Contents 16

16. Integrating and Commissioning a Drive with Startdrive

At the end of the chapter the participant will ...

... be able to parameterize and test a drive with Startdrive

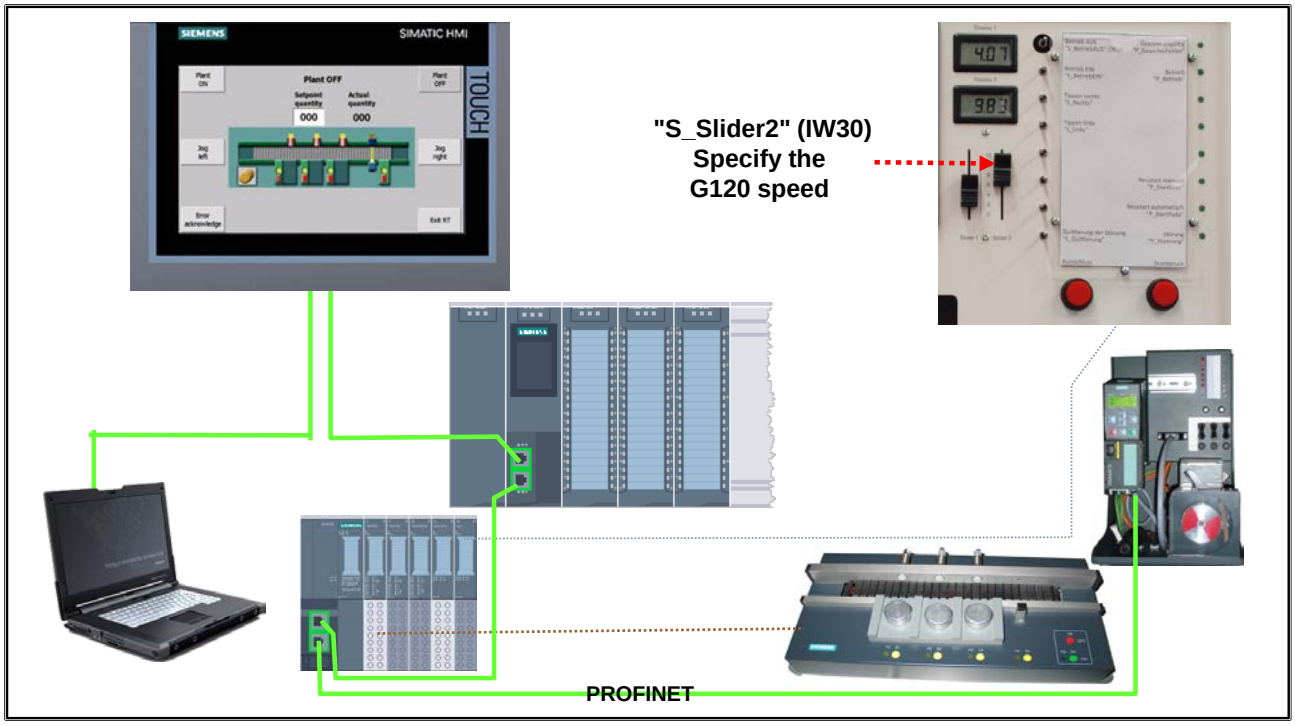
... be able to integrate a drive in the device configuration

… be able to reset (restore) the inverter to factory settings

... be able to set basic parameters via Startdrive

… be able to control the drive via a PLC

16.1. Task Description: G120 as an Additional Conveyor Drive



Task Description

Imagine that the drive is being used as an additional drive for the conveyor model.

The drive is to be controlled as follows:

- When "P_Operation" (Q0.1) is switched on (activated operation), the G120 drive is automatically also switched on and off parallel to the conveyor motor.
- The speed of the G120 can be set via the right slide control (potentiometer) on the simulator.

16.2. Communication Standard PROFIdrive

PROFIdrive

PROFIBUS & PROFINET International (PI)

- Consistent industrial communication
- Comprehensive range of applications
- PROFIdrive is the standard profile for drives technology in conjunction with the PROFIBUS and PROFINET communication systems
- Proven method for the easy and integrated connection of drives and controllers of different manufacturers

Communication via PROFIBUS and PROFINET

PROFIBUS and PROFINET are the solutions which provide absolute consistency and are highly application-oriented. The main reason that PROFIBUS and PROFINET stand out from other industrial communication systems is because they span such an extraordinary breadth of applications.

One of the most important applications in industrial automation is drives technology.

Open technologies need, for their maintenance, ongoing development and market penetration, a company-independent institution that can serve as a working platform. For this purpose, the PROFIBUS User Organization (PNO) was founded in 1989 as a non-profit organization representing the interests of manufacturers, users and institutes (world's largest interest association in the field of industrial communication).

PNO is a member of the international umbrella organization PI (PROFIBUS & PROFINET International) founded in 1995.

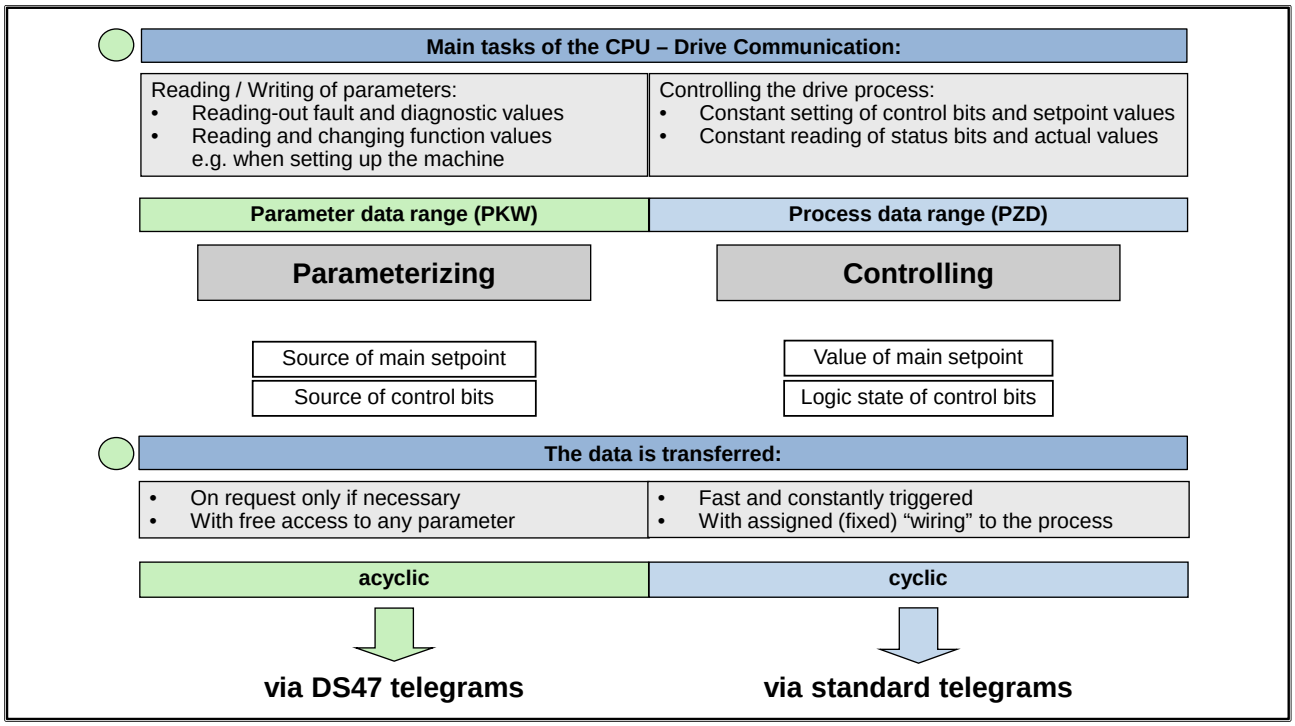
PROFIdrive

PROFIdrive is the standard profile for drives technology in conjunction with the communication systems PROFIBUS and PROFINET.

→ open "application profile" for connecting drives and controllers of different manufacturers via communication systems

The control word and status word of the G120 comply with the specifications of PROFIdrive profile Version 2.0 or Version 3.0 for the "speed control" operating mode.

16.2.1. CPU - Drive Communication: CPU - G120



Process Control

Fast data transmission of short data telegrams to all participating stations with the maximum speed available on the bus whereby all participants can receive different data. In drive systems these are typically setpoints, control commands, status replies and actual values (measured values).

Operating Control

In addition to this permanently available data, there is data that is only needed in particular cases. It would therefore be senseless to permanently put load on the bus if this data is only needed once per hour or per day, for example, when starting up the machine (Class 1 Master). Another reason for an expanded communication need could be the commissioning, optimization or diagnosis of machine components from a central location. In this case, (such as a fault) a detailed access of an Engineering Tool to the system components or the drive is enabled. Since, as a rule, only one affected device/component is directly addressed, this window is only made available once per bus cycle for one bus station and not simultaneously for every station.

Cyclic Data Exchange:

This is used to fulfill the demand for fast, permanent data exchange.

Acyclic Data Exchange:

The acyclic exchange of entire data sets (for example, DS47, DS100) between Master/Controller and Slave/Device occurs according to standardized procedures which are implemented with FBs from the libraries (for example, Drive ES SIMATIC).

The initiation of a data transmission for the acyclic communication of a Class 1 Master/Controller with a Slave/Device is always triggered by the user program. That is, the user program decides whether a data exchange with a Slave/Device is necessary or not based on further conditions. Only when there is a need, does a data transmission request get signaled to the DP Master/Controller which then executes it.

16.2.2. Standard Telegrams

Telegram	1		20		352		354		999	
PZD1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1	ZSW1	STW1 <4>	ZSW1 <4>
PZD2	NSOLL_A	NIST_A	NSOLL_A	NIST_A_GL	NSOLL_A	NIST_A_GL	NSOLL_A	NIST_A_GL	Receive telegram length freely selectable via central PROFIdrive configuration in the master	Transmit telegram length freely selectable via central PROFIdrive configuration in the master
PZD3	Receive telegram from PRPFIBUS/PROFINET	Send telegram to PROFIBUS/PROFINET		IAIST_GL	<3>	IAIST_GL	<3>	IAIST_GL		
PZD4				MIST_GL	<3>	MIST_GL	<3>	MIST_GL		
PZD5				PIST_GL	<3>	WARN_CODE	<3>	WARN_CODE		
PZD6				<2>	<3>	FAULT_CODE	<3>	FAULT_CODE		
PZD7										
PZD8										
PZD9										
PZD10										
PZD11										
PZD12										

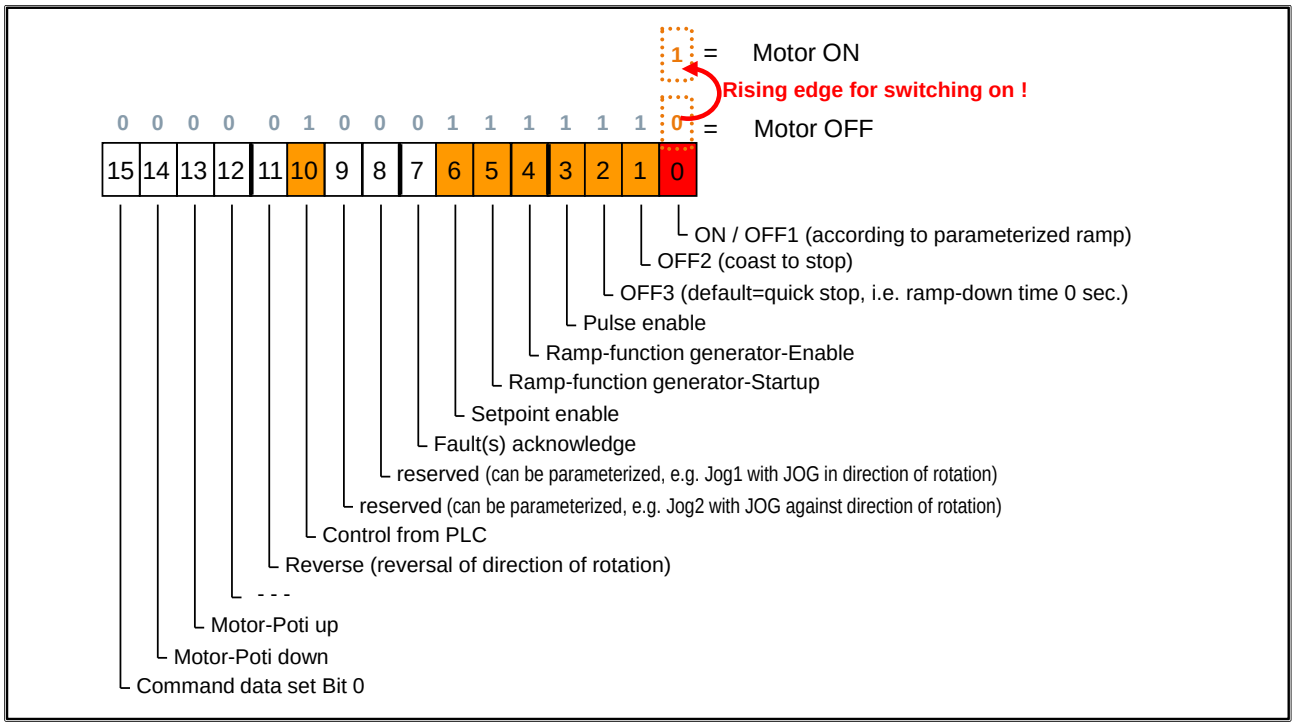
Telegrams 1, 20	Manufacturer-independent Standard Tel.	automatic configuration in drive
Telegrams 352 to 391	Siemens-specific Standard Telegrams	automatic configuration in drive
Telegram 999	Free telegram	manual configuration required

Master-Slave / Controller-Device Communication via Standard Telegram

The best way to implement a cyclic data exchange between Master/Controller (CPU) and Slave/Device (G120) is using a standard telegram, which typically is also used for simple speed controls. Between the Master/Controller and Slave/Device, two input words and two output words with the following contents are exchanged:

- Output word 1: Control word
- Output word 2: Main setpoint value
- Input word 1: Status word
- Input word 2: Main actual value

16.2.3. Structure of the Control Word



The inverter can be controlled in various ways. The G120 can either be operated via the field bus or via the terminal strip.
This is controlled through a relevant Control Data Set (CDS)

default for G120 = two CDS:
- Control data set CDS0: Control of the inverter via field bus
- Control data set CDS1: Control of the inverter via terminal strip

Control Word

The control word (Bit 0 to 10) complies with the PROFIdrive profile standard. Bits 11 to 15 are inverter-specific.

For reasons of safety in the case of a wire break, the inverter is always switched off when the relevant OFF bit has signal 0.

ON/OFF1

A rising edge of this bit is generally required for switching on the inverter, and bits OFF2 and OFF3 must have status 1.
When it is switched off using this bit, the motor is braked by the ramp down of the ramp-function generator (Parameter 1121) and the inverter then switches itself off.

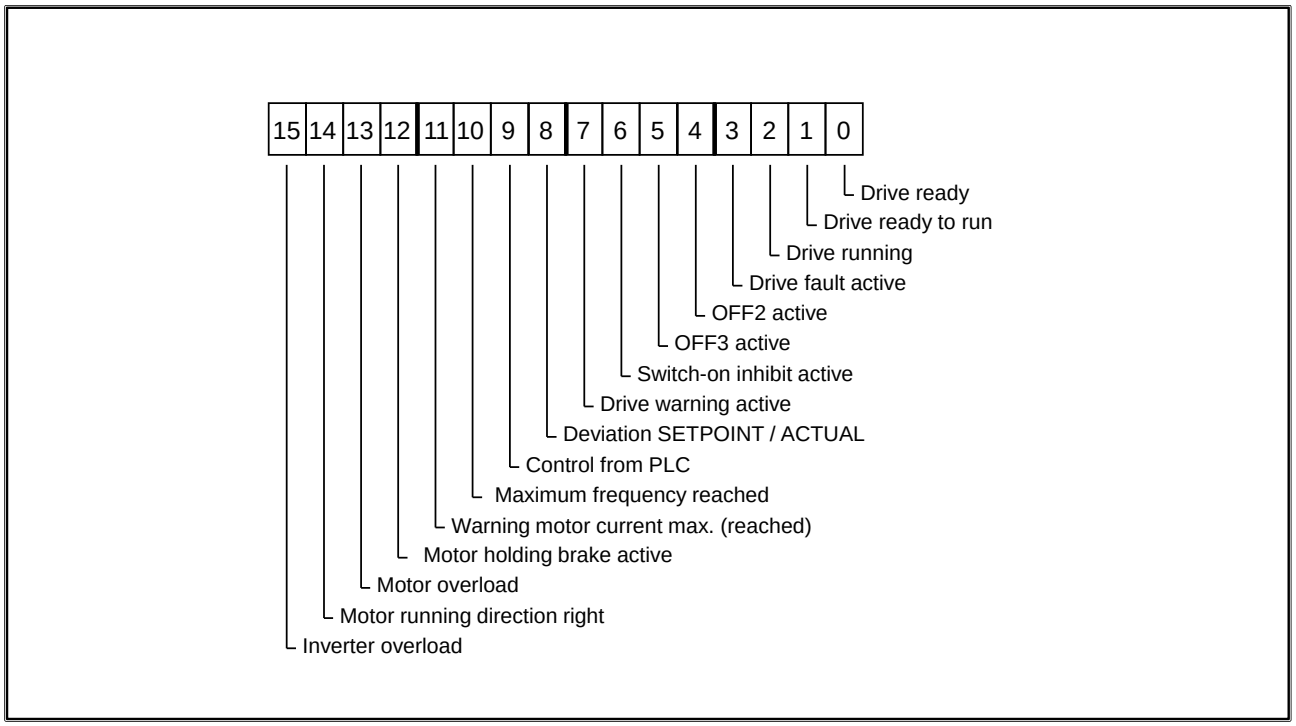
OFF2

The inverter switches itself off immediately and as a result, the motor coasts down without braking (coasts to a standstill). To switch the inverter on again, this bit must be set to 1 again and a rising edge is necessary at ON/OFF1.

OFF3

The motor is braked by the OFF3 ramp down and the inverter remains on. This function is often used as an EMERGENCY STOP
→ default for OFF3 = 0 seconds (in case of larger motors, this cannot always be achieved).

16.2.4. Structure of the Status Word



Status Word

The status word (Bit 0 to 10) complies with the PROFIdrive profile standard.

Bits 11 to 15 are inverter-specific.

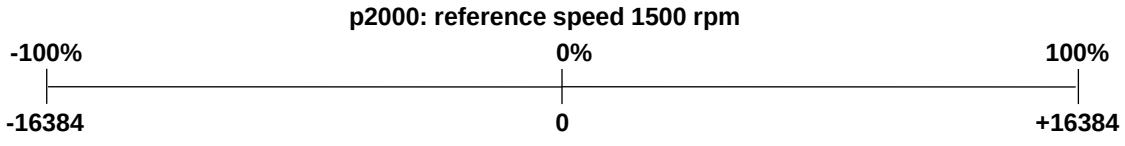
Switch-on Inhibit

This status is reached following the error elimination and acknowledgement of a drive fault. A subsequent switch on is only possible with a "0"→"1"-edge of the bit ON/OFF1.

Warning, Message

Messages (bit 13, bit 15) and Warnings (bit 11)

16.2.5. Setpoint / Actual Value → Speed Values



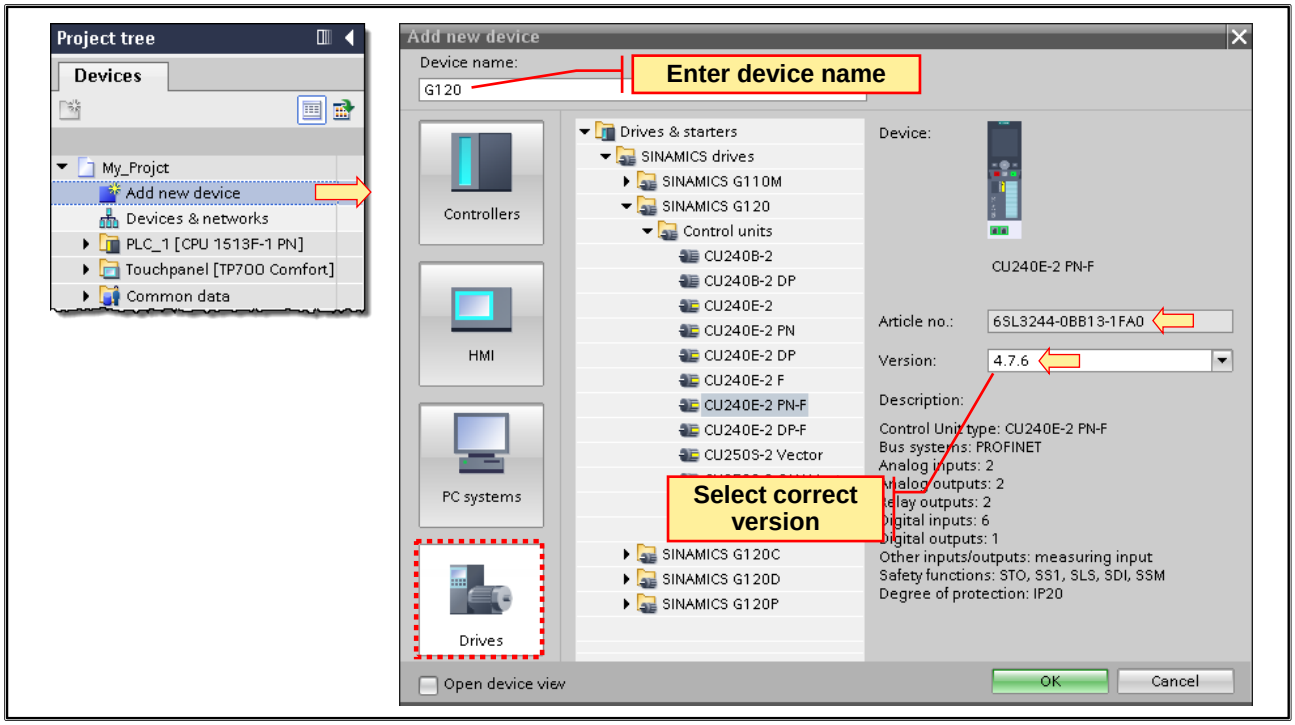
	Value (hexadecimal)	Value (decimal)	Inverter frequency (Hz)	Speed under rated load (rpm)
Positive setpoint = direction of rotation right (view onto the drive axis)	4000	16384	50	1500
	3000	12288	37.5	1125
	2000	8192	25	750
	1500	5376	16.4	492.2
	1000	4096	12.5	375
	500	1280	3.91	117.2
	0	0	0	0
Negative setpoint = direction of rotation left (view onto the drive axis)	F000	-4096	-12.5	-375
	E000	-8192	-25	-750
	C000	-16384	-50	-1500

Scaling the Speed Values

Via the parameter p2000, a reference speed is defined which all setpoint and actual values use as a reference.

The range of -100% to 100% of the setpoint or actual value, in turn, is scaled to the range -16384 ($C000_{HEX}$) to +16384 (4000_{HEX}).

16.3. Inserting a Drive into the Project

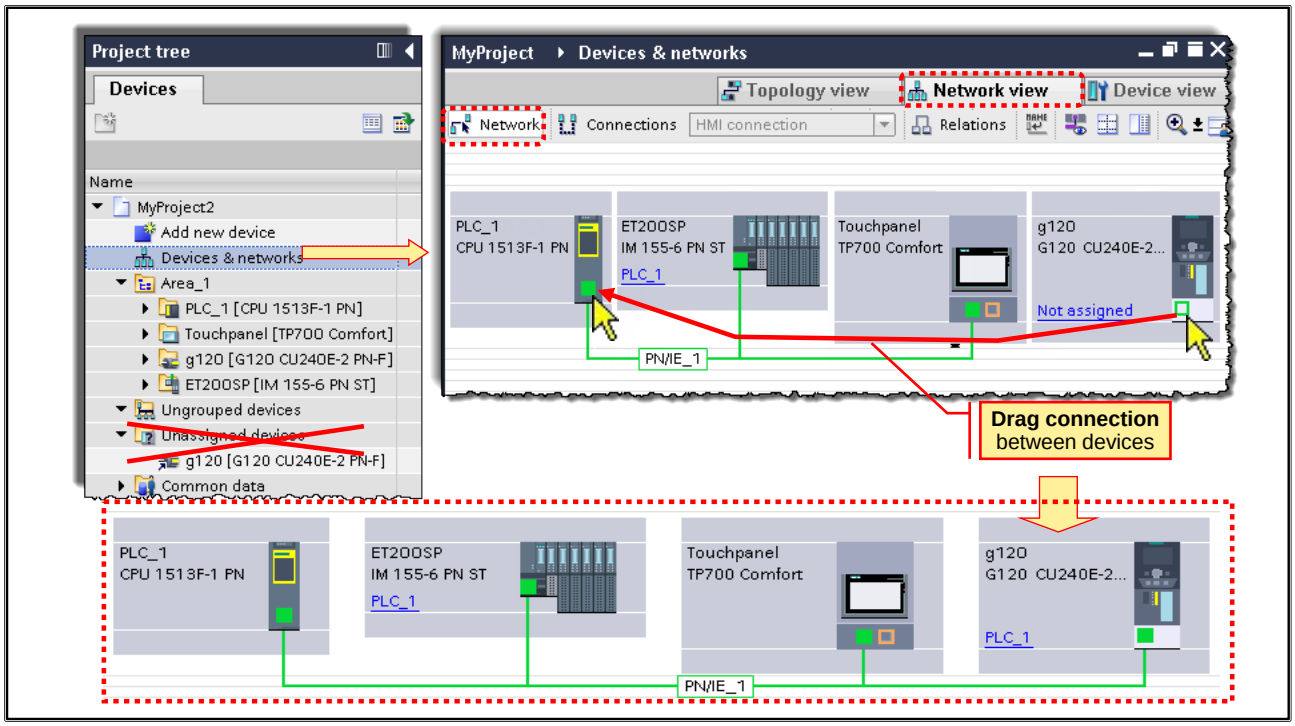


"Startdrive" Option Package

If the "Startdrive" option package is installed in TIA Portal, drives can be added, configured and assigned parameters as a new device.

Otherwise, a drive can be inserted in the project via GSD file as a distributed I/O station using the Hardware catalog. However, then only the communication with the CPU can be configured in the TIA Portal, no hardware configuration, no parameter assignment.

16.3.1. Networking a Drive with the CPU



Editor

Hardware & Networks → "Network view"

Networking

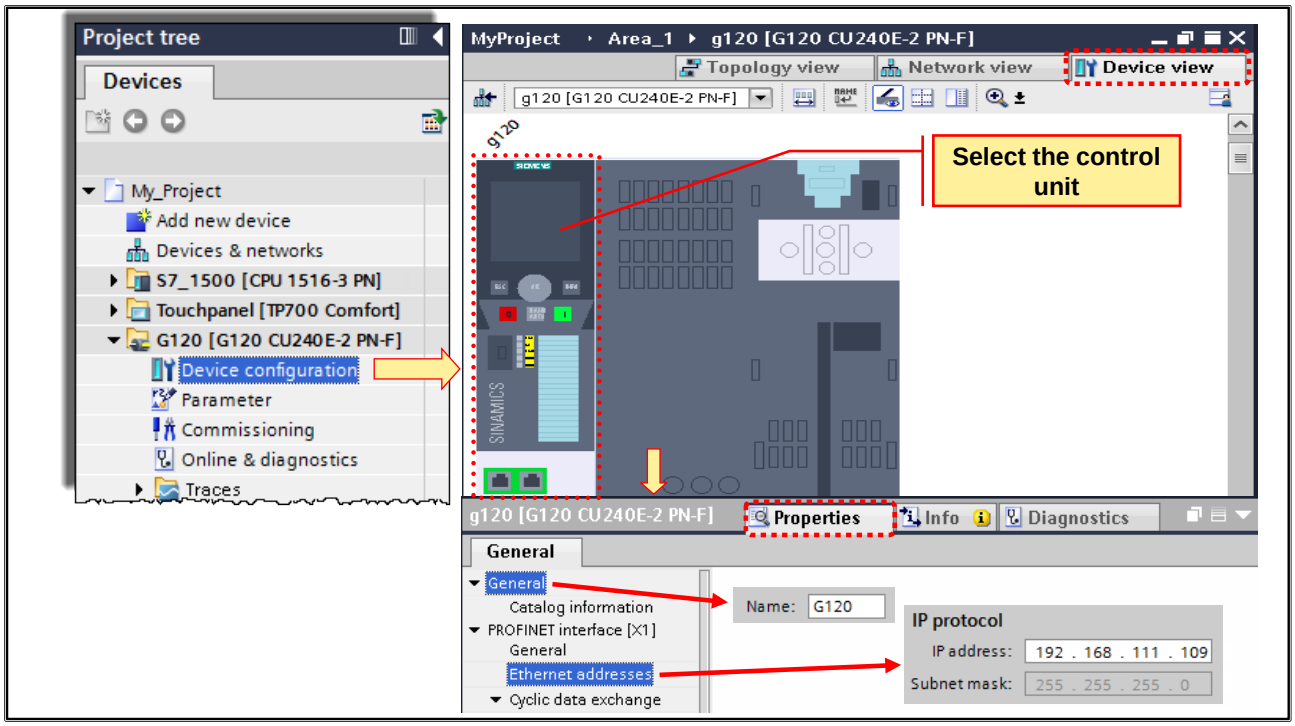
Click on the interface of the one module, hold the left mouse button and drag onto the interface of the other module.
→ here in the picture: PN interface of the G120 dragged onto PN interface of the CPU

Unassigned Devices

This section then disappears since the device is now assigned to the CPU.

And the link can be found in the Distributed I/O folder of the controller.

16.3.2. Parameterizing the Module Address and Module Name



Name of the Module

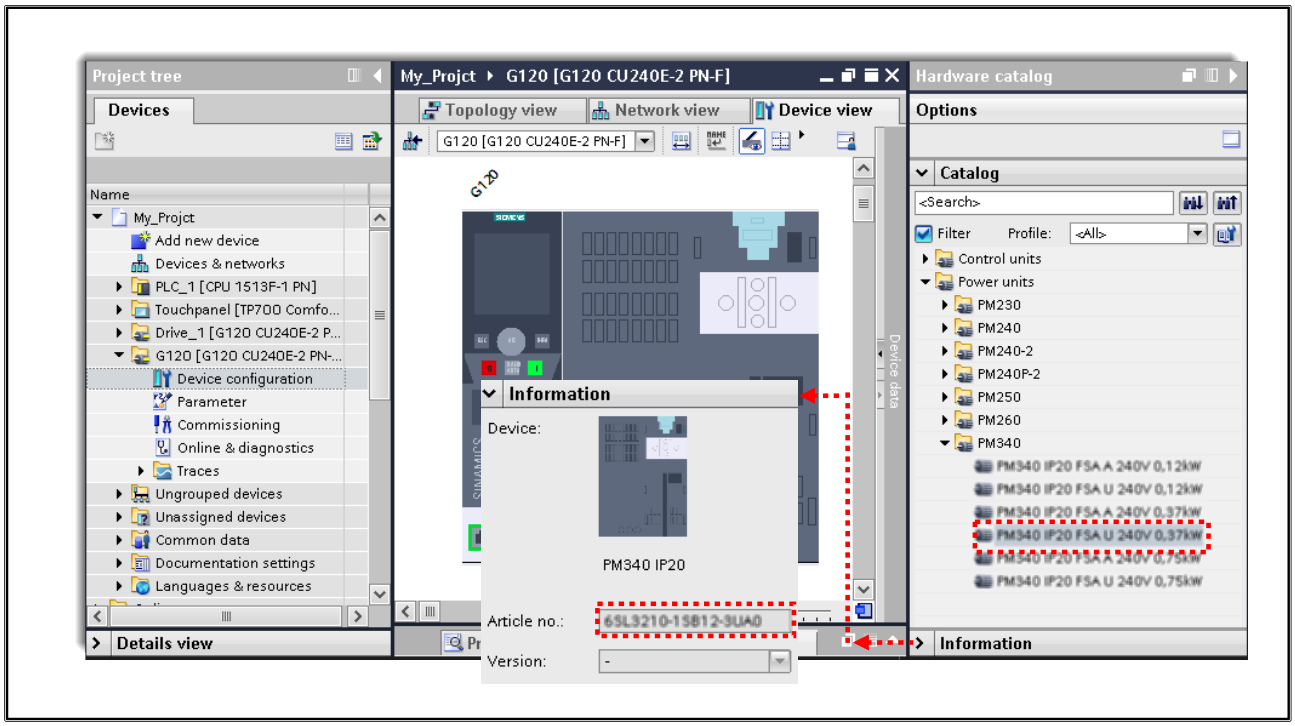
If the property "Generate PROFINET device name automatically" is activated in the Properties of the drive under *PROFINET interface > Ethernet addresses > PROFINET* then the module name set under "Properties > General" is also the PROFINET device name. With the help of this name, it is possible for the CPU to assign the module, that is, the PROFINET-IO Device is identified by the PROFINET-IO Controller through this name.

This name must be assigned to the PROFINET-IO module online; otherwise, the CPU (PROFINET-I/O Controller) cannot identify the module.

Address Assignment of the Distributed IO-Module

For PROFINET-IO, the parameterized IP address of the module is assigned by the CPU through the configured device name.

16.3.3. Configuring a Power Unit

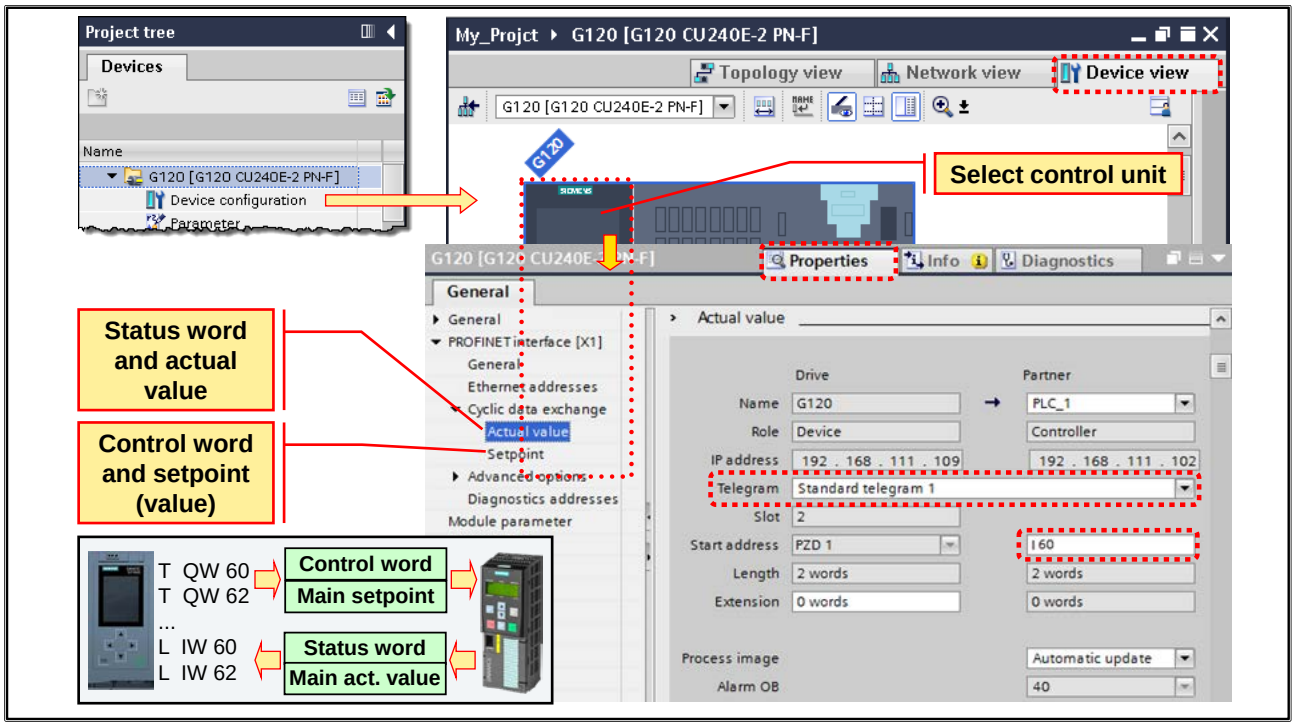


Configuring a Power Unit:

A drive consists of two components

- Control unit → already configured with the device that is added
- Power unit → must be configured

16.3.4. Parameterizing the Process Data Area (PZD)



Process Data Area

Communication using Standard telegram 1 is based on a cyclic process data exchange that is very easy to program.

The control word and status word comply with the specifications of PROFIdrive profile Version 2.0 or Version 3.0 for the "speed control" operating mode.

The control word and, if necessary, the main setpoint are sent from the CPU to the drive. In the response telegram, the drive returns the status word and the main actual value.
Since only two words are exchanged with the drive, simple load and transfer operations are all that are required in the program. When a double word is transferred, data consistency is also assured.

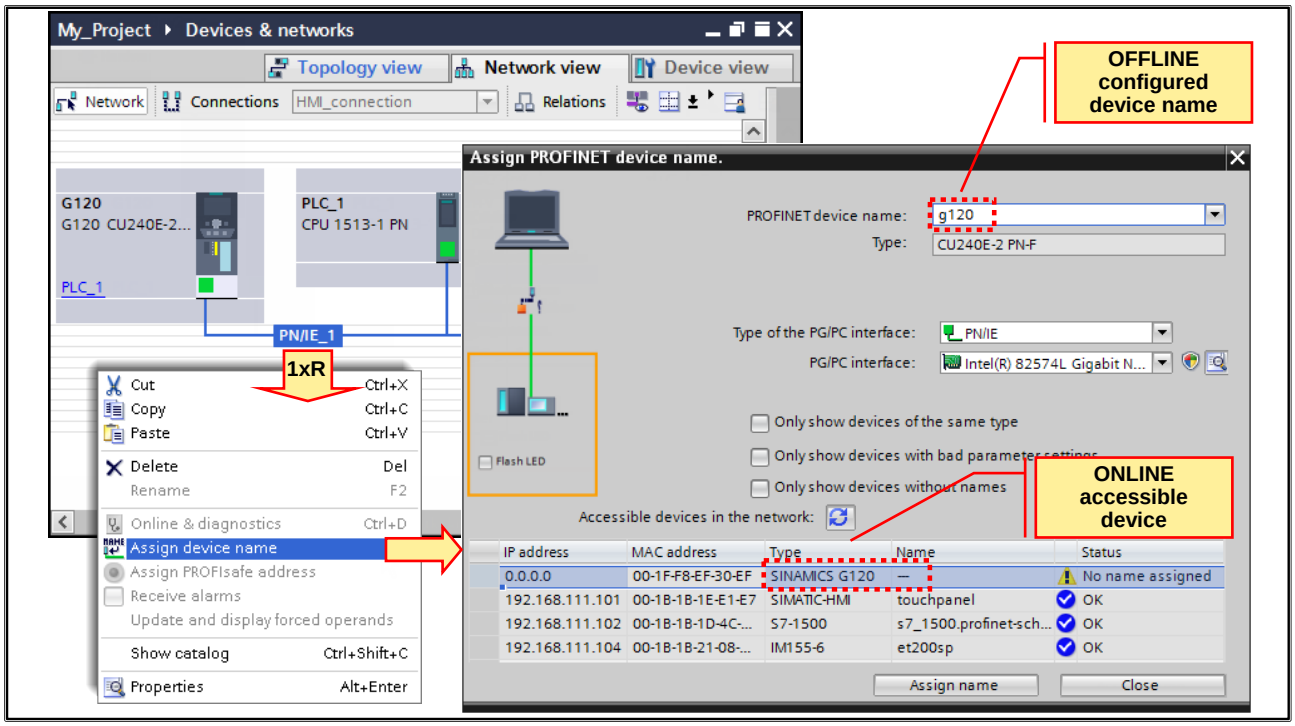
Control Word

The control word contains 16 binary signals for controlling (On/Off, direction of rotation) the drive.

Main Setpoint

According to standard parameterization of the drive, the main setpoint specifies the setpoint speed.

16.3.5. Assigning a Device Name ONLINE (Module Initialization)



Device Name

The PROFINET device name that was configured OFFLINE must be assigned to the drive that actually exists ONLINE.

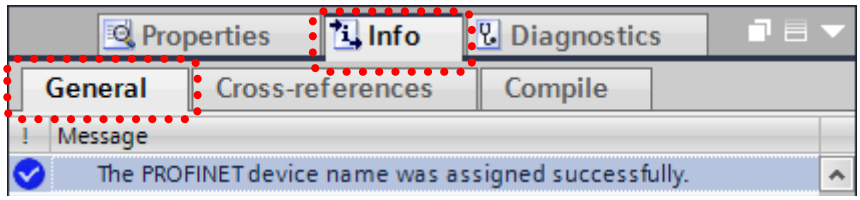
Name of the Module

The name is the assignment CPU ↔ module.

Through this, the PROFINET-IO is identified by the PROFINET-Controller.

This name must be assigned to the PROFINET-IO module online; otherwise, the CPU (PROFINET-Controller) cannot identify the module.

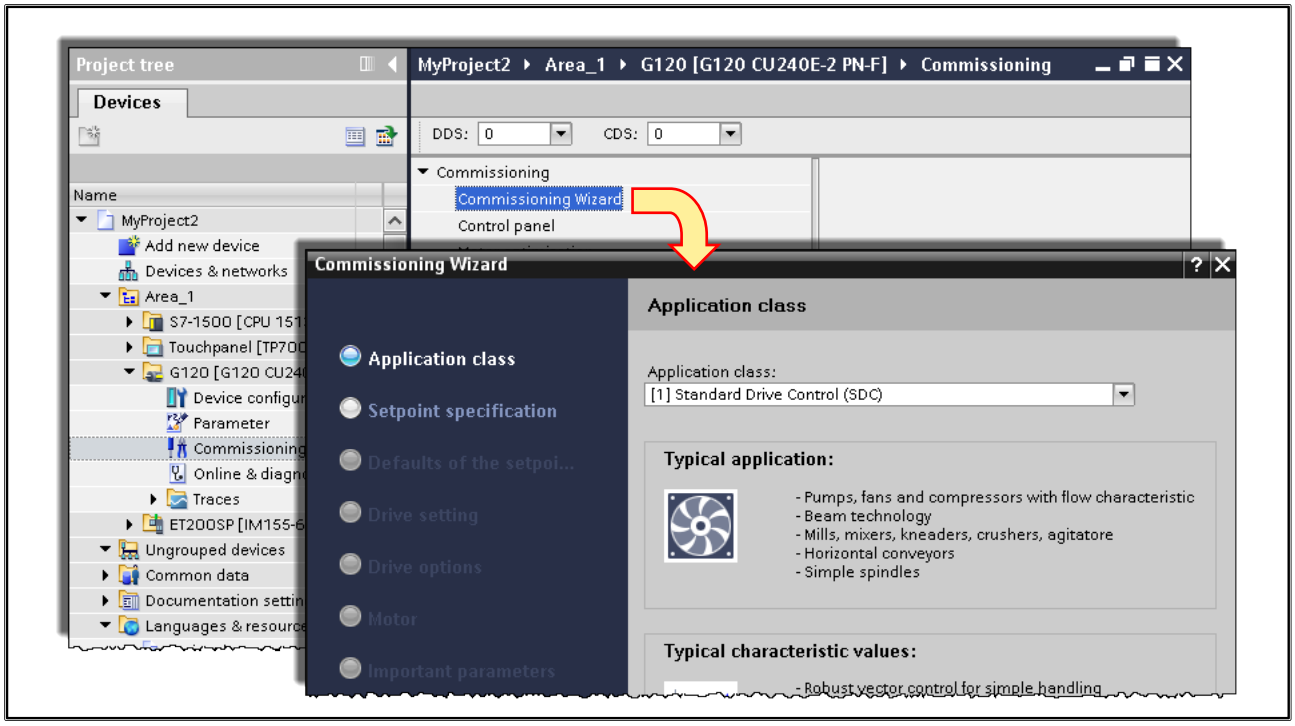
Checking the Result in the Inspector Window



Note:

If you do not use the "Assign device name" dialog but instead the Online access (Online & diagnostics/Functions/Assign name) to set the device name on a device which already has a PROFINET device name, then you will have to restart the device.

16.4. Parameterizing the Drive with the "Commissioning Wizard"

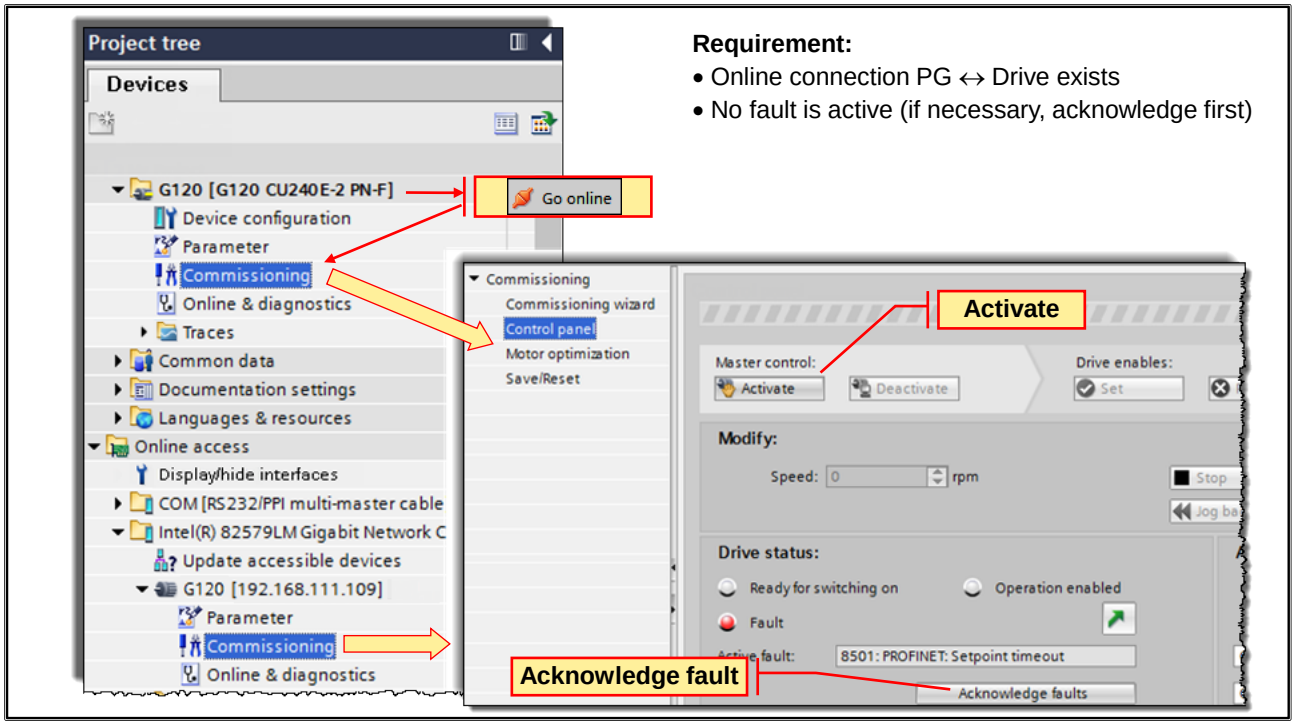


Commissioning Wizard

The most important settings for the drive can be made with the menu-driven Commissioning Wizard. These are, among others:

- Details of the setpoints / command sources
- Drive setting(s)
- Motor (data)
- Important parameters (dynamic data)
- Drive functions

16.5. Online Commissioning: Activating / Deactivating the Control Panel



Requirement:
- Online connection PG ↔ Drive exists
- No fault is active (if necessary, acknowledge first)

As soon as the drive has a valid IP address and thus is accessible online, the parameterization and functions of commissioning are available.

Online Accesses

As soon as the drive has been assigned a valid IP address in the subnet used, the functions of commissioning are available here.

Device in the Project Tree

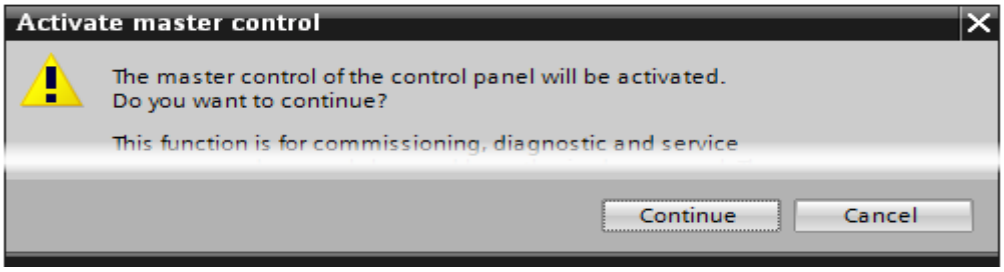
If the drive was inserted as a new device, it is assigned the default IP address 192.168.0.1.

Go online is only possible when the IP address of the device configuration corresponds to the subnet used and is also assigned to the drive.

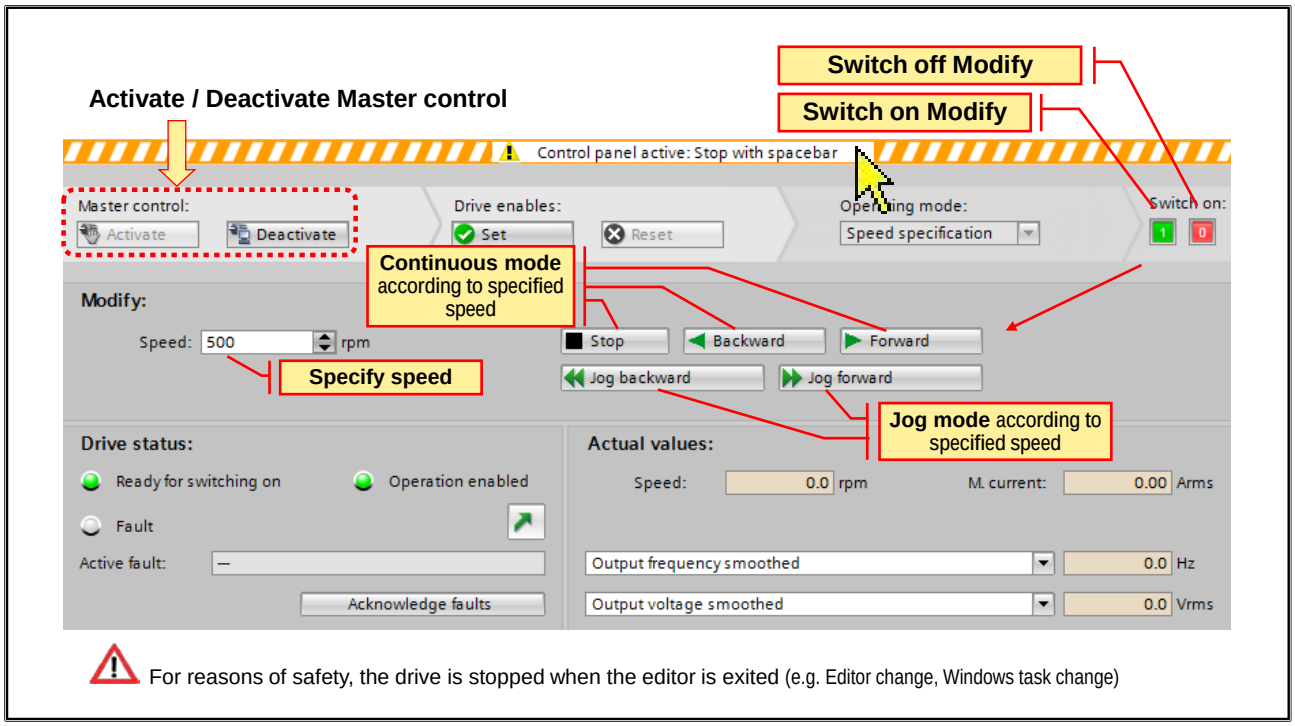
Control Panel Activate

This can only be activated when an online connection exists and no fault exists.

Caution!
Activation terminates a possibly existing connection to the CPU and gives the operator full control of the drive. Therefore it is important to have at your disposal a hardware solution for an Emergency Stop.



16.5.1. Operating the Control Panel for Commissioning



If the Master control is "switched to the PG" you can switch on "Modify".

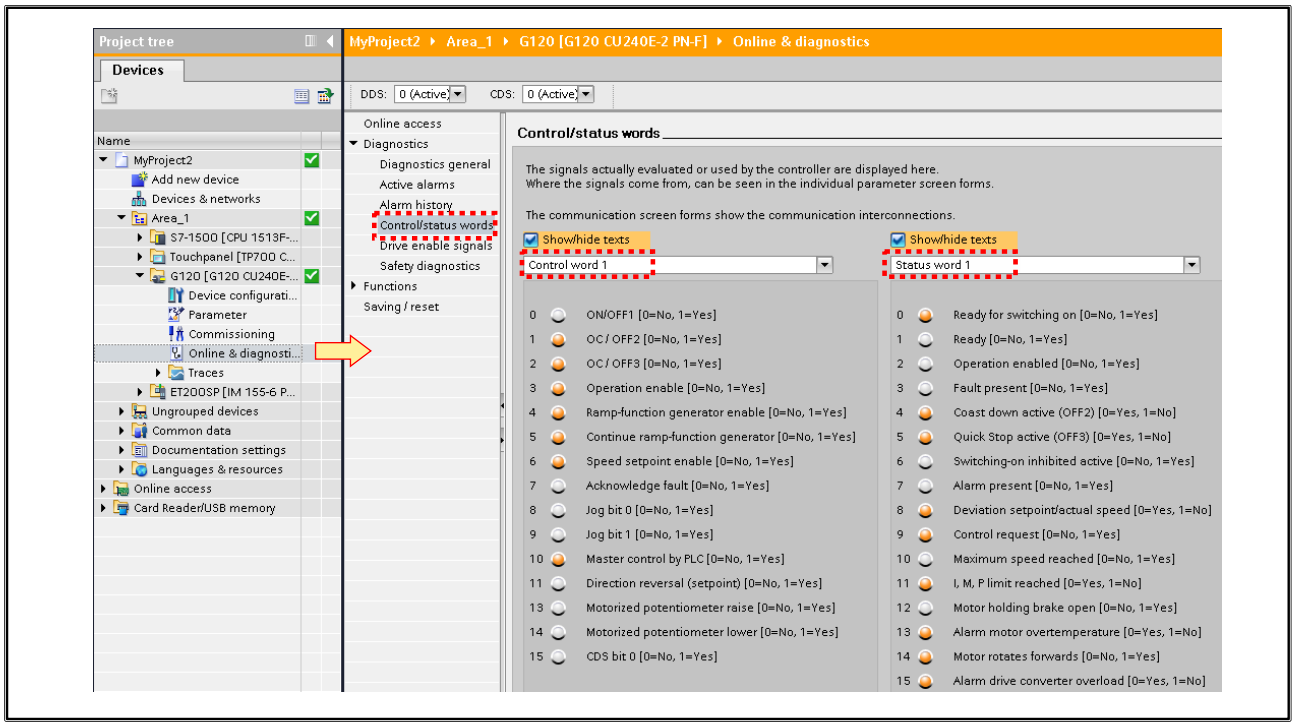
Operation is enabled and the buttons for modifying are active.

Safety Shutdown

The drive is stopped and...

- operating enables are cancelled,
  when the "Commissioning" editor is exited through a Windows task change.
  ⇒ Set
- the Master control is deactivated with a fault message,
  when a switch is made to the editor of another device.
  ⇒ Acknowledge faults and Activate

16.5.2. Monitoring Control and Status Word(s) ONLINE

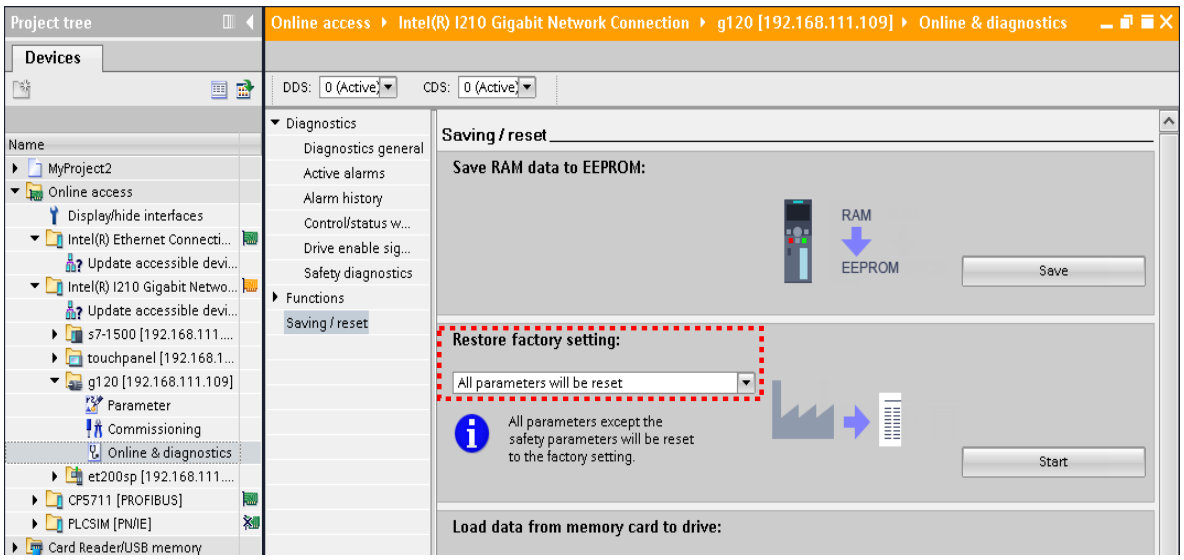


Monitoring Control and Status Word(s)

The Control and Status words dialog displays the different control and status words for diagnostics.

The signals actually used by the inverter are indicated by LED lights. The display is only relevant if the drive is controlled via the fieldbus.

16.6. Exercise 1: Resetting to Factory Settings



Task

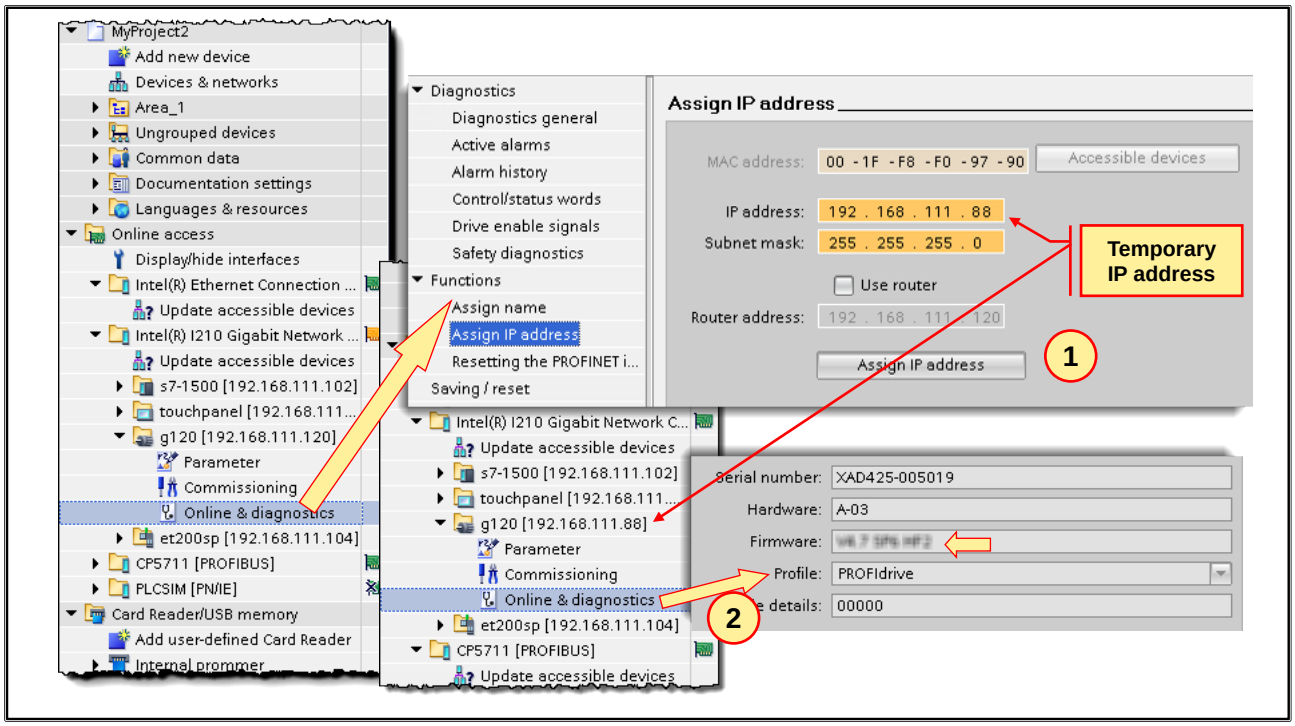
The drive is to be reset to its factory settings.

With the "Restore factory settings" function, the PROFINET device name and the IP address are also deleted.

What to Do

1. Connect a LAN cable between the drive and the PROFINET network of the training unit.
2. Under the Online access, select the relevant interface and update the list "Update accessible devices".
3. Open the drive and there activate the function "Online & diagnostics".
4. Give the interface of the drive an IP address, if one hasn't been assigned.
5. In the window that appears on the right, select "All parameters will be reset" for the function "Restore factory setting:" and Start the function.
6. Close the window.

16.6.1. Exercise 2: Reading-out the Firmware Version of the Drive



Task

In order to be able to configure the drive in the project in the next exercises, you must know the firmware version of the training unit. Since the firmware of the drive can be upgraded, the version of the firmware specified on the outside does not necessarily reflect reality. For that reason, the current version of the firmware is now to be read out online from the drive.

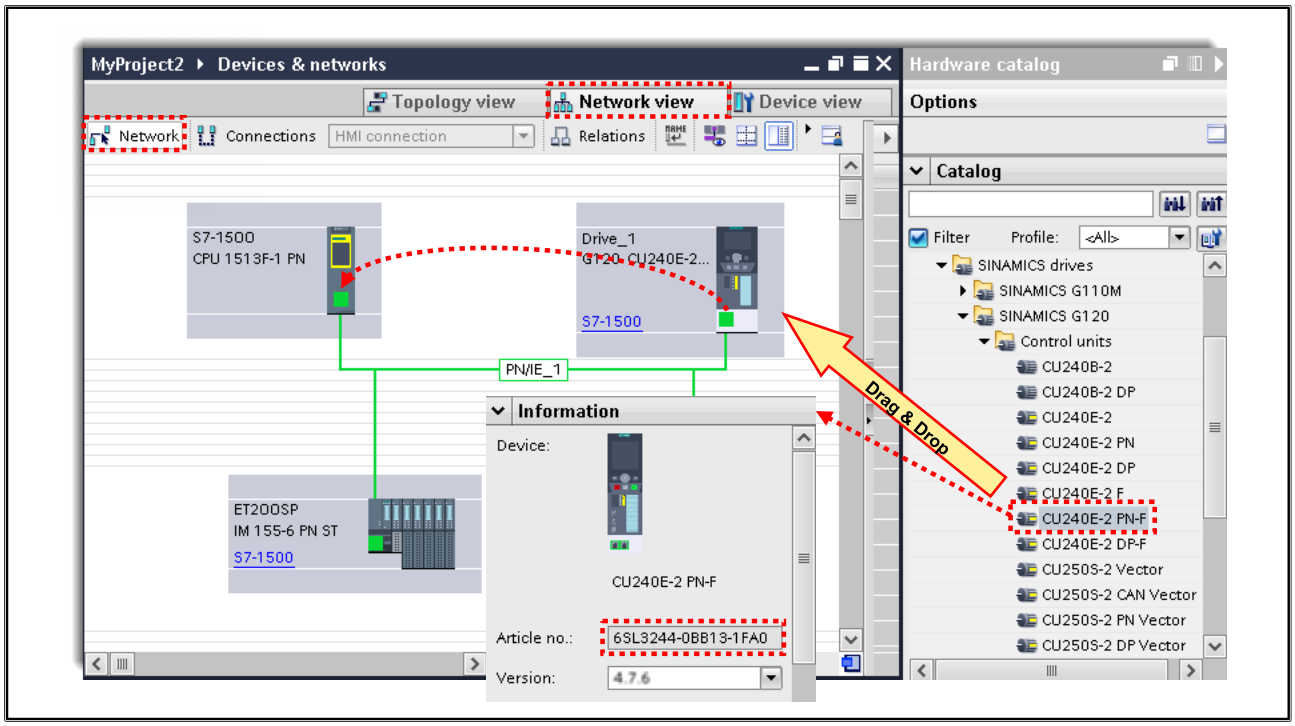
Problem

Should the drive only have a MAC address (see Project tree, to the left in the picture) and neither a PROFINET device name nor an IP address, the firmware version cannot be read out, since an IP address is required for this diagnostic service.

What to Do

1. In case the drive does not yet have an IP address:
   Assign a temporary IP address as shown in the picture and update the list "Update accessible devices".
2. In the list of "accessible devices", open the drive and activate "Online & diagnostics".
3. In the work area, activate "Diagnostics -> General diagnostics" and make note of the firmware version of the inverter.
4. Close the window.

16.6.2. Exercise 3: Inserting and Networking the Drive in the Offline Project



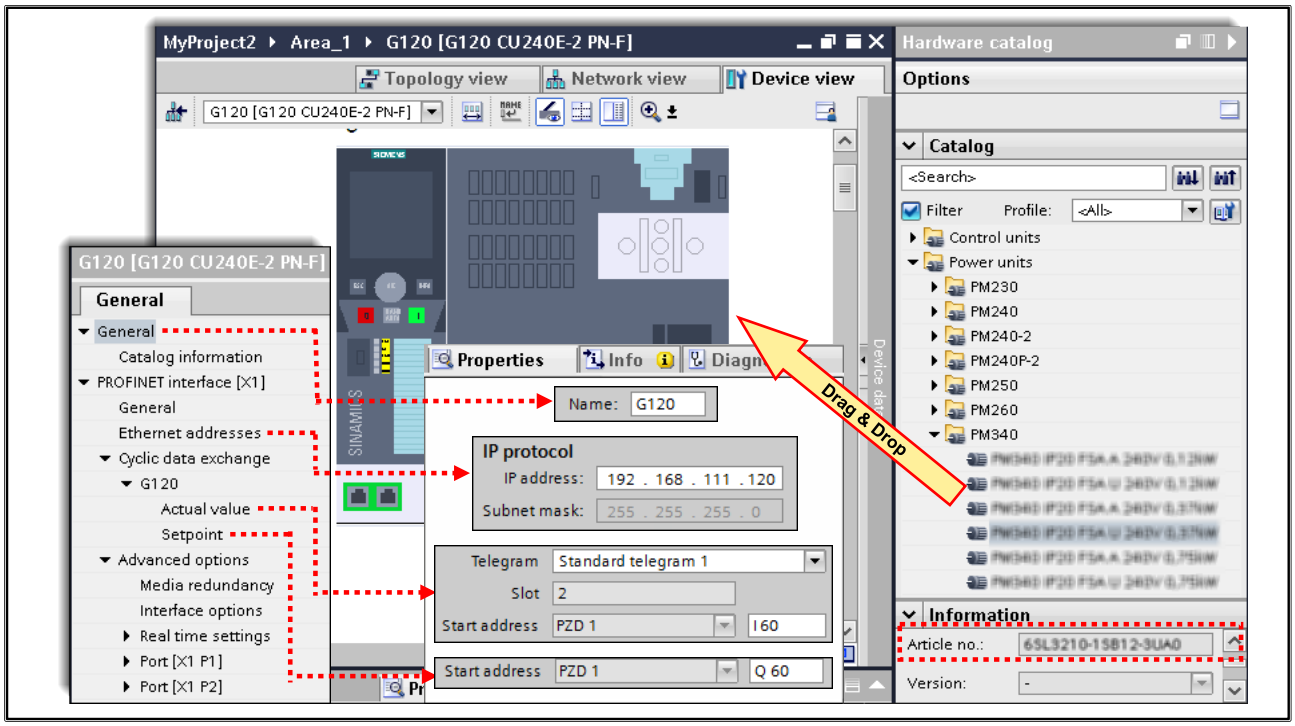
Task

The drive is to be inserted in the project and networked with the CPU via PROFINET.

What to Do

1. Open the "Hardware & Networks" editor and there activate the Network view.
2. In the Task Cards, open the Hardware catalog.
3. Insert the G120 drive by dragging the CU240E-2PN-F control unit into the Network view using drag & drop.
   Pay attention to the Article no (order number) and the Version in the "Information".
4. Network the drive with the CPU by dragging the PROFINET interface of the drive to the PROFINET interface of the CPU using drag & drop.
5. Save your project.

16.6.3. Exercise 4: Parameterizing the Drive Communication



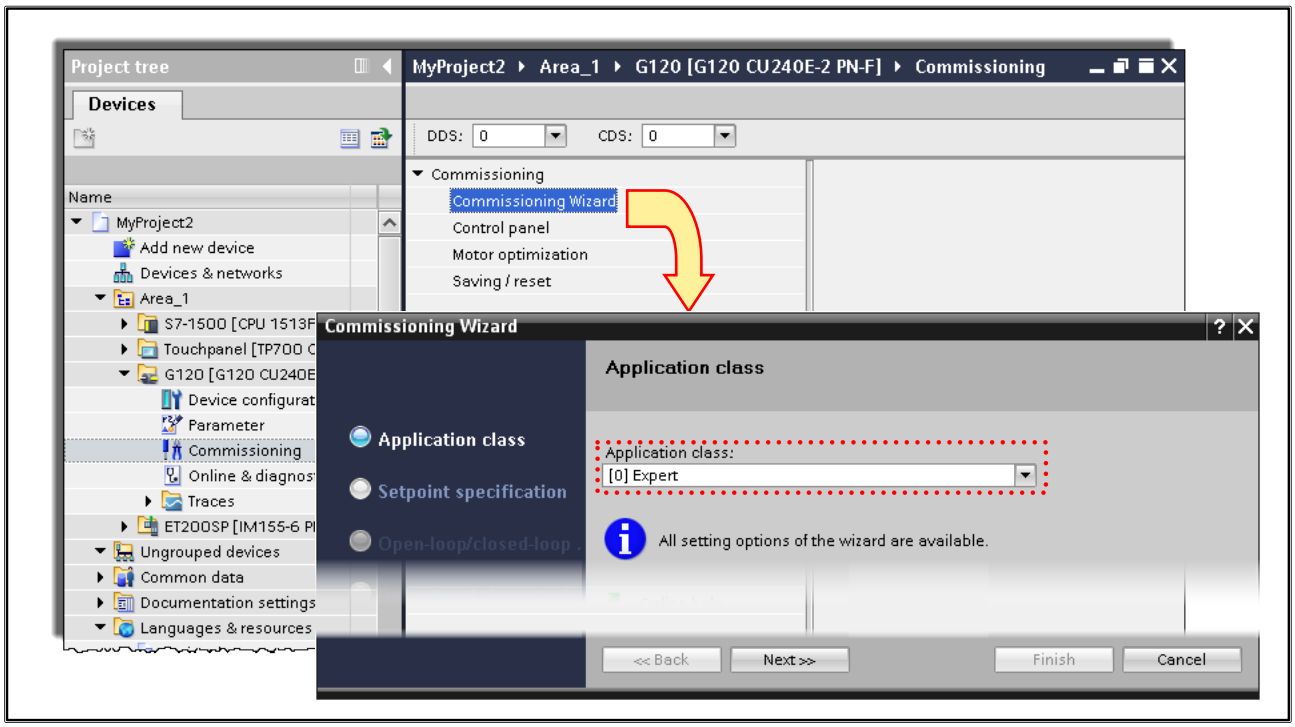
Task

So that the configuration of the drive is complete, a power unit still has to be added. Furthermore, the control unit still has to be parameterized.

What to Do:

1. Open the Device configuration of the drive.
2. Open the Hardware catalog and, using drag & drop, add the power unit. Pay attention to its Article no (order number) and Version in the "Information".
3. Select the control unit and, in the Inspector window under "Properties", parameterize the module with the parameters shown in the picture.
4. Save your project.

16.6.4. Exercise 5: Parameterizing the Drive OFFLINE with the Commissioning Wizard



Task

OFFLINE, you are to set the most important drive parameters and use the "Commissioning Wizard" to do this.

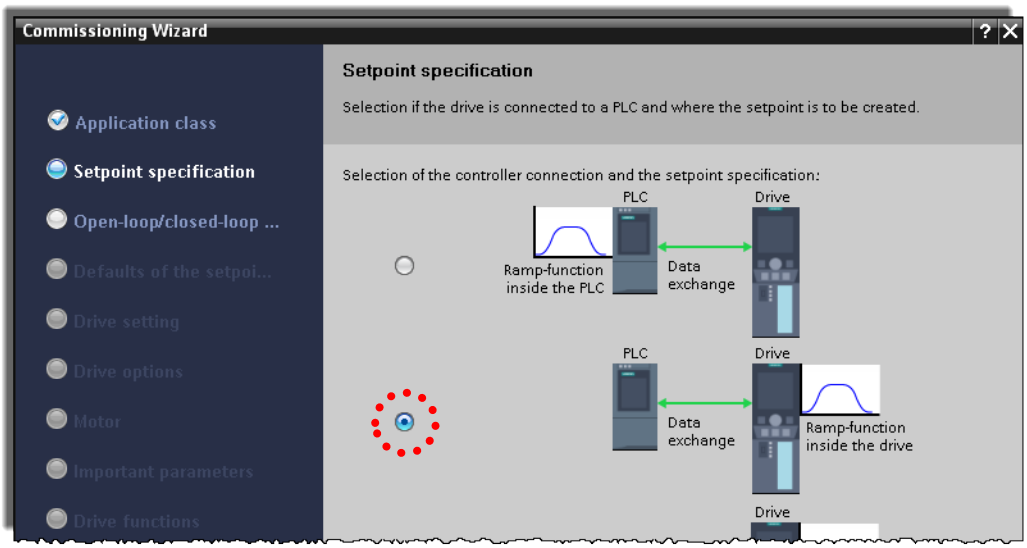
What to Do

1. Start the Commissioning Wizard as shown in the picture. Implement the parameterization as shown in the following.

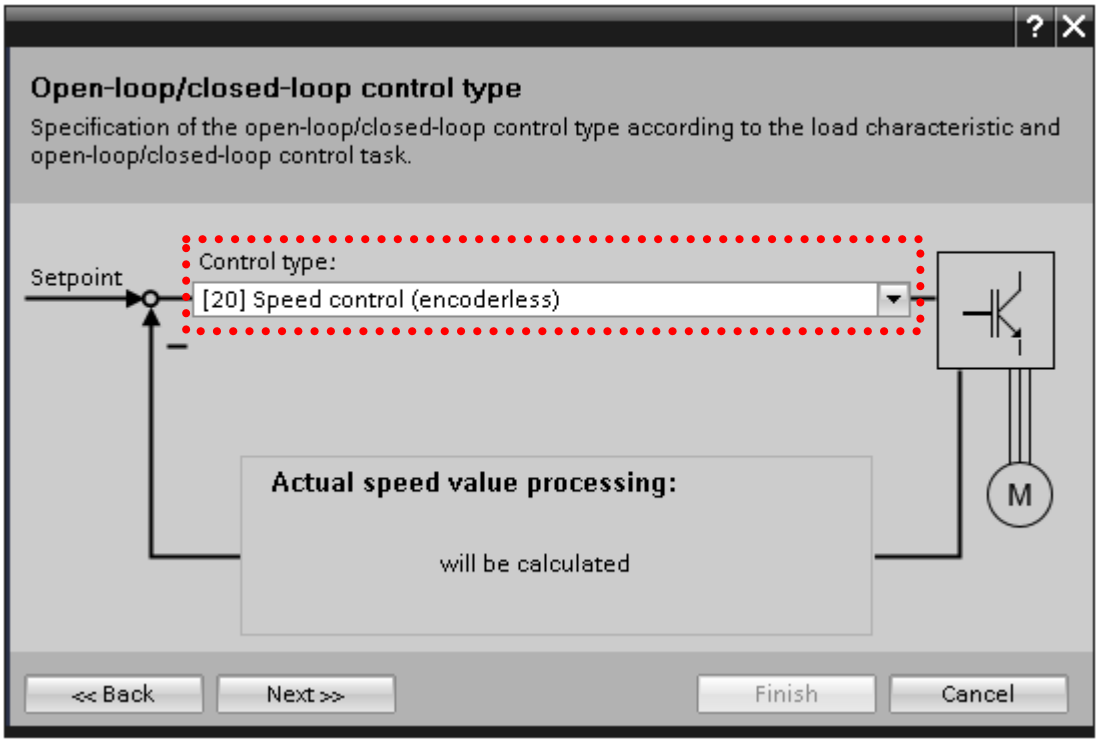
Note if Firmware of the drive is lower than 4.7.3

For a Firmware of the drive that is lower than 4.7.3., the Commissioning Wizard starts with the setting "Setpoint specification".

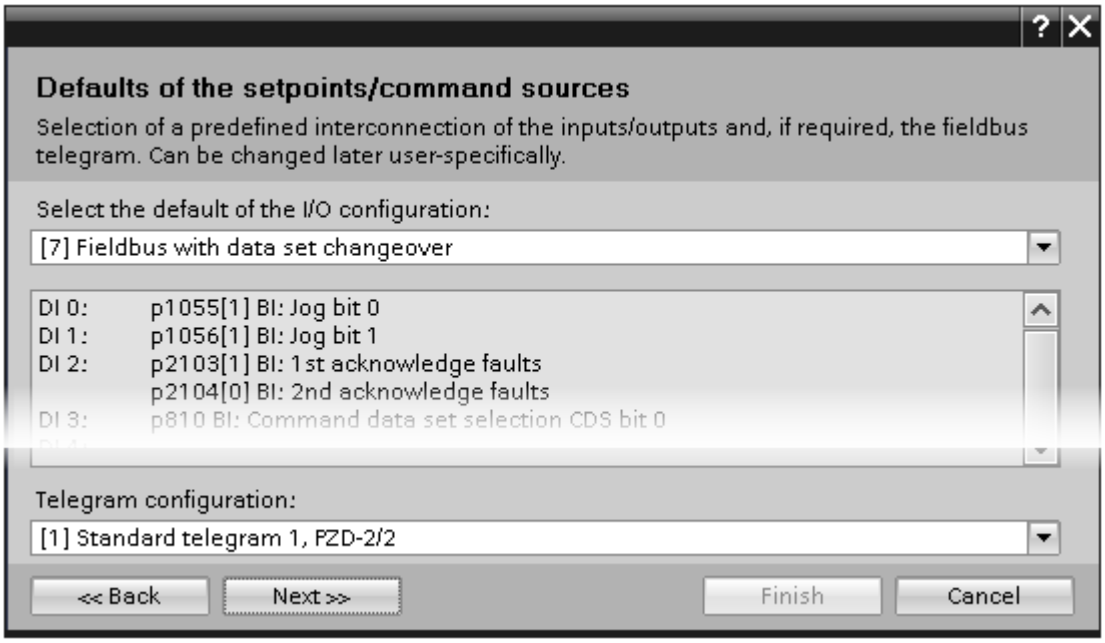
- **Setpoint specification**



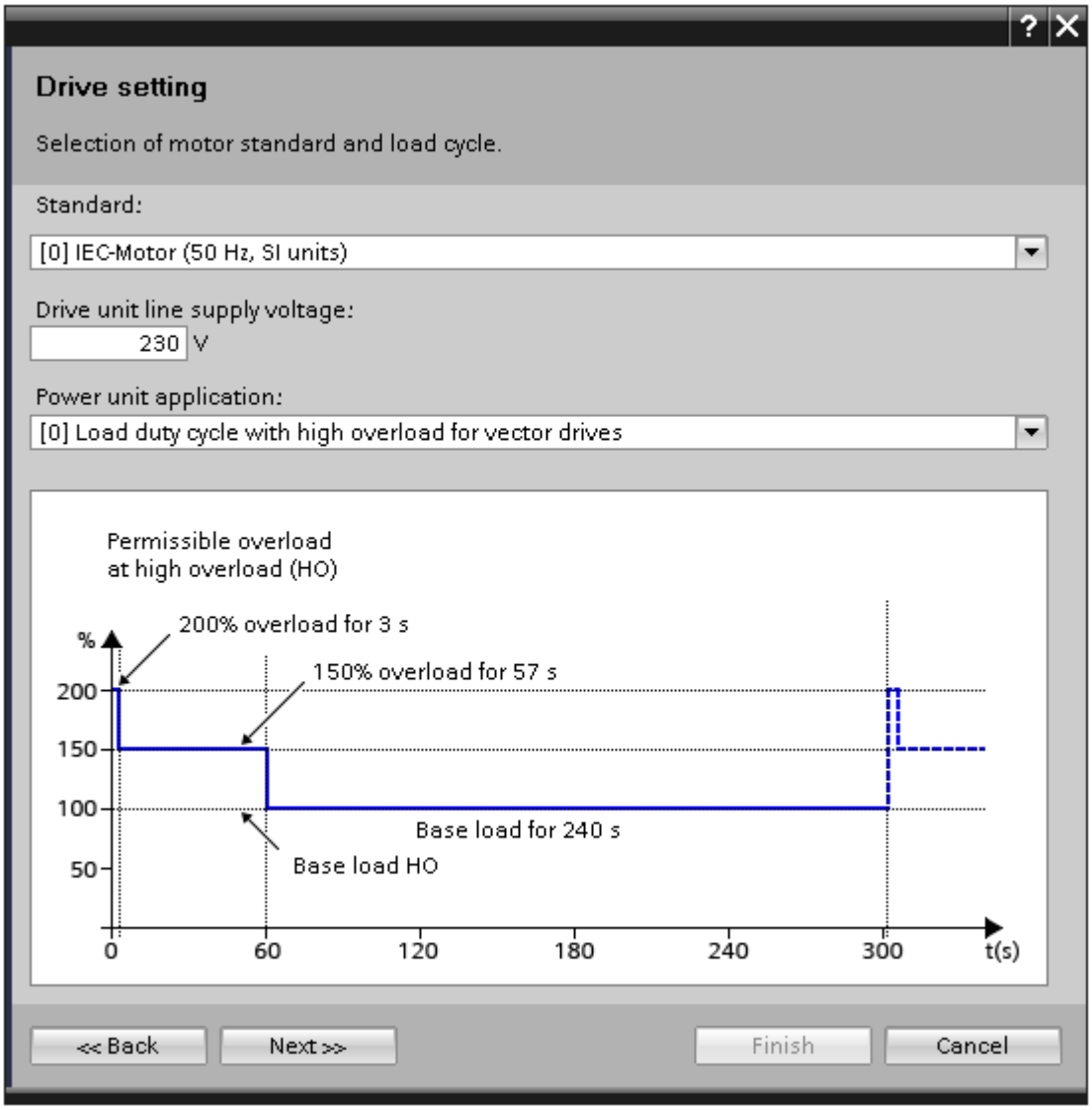
- **Open-loop/closed-loop control type**



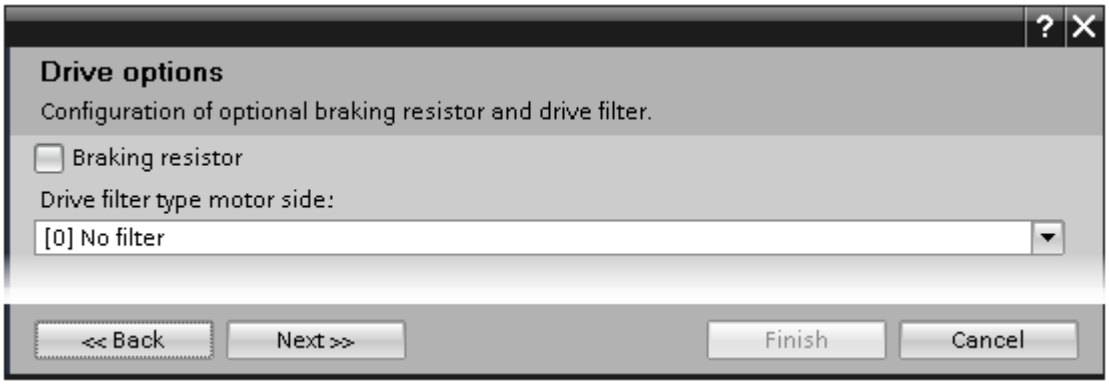
- **Defaults of the setpoints / command sources**



- **Drive setting**

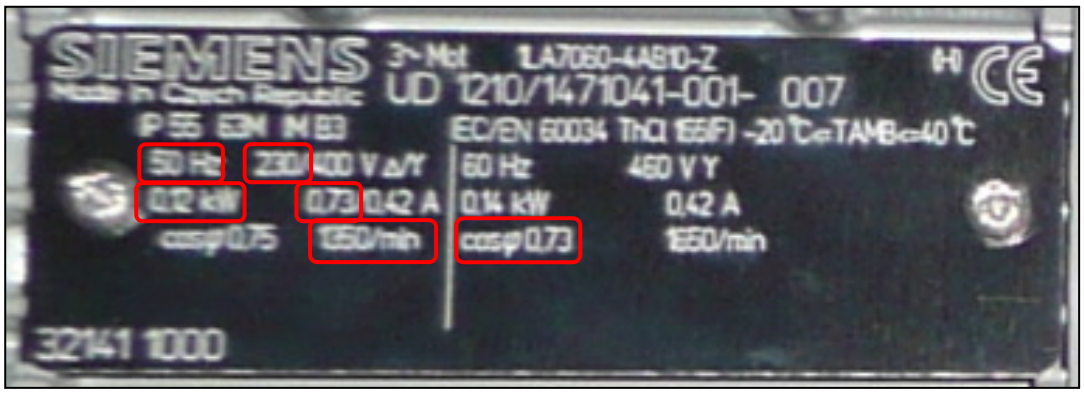


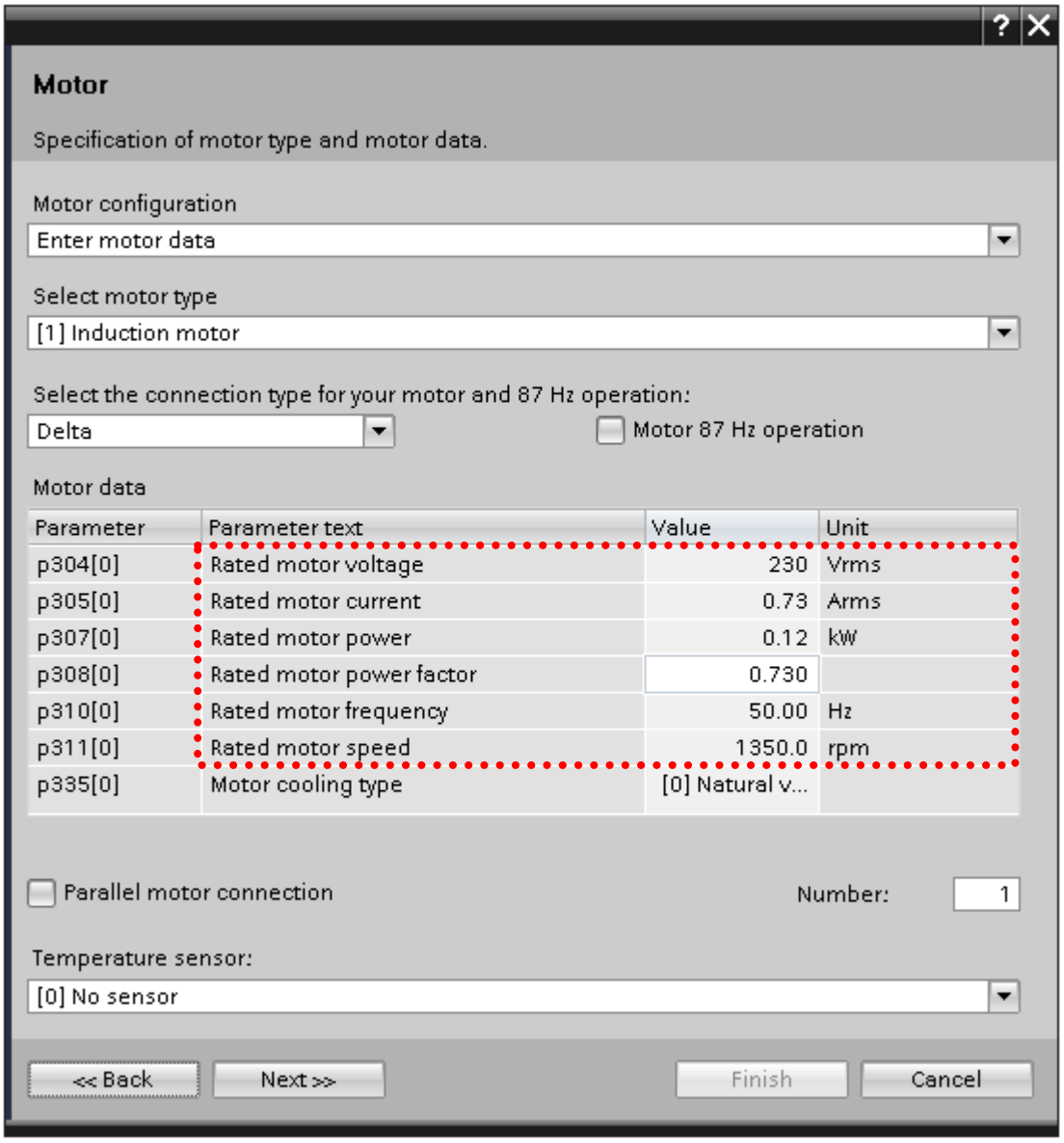
- **Drive options**



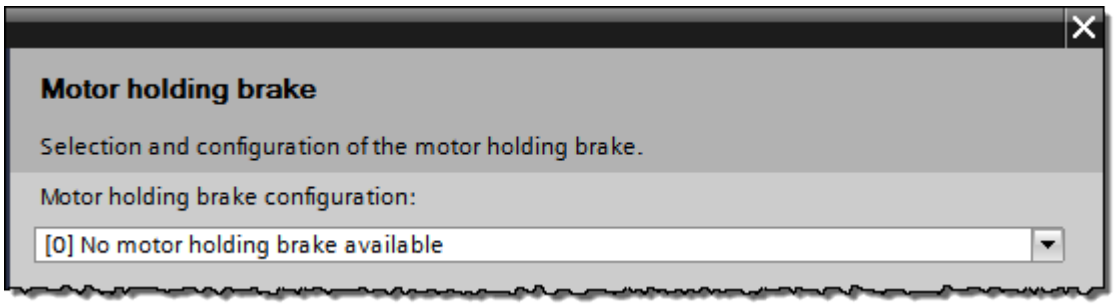
- **Motor**

Take the motor data from the motor's nameplate and enter it in the Motor dialog:



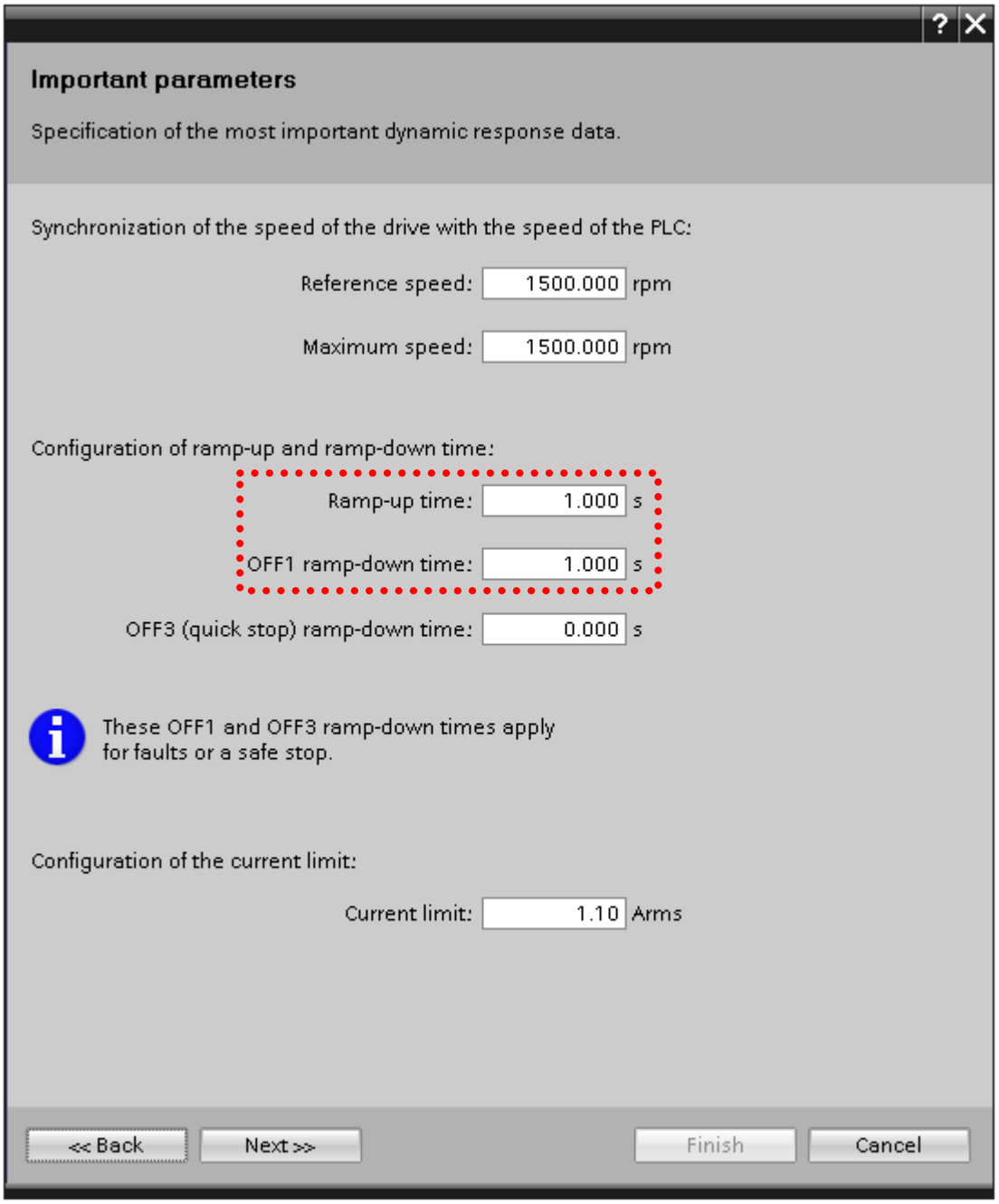


- **Motor holding brake**

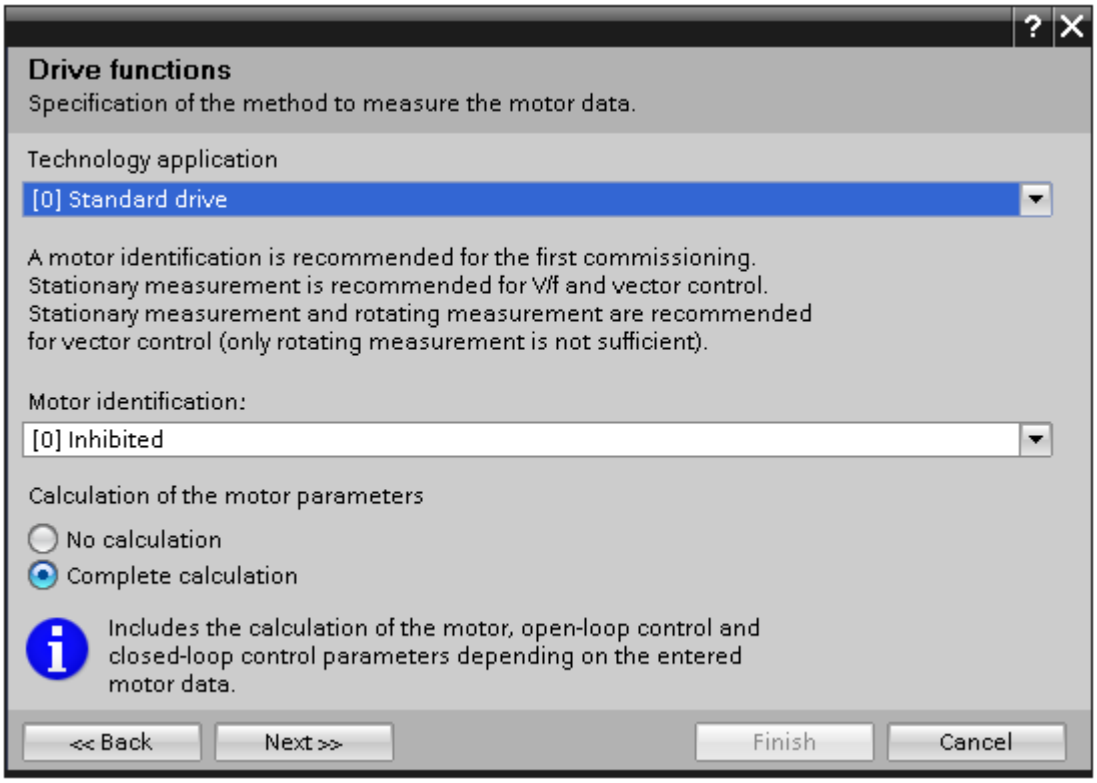


- **Important parameters**

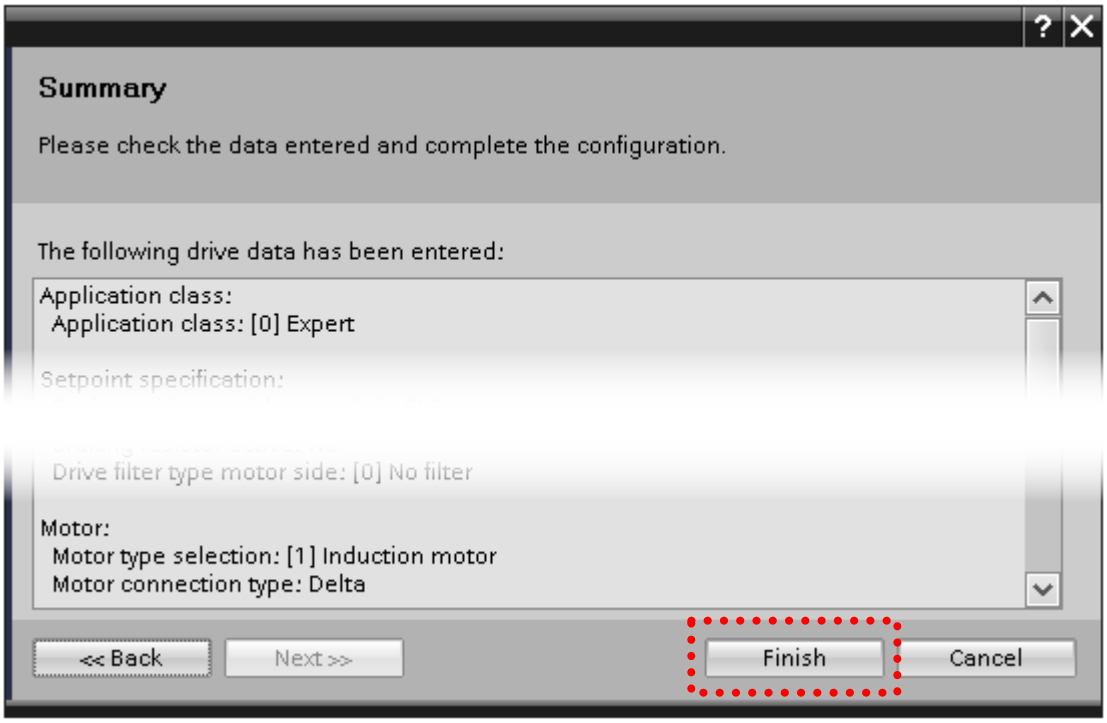
Change the ramp-up and ramp-down times:



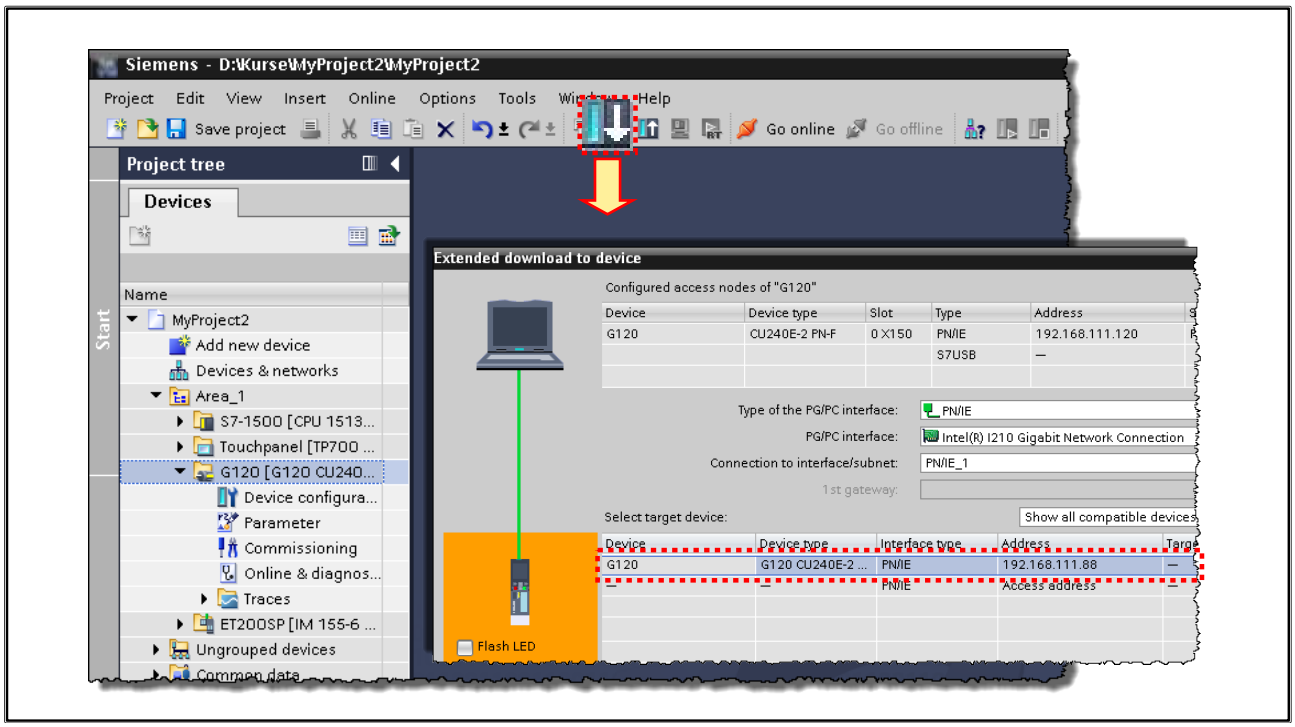
- **Drive functions**



- **Summary**



16.6.5. Exercise 6: Downloading Drive Parameterization to the Drive and Hardware Configuration to the CPU



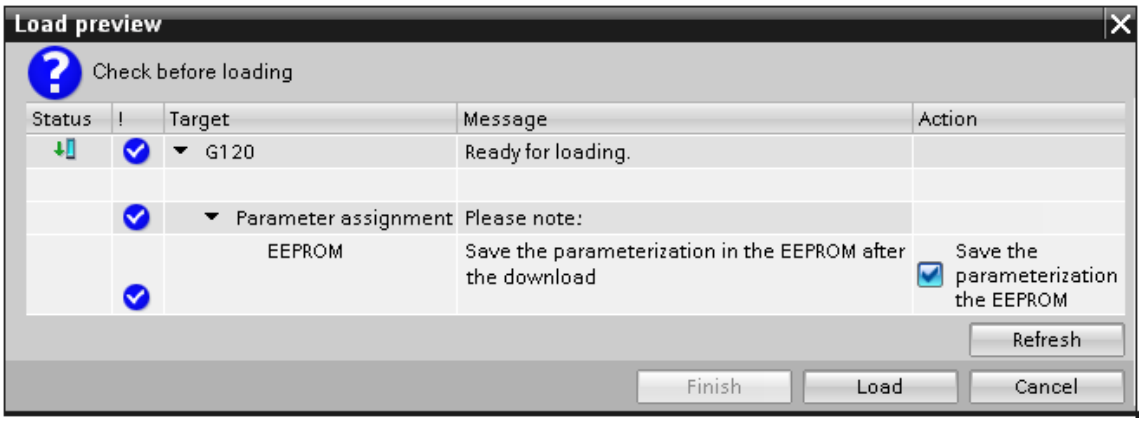
Task

Now that you have implemented the basic parameterization offline, it is now to be downloaded into the drive online. In addition, the hardware change of the CPU is also to be downloaded.

What to Do

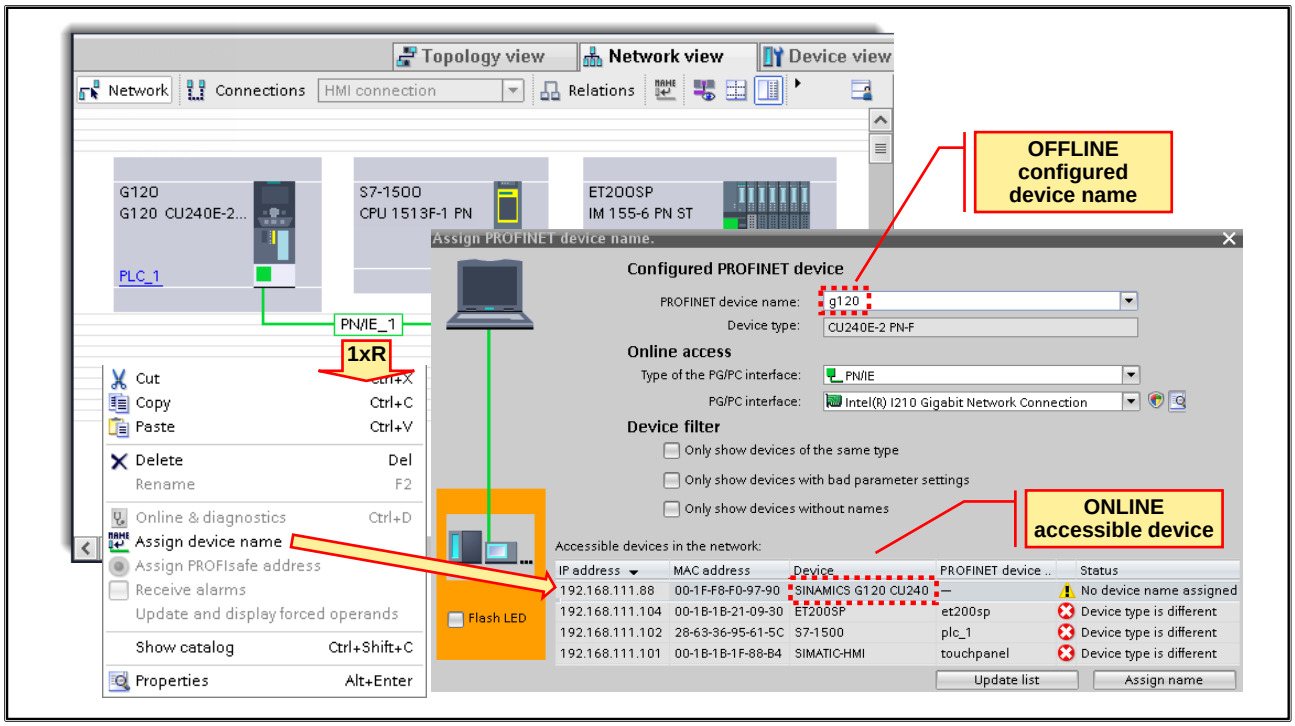
1. In the Project tree, select the drive and start the download of the hardware configuration and parameter assignment using the button "Download to device" (see picture).
2. The dialog "Extended download to device" appears which contains the list of compatible devices in the target subnet in the lower part. Should the drive of your training area not be listed there, activate the option "Show all compatible devices" (see picture).
3. In the list "Select target device", select the drive of your training area and start the "Download".

   So that the drive doesn't lose the parameterization even after a power failure, answer the following dialog as follows:



4. Also download the hardware configuration of the SIMATIC station once more into the S7-1500 so that the G120 is entered (listed) as a new IO-Device.

16.6.6. Exercise 7: Assigning the PROFINET Device Name ONLINE



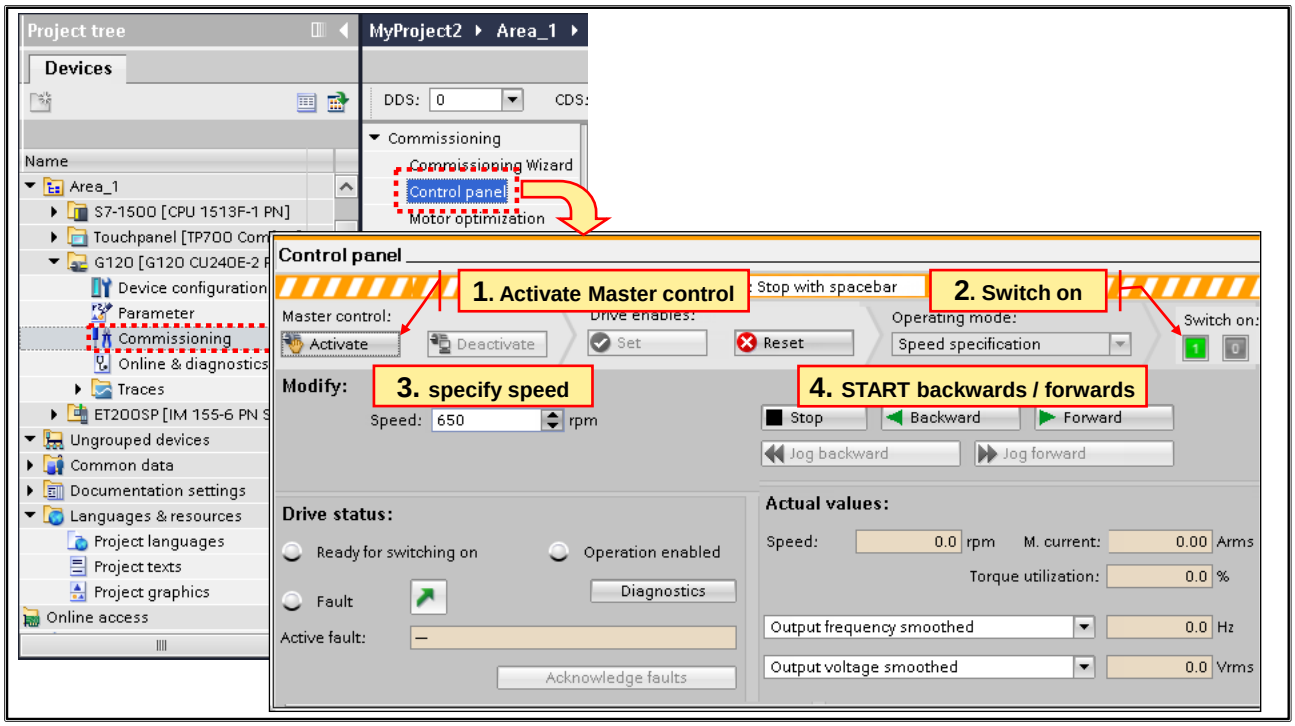
Task

ONLINE, assign the OFFLINE configured PROFINET device name and the IP address to the drive.

What to Do

1. Open the "Hardware & Networks" editor and there activate the Network view.
2. Select the subnet (see picture) and via the right mouse button, activate the function "Assign device name"
3. In the dialog that follows, complete it as shown in the picture and assign the name.
4. Check whether the name assignment was successful by "Updating the accessible devices" under the Online access.
5. Save your project.

16.6.7. Exercise 8: Operating the Drive via the Control Panel



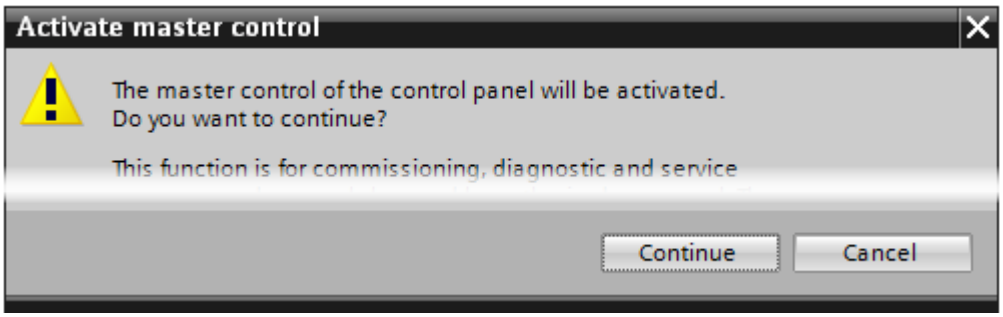
Task

Since the drive is already configured and has been assigned an IP address by the Controller, it can be operated via the Control panel.

What to Do

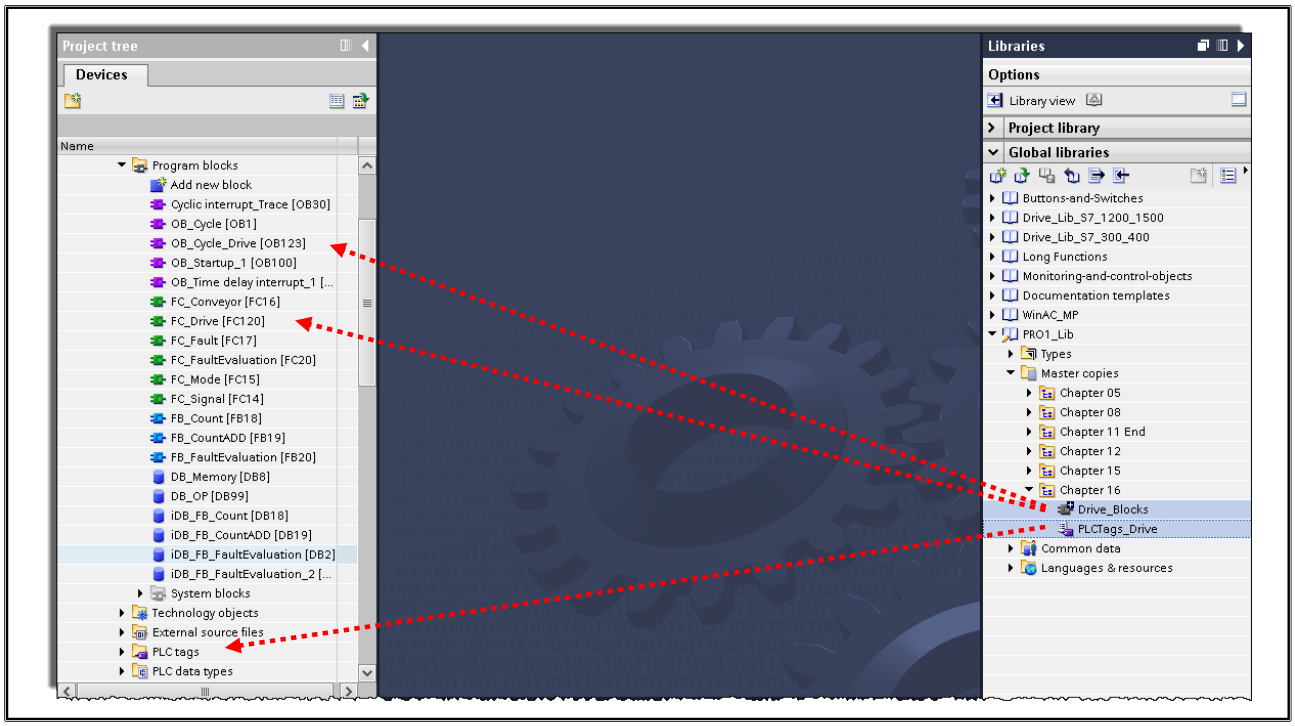
For controlling the drive open the "Control panel" and follow the numbers shown in the picture:

1. Activate the "Master control" (see picture) and acknowledge the dialog that appears with "Continue".



2. Switch on the drive.
3. Specify a speed.
4. To start the motor use one of the two buttons "Forward" or "Backward" and let the motor move with different speeds.
5. Switch the motor off and deactivate the master control.
6. Close the "Commissioning" editor and disconnect the online connection to the

16.6.8. Exercise 9: Commissioning "FC_Drive"



Task

Imagine that the G120 serves as the drive for the conveyor model when parts are transported from Bay1 or 2 automatically through the light barrier.

Accordingly, the G120 must be switched on and off parallel to the conveyor model motor when "P_Operation" (Q0.1) is switched on. The speed can be set using the right slide control potentiometer.

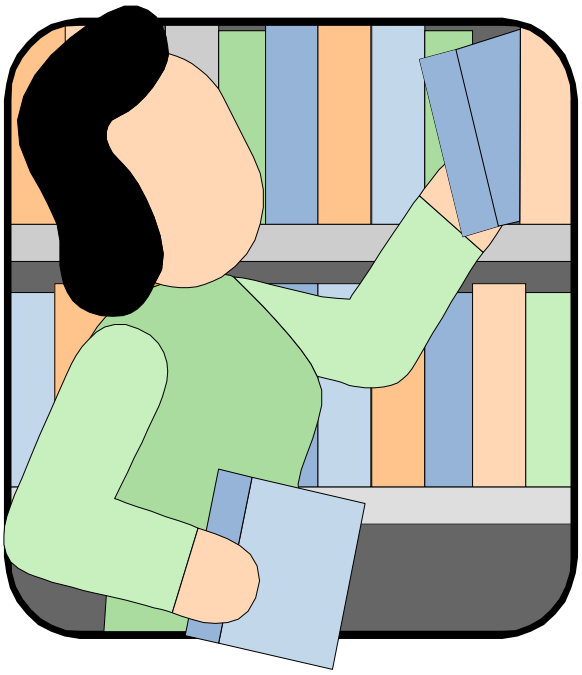
The described function is already implemented in the "FC_Drive" block and is now to be copied from a library and commissioned.

What to Do

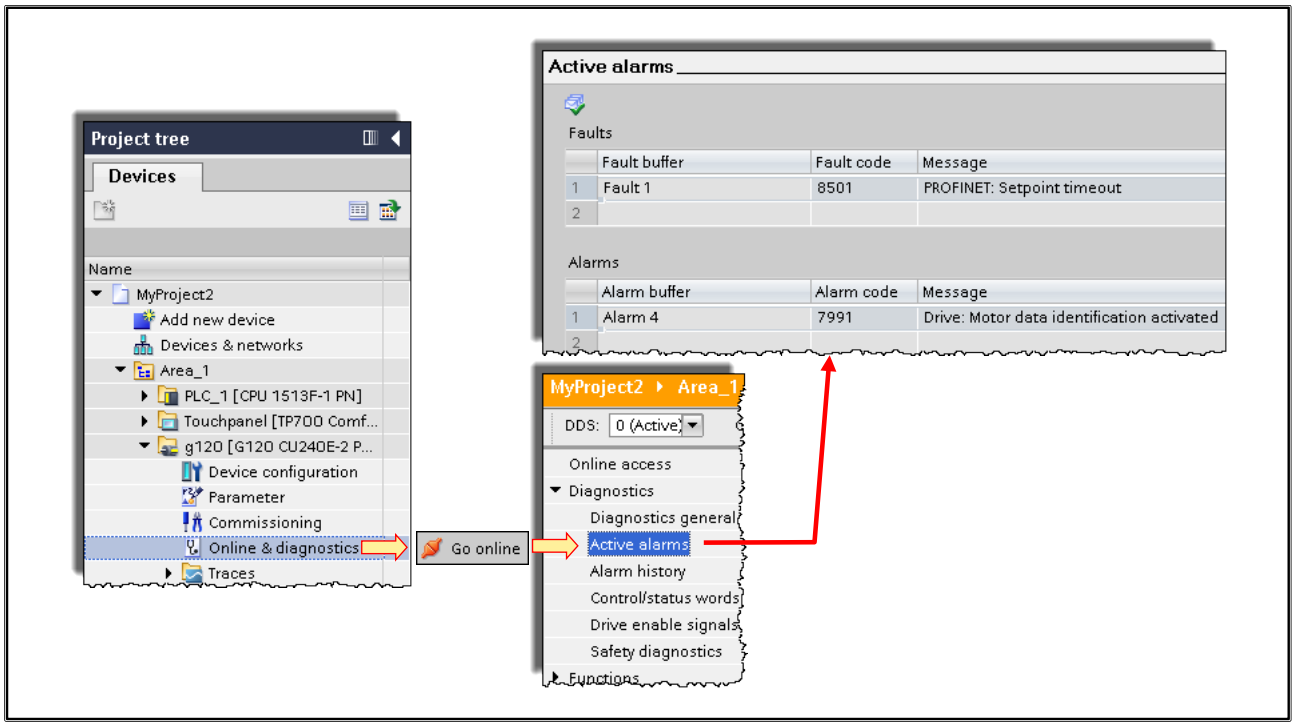
1. Open the library C:\02_Archives\TIA_Portal \TIA-PRO1\PRO1_Lib.
2. Using drag & drop, copy the library elements "Drive_Blocks" and "PLCTags_Drive" (tag table) into your project.

   Note:
   Since the object "Drive_Blocks" contains the FC_Drive and a "Program cycle OB" which calls the FC, the new program can be loaded directly.
3. Download all blocks into the CPU and check whether the G120 is switched on and switched off parallel to the conveyor model motor when "P_Operation" (Q0.1) is switched on.
4. Check whether the speed of the G120 can be changed using the right slide control potentiometer on the simulator.
5. Save your project.

16.7. Additional Information



16.7.1. Monitoring Active Alarms ONLINE



Description

"Active alarms" displays the currently pending alarms and faults.

- For a fault, the parameterized fault reaction is initiated and the status signal word 1.3 is sent. In addition, the fault is entered in the Fault buffer. Faults must be acknowledged after the cause is eliminated.
- For an alarm, the status signal word 1.7 is set. In addition, the alarm is entered in the Alarm buffer.

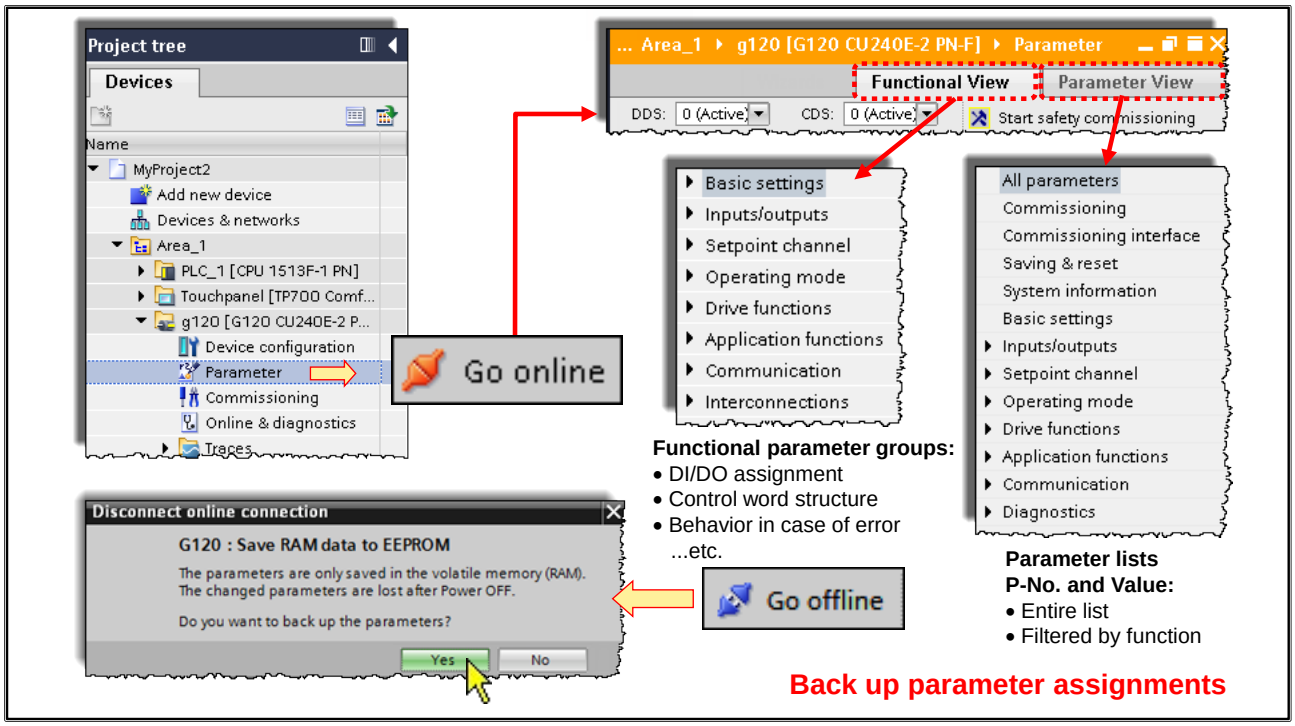
Faults and Alarms

Fault code / Alarm code	Number of the fault / alarm
Message	Description of the fault / alarm
Fault time / Alarm time	Time stamp that shows when the fault / alarm occurred.

Acknowledging Faults

Click on the  button in order to acknowledge all active faults.
Faults and alarms are moved to the Alarm history after they have been acknowledged.

16.7.2. Changing Parameters in the Inverter



Parameters can be changed through the "Parameter" editor.

Calling the "Parameter" Editor from the Device in the Project Tree

When the online connection is to be terminated, a prompt comes up questioning whether the data is to be copied to EEPROM (nonvolatile backup of the parameter changes).

If the change is only to be tried for test purposes, you can answer the query for copying with NO and after a PowerOFF/ON, the inverter then works with its previous values.

Calling the "Parameter" Editor from the Online Access

The change of these parameters is immediately written to the EEPROM.

16.7.3. G120 Reset to Factory Settings via BOP-2