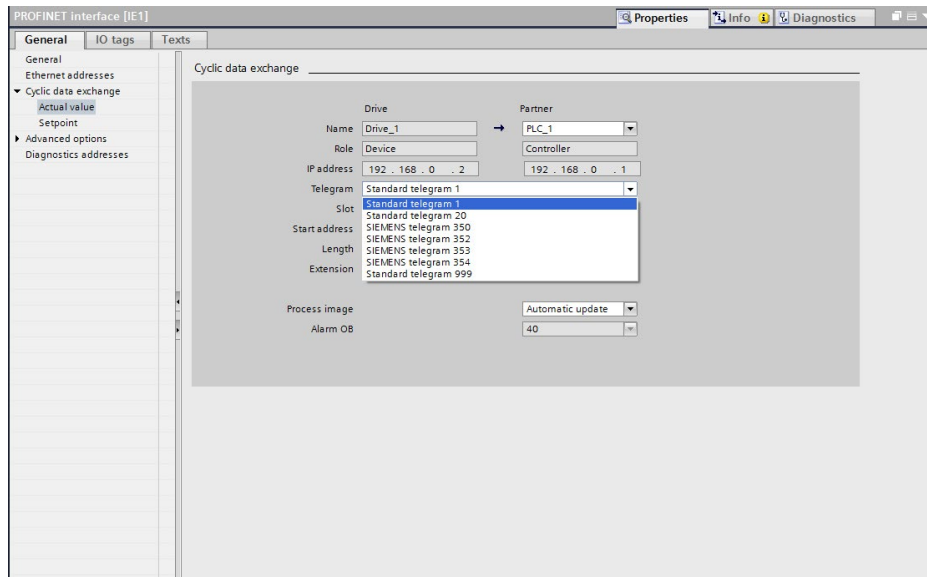
- Click the button for the telegram configuration. The cyclic data exchange as well as the telegram configuration for the actual values and setpoints are displayed in the "Properties" tab of the inspector window.



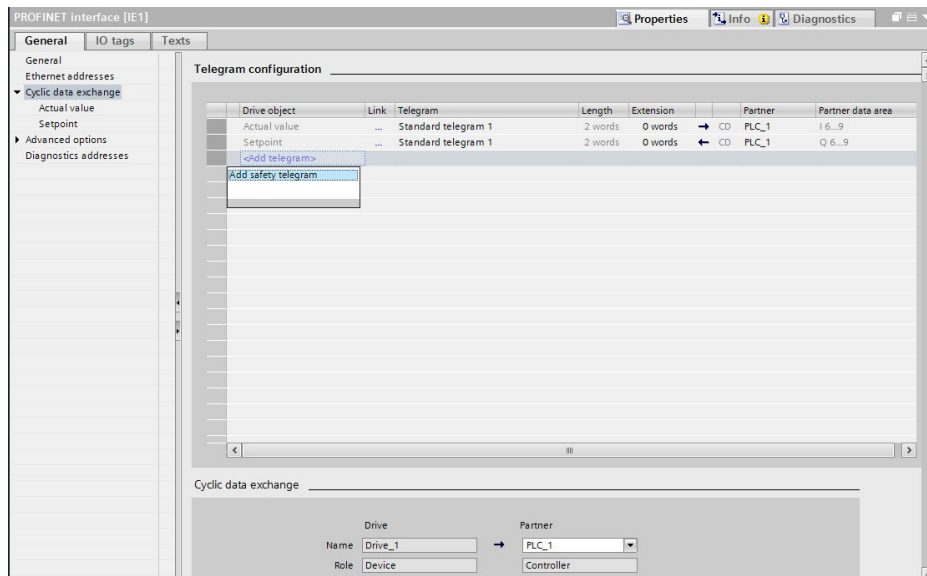
- You can also open the telegram configuration from the network or device view. Click the Ethernet port used for the drive in these views. The cyclic data exchange is displayed in the "Properties" tab of the inspector window.



- You can change or configure the telegram in the "Cyclic data exchange", "Actual value" and "Setpoint" screen forms.



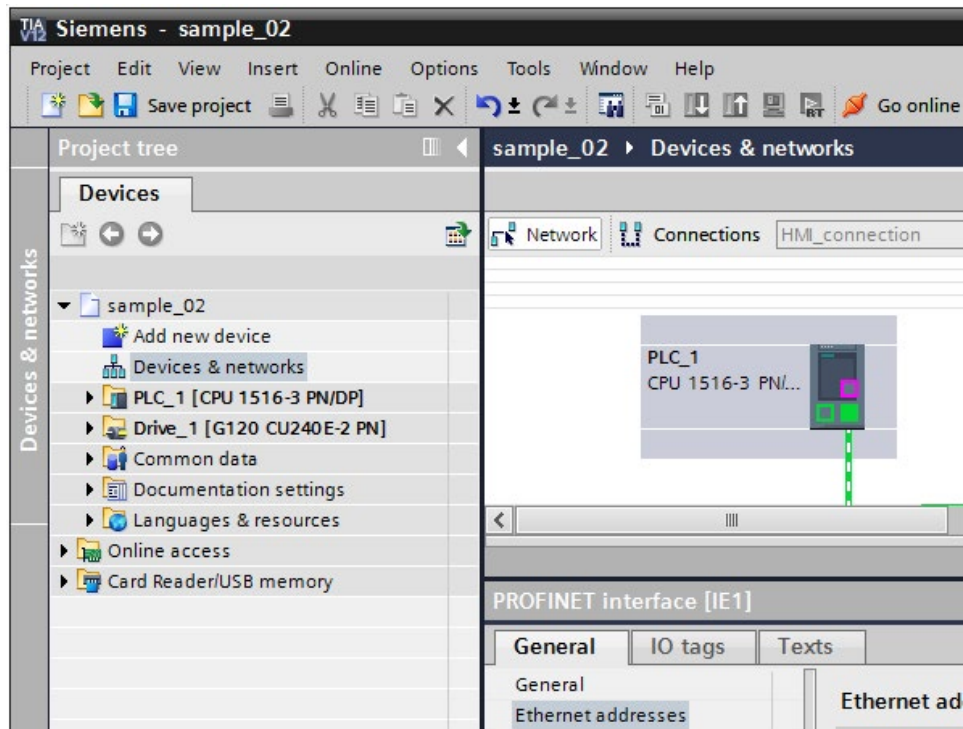
- If you want to configure a drive with safety functionality, enter the safety telegram at "Cyclic data exchange".



8.9 Saving and loading into the target system

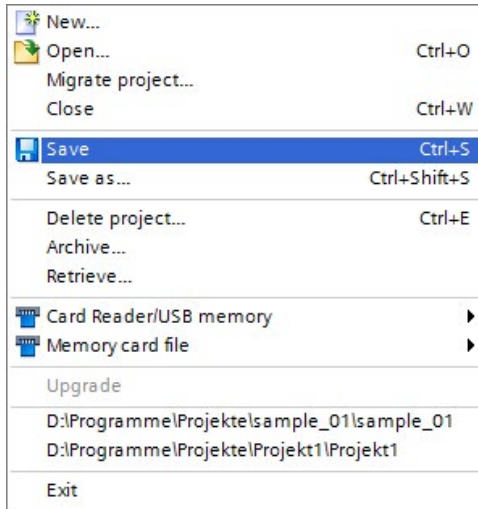
Saving and loading into the target system

After the hardware configuration you have completed the online basic commissioning for the drive. The overall project now just needs to be saved, compiled, and loaded into the target system.

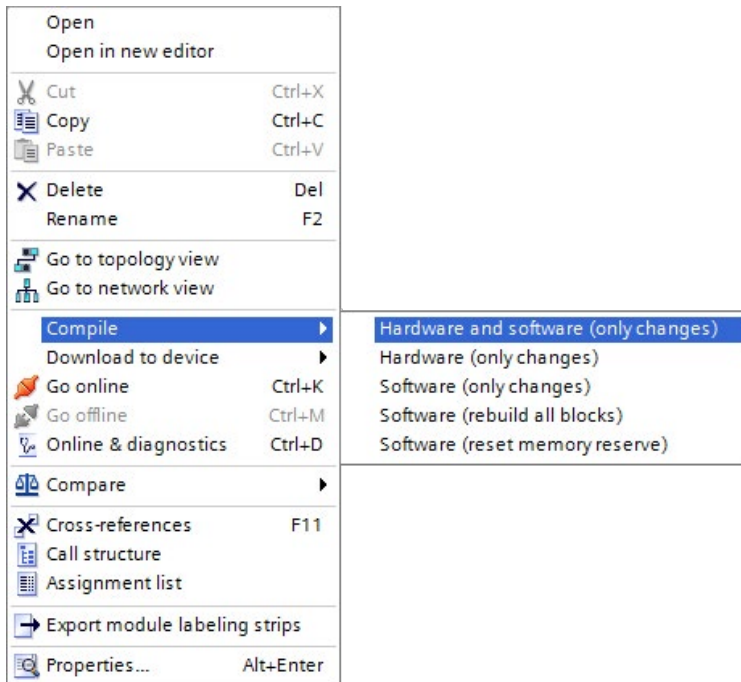


Follow the steps below

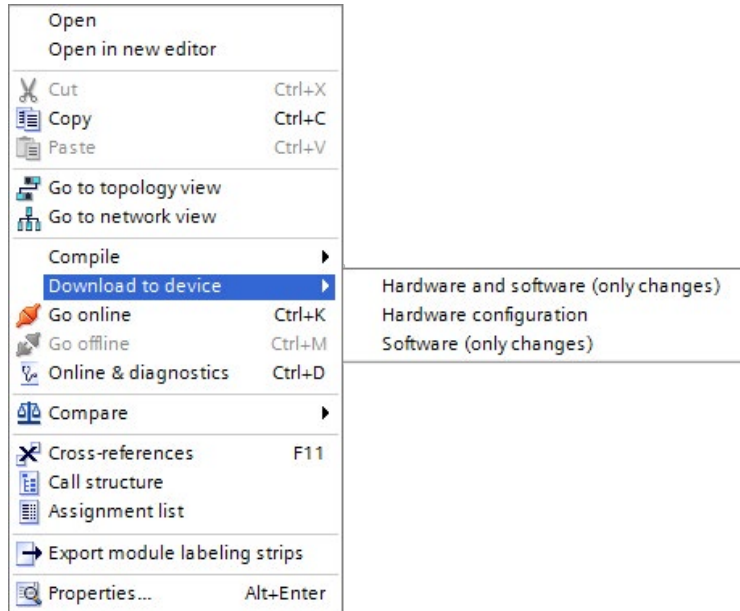
- 1. Save the current project via "Project" > "Save."



- 2. Compile the current settings to the devices via the shortcut menu.



3. Load the data into the devices after saving. Select "Download to device" > "Hardware and software" in each case in the shortcut menu. For this the TIA Portal Online must be connected with the devices and the relevant online access configured, e.g. USB or PROFINET.



This completes the configuration.

Safety Integrated

9.1 Safety Integrated overview

Safety Integrated



The safety functions integrated in the SINAMICS inverters can be parameterized intuitively using graphic screens with Startdrive that is part of TIA Portal. Most drives of the G120 family are equipped with the "Safe torque off (STO)" drive-autonomous safety function. This function is also available for Standard Control Units (without F suffix). The extended functions make available further safety functions, such as Safe Stop 1 (SS1) and Safely-limited Speed (SLS).

A brief overview of safety configuring in Startdrive follows.

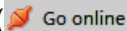
9.2 Activating the safety commissioning mode


Activating the commissioning mode

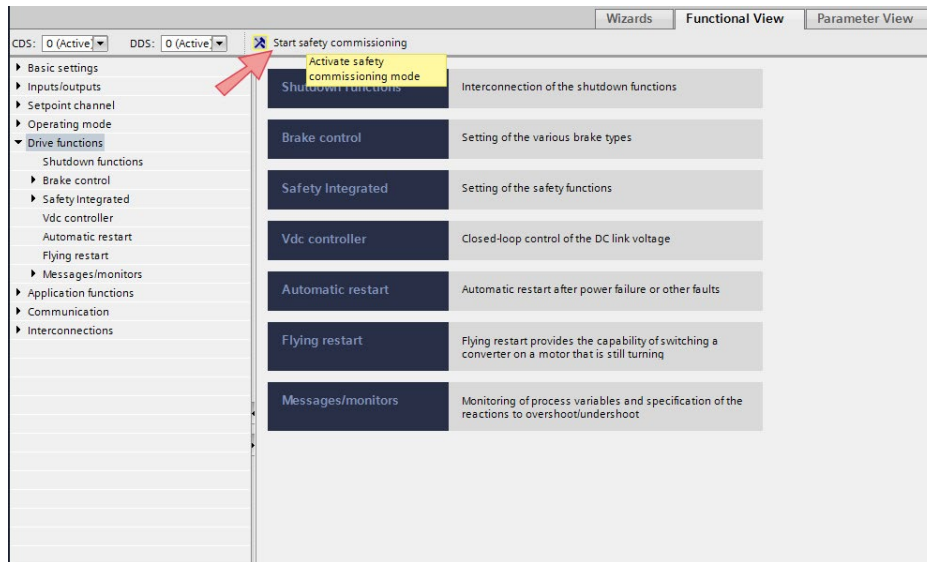
Safety Integrated can be commissioned offline in the project or online directly on the drive. For the offline commissioning, you must explicitly activate the safety functions after the download. In the example, you perform both an online and an offline commissioning.

How to activate the safety commissioning mode for online commissioning

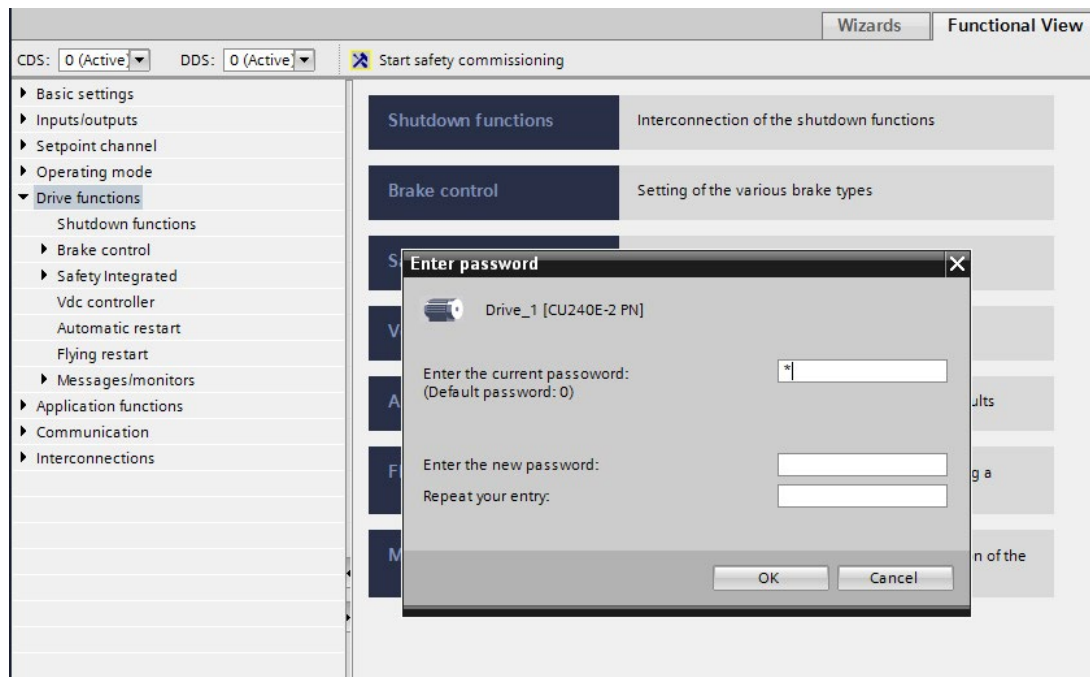
For the online commissioning, you have already configured the drive and performed a first commissioning.

1. Double-click "Parameters" below the drive device in the project navigation. The parameters will be displayed in the working area.
2. Switch to the "Function view" tab.
3. Connect Startdrive online with the drive () **Go online**).

- 4. Activate the commissioning mode of the safety functions by clicking the  Start safety commissioning "Activate safety commissioning mode" button.



- 5. The safety functions are protected against unauthorized changes by a password. Enter a new password and confirm the dialog. Only with this password can the safety parameterization be re-edited.



The safety commissioning can now be performed. In the next step, select the safety functionality.

9.3 Selecting the safety functionality in the Startdrive

Safety functionality

To edit the safety functions, you must first select the appropriate safety functionality.

1. Click "Select safety functionality" below "Drive functions" > "Safety Integrated" in the "Function view" tab.
2. In the opened window, you can choose between "Basic functions" and "Extended functions" depending on the type of the drive device.

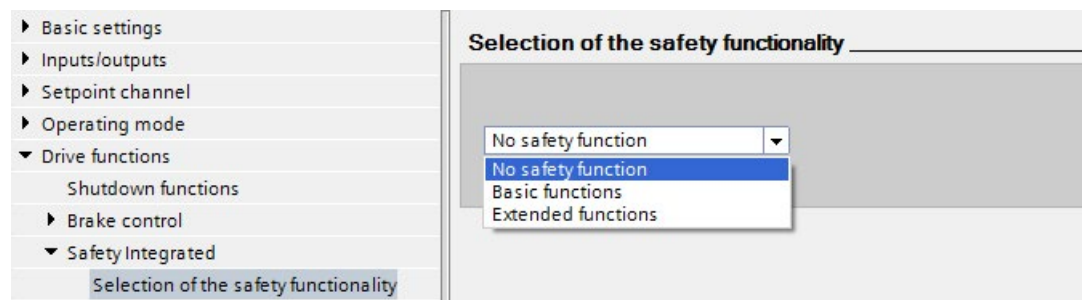


Figure 9-1 Selecting the safety functionality

3. After selecting the safety functionality, the possible safety functions are displayed in the secondary navigation and in the project window where they can be configured.

4. This is the STO (Safe Torque Off) safety function for the basic functions.

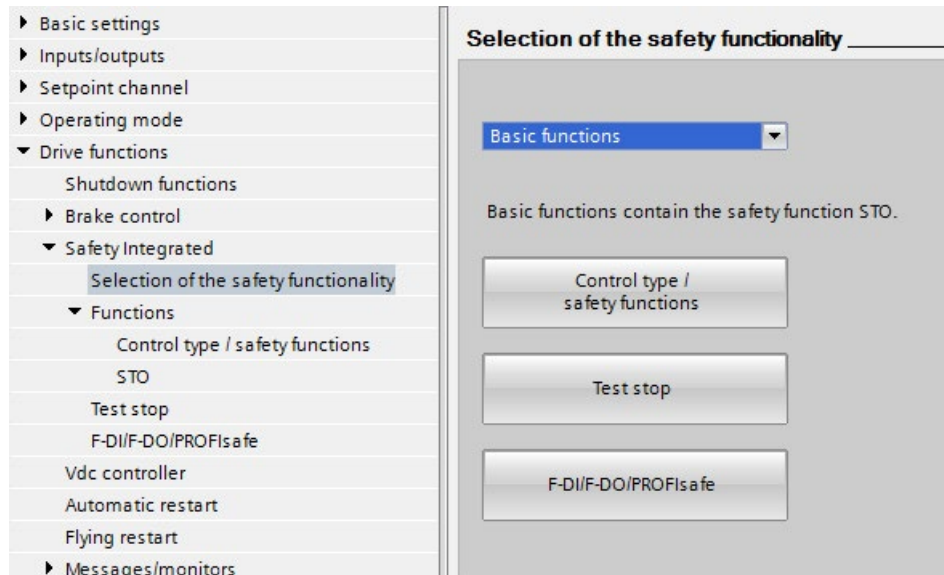


Figure 9-2 Safety functionality basic functions

5. The extended functions also contain the Safe Stop 1 (SS1), Safely-limited Speed (SLS), Safe Direction (SDI) and Safe Speed Monitor (SSM) safety functions.

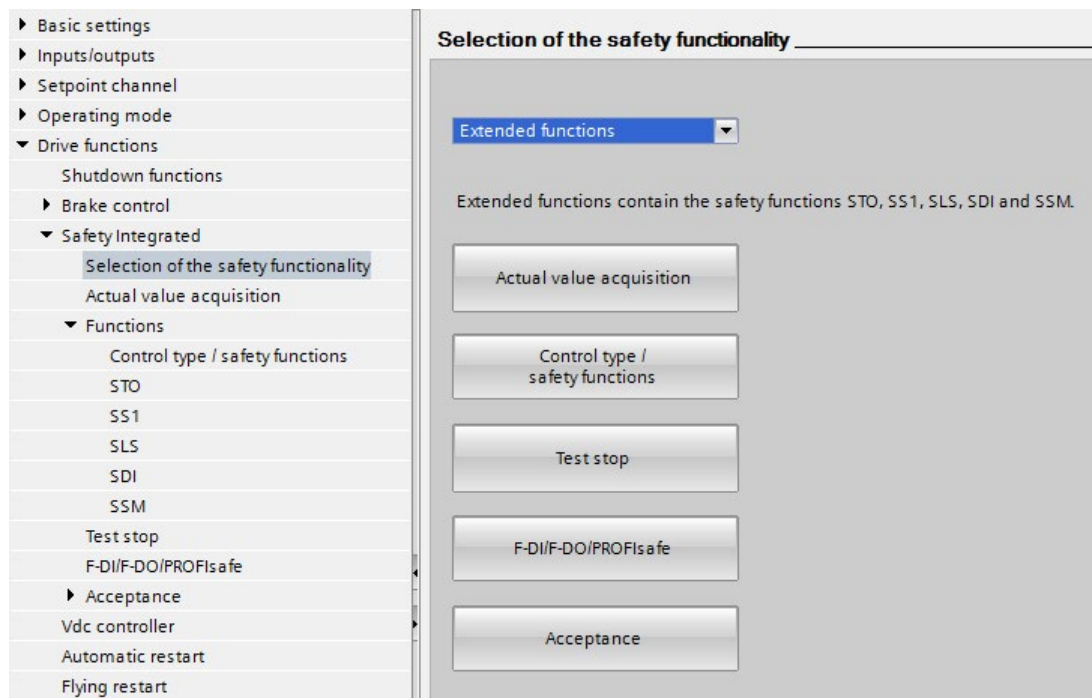


Figure 9-3 Safety functionality extended functions

The following example illustrates the commissioning of a safety function of the basic functions and one of the extended functions.

9.4 Commissioning the basic functions

9.4.1 Commissioning the Safety Integrated basic functions

Basic functions



Based on the example of a G120 CU240E-2 PN-F, commission the Safe Torque Off (STO) by means of terminals. A drive device with active STO function prevents the inadvertent starting of machine components. The safety commissioning is performed online.

Note

Prior to the safety commissioning, the drive device must be connected online with the Startdrive and the safety commissioning mode activated.

9.4.2 Commissioning basic functions with STO

STO commissioning

As first step, activate the safety functionality and then configure the Safe Torque Off (STO) safety function. The safety commissioning is performed online directly on the drive.

1. Select the "Basic functions" safety functionality in the "Function view" tab.
2. To configure the basic functions, you can display the individual screens directly via the buttons or the secondary navigation.

Note

For a structured commissioning, you should process the screens via the secondary navigation sequentially from top to bottom.

3. Click "Control type / safety functions" in the secondary navigation.

- In the opened screen, select "Via terminals" as control type.

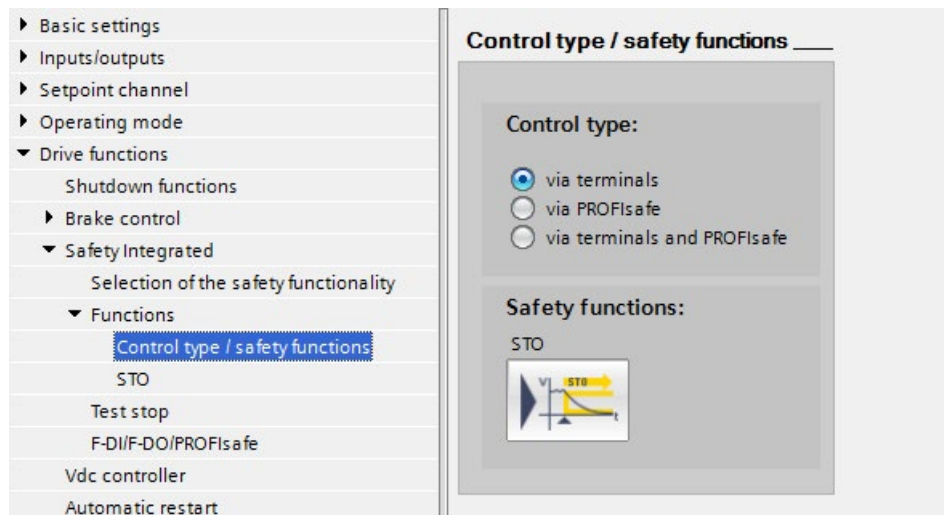


Figure 9-4 Selecting via terminals control type

- Click "STO" in the secondary navigation. Because the Control Unit input is permanently wired with the emergency stop, you do not need to make any further settings. If, for example, you want to interconnect the emergency stop with a signal lamp, you can use the "STO active" output.

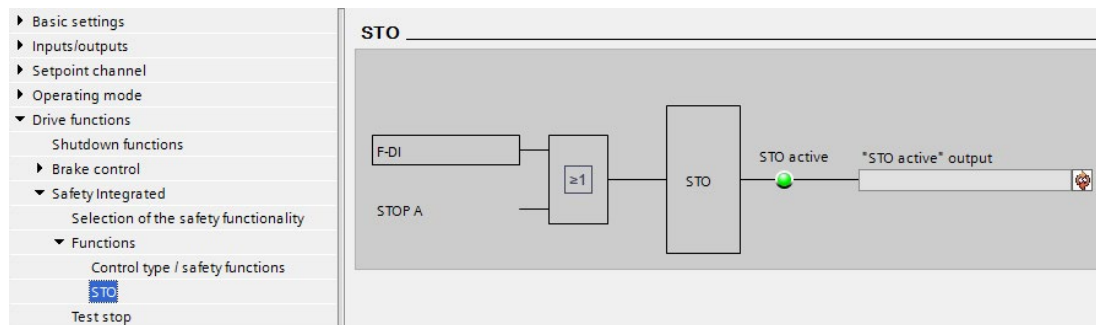


Figure 9-5 Configuring the STO basic function

This completes the configuration of STO. In the next step, configure the test stop.

9.4.3 Configuring test stop

Test stop

The test stop of the basic functions is a self-test of the inverter in order to test the circuits for the safe torque off. The test stop is restarted after each selection of the STO function and after the connection of the supply voltage (switch on). A time block monitors whether the test stop is performed regularly.

1. Click "Test stop" in the secondary navigation.
2. In the opened screen, enter the duration of the time interval in which the test stop must be performed.

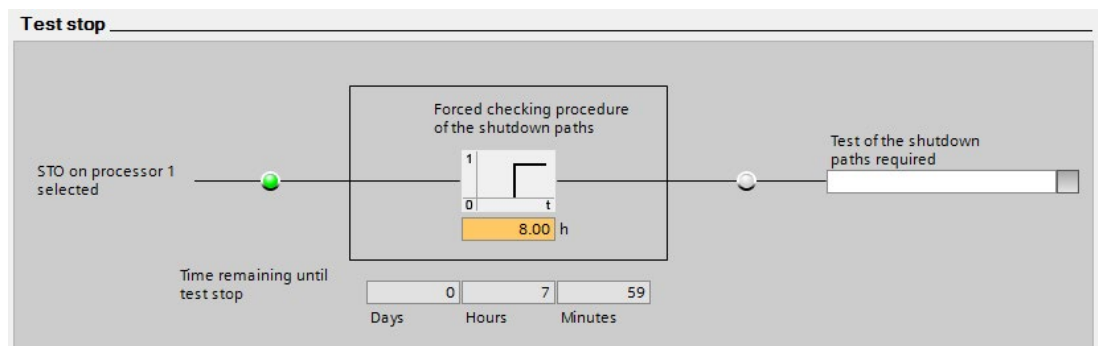


Figure 9-6 Configuring the test stop basic functions

3. You can specify the time interval. The permitted maximum value is 8760 hours (one year) that is normally determined with a risk analysis. Eight hours are entered as default setting. Alarm A1699 (test stop required) is issued when the time interval expires.

Note

The remaining time until the occurrence of the alarm A1699 is also displayed in the screen. This timer is reset for each test stop to the previously configured value.

You have now configured the test stop of the basic functions.

9.4.4 Configuring the discrepancy time and the filter time

Discrepancy/filter time

If Safety Integrated is active, the inverter checks whether the signals at both inputs always have the same signal state. Because of the technical characteristics of the sensors, brief discrepancies or signal changes between the two input signals that are not safety relevant can occur. A fail-safe logic with safe outputs connected with the SINAMICS G120 can also be used for the activation. Some such fail-safe outputs provide test pulses that can be suppressed by the filter. The discrepancy or filter time can be used to prevent a faulty initiation or discrepancy error because of transient different signal levels of the safety function.

1. Click "F-DI/F-DO/PROFIsafe" in the secondary navigation.
2. You can set the discrepancy time and the input filter time in the displayed screen. Adapt these values to the connected sensors and to the duration of the test pulses for the deployed fail-safe outputs.

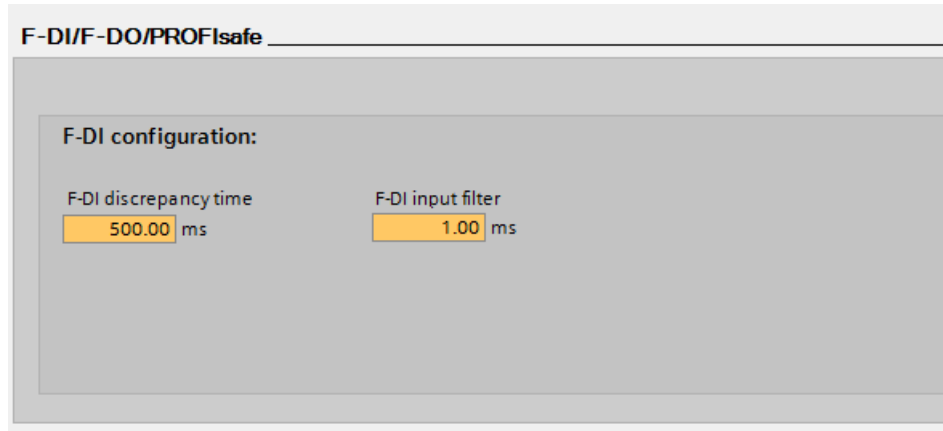



Figure 9-7 Configuring the discrepancy time and filter time basic functions

The safety commissioning is completed in the next step.

9.4.5 Completing the safety commissioning

Safety commissioning completion

To complete the commissioning, the safety parameterization must be copied to the ROM of the drive and into the project.

1. Click the  End safety commissioning button to exit the safety commissioning mode.
2. Click "Yes" to confirm the opened dialog. The drive parameters are copied from RAM to ROM.

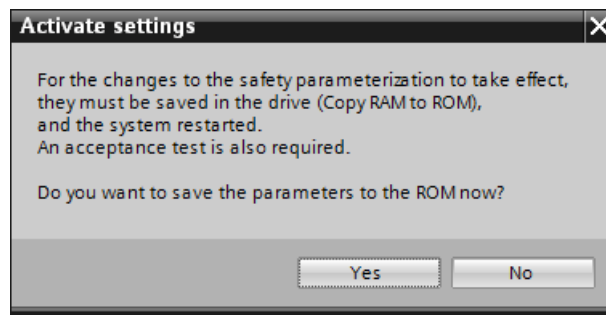


Figure 9-8 Safety commissioning: Copy RAM to ROM

3. Close the online connection to the drive device.
4. Click the "Load from device (software)" button in the toolbar to save the safety parameterization in the Startdrive project.
5. Switch the drive device Off and On so that the safety commissioning in the drive device acts.

This completes the safety commissioning.

9.5 Commissioning extended functions

9.5.1 Commissioning Safety Integrated extended functions

Extended functions



Based on the example of a G120 CU240E-2 PN-F drive device and a higher-level SIMATIC S7-1500 CPU 1516F-3 PN/DP controller, commission the Safely-limited Speed (SLS) safety function by means of PROFIsafe.

You have already included the controller and the drive device, and configured the communication in the project. The safety commissioning is performed offline in the Startdrive, and after the download safety is activated in the drive device.

9.5.2 Configuring SLS

Safety function and actual value acquisition

As first step, activate the safety functionality and then configure the actual value acquisition.

1. Select the "Extended functions" safety functionality in the "Function view" tab.
2. To configure the extended functions, you can display the individual screens directly via the buttons or the secondary navigation.

Note

For a structured commissioning, you should process the screens via the secondary navigation sequentially from top to bottom.

3. Click "Actual value acquisition" in the secondary navigation.
4. For safety functions without encoders, the pole pair number of the motor is included in the conversion from the motor side to the load side. You must first configure them.

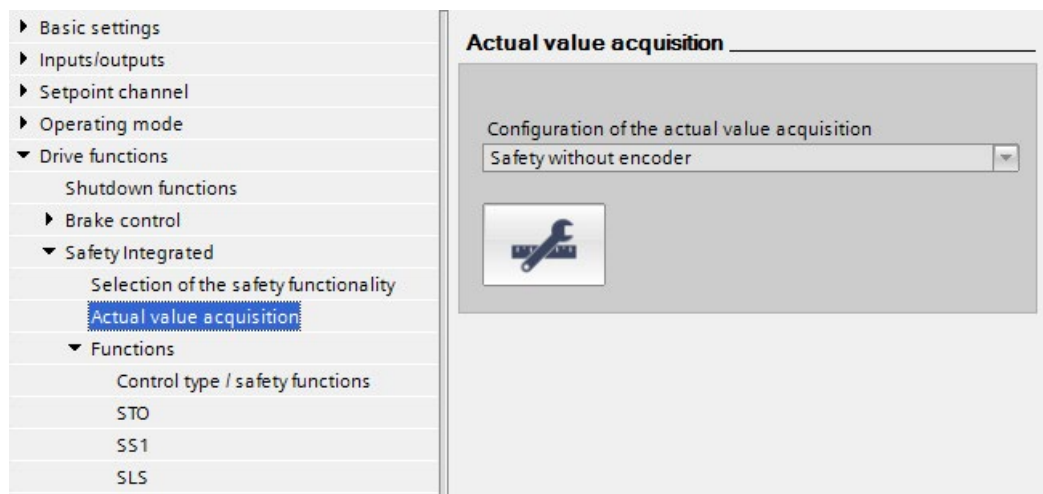


Figure 9-9 Actual value acquisition extended functions

5. Click the "Actual value acquisition configuration" button.



- The pole pair number of the motor is displayed grayed-out in the opened dialog. This value must be considered for the input of the gear ratio. No mechanical gearbox is used in the example. Consequently, the gear ratio consists only of the pole number (2 in the example).

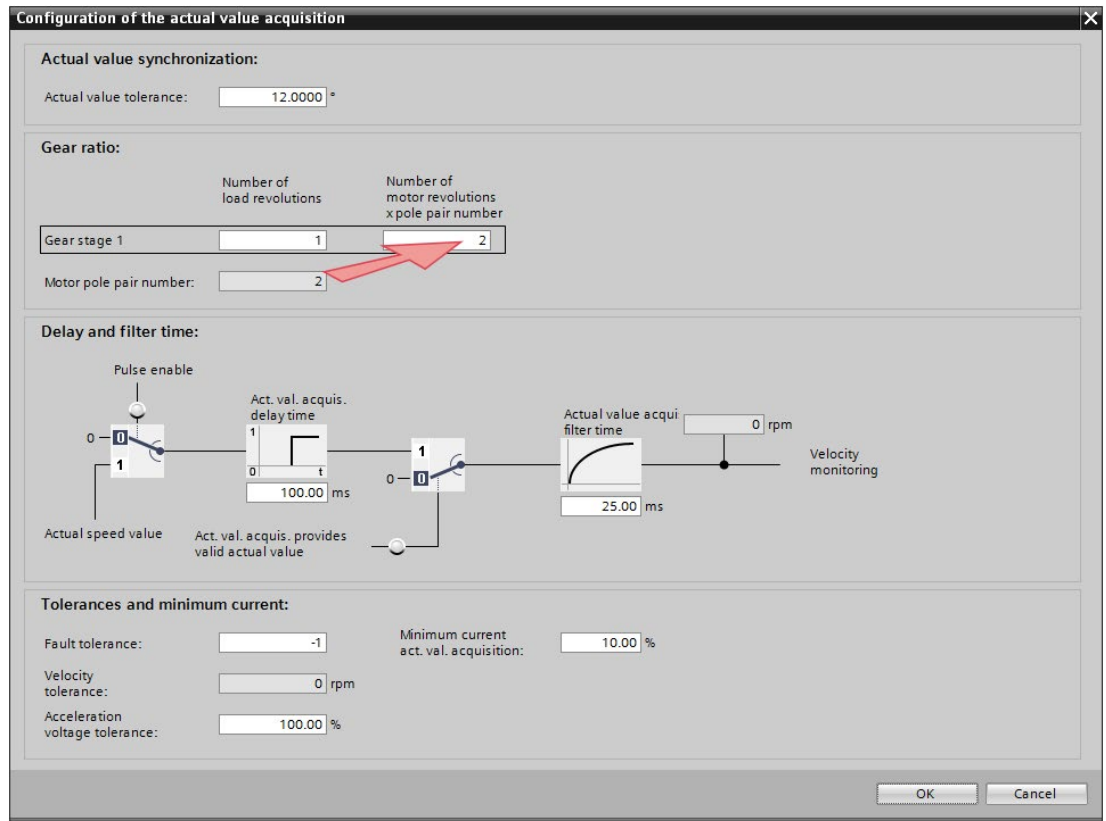


Figure 9-10 Actual value acquisition pole pair number configuration extended functions

- Click "OK" to confirm.

This completes the configuration of the actual value acquisition. In the next step, configure the safety function.

9.5.3 Configuring the control type and the SLS

Configuring the control type and the SLS

Now configure the control type and the SLS safety function.

- Click "Control type / safety functions" below "Functions" in the secondary navigation.
- Select "via PROFIsafe" as control type. Insert the PROFIsafe telegram later during the safety commissioning.

- 3. You must enable the associated SLS safety function. Select "Enable" in the selection list in front of the required safety function. The other safety functions also enabled but not deployed are deactivated later in the safety program.

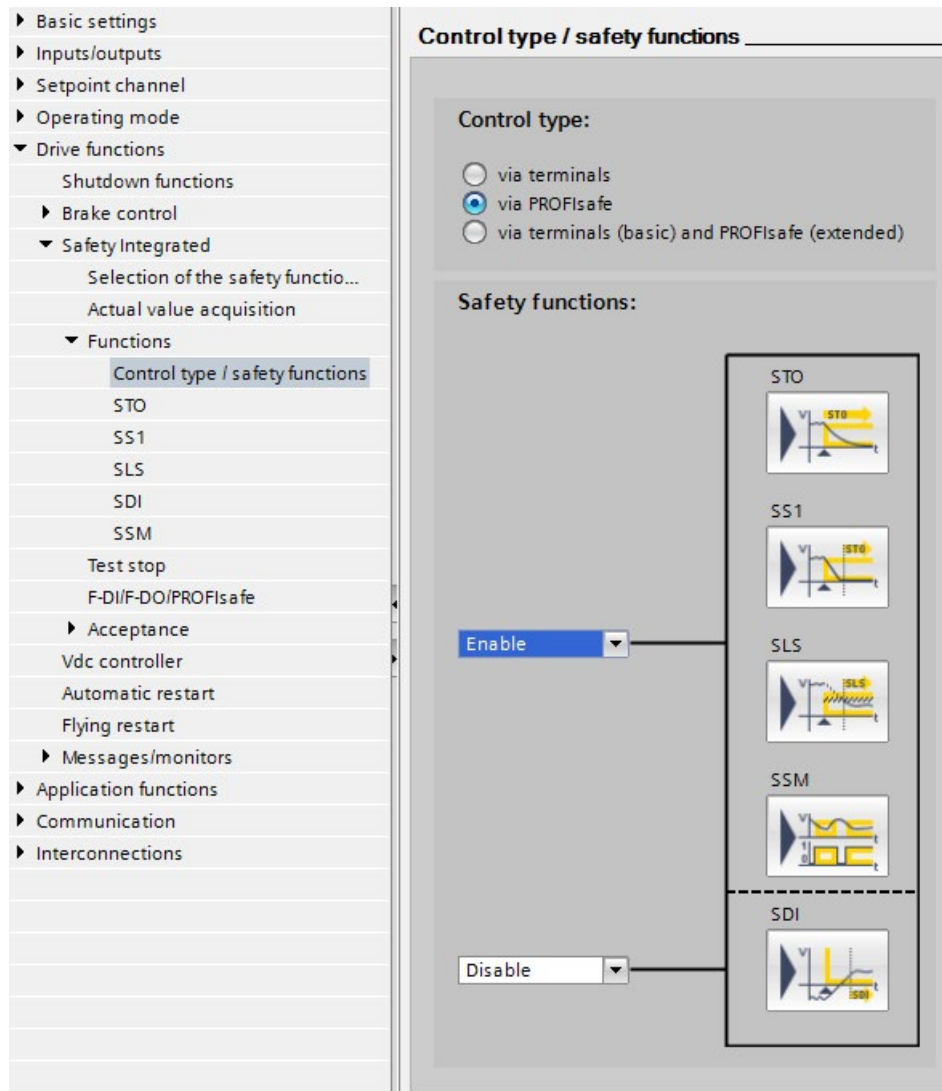


Figure 9-11 Extended functions: Enable PROFIsafe control type and safety function

- 4. Click "SLS" in the secondary navigation.

5. Select the monitoring mode. In the example, safety without encoder with a braking ramp ("with SBR" in the example) is selected.
6. For SLS via PROFIsafe, you can select as many as four monitoring levels. Only level 1 is used in the example. Enter a value for the maximum speed (500 rpm in the example) and the "stop response" when the monitoring is triggered (STOP A in the example). Leave the other parameters at their standard values.

Parameter	Level 1	Level 2	Level 3	Level 4
n_max in rpm	500.00	2000.00		
Stop response	[0] STOP A	[0] STOP A		[0]

Figure 9-12 Extended functions: Configure SLS

This completes the configuration of SLS. In the next step, configure the test stop.

9.5.4 Configuring a test stop (forced checking procedure)

Test stop

The test stop (forced checking procedure) of the extended functions is a self test of the inverter that tests its circuits for monitoring the speed and for the safe torque shutdown. A time block monitors whether the test stop is performed regularly. The test stop is started with a freely selected signal.

1. Click "Test stop" in the secondary navigation.
2. In the opened screen, use "Test stop selection" to interconnect a signal or a bit of a control word in order to start the test stop. In the example, digital input DI1 (r722.1) is interconnected.
3. You can specify the time interval. The permitted maximum value is 8760 hours (one year) that is normally determined with a risk analysis. Eight hours are entered as default setting. Alarm A1699 (test stop required) is issued when the time interval expires.

Note

The test stop of the extended functions includes the test of the basic functions (STO). Consequently, you should set the two timers to the same value.

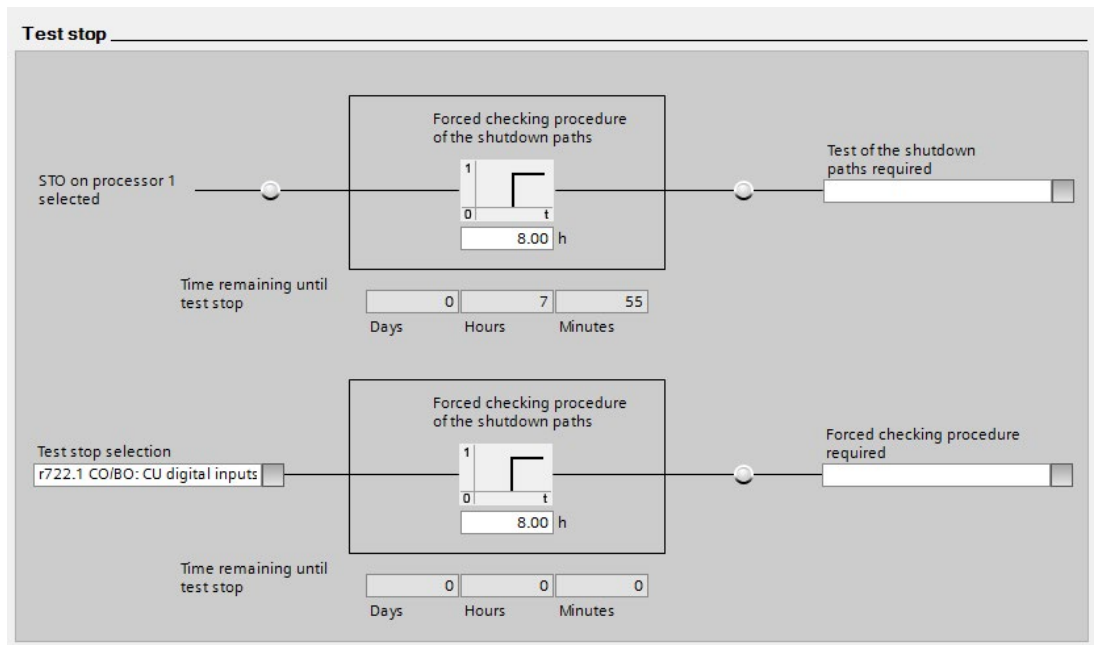


Figure 9-13 Extended functions: Configure test stop

Leave the other parameters at their default settings. You have now configured the test stop of the extended functions.

9.5.5 Configuring PROFIsafe

PROFIsafe

In the example, Safety Integrated via PROFIsafe is configured. For the fail-safe communication between the controller and the drive, a PROFIsafe telegram must be added and the PROFIsafe address entered.

1. Click "F-DI/F-DO/PROFIsafe" in the secondary navigation.
2. The PROFIsafe address of the drive is displayed in the opened screen (0x5 in the example). You can change it offline. The PROFIsafe address corresponds to the F address (F_Dest_Add).

Note

The PROFIsafe address can be changed in this screen only as of SINAMICS V4.7 or Startdrive V13 SP1. To change the PROFIsafe address for earlier versions, use the telegram configuration (F address) in the details display.

3. Click the "Telegram configuration" button to open the telegram configuration in the details view. "Cyclic data exchange" is displayed in the "Properties" tab in the details view footer.
4. Click <Add telegram> below the actual value and the setpoint in the table, and select "Add safety telegram" in the opened context menu.

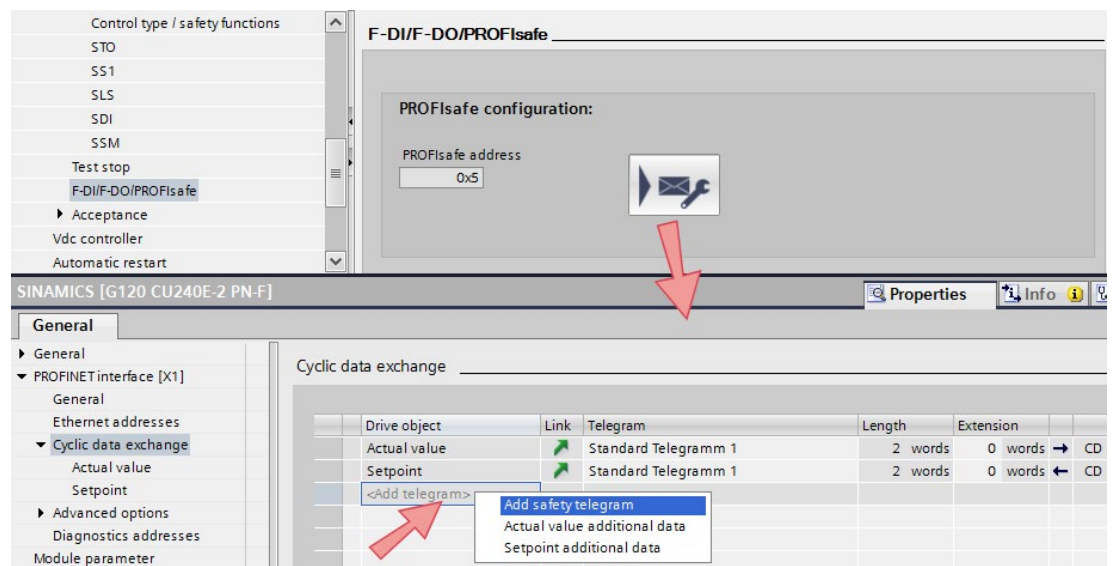


Figure 9-14 Configuring a PROFIsafe telegram

5. The PROFIsafe telegram 30 is added.

Cyclic data exchange								
	Drive object	Link	Telegram	Length	Extension		Partner	Partner data area
	Safety actual values	➔	PROFIsafe Telegramm 30	6 bytes	0 bytes	➔ F-CD	PLC_1	I 0...5
	Safety setpoints	➔	PROFIsafe Telegramm 30	6 bytes	0 bytes	← F-CD	PLC_1	Q 0...5
	Actual value	➔	Standard Telegramm 1	2 words	0 words	➔ CD	PLC_1	I 7...10
	Setpoint	➔	Standard Telegramm 1	2 words	0 words	← CD	PLC_1	Q 7...10
	<Add telegram>							

Figure 9-15 PROFIsafe telegram 30

6. Also check the "F address" in the "Safety setpoints" and "Safety actual values" fields in the same screen. It is used for the safety configuring and corresponds to the PROFIsafe address for the safety commissioning. Address 0x5 is used in the example.

> Safety actual values

Drive	Partner
Name: SINAMICS	PLC_1
Role: Device	Controller
IP address: 192 . 168 . 0 . 2	192 . 168 . 0 . 1
Telegram: PROFIsafe Telegramm 30	1
F-address: 5	
Slot: 2	
Start address: PZD 1	I 1
Length: 6 bytes	6 bytes
Extension: 0 bytes	0 bytes
<input type="checkbox"/> Manual assignment of the F-monitoring time	
F-monitoring time: 150	
<input type="checkbox"/> F-I/O DB manual number assignment	
F-I/O DB number: 30002	
F-I/O DB name: F00001_Safety_setpoints_Safety_	

> Safety setpoints

Drive	Partner
Name: SINAMICS	PLC_1
Role: Device	Controller
IP address: 192 . 168 . 0 . 2	192 . 168 . 0 . 1
Telegram: PROFIsafe Telegramm 30	1
F-address: 5	
Slot: 2	
Start address: PZD 1	Q 1
Length: 6 bytes	6 bytes
Extension: 0 bytes	0 bytes


Figure 9-16 Configuring the PROFIsafe address (F address)

The PROFIsafe telegram is now configured. The safety commissioning is completed in the next step.

9.5.6 Completing the safety commissioning

Activating safety

To complete the commissioning, the safety parameterization must be loaded into the drive device and activated.

1. Save the project and select "Load to device" in the context menu of the drive device.
2. Connect Startdrive online to the drive unit ( Go online).
3. Activate the commissioning mode of the safety functions.
4. A password protects the safety functions against unauthorized changes. Enter a new password and confirm the dialog.

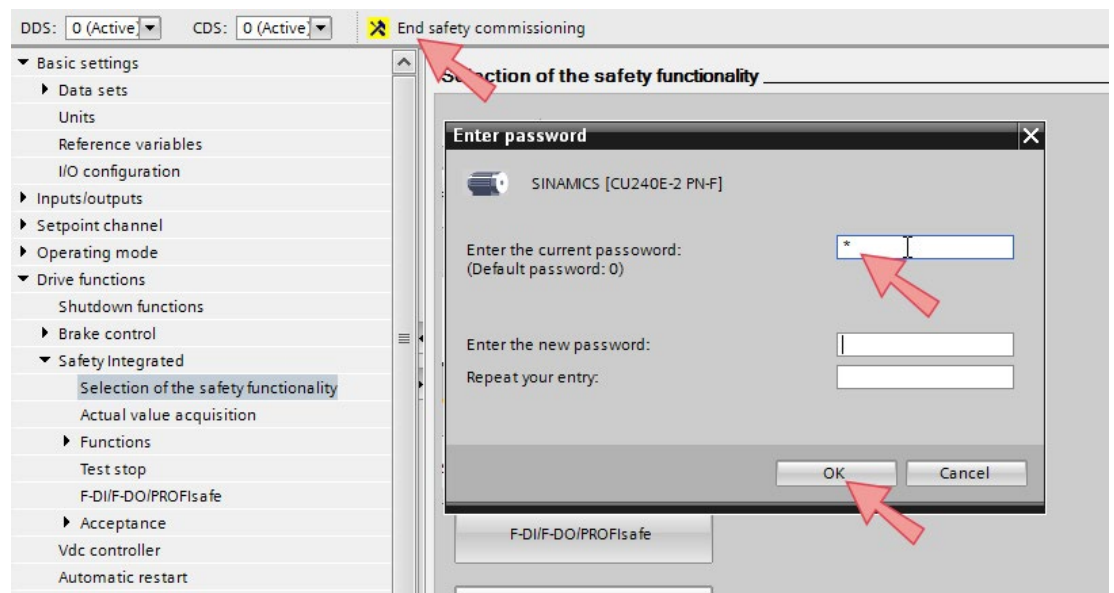



Figure 9-17 Activating Safety Integrated in the drive

5. Click the  End safety commissioning button to exit the safety commissioning mode.
6. Click "Yes" to confirm the opened dialog. The drive parameters are copied from RAM to ROM.
7. Close the online connection to the drive device.
8. Click "Load from device (software)" in the context menu of the drive device in the project navigation to save the safety parameterization in the Startdrive project.
9. Switch the drive device Off and On so that the safety commissioning in the drive device acts.

This completes the safety commissioning.

9.5.7 Safety program and F-runtime group

Security program

To use the safety functions of the SINAMICS drive device in conjunction with an F-CPU, you must create the safety programs. For each F-peripheral of the SIMATIC S7-1500F CPU, an F-block with the associated instance DB and an F-runtime group are created automatically during the configuring so that you can begin immediately with programming the safety program.

To display the F-runtime group, proceed as follows:

1. Click "Safety Administration" below the SIMATIC CPU in the project navigation. In the working area, you can use the secondary navigation to access the individual functions of the Safety Administration.

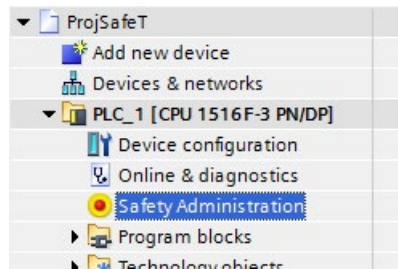


Figure 9-18 Safety Administration for SIMATIC CPU

- Click "F-runtime group" to display the automatically created F-blocks. The F-peripheral DB contains tags that you can evaluate in the safety program. The F-runtime group consists of an F-OB that calls the main safety block in which the safety functions are programmed.

This example does not require any change to be made to the F-runtime group.

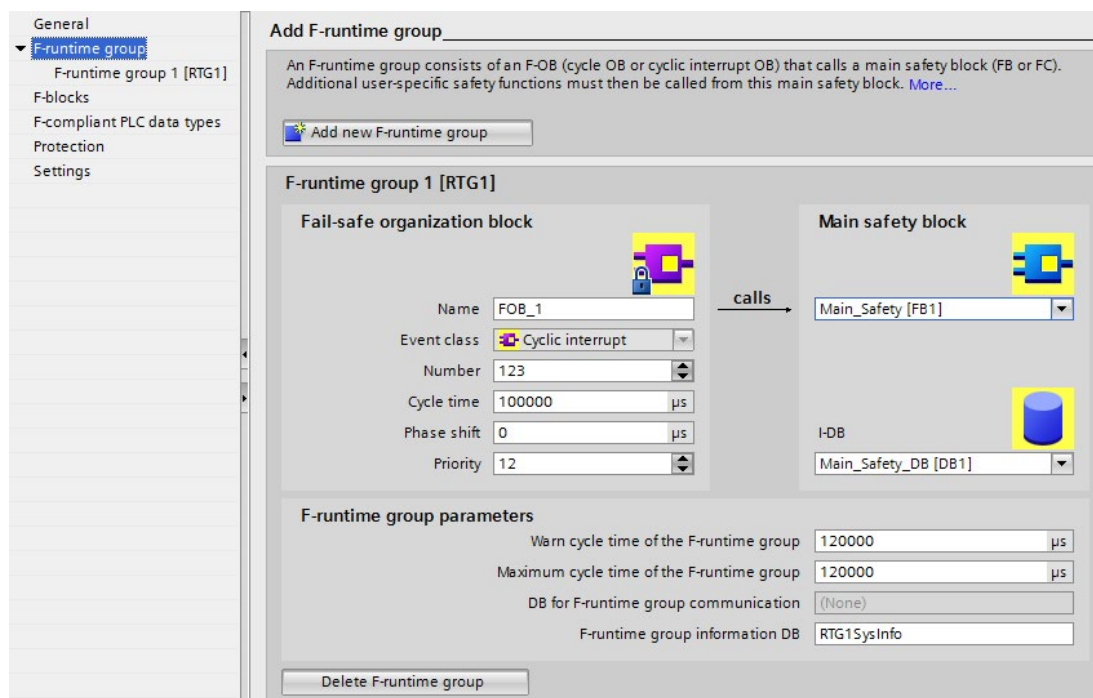


Figure 9-19 F-runtime group for safety programs

In the next step, program the main safety block.

9.5.8 Programming the main safety block

Main safety block

In the main safety block, the F-peripheral is acknowledged and re-integrated concurrently in the F-runtime group. The superfluous safety functions are deselected and the deployed safety functions are selected. In the example, the main safety block is programmed in F-FUP.

Note

Further information about the general programming and about the F-peripheral is contained in the online help of the TIA Portal.

1. Create in the project navigation under "PLC tags" a new tag table with the following tags:
 - STO (%Q1.0)
 - SS1 (%Q1.1)
 - SLS (%Q1.4)
 - ACK (%Q1.7)

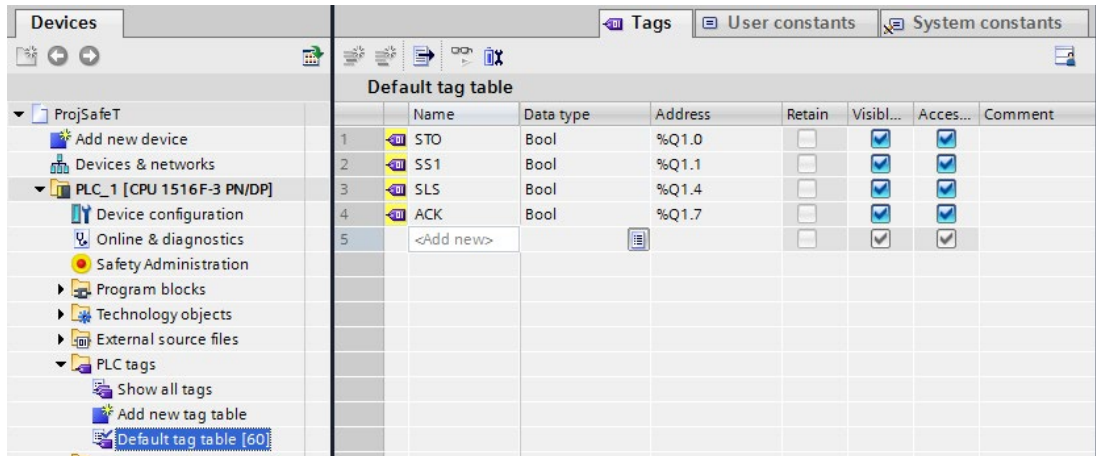


Figure 9-20 Creating tags for the safety program

Note

The addresses of the tags result from the PROFIsafe control word and are used for the selection or deselection of the safety functions. To improve clarity, the tag names correspond to the name of the safety function.

Control word															
Byte 1								Byte 0							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
		SDI neg.	SDI pos.		SLS-Limit Selection			ACK			SLS			SS1	STO
Status word															
Byte 1								Byte 0							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Status SSM		SDI neg.	SDI pos.		active SLS-Limit			Int. event			SLS active			SS1 active	Power removed

Figure 9-21 PROFIsafe control word 1

2. Click "Main_Safety [FB1]" below the "Program blocks" of the project navigation. The program block opens in the editor.

- Click the "ACK_GL" block below the "Safety functions" in the "Basic instructions" instruction window and drag-and-drop it to the program editor. A positive edge must be present as user acknowledgment at the block input.

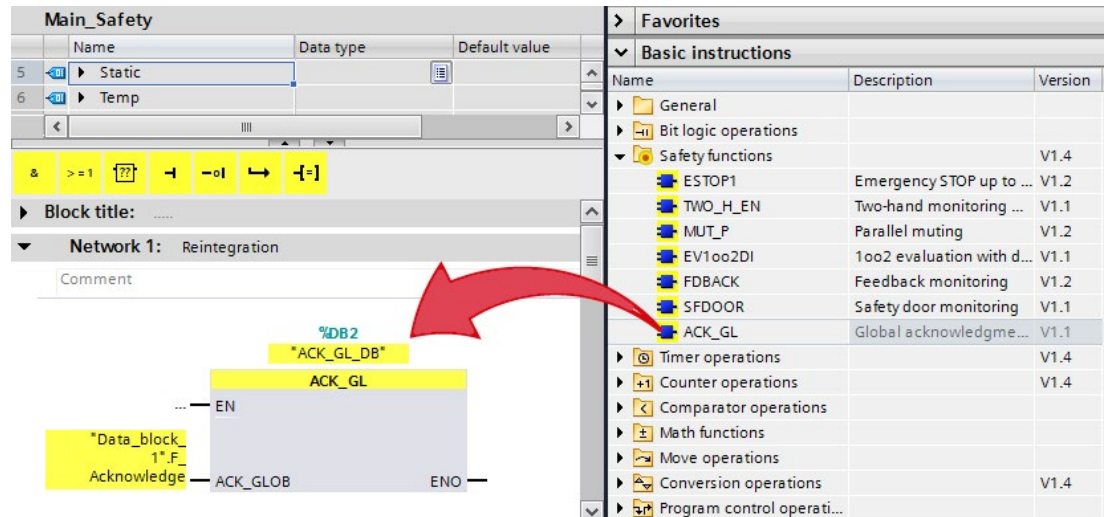


Figure 9-22 ACK_GL block: Global acknowledgment of all F-peripherals

- Insert a new network. All safety functions other than SLS with a fail-safe "High" signal are deselected in this network. To do this, create a new static tag **vke1** of the "Bool" type with default value "true" in the block parameters table.

Main_Safety									
	Name	Data type	Default..	Retain	Accessible...	Visible in ..	Setpoint	Comm	
5	Static								
6	vke1	Bool	true	Non-retain	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>			
7	Temp								
8	Constant								

Figure 9-23 Creating a static vke1 tag for the high signal

- Assignments of the **vke1** "High" signal at the Q1.0 and Q1.1 outputs deselect the STO and SS1 safety functions.

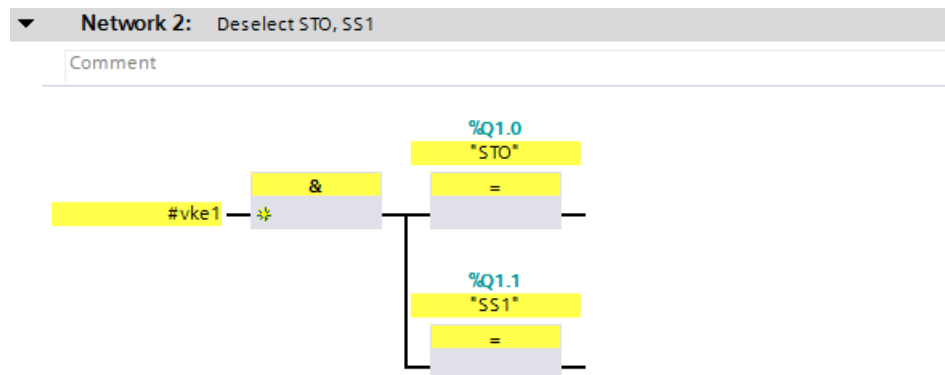


Figure 9-24 Deselecting safety functions with logical "high"

- 6. In a new network, the SLS safety function is deselected with "high" at the Q1.4 output, otherwise the function remains active.



Figure 9-25 Selecting/deselecting the SLS safety function

- 7. To reliably acknowledge the SINAMICS safety fault, the Reset pushbutton is interconnected with the acknowledge bit (Q1.7) from the PROFIsafe control word.

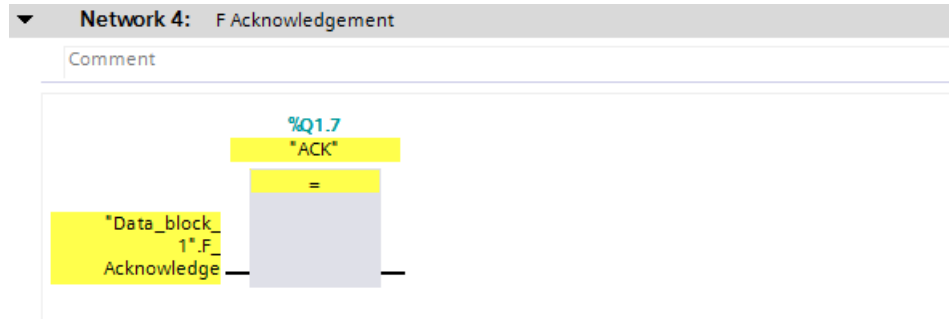


Figure 9-26 Acknowledging safety faults with the Reset pushbutton

- 8. Mark the CPU in the project navigation and click on "Compile" and then save the project. The programming is complete after a fault-free compilation. It only remains to load the project to the target system.

9.6 Acceptance of the safety functions

Acceptance test



The acceptance test of the drive device is part of the acceptance test of the complete machine or system. The acceptance test checks whether the drive-integrated safety functions are set to match the configured safety function of the machine. The results of the acceptance test and the settings of the drive-integrated safety functions must be documented.

The safety commissioning and programming are completed after performing and documenting the acceptance.

Note

A detailed description of the acceptance test and the documentation scope is contained in the *SINAMICS G120 Safety Integrated* Function Manual.

Because the acceptance documentation is not generated automatically in the Startdrive, use the tabular overview of the acceptance logs contained in the Function Manual appendix.

Diagnostics

10.1 Diagnostics overview

Diagnostics



The TIA Portal with integrated Startdrive offers a range of diagnostic options. You can identify the drive and have the most important information displayed via general diagnostics. In the event of an error you receive support in the form of proposed solutions for any faults and warnings displayed. For targeted diagnostics you can record signal sequences with the trace and analyze these.

You will find a brief overview of diagnostic options below.

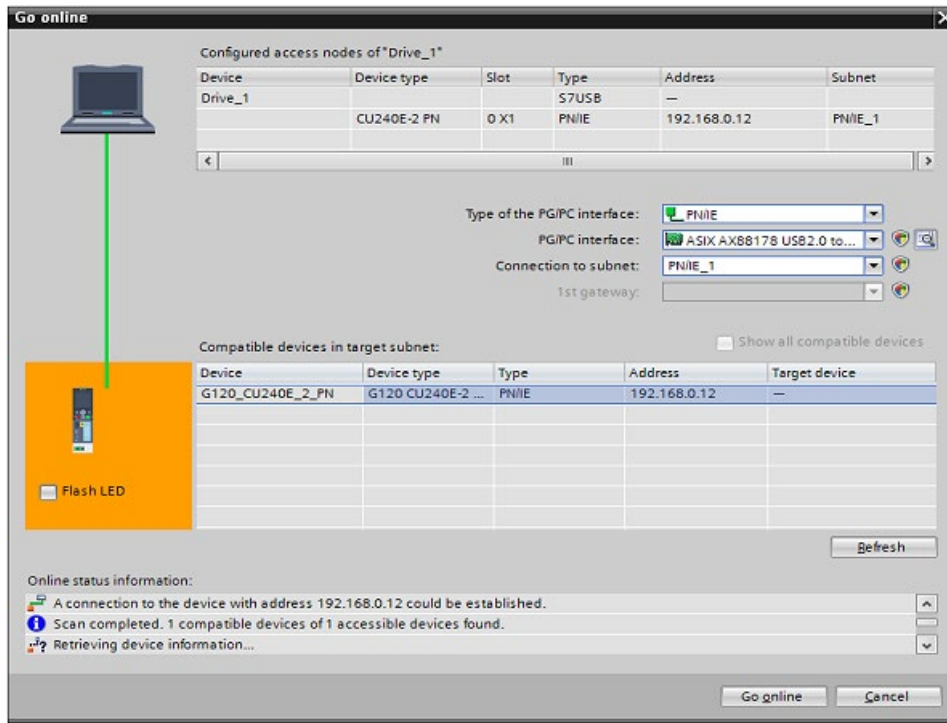
10.2 Drive diagnostic options

Diagnostic options

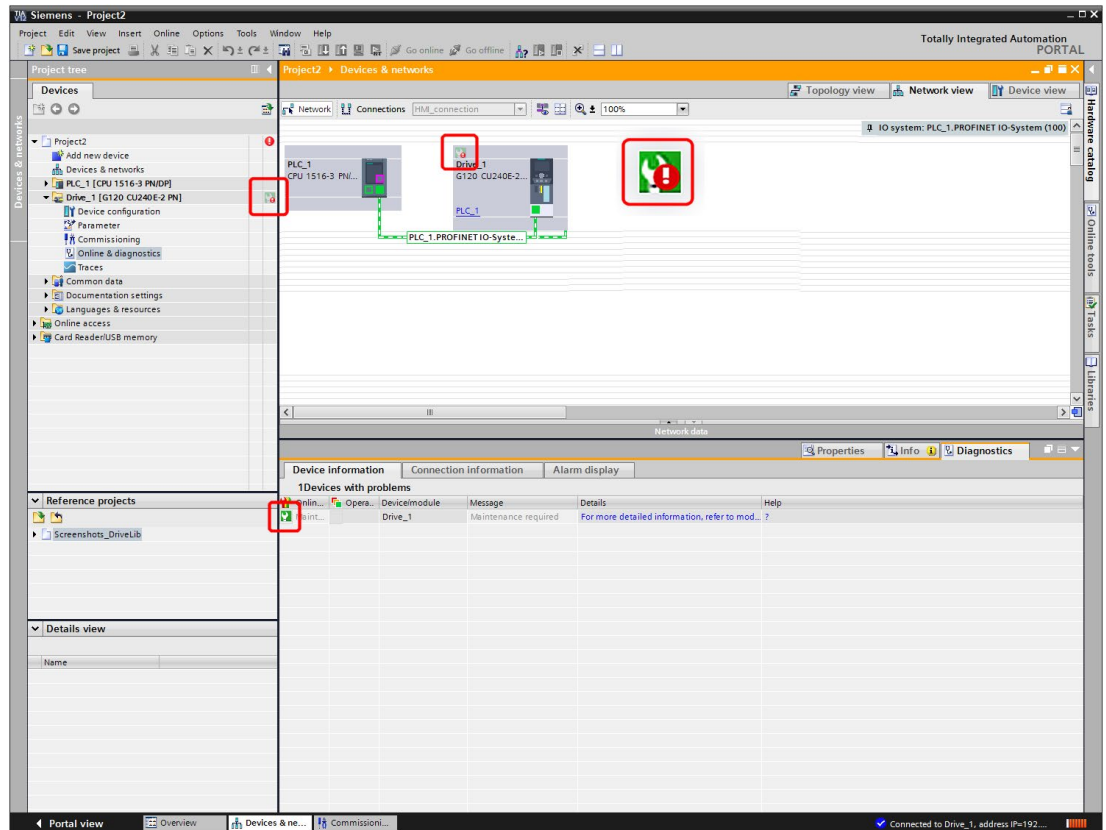
A series of diagnostic options are available to you in online mode.

How to display the diagnostics

1. Connect the TIA Portal Online with the drive unit. This is a PN connection in the example.



- Unique icons for the diagnostic status are displayed in the TIA Portal. These can be found e.g. in the project navigator, in the "Diagnostics" tab or "Info" tab in the inspector window, or directly in the network view.



- You can open more detailed explanations for the icons via online help.

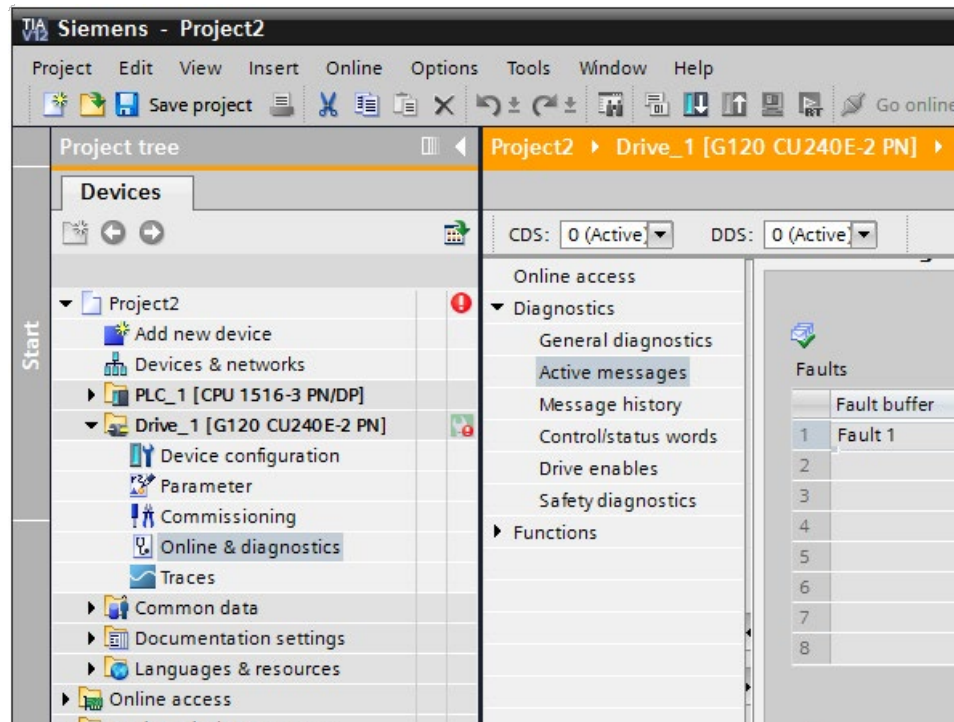
Examples See also History Extra

Displaying diagnostics status and comparison status using icons

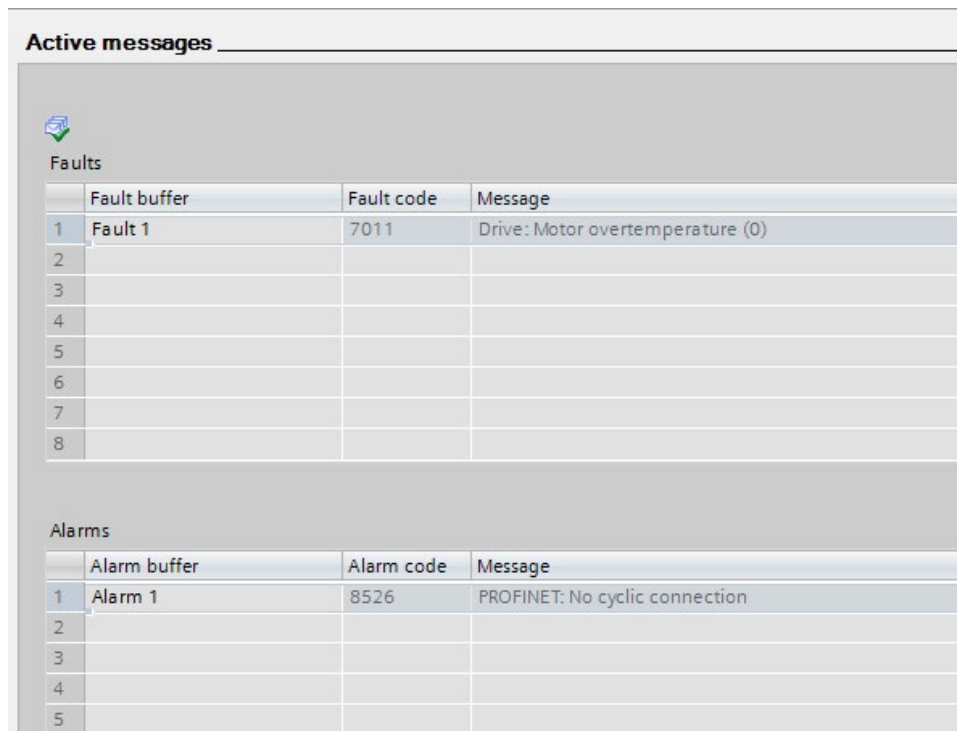
Diagnostics icons for modules and devices
The following table shows the available icons and their respective meaning.

Icon	Meaning
	The connection with a CPU is currently being established.
	The CPU is not reachable at the set address.
	The configured CPU and the CPU actually present are of incompatible types.
	On establishment of the online connection to a protected CPU, the password dialog
	No fault
	Maintenance required
	Maintenance demanded
	Error
	The module or device is deactivated.
	The module or the device cannot be reached from the CPU (valid for modules and
	Diagnostics data are not available because the current online configuration data c

- Double-click "Online & diagnostics" below the drive. You can have the general diagnostics, active messages, or the message history displayed in the window shown.



5. "Active messages" displays, e.g. all faults and warnings in tabular form.



Active messages

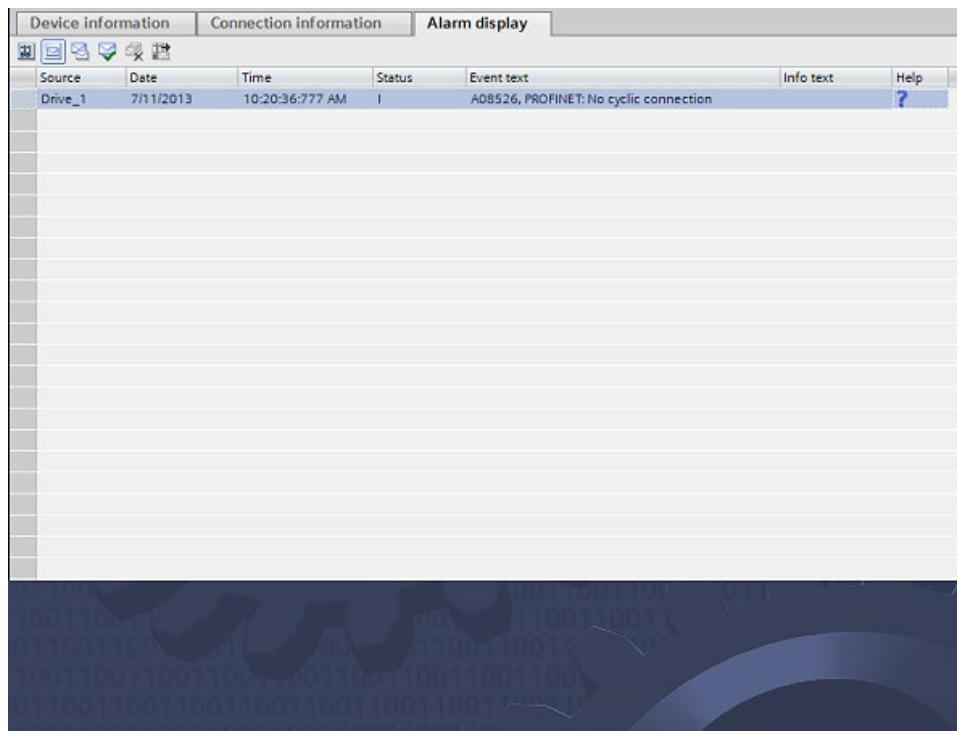
Faults

	Fault buffer	Fault code	Message
1	Fault 1	7011	Drive: Motor overtemperature (0)
2			
3			
4			
5			
6			
7			
8			

Alarms

	Alarm buffer	Alarm code	Message
1	Alarm 1	8526	PROFINET: No cyclic connection
2			
3			
4			
5			

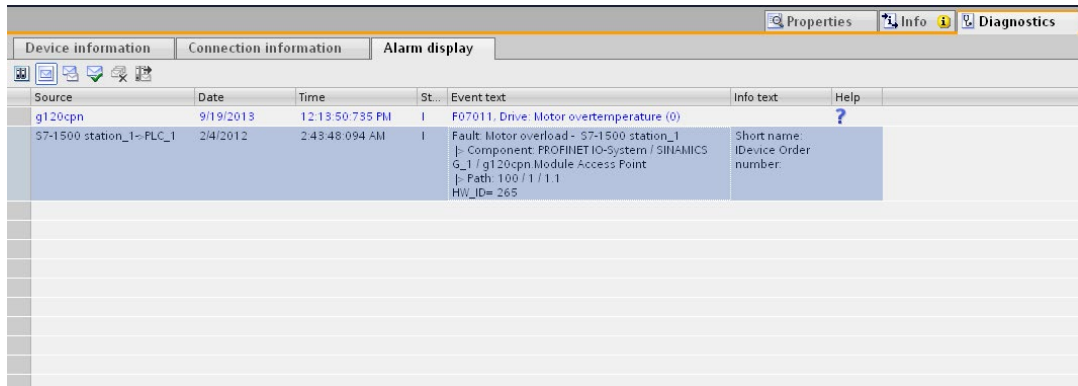
6. Pending alarms are displayed in the message display. Click the question mark for the error to display the online help correction options.




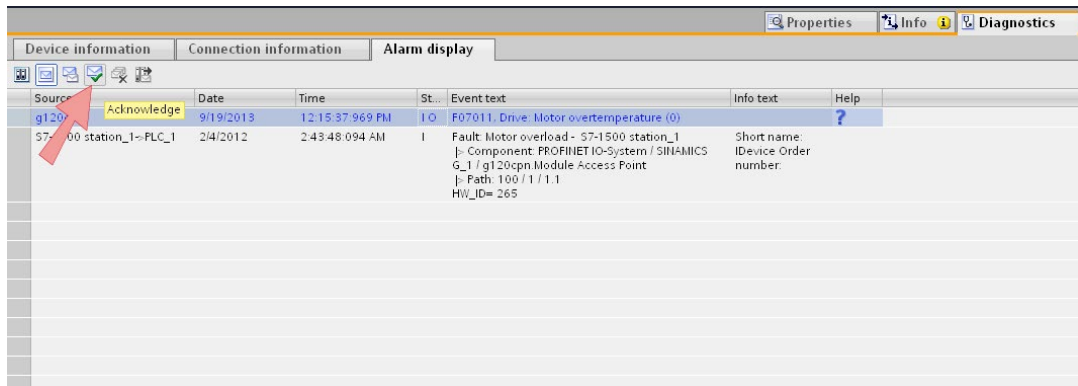
Device information | Connection information | **Alarm display**

Source	Date	Time	Status	Event text	Info text	Help
Drive_1	7/11/2013	10:20:36:777 AM	I	A08526, PROFINET: No cyclic connection		?

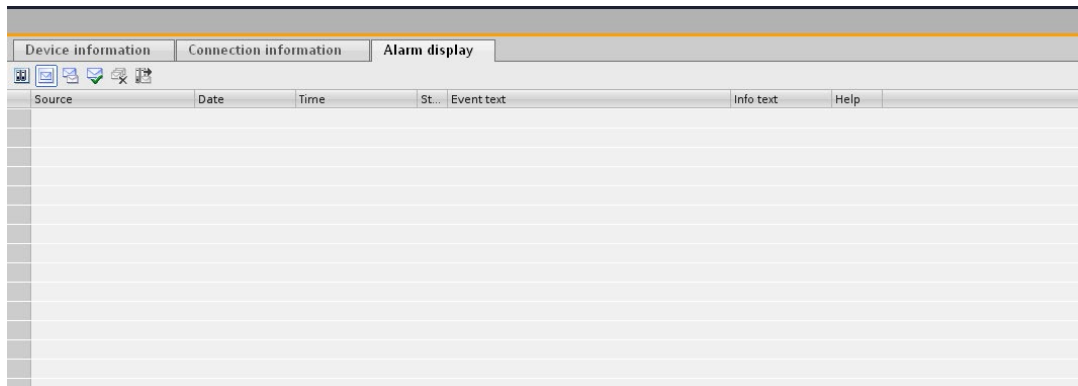
- 7. For drives with a higher-level controller, the drive alarms are shown directly on the drive unit and as group faults on the controller.



- 8. The selected alarms can be acknowledged using the  button after the fault has been resolved.



- 9. After updating, acknowledged alarms are no longer shown in the alarm display.



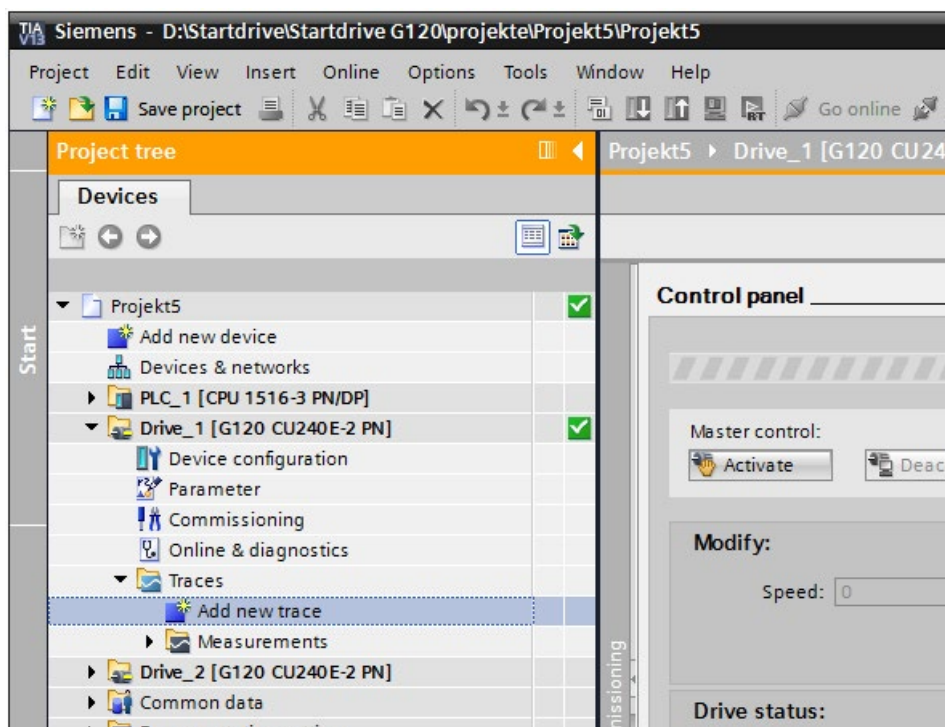
10.3 Diagnostics with the trace

Diagnostics with trace

You can record signal sequences from drive parameters with the trace. Using a SINAMICS drive as an example, you will configure a trace recording that is started with a pretrigger when an error occurs. Startdrive is connected online to the drive unit.

How to work with the trace

1. Double-click "Add new trace" below "Traces". A new trace is created in the project tree. You can click it to rename it.



- 2. Double-click the new trace in the project tree. The trace configuration is displayed in the working area. The trace configuration can be created offline or online. However, the signals can only be recorded online.

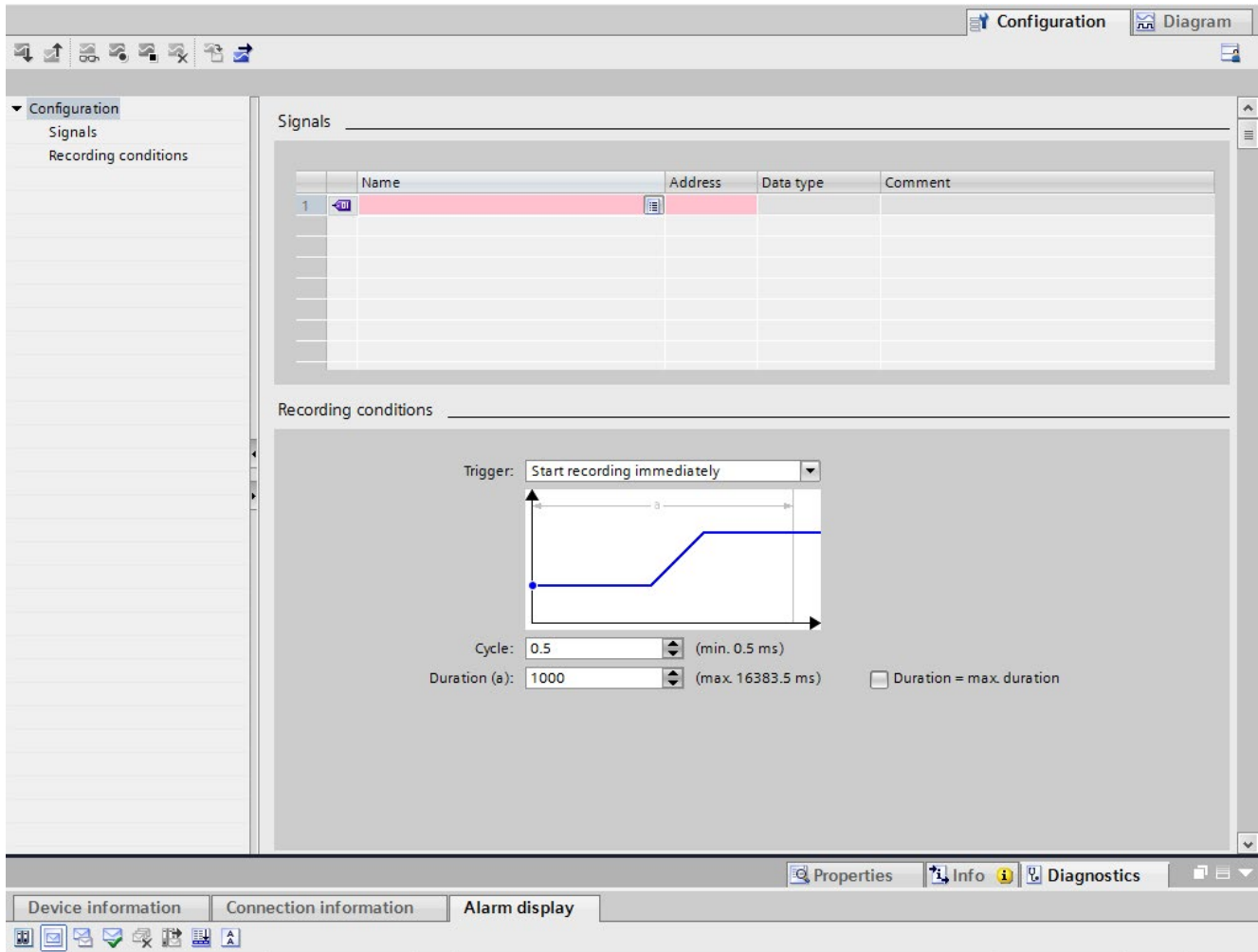


Figure 10-1 Trace configuration opened in the working area

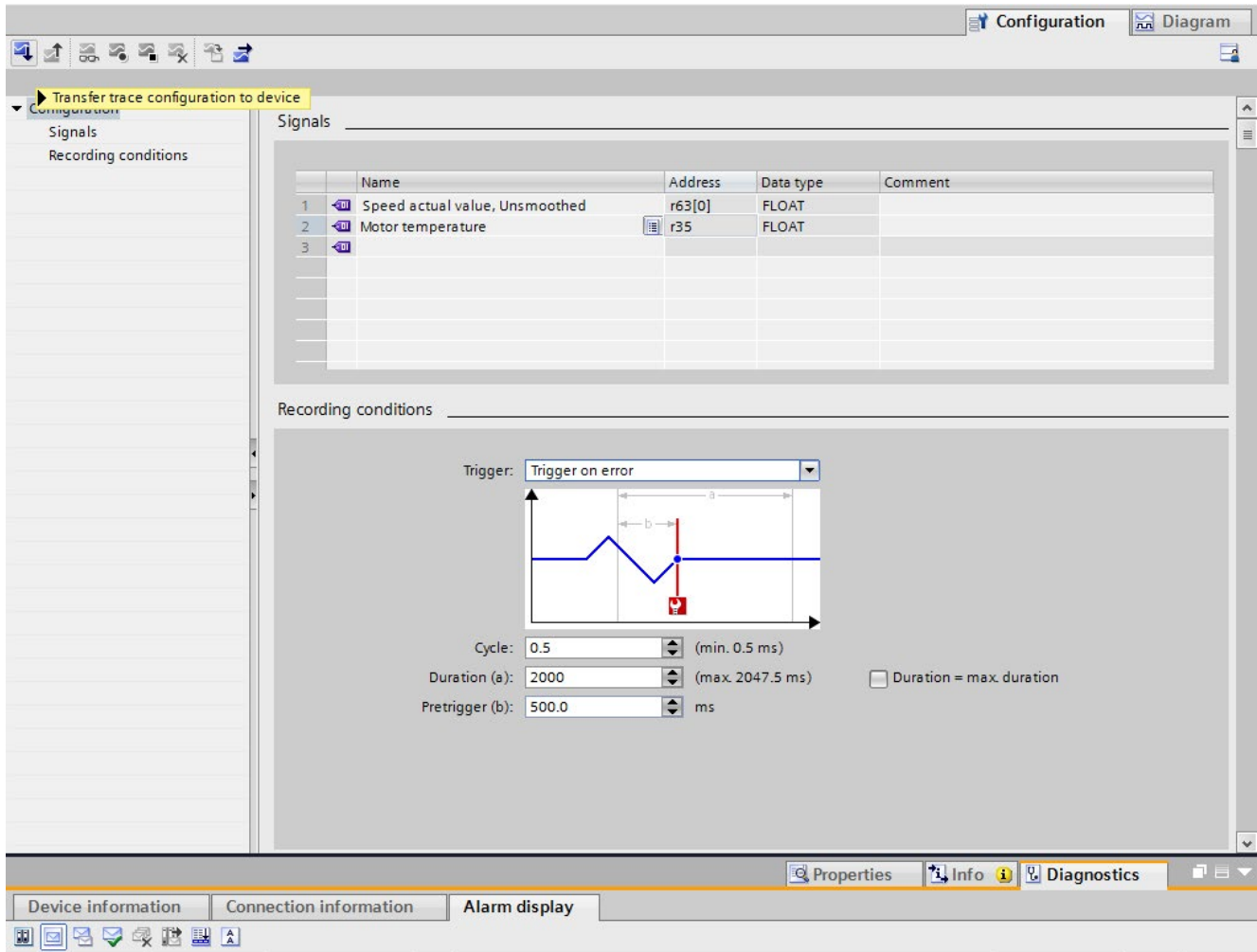
3. Select the signals for the trace recording.

The screenshot shows a software interface for configuring trace recording. The interface is divided into several sections:

- Configuration:** A sidebar on the left with options for "Signals" and "Recording conditions".
- Signals:** A table with columns for Name, Address, Data type, and Comment. Two signals are listed:

	Name	Address	Data type	Comment
1	Speed actual value, Unsmoothed	r63[0]	FLOAT	
2	Motor temperature			
- Recording conditions:** A section containing a "Trigger" dropdown menu set to "Start recording immediately", a graph showing a signal profile, and input fields for "Cycle" (0.5) and "Duration (a)" (1000). A checkbox for "Duration = max. duration" is also present.
- Bottom Panel:** Includes tabs for "Device information", "Connection information", and "Alarm display", along with icons for "Properties", "Info", and "Diagnostics".

- 4. Configure the trace, e.g. trigger and recording conditions. In the example the trigger is set when an error occurs.



- 5. Transmit the trace configuration to the drive unit and activate the recording.

- The drive is started via the drive control panel and the trace recording runs once the error occurs in the drive, as configured for the trigger. An icon in the project navigator also displays the error in the drive.

The screenshot displays the Siemens SIMATIC Manager interface. On the left, the 'Project tree' shows the hierarchy: Projekt5 > Drive_2 [G120 CU240E-2 PN] > Traces > Trace. The main window shows a 'Trace [Installed traces]' graph with the following data series:

- Speed actual value, Smoothed with p0045 [r63[1]] [rpm]:** Represented by a red line, it starts at 0, rises to a peak of approximately 190 rpm at 0.0 seconds, and then drops to 0 rpm.
- Motor temperature [r35] [°C]:** Represented by a green line, it starts at 0, rises to a peak of approximately 190°C at 0.0 seconds, and then remains constant.

Below the graph is a table with the following columns: Name, Data t..., Address, Color, Scaling group, Min. Y scale, Max. Y scale, Unit, and Comm... The table contains two rows:

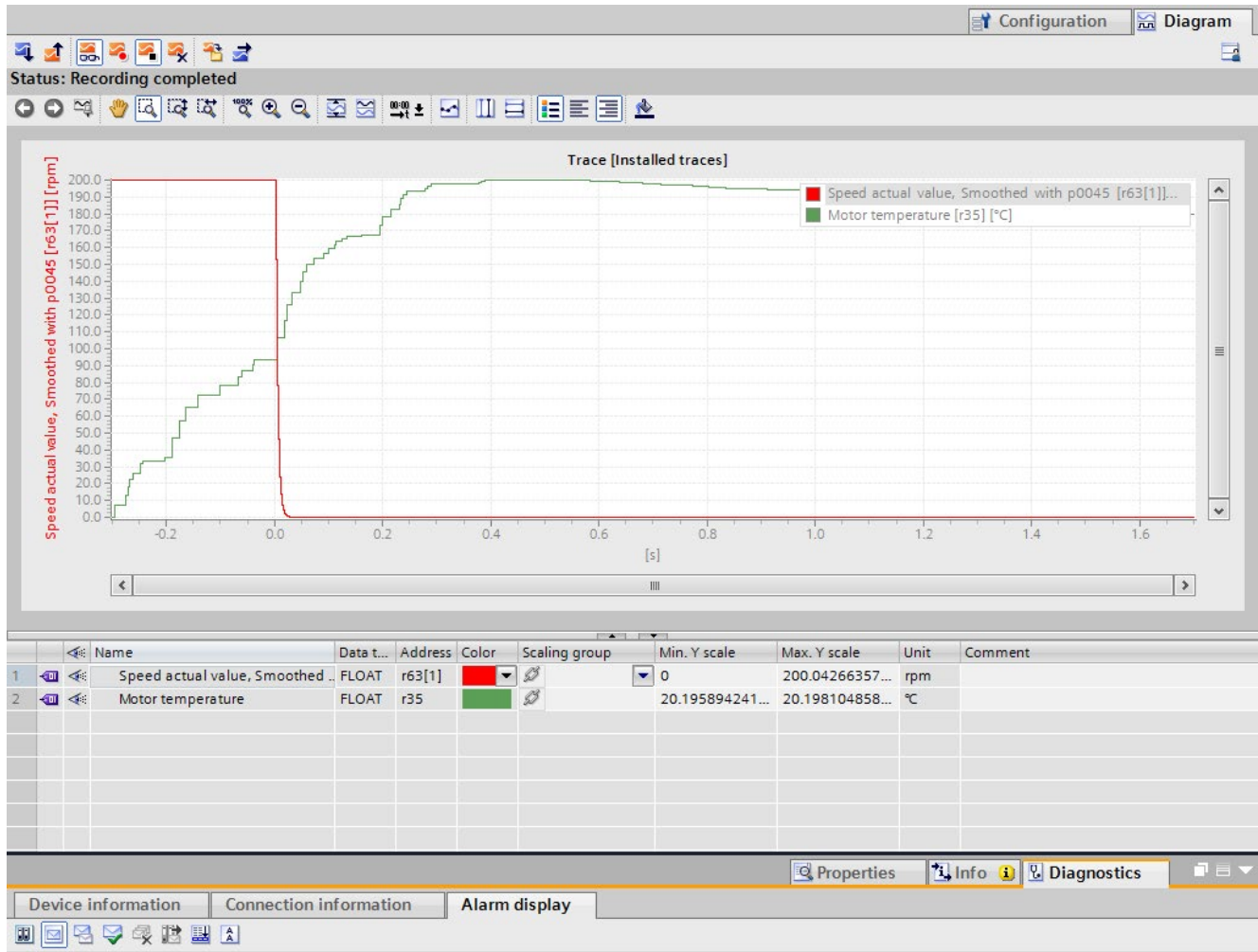
Name	Data t...	Address	Color	Scaling group	Min. Y scale	Max. Y scale	Unit	Comm...
Speed actual value, Smoothed with p0045 [r63[1]]	Float	r63[1]	Red		0	200.04266357...	rpm	
Motor temperature	Float	r35	Green		20.195894241...	20.198104858...	°C	

At the bottom, the 'Alarm display' tab is active, showing a table with columns: Source, Date, Time, St..., and Event text. The table contains one row:

Source	Date	Time	St...	Event text	Inf...
Drive_2	12/3/2014	11:49:26:160 AM	K	F07011, Drive: Motor overtemperature (0)	

10.3 Diagnostics with the trace

- 7. You can display the recorded signals graphically in the Editor and save them locally on the PC.



Summary

11.1 Summary of the tutorial

Summary



You will have gained an overview of Startdrive after working through the tutorial. You can integrate a drive into a project, complete a basic commissioning, and rotate the motor.

Please use the drive unit documentation and the Startdrive help system for further training. Startdrive can be found on the Internet at www.siemens.com/startdrive

Thank you for your attention.

