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Speed control of a SINAMICS G120/S120 with S7-300/400 (STEP 7 V5) via PROFINET RT

SINAMICS G/S

http://support.automation.siemens.com/WW/view/en/38844967

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The functions and solutions described in this article confine themselves to the realization of the automation task predominantly. Please take into account furthermore that corresponding protective measures have to be taken up in the context of Industrial Security when connecting your equipment to other parts of the plant, the enterprise network or the Internet. Further information can be found under the Item-ID 50203404.

http://support.automation.siemens.com/WW/view/en/50203404

Table of contents

1 Task

1.1 Overview

Description of the automation task

A drive shall be moved speed-controlled.

For this purpose the drive is operated as IO device connected to an IO controller. In this case, no special control-related tasks are required. This is the reason that a communication via PROFINET RT is configured between controller and drive.
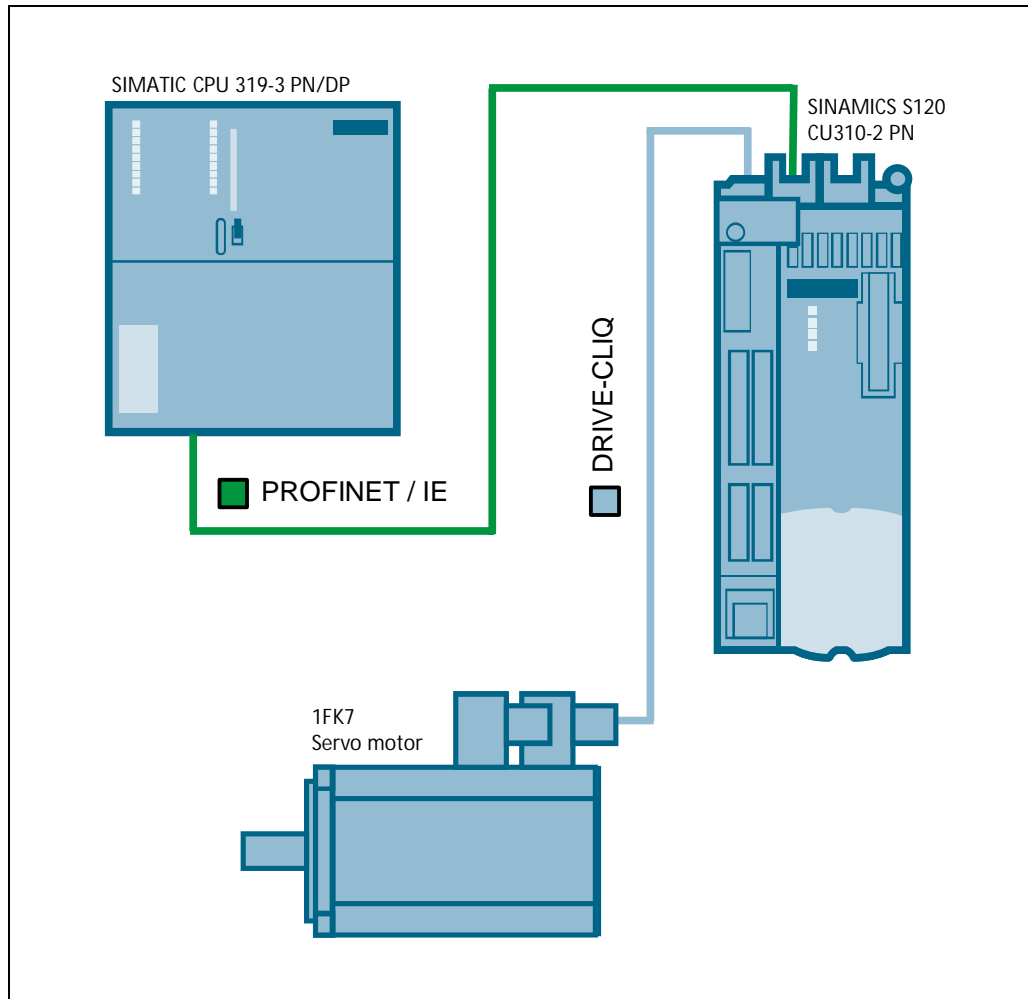
2 Solution

2.1 Overview

Schema

The following figure displays the most important components of the solution:

Fig. 2-1

This application description shows how a SINAMICS drive can be moved speed-controlled using a SIMATIC S7-300/400 (STEP 7 V5). A communication via PROFINET RT is configured between controller and drive.

The SIMATIC CPU sets the required releases so that the servo motor of the SINAMICS drive can be moved speed-controlled. To achieve this, control word ("STW1") and speed setpoint ("NSOLL_B") are sent from the CPU to the drive in OB1. The drive sends its status word ("ZSW1") and actual speed value ("NIST_B") back to the controller. Any upcoming drive faults are acknowledged by the SIMATIC controller via application.

2.1 Overview

Advantages

The solution described here offers you the following advantages:

- Simple control of the SINAMICS drive.
- Simple design using standard technology.
- The existing system can be expanded quick and simple.

Delimitation

This application does not include a description of:

- the general drive functions of the SINAMICS G120/S120
- the SIMATIC S7-300/400

It is assumed to have basic knowledge of these topics.

Knowledge required

Basic knowledge about configuring SIMATIC control systems with the STEP7 engineering system and configuring SINAMICS drives with STARTER or SIMOTION SCOUT is assumed.

2.2 Hardware and software components

2.2.1 Validity

This application is valid for

- STEP 7 as from V5.x
- STARTER as from V4.x
- SIMOTION SCOUT as from V4.x
- S7-300 as from V3.x
- S7-400 as from V6.x
- SINAMICS S120/G120 as from V4.x

2.2.2 Components used

The application was created with the following components:

Hardware components

Table 2-1

Component	Qty.	Order number	Note
SIMATIC S7 CPU 319-3 PN/DP	1	6ES7318-3EL01-0AB0	V3.2.10
SINAMICS S120 CU310-2 PN	1	6SL3040-1LA01-0AA0	V4.6 HF10
SINAMICS training case	1	6ZB2480-0AD00	---

NOTE	The sample project was created with the hardware components listed here. Alternatively, other components with the same function may be used. A different parameter assignment and different wiring of the components may be required.
	When configuring **PROFINET RT-based communication** between an S7-CPU and a CU320-2 PN – or a SINAMICS G120 V4.x with PROFINET interface – then proceed as described for this particular application. A CU310-2 PN is used in the application description and in the sample project.

Software components

Table 2-2

Component	Qty.	Order number	Note
STEP 7	1	6ES7810-4CC10-0YA5	V5.5 SP3 HF2
STARTER	1	---	V4.3 SP3 HF1 (Download)
SIMOTION SCOUT (as an alternative to STARTER)	1	6AU1810-1CA43-1XA0	V4.3 SP1 HF17

2.3 Alternative solution

Sample files and projects

The list below contains all the files and projects used in this example.

Table 2-3

Component	Note
38844967_SIMATIC_SINAMICS_PN_RT_V2_0.zip	This zipped file contains the STEP 7 project.
38844967_SIMATIC_SINAMICS_PN_RT_V2_0_en.pdf	This document

2.3 Alternative solution

Drive connection via PROFINET IRT

If the control system (e.g. a SIMOTION control system) is to handle control-related tasks, then it is no longer sufficient to use PROFINET RT to connect the drive.

The drive must then be connected using PROFINET IRT (isochronous).

Note	Further information concerning the drive connection via PROFINET IRT can be obtained in the following article. http://support.automation.siemens.com/WW/view/en/53477498

3 Basics

3.1 PROFINET communication

In addition to the MAC address and IP address, PROFINET uses additionally a device name to identify the PROFINET devices. This device name must be unique within the PROFINET network.

3.1.1 Device name

During the commissioning phase a device name is assigned to each PROFINET device by the engineering system (HW Config, NetPro, STARTER, SCOUT, Primary Setup Tool). The device name can be assigned by different ways:

- IO-Controller
  - Engineering Software (HW Config, NetPro, STARTER, SCOUT, Primary Setup Tool)
  - By downloading the HW Config
  - By user program (system function `_setNameOfStation()` for SIMOTION)
- IO-Device
  - Engineering Software (HW Config, NetPro, STARTER, SCOUT, Primary Setup Tool)
  - From IO-Controller via topology-based initialization

The device name will be stored in the device (on MMC or CF card). When replacing this device (e.g. in case of malfunction), this device must be initiated using the device name of the replaced device. For this step more possibilities are available:

- By plugging the MMC or CF card (if available)
- Engineering software (HW Config, NetPro, STARTER, SCOUT, Primary Setup Tool)
- Topology-based initialization by the IO-Controller itself. For this the PROFINET interface must be in factory settings.

It means the new device can assume the function of the replaced device without changing the configuration.

3.1.2 Assign device name via HW Config

Open HW Config and select the PROFINET IO-System. Click in menu under „PLC > Ethernet" onto "Assign Device Name…". The dialog assign device name will appear. All configured device names are in dropdown box listed. All recognized PROFINET devices via Network interface are shown under available devices. IO-Controllers are not shown here, because they will get the device name by downloading the HW Config explicit.
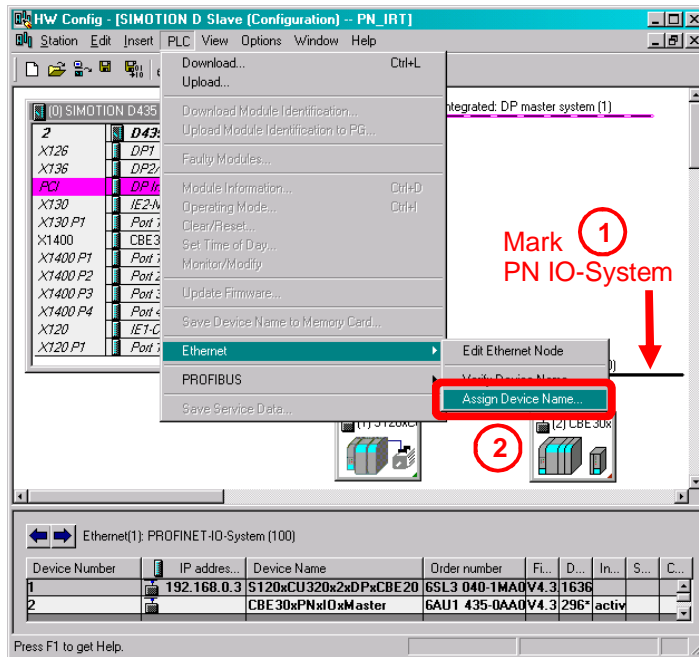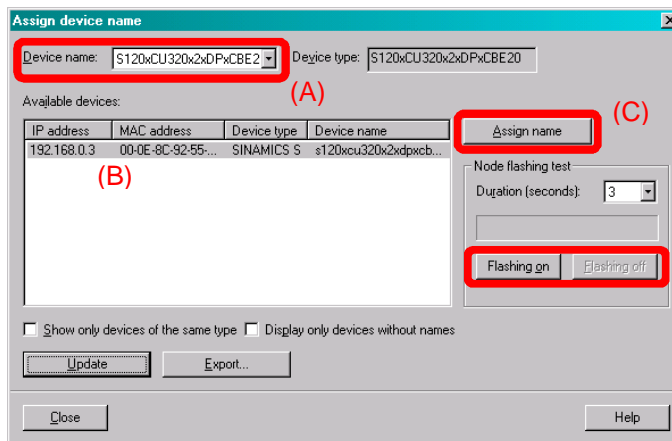
3.1 PROFINET communication

Figure 3-1

Figure 3-2

Select the configured device name (A) and select the corresponding device (B) and click on "Assign name" (C). The device name will be transferred to the device.

If the device identification is not clear you can activate the flashing of a specified LED. Select the device and click on "Flashing on" to activate the function. Depending on the device type following LED will start flashing:

Table 3-1

Device	LED
SIMATIC	LINK-LEDs
SIMOTION	SF-LED
SINAMICS S120	RDY-LED
SINAMICS G120	RDY-LED

3.1.3 SINAMICS: Assign device name via parameters

The device name of a SINAMICS drive can also be specified offline via parameters in the expert list of the CU. By using the STARTER / SCOUT functionality "Load to file system" afterwards the configuration can be transferred directly to the CF card via card reader or to the drive via download of the offline configuration. The device name will be activated in the drive and stored non-volatile after the next run-up (Power OFF/ON required!).

| NOTE | Beside the device name, also the IP address and the subnet mask of the drive have to be specified correctly in the expert list of the CU, because these will also be activated in the drive and stored non-volatile after the next run-up. |

For the assignment of the device name, the IP address and the subnet mask, proceed as follows:

1. Open the expert list of the CU in the STARTER / SCOUT project.

2. Depending on which PROFINET interface of the drive you are using (onboard PROFINET interface or CBE20), proceed as follows:

   – **Settings for the onboard PROFINET interface**

     - Enter the drives' device name from HW Config into parameter p8920.
     - Enter the drives' IP address from HW Config into parameter p8921.
     - Enter the drives' subnet mask from HW Config into parameter p8923.
     - Set parameter p8925 to the value "[2] Save and activate configuration".

   – **Settings for the CBE20**

     - Enter the drives' device name from HW Config into parameter p8940.
     - Enter the drives' IP address from HW Config into parameter p8941.
     - Enter the drives' subnet mask from HW Config into parameter p8943.
     - Set parameter p8945 to the value "[2] Save and activate configuration".

3. Save the changes carried out in the project. Afterwards mark the drive in the project tree and open its context menu via right clicking. Choose the option "Load to file system".

4. Choose the option "Save normally" as type of saving and click on the button "Select target…". Choose the path of the card reader and start the transmission of the configuration via the button "OK".

5. After the successful transmission of the configuration and subsequent run-up of the drive the device name, the IP address as well as the subnet mask is taken over from the parameters and stored non-volatile.

3.1.4 Topology-based initialization

The device name can be assigned by the PROFINET IO-Controller itself. With the checkbox "Support device replacement without exchangeable medium" the PROFINET feature topology-based initialization is activated. This feature is activated by default.

Figure 3-3
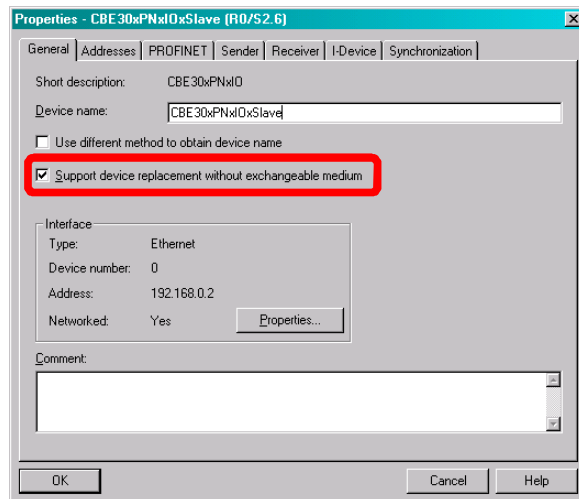
This properties window will open by double clicking on the PN interface of the IO-Controller in HW Config.

Please observe that **the PN interface of IO-Device must be in factory settings** to support this function (in this state the interface has the IP address = 0.0.0.0 and an empty device name = „"). To reset the PROFINET interface to factory settings open HW Config and click on „PLC > Ethernet > Edit Ethernet Node > Reset" (see following figure).

Figure 3-4
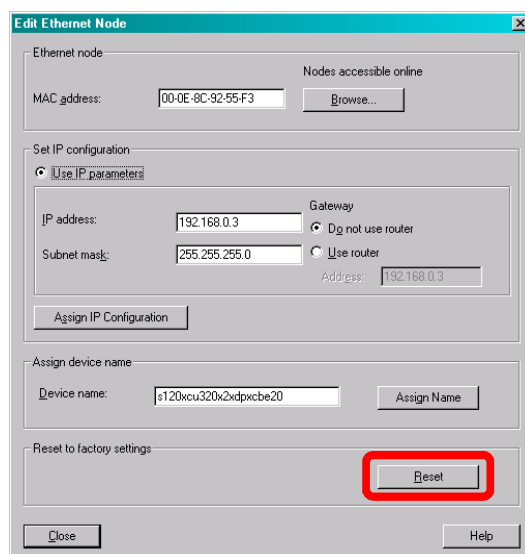
3.1.5 Device name assignment rules

The device name has to follow the rules of DNS (Domain Name System). Following possibilities for DNS names are given:

- Letters (a..z),
- Numbers (0..9) and the signs
- Minus (-) and
- Dot (.) are allowed.

The dot divides the device name into labels. The device name can include more labels, for example:

<CPU name>.<Interface number >.<Name of IO-System>…

- *<Interface number>*, if the device has more than one PN interfaces available (e.g. "X150")
- *<Name of IO-System>*, optional and configured by HW Config (see Figure 3-5).
- Each label must start with a letter and doesn't end with minus or a dot.
- The maximum length of one label is 63 characters.

Figure 3-5
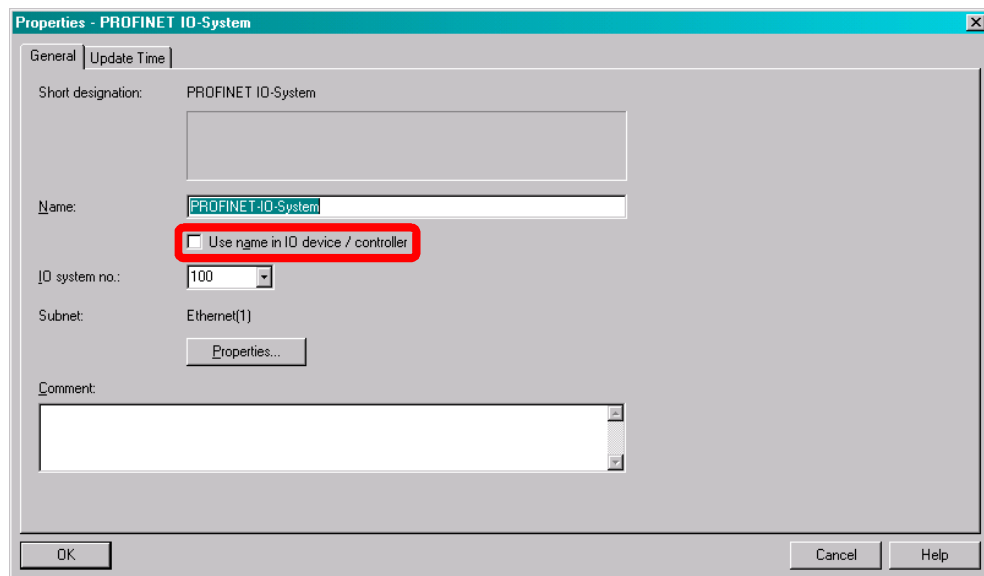
3.1 PROFINET communication

Observe also following additional rules:

- The maximum total length is 127 characters (incl. minus and dot)

- The device name may only include lower case. On the device upper case are replaced through lower case.

- Do not use umlauts (ä, ö, ü)

- Do not use special characters ! " § $ % & / ( ) = ? * ' _ : ; > < , # + | ~ \ }] [{

- Do not use blanks

- The device name does not start with "port-xyz" (x, y, z = 0..9).

- **Do not use the minus sign on SIMOTION controllers. Up from SIMOTION SCOUT Version 4.3 this limitation is raised.**

3.1.6 IP address

PROFINET uses IP addresses for establishing the PROFINET IO communication and for NRT (Non Real Time Communication e. g. TCP, UDP, S7 communication).

The IP address is also needed to go online to the device. It is recommenced to assign an IP address to each PROFINET IO-Device during startup of a project commissions. To do this you have more possibilities:

- IO-Controller
    - Engineering software (HW Config, NetPro, STARTER, SCOUT, Primary Setup Tool)
    - Download of HW Config, please observe the current active IP address of the device!

- IO-Device
    - Engineering software (HW Config, NetPro, STARTER, SCOUT, Primary Setup Tool)

In a PROFINET IO-System it is possible to receive the IP address from the IO-Controller. This feature is activated by default.
For this a correct working PROFINET connection between IO-Controller and IO-Device is required and the active device name must be the same as in the HW Config. Figure 3-6 shows the configuration of a SINAMICS S120. The device with device name "SINAMICS" will get the IP address 192.168.0.3 and the same subnet mask as the IO-Controller.

If the device doesn't receive the IP information from IO-Controller it is maybe not possible to go online with the engineering software (e. g. Starter or SCOUT). In this case assign a fixed IP to the device.

3.1 PROFINET communication

Figure 3-6
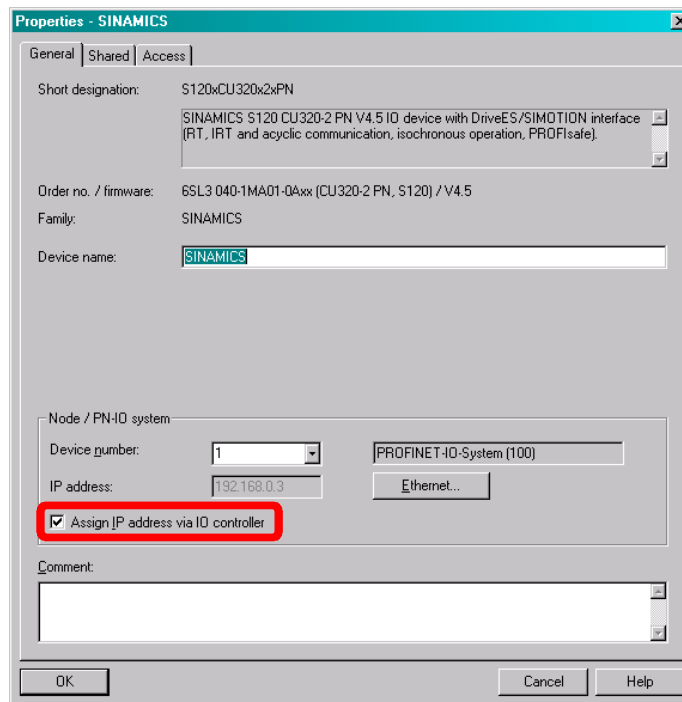
The received IP address from IO-Controller is just a temporary address (till next power OFF/ON of the device). The received address is higher prior as a fixed set IP address via engineering software.
After power ON the IP address must be received from IO-Controller first. If the address will not receive, the IP address set by the engineering system or the default IP address 0.0.0.0 (default setting of the PN interface) will be active.
An IP address assigned by any engineering software is permanently saved.

If you disable the function „Assign IP address via IO-Controller" the fixed IP address will be used. The IO-Controller will not assign the configured IP address.

The IP address in the device must be unique. Please observe that the IP addresses used by PN interfaces (e.g. X150) and the IP addresses of the standard Ethernet interfaces (e.g. X127) must be in different IP subnets. For example: If you assign an IP address 169.254.11.23 to the PN interface X150 so the device will report an error if the standard Ethernet interface X127 is still assigned to 169.254.11.22 (default IP address of X127).
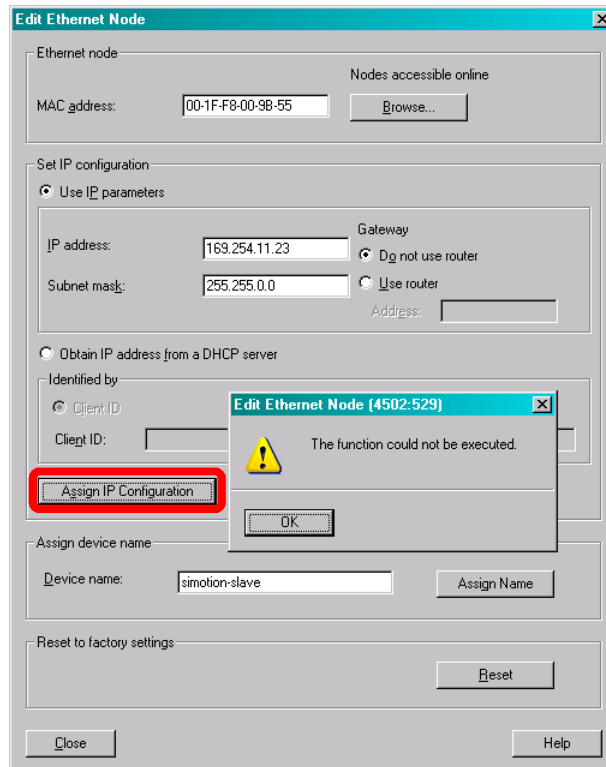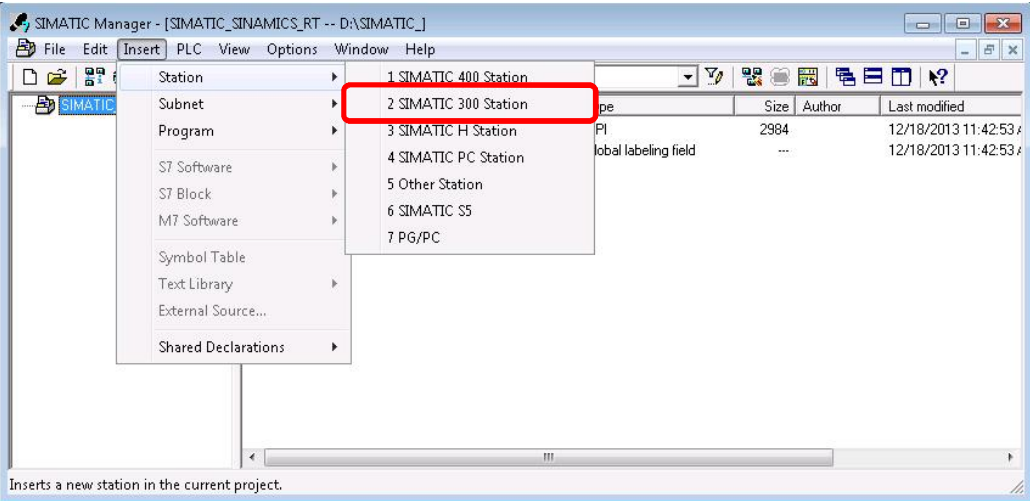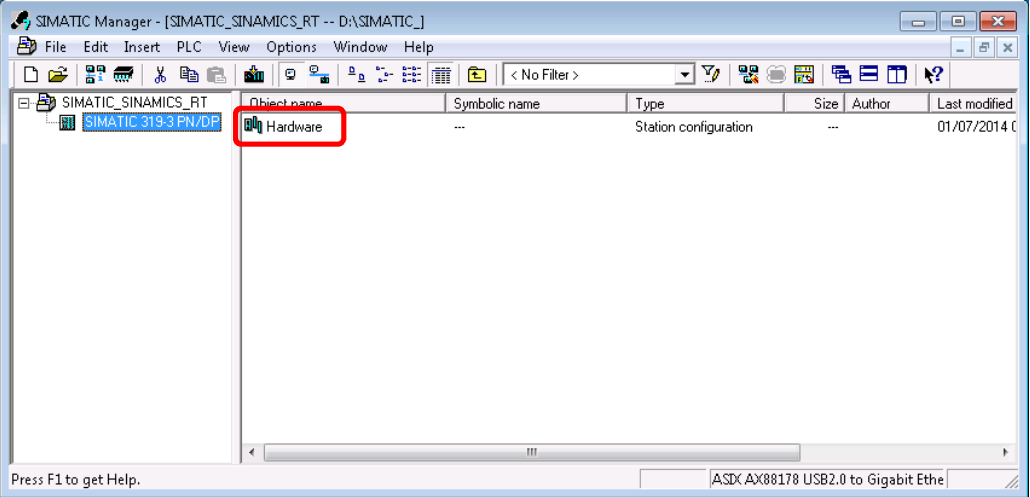
Figure 3-7

4 Configuration and programming

4.1 HW Config of the SIMATIC CPU
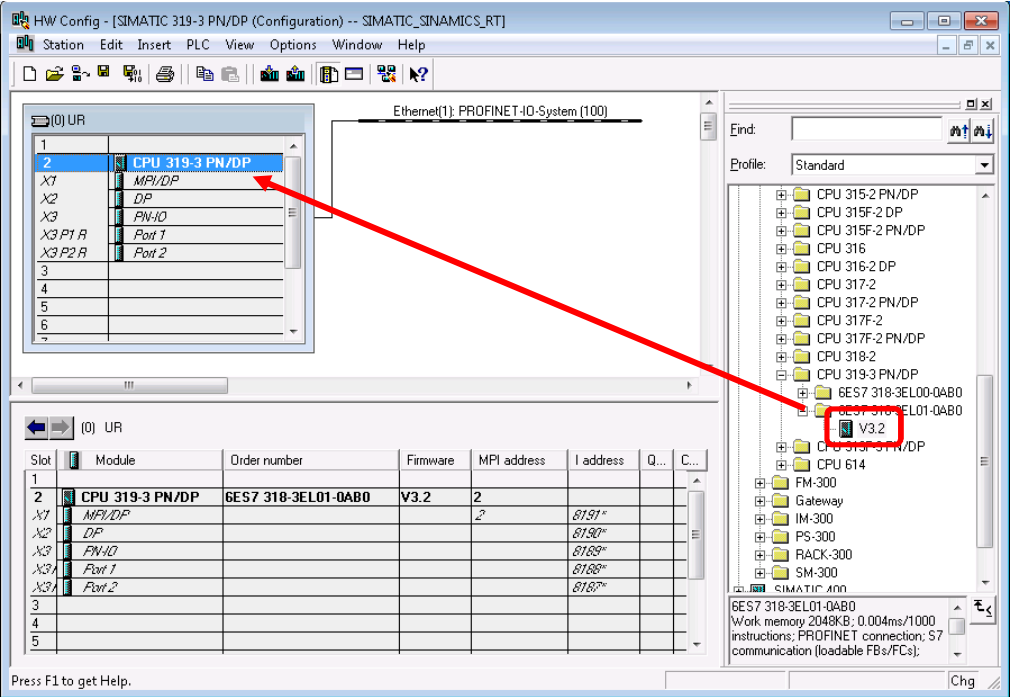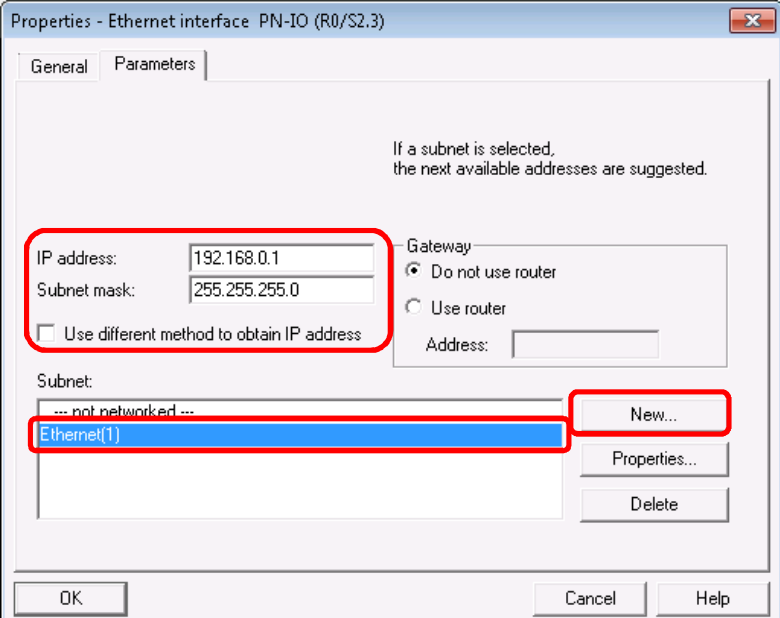
In the sample project, a SIMATIC CPU 319-3 PN/DP V3.2 is used to enter the speed setpoint for the drive. This CPU is configured as follows.

Table 4-1

No.	Action
1.	Open the STEP 7 SIMATIC Manager engineering system to create a new project. Add a new `SIMATIC 300 Station`
2.	Open HW Config of the SIMATIC CPU.

4.1 HW Config of the SIMATIC CPU
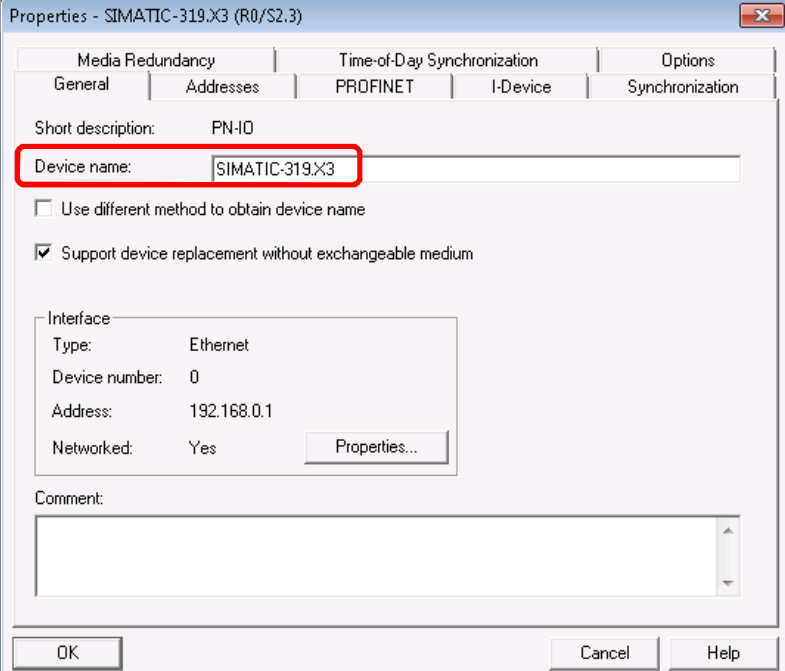
No.	Action
3.	Insert a `SIMATIC CPU 319-3 PN/DP V3.2` into HW Config. Using `"F4"` automatically arranges the modules present in the HW Config.
4.	Create a new Ethernet subnet using the `"New"` button, and assign an IP address and subnet mask (here: `192.168.0.1 / 255.255.255.0`).

4.1 HW Config of the SIMATIC CPU

NOTE	The PROFIBUS interface (X2) of the SIMATIC CPU must **not** be networked! Close the properties window using the `"OK"` button.
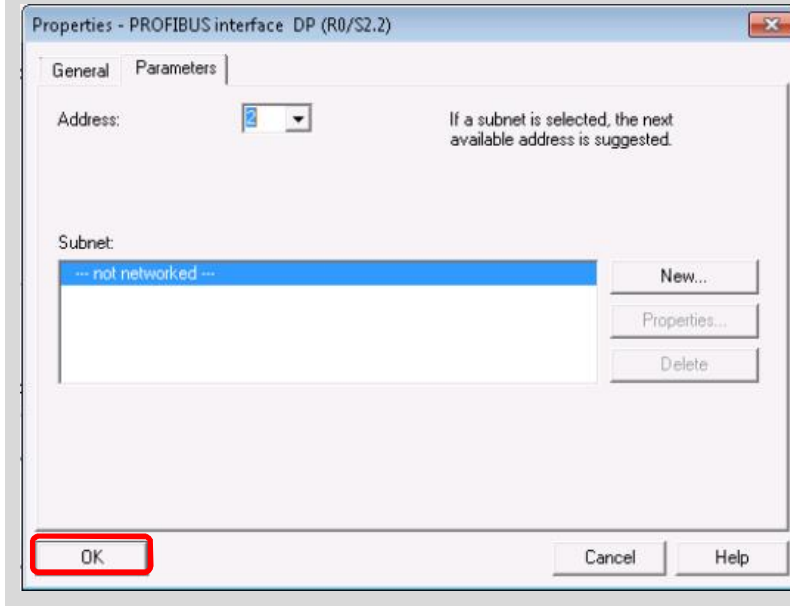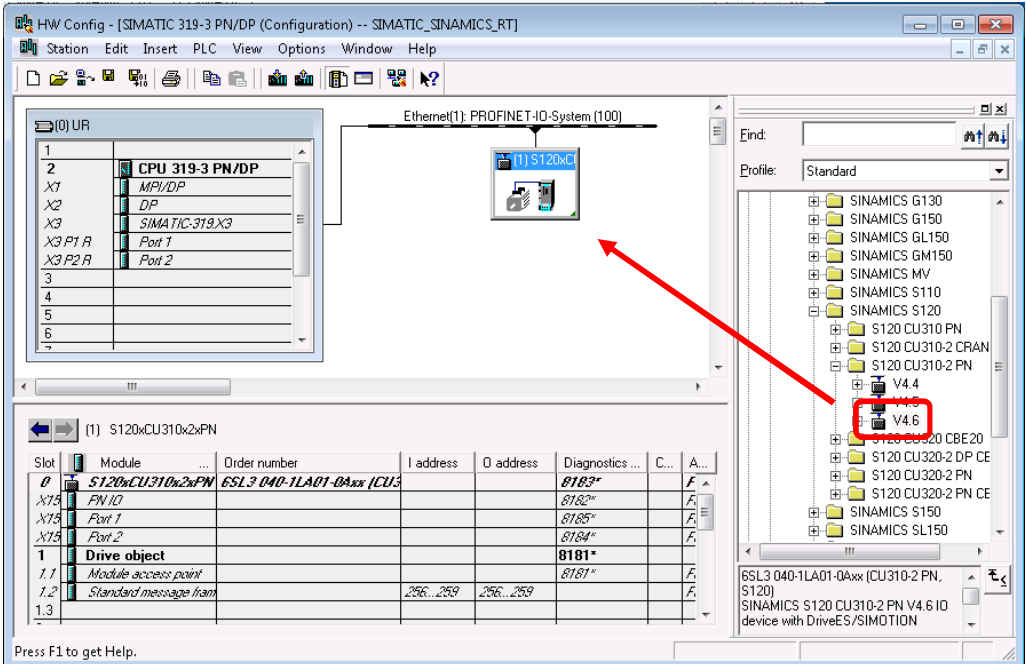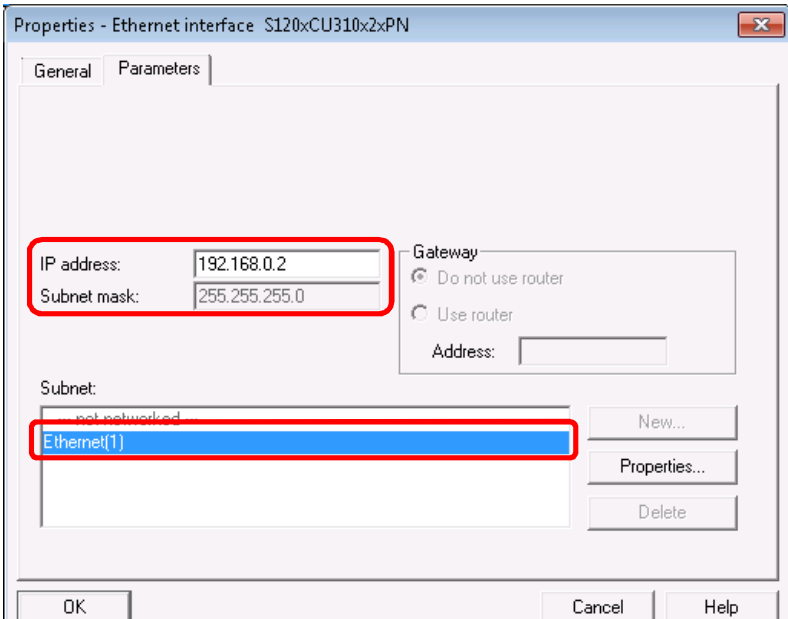
No.	Action
5.	By double-clicking on the PROFINET interface (X3) of the SIMATIC CPU, its properties window opens. There, define the device name of the controller (here: `"SIMATIC-319.X3"`).

4.2 HW Config of the SINAMICS drive

The SINAMICS drive can either be configured with the OM (ObjectManager, Drive ES BASIC, hardware catalog) or using a GSD file. The drive is configured using the OM in the following.

Table 4-2

No.	Action
1.	Drag the `CU310-2 PN V4.6` to the already available PROFINET network.
2.	Select the existing Ethernet subnet and assign a free IP address (here: `192.168.0.2`).

4.2 HW Config of the SINAMICS drive

NOTE	In the following dialog, confirm the type as well as the version of the SINAMICS drive using the `"OK"` button.

No.	Action
3.	Double-click the inserted SINAMICS drive to open its properties window. There, define the device name of the drive (here: `"SINAMICS-CU310-2.X150"`).
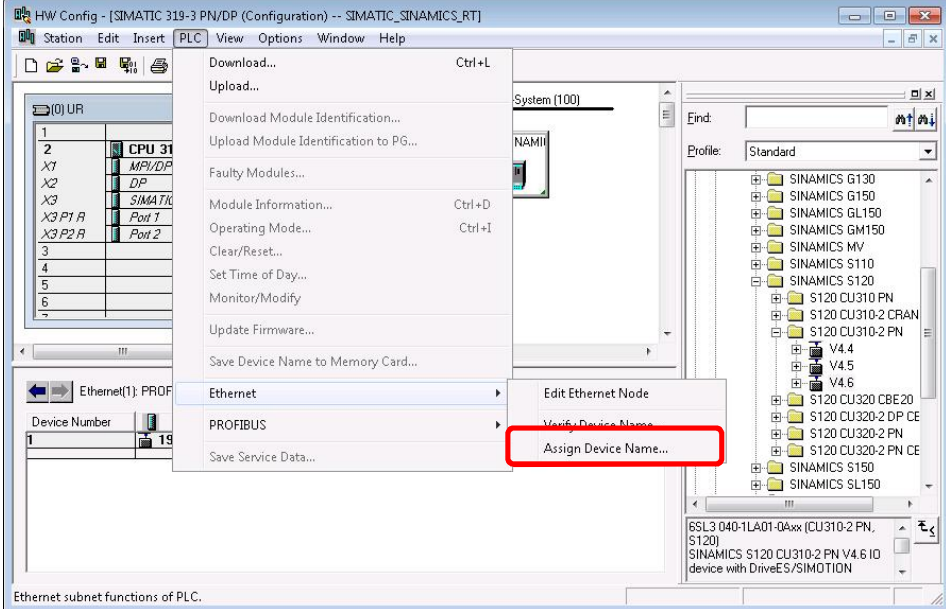
4.2 HW Config of the SINAMICS drive

NOTE	For the steps described in the following, a functional connection is required between the engineering PC and the hardware being used!
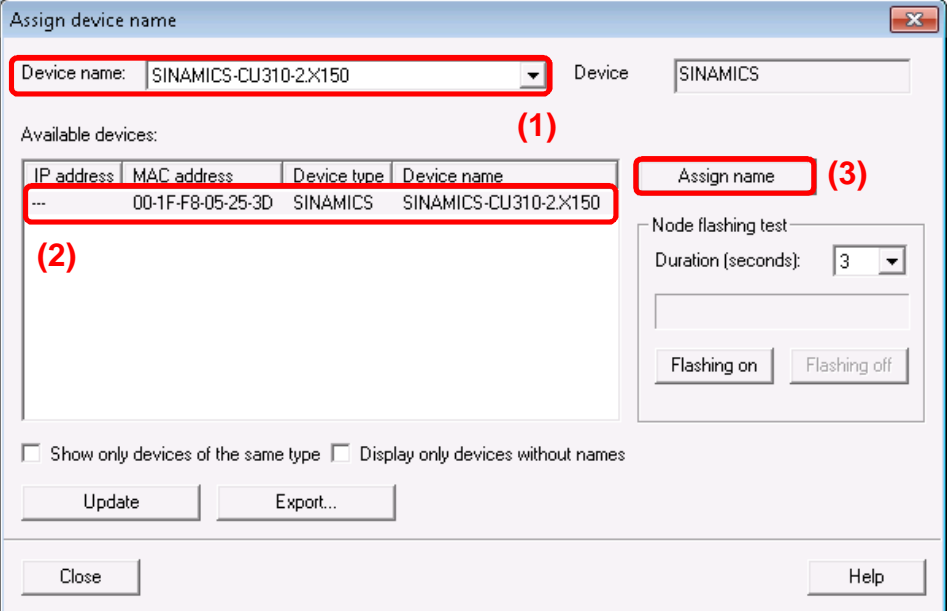
In SIMATIC Manager, using the menu item `"Options > Set PG/PC Interface…"` open the window to set the PG/PC interface. There, for the access point `"S7ONLINE"`, select the network card of your engineering PC that you are using with the supplement `"TCPIP.1"` (not `"TCPIP.Auto.1"`).

No.	Action
4.	The device name configured in HW Config must then be assigned to the SINAMICS drive. To do this, in HW Config select the PROFINET network of the SIMATIC CPU and via `"PLC > Ethernet > Assign Device Name…"` open the window to assign the name.
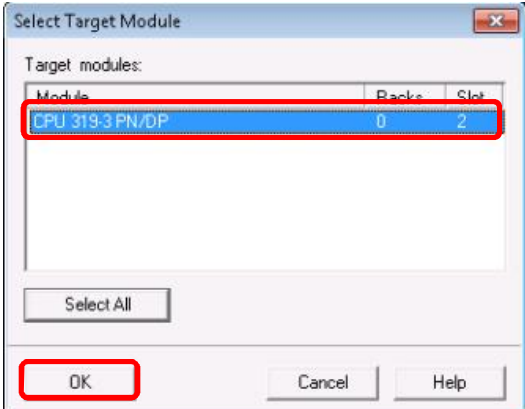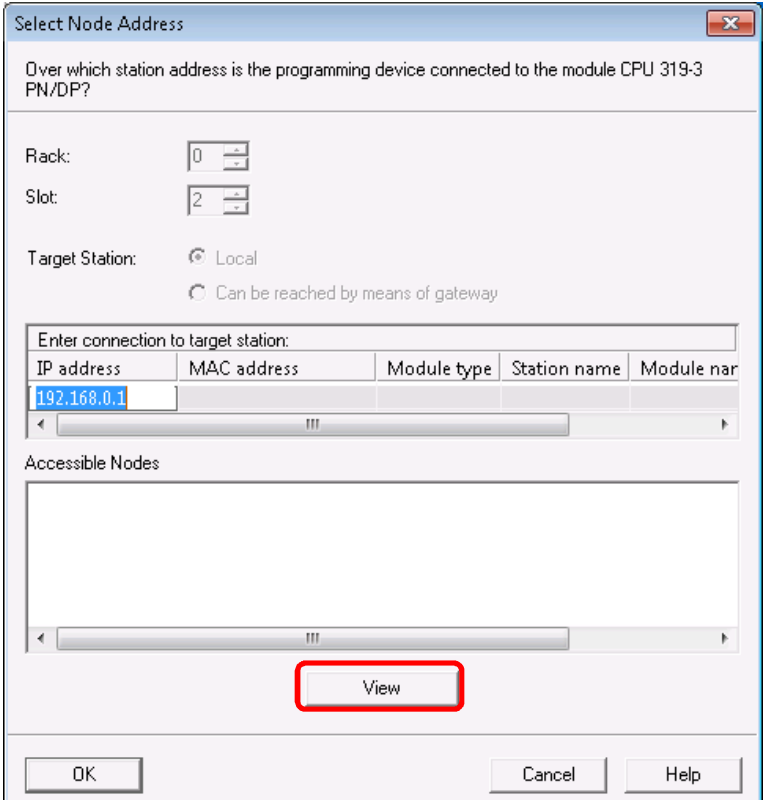
4.2 HW Config of the SINAMICS drive

No.	Action
5.	Select the device name configured in HW config using the drop-down menu (1). Then select the SINAMICS drive from the list of available devices (2) and assign the device name using the "Assign name" (3) button.

Note	The IP address of the SINAMICS drive configured in HW Config is automatically assigned by the IO controller after HW Config has been downloaded (temporary IP address!).

4.3 Download of the HW Config

No.	Action
1.	Save and compile the HW Config.
2.	Download it into the SIMATIC CPU.
3.	To do this, select the corresponding target device, and confirm your selection using the "OK" button.
4.	If the SIMATIC CPU is still in the factory setting (i.e. the IP address is 0.0.0.0), a download is only possible after assigning the IP address configured in HW Config. Browse through the network for controllers that can be accessed by pressing the "View" button.

No.	Action
5.	All of the controllers that can be accessed are displayed. Select the corresponding controller by identifying it based on its MAC address and confirm your selection by pressing the "OK" button. **Note** First reset the interface of the controller to the factory settings, if the SIMATIC CPU already has an IP address, which does not match the IP address configured in HW Config! ("PLC > Ethernet > Edit Ethernet Node > Browse > Select CPU > OK > Reset")
6.	Confirm the following message with "Yes", to assign the IP address configured in HW Config to the controller (192.168.0.1) (permanent IP address!).
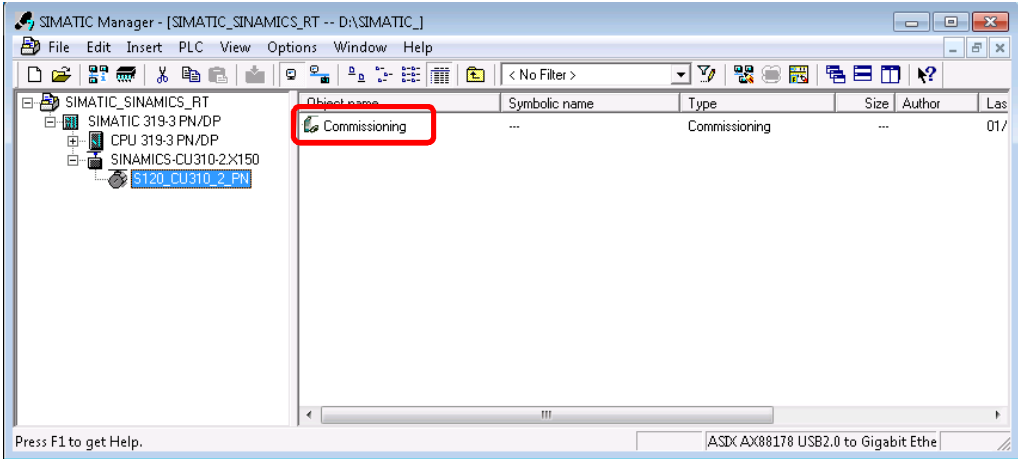
No.	Action
7.	Then switch the SIMATIC CPU back into the `"RUN"` operating state. Download (13:4363) ⚠ The module CPU 319-3 PN/DP [R 0/S 2] is in the STOP mode. Do you want to start the module now (complete restart)? [Yes] [No]

4.4 Configuration of the SINAMICS drive
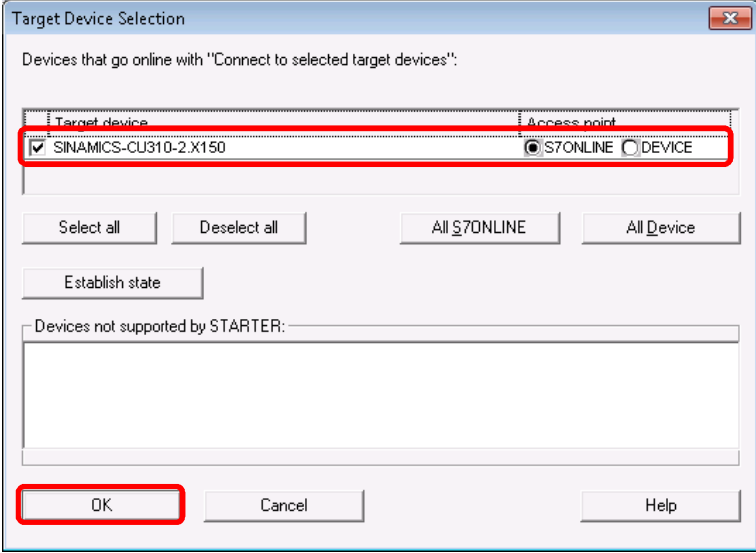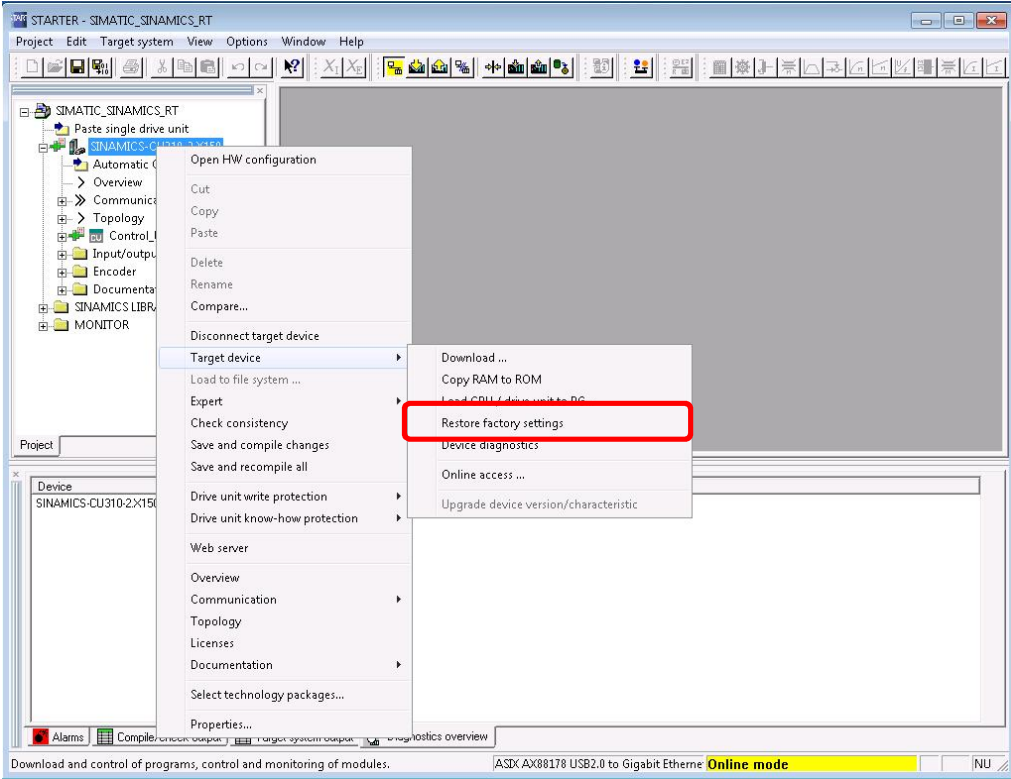
The standard configuration of the SINAMICS drive with the STARTER engineering system is shown below.

Table 4-3

No.	Action
1.	Open the current project in the STARTER engineering system from the SIMATIC Manager. SIMATIC Manager - [SIMATIC_SINAMICS_RT -- D:\SIMATIC_] File Edit Insert PLC View Options Window Help SIMATIC_SINAMICS_RT — SIMATIC 319-3 PN/DP —— CPU 319-3 PN/DP — SINAMICS-CU310-2.X150 —— S120_CU310_2_PN Object name: Commissioning Symbolic name: ... Type: Commissioning Size: ... Author Las: 01/ Press F1 to get Help. ASIX AX88178 USB2.0 to Gigabit Ethe
2.	Establish an online connection to the SINAMICS drive. 🖥 **Note** To establish an online connection, the network card of the engineering PC being used must be in the same IP subnet as the target device. Ensure that this precondition is complied with and if required adapt the IP configuration of your network card! Example • IP address of the target device 192.168.**0.2** subnet mask 255.255.255.0 • IP address of the engineering PC 192.168.**0.99** subnet mask 255.255.255.0
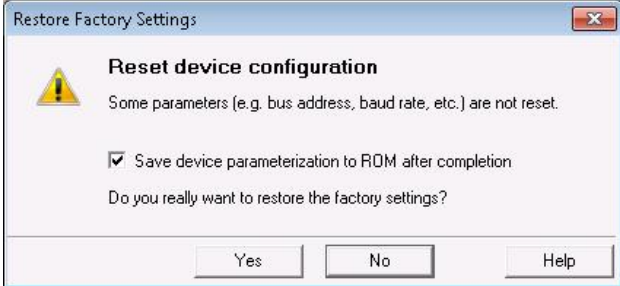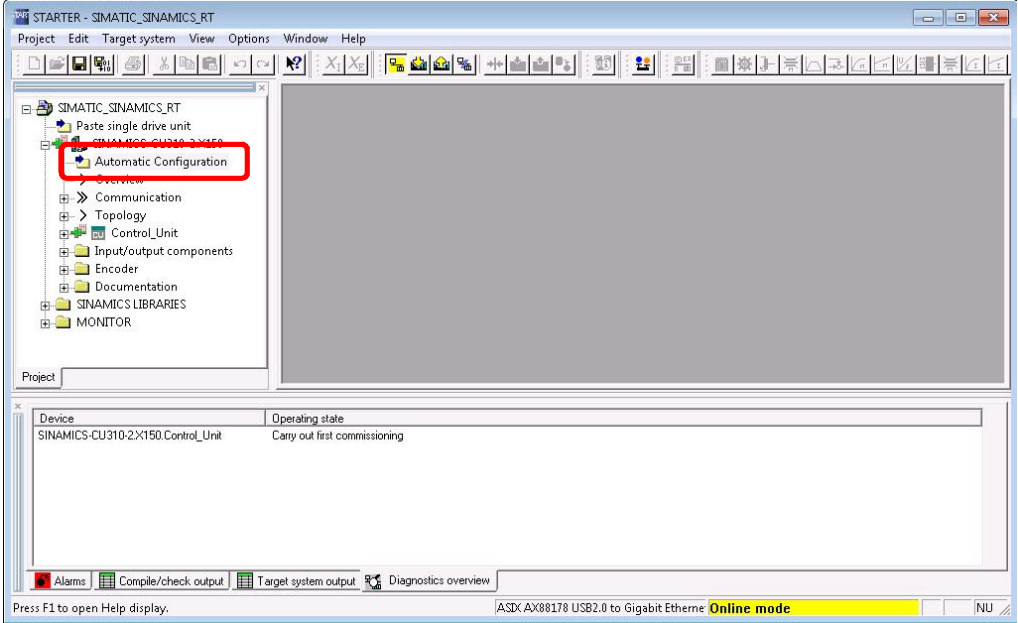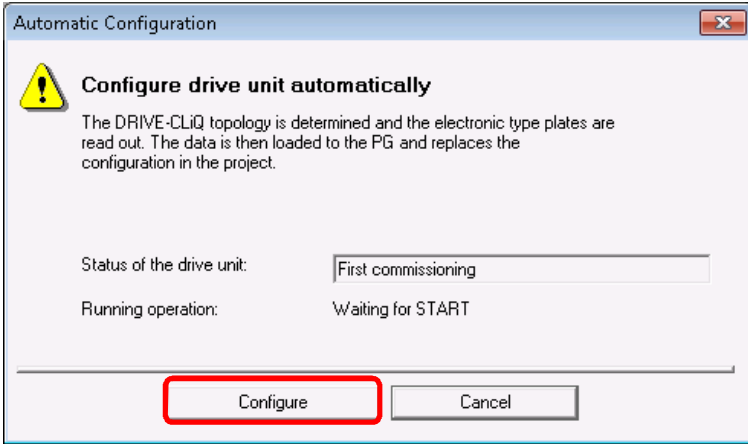
4.4 Configuration of the SINAMICS drive

No.	Action
3.	Select the configured SINAMICS drive (set the checkmark in the checkbox) and confirm your selection by pressing the `"OK"` button.
4.	After this, restore the factory settings at the SINAMICS (if this has still not been done).

4.4 Configuration of the SINAMICS drive

No.	Action
5.	Confirm the following message with `"Yes"`. The drive is then reset to the factory settings. **Restore Factory Settings** ⚠ **Reset device configuration** Some parameters (e.g. bus address, baud rate, etc.) are not reset. ☑ Save device parameterization to ROM after completion Do you really want to restore the factory settings? [Yes] [No] [Help]
6.	Afterwards carry out the automatic configuration of the drive. STARTER - SIMATIC_SINAMICS_RT Project Edit Target system View Options Window Help SIMATIC_SINAMICS_RT — Paste single drive unit — SINAMICS-CU310-2.X150 — **Automatic Configuration** — Overview — Communication — Topology — Control_Unit — Input/output components — Encoder — Documentation — SINAMICS LIBRARIES — MONITOR Project Device	Operating state SINAMICS-CU310-2.X150.Control_Unit	Carry out first commissioning Alarms Compile/check output Target system output Diagnostics overview Press F1 to open Help display. ASIX AX88178 USB2.0 to Gigabit Etherne **Online mode** NU
7.	Start the configuration by pressing the `"Configure"` button. The Drive-CliQ topology of the drive is read out. **Automatic Configuration** ⚠ **Configure drive unit automatically** The DRIVE-CLiQ topology is determined and the electronic type plates are read out. The data is then loaded to the PG and replaces the configuration in the project. Status of the drive unit: First commissioning Running operation: Waiting for START [Configure] [Cancel]

4.4 Configuration of the SINAMICS drive

No.	Action
8.	A servo motor is used in the SINAMICS training case. **Automatic Commissioning** During the automatic commissioning, components have been found that cannot be clearly assigned to a drive object type. Please select the drive object type that is to be created for the components. Default setting for all components: Servo | Component	Drive Object Type	Identification
Drive 1	Servo	Identification via LED	 Create Help
9.	If the firmware version of the drive has changed compared to the last commissioning, after the automatic configuration it may be necessary to "`Power OFF/ON`" the drive to update the firmware of the Drive-CliQ components STARTER - SIMATIC_SINAMICS_RT Project Edit Target system View Options Window Help SIMATIC_SINAMICS_RT Paste single drive unit SINAMICS-CU310-2.X150 Automatic Configuration > Overview >> Communication > Topology CU_S Input/output components Encoder SERVO_02 Documentation SINAMICS LIBRARIES MONITOR Component: All ☑ Display information Acknowledge all Acknowledge Help for event Warning 08.01.92 08:02:45:634 SINAMICS-CU310-2.X150 : CU_S 6 - SM_6 1007 : POWER ON for DRIVE-CliQ component required(Component number: 6) Warning 08.01.92 08:02:45:634 SINAMICS-CU310-2.X150 : SERVO_02 2 - Motor_Module... 1007 : POWER ON for DRIVE-CliQ component required(Component number: 2) Alarms Compile/check output Target system output Load to PG output Diagnostics overview Press F1 to open Help display. ASIX AX88178 USB2.0 to Gigabit Etherne Online mode NU **Note** **Before** "`Power OFF/ON`" execute the "`RAM to ROM`" function at the drive to save the previous configuration in a non-volatile way.

4.4 Configuration of the SINAMICS drive

| NOTE | If you are working with a SIMOTION training case (MLFB: 6ZB2470-0xx00) and an external CU320-2 PN (or CU320-2 DP + CBE20), please note that after the automatic drive configuration, the following steps still have to be performed: |

- At the SIMOTION training case, the blue drive ("SERVO_03") must be reconfigured, as it does not have a Drive-CliQ interface.
  All windows, which are not described in the following, can be skipped!
  - Open the drive configuration.
    ("Drives > SERVO_03 > Configuration > Configure DDS")
  - Connect the enable for the infeed ("p0864") with the fixed binector "1".
  - Select the motor installed in the training case.
    ("Select standard motor from list > Motor type: 1FK7 synchronous motor > MLFB: 1FK7022-xAK7x-xxxx")
  - Select the encoder type installed in the training case.
    ("MLFB: 1FK7xxx-xxxxx-xAxx")
  - Close the configuration and save the settings.

- At the two motors ("SERVO_02 + SERVO_03") set the following parameter values. To do this, go offline and open the relevant expert list.

Parameter	Description	Value
p0340	Automatic calculation	0
p0210	Supply voltage	345 V
p0864	Infeed in operation	1
p1244[0]	Upper voltage limit for the DC link	401 V
p1248[0]	Lower voltage limit for the DC link	240 V
p1460[0]	P component for the speed controller	0.01 Nms/rad
p1462[0]	Integral time for the speed controller	20 ms

Please note that these settings apply only when you are working with a SIMOTION training case!

- Afterwards go online, load the configuration into the drive and carry out the "RAM to ROM" function.
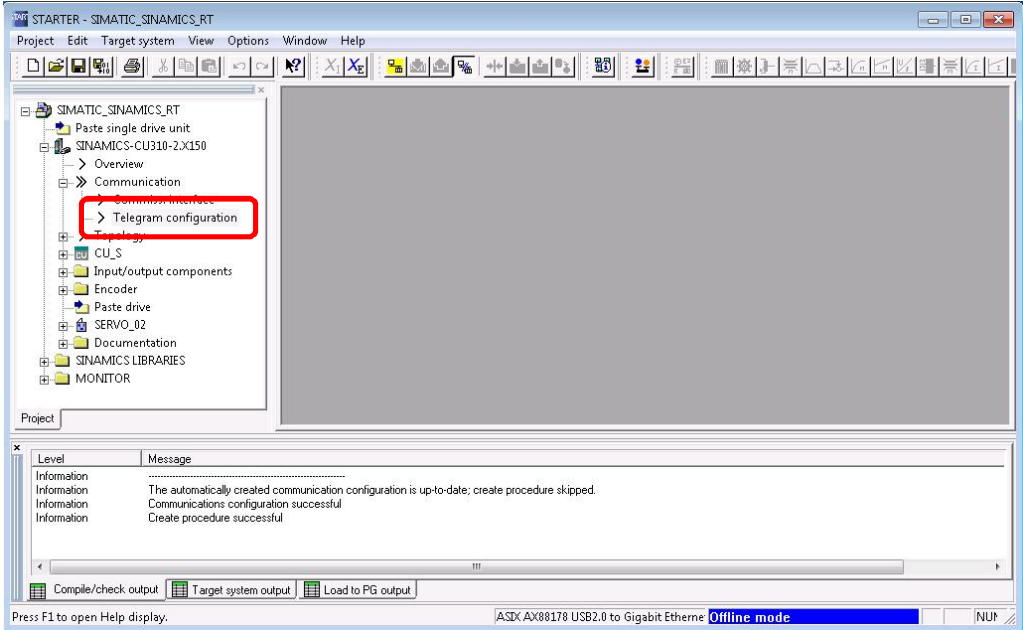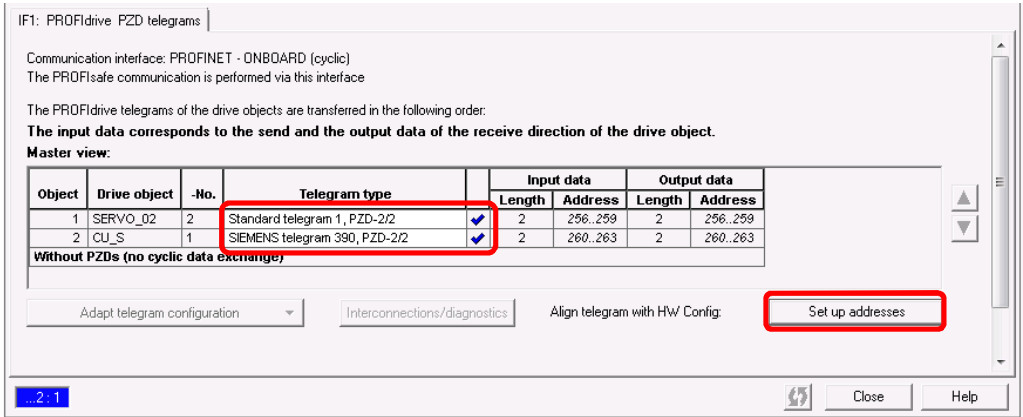
| NOTE | If you are working with a SINAMICS training case (MLFB: 6ZB2480-0xx00) and a CU2x0x-2 PN(-F), please note that here it is not possible to automatically configure the drive!

In this particular case, the SINAMICS G120 must be manually configured. For this purpose, use the nameplates for the Power Module (PM) and motor attached to the training case, and enter the corresponding data into the configuration screen forms in STARTER. |
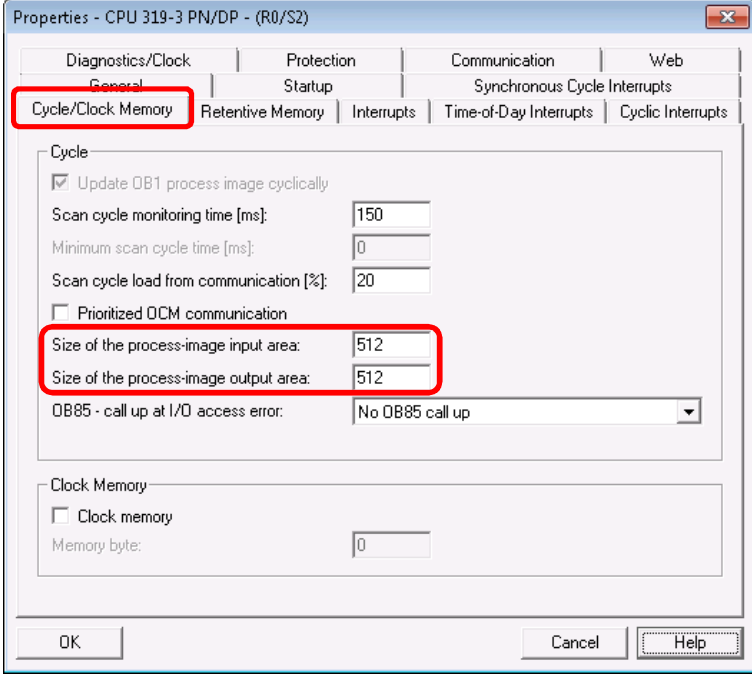
4.4 Configuration of the SINAMICS drive

No.	Action
10.	Open the drive telegram configuration using the menu item `"Communication > Telegram configuration"`. **Note** Carry out the following steps that are described offline!
11.	The following telegrams are used for cyclic communication between the controller and drive in the sample project: • SERVO_02 Standard telegram 1, PZD-2/2 • CU_S SIEMENS telegram 390, PZD-2/2 Set these telegrams in the drive telegram configuration and align the telegram configuration with HW Config (`"Set up addresses"`). **Note** Confirm the message that follows with `"Yes"`. A blue tick after the telegrams indicates that the telegram configuration has been successfully aligned with HW Config.

4.4 Configuration of the SINAMICS drive

No.	Action
12.	Change to the HW Config of the SIMATIC CPU, and check the size of the process image of the controller (double click on the CPU > tab `"Cycle/Clock Memory"`). **Note** If required, adapt the size of the process image of the inputs and outputs so that the input and output data of the SINAMICS drive telegrams are completely inside of the process image of the controller!
13.	Save and compile the configuration of the SINAMICS drive in STARTER and in the HW Config of the SIMATIC CPU.
14.	Establish an online connection with the drive.
15.	Download to the SINAMICS drive and load HW Config into the controller.
16.	Execute the `"RAM to ROM"` function in the drive to save its configuration in a non-volatile way.
17.	The communication between the SIMATIC CPU and SINAMICS drive has therefore been configured.

4.5 Activation of the servo motor

In the sample project, the cyclic communication between SIMATIC CPU and SINAMICS drive is implemented in OB1. The OB1 contains the user program subsequently described.

Table 4-4

No.	Action
1.	⊟ **Network 1**: User program `Speed calculation, drive control and failure reset` ```// speed calculation` ` L "N_SOLL_USER" MD100` ` L 6.000000e+003` ` /R`  ` L 1.638400e+004 ────► W#16#4000`  ` *R` ` TRUNC` ` T "N_SOLL" MW110`  ` U "boMove" M0.0` ` SPBN S002` ``` The user must specify the speed setpoint used to operate the servo motor ("N_SOLL_USER"). The calculation of the speed setpoint is based on the specified definitions of the PROFIdrive profile. 6000 rpm corresponds to the value "W#16#4000". The calculated speed is then buffered so that it can be further accessed ("N_SOLL"). The servo motor is operated with the calculated speed and is stopped again by setting the "boMove" flag. **Note** The rated speed of the servo motor installed in the training case is 6000 rpm. The maximum speed is 10000 rpm.

4.5 Activation of the servo motor

No.	Action
| 2. | ```
// drive control
    L     W#16#47E          →  2#0000_0100_0111_1110

    T     MW    10

    L     "N_SOLL"              MW110
    T     "N_SOLL_Drive"        AW258

    L     "ZSW1_Drive"          EW256

    L     W#16#211          →  2#0000_0010_0001_0001

    UW
    L     W#16#211
    ==I
    SPBN  S001

    L     W#16#47F          →  2#0000_0100_0111_1111

    T     MW    10

S001: L     MW    10
    T     "STW1_Drive"          AW256

    SPA   S003
``` <br><br> If flag `"boMove"` is controlled to a value of `"1"`, then the required releases are set in control word 1(`"STW1"`) of the servo motor (**W#16#47E**), so that it can be moved. <br> To ensure that the motor is only moved when all releases required are actually present, its status word 1 (`"ZSW1"`) is compared with a constant word that represents the required releases (**W#16#211**). <br> Only when status word 1 (`"ZSW1"`) matches this value, the bit in control word 1 (`"STW1"`) is set, that switches on the servo motor (**W#16#47F**). The servo motor is then moved with the speed setpoint entered by the user. |
| 3. | ```
S002: L     0
    T     "N_SOLL_Drive"        AW258

    L     W#16#400          →  2#0000_0100_0000_0000

    T     "STW1_Drive"          AW256

// failure reset
    U     "boReset"             M1.0
    SPBN  S003

    L     W#16#480          →  2#0000_0100_1000_0000

    T     "STW1_Drive"          AW256

S003: NOP   0
``` <br><br> The speed setpoint of the servo motor is 0 rpm as long as the `"boMove"` flag is not controlled to a value of `"1"`. <br> In control word 1 (`"STW1"`), only bit 10 (`"Control by PLC"`) is set (**W#16#400**). <br> If faults are active, flag `"boReset"` can be controlled to a value of `"1"`. <br> As a consequence, in control word 1 (`"STW1"`) of the servo motor additionally bit 7 (`"Acknowledge faults"`) is set, which acknowledges the fault (**W#16#480**). In this case, flag `"boMove"` must have the value `"0"`! |

4.5 Activation of the servo motor

NOTE	The structure of the relevant (standard) telegram (i.e. STW1, NSOLL_B, etc.) is defined in the PROFIdrive profile. You can find further information about this at the following link:
	SINAMICS S120 / S150 List Manual (Chapter 2.9)

NOTE	The following addresses are used in the sample project to control the SINAMICS drive:

- AW 256   Control word 1 ("STW1")
- AW 258   Speed setpoint ("NSOLL_B")
- EW 256   Status word 1 ("ZSW1")

Slot	Module	Order number	I address	O address	Diagnostics address
0	SINAMICS-CU310-2.X150	6SL3 040-1LA01-0Axx			8183*
X150	PN IO				8182*
X150.P1 R	Port 1				8185*
X150.P2 R	Port 2				8184*
1	SERVO_02				8181*
1.1	Module access point				8181*
1.2	Standard message frame 1		256...259	256...259	
1.3					
2	CU_S				8180*
2.1	Module access point				8180*
2.2	SIEMENS message frame 39		260...263	260...263	
2.3					

5 Commissioning the sample project
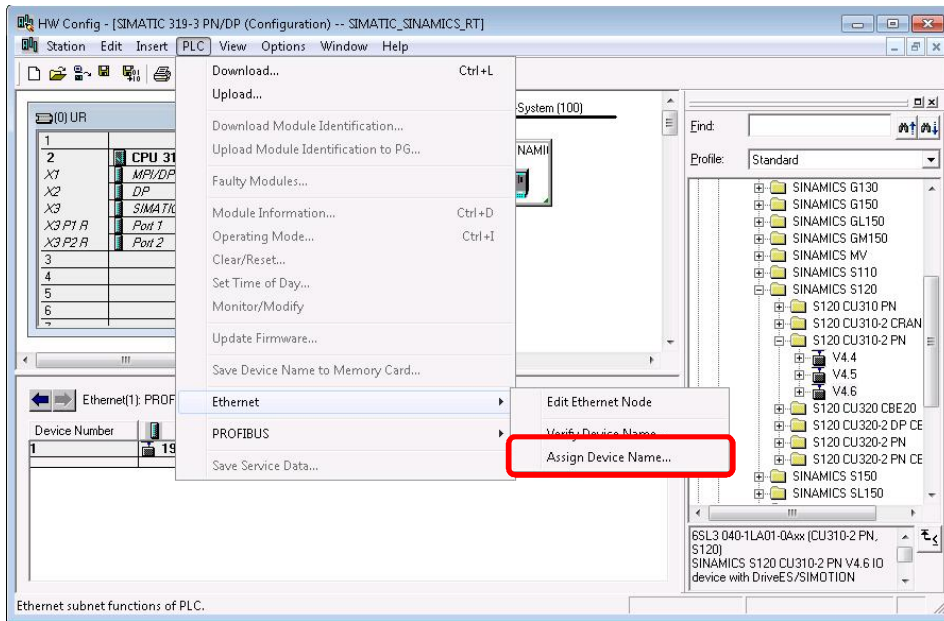
5.1 Overview

An executable sample project is included in the zip archive
`"38844967_SIMATIC_SINAMICS_PN_RT_V2_0.zip"` provided.

5.2 Commissioning

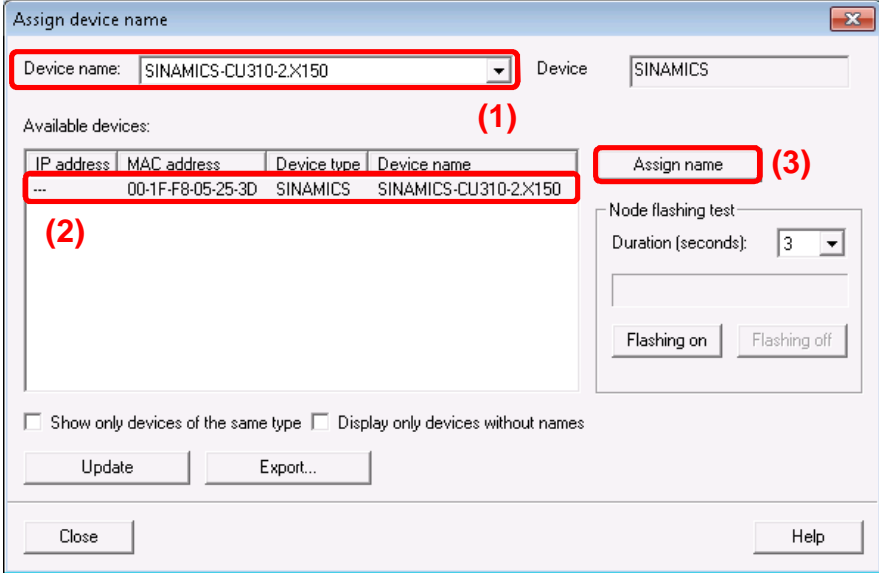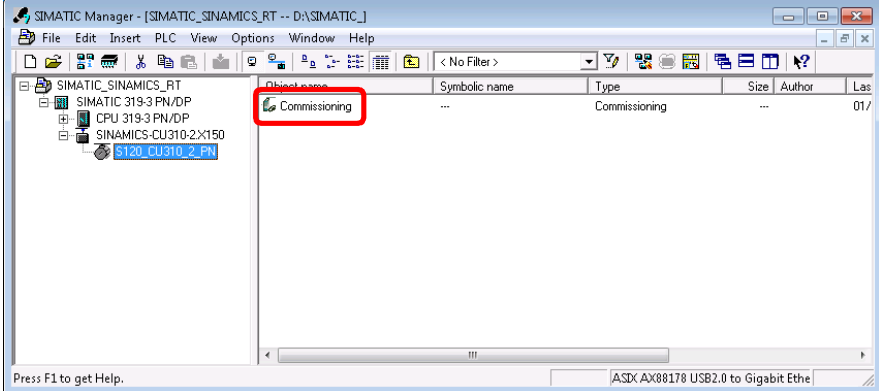The steps described in the following must be performed to commission the sample
project.

Table 5-1

No.	Action
1.	All hardware components listed in Table 2-1 (Page 7) are available, and have been upgraded to the required firmware version.
2.	All PROFINET components are networked and accessible from the engineering system.
3.	The Ethernet interface of the engineering system is configured correctly and is working. Example IP address: `192.168.0.99` subnet mask: `255.255.255.0`
4.	Start the STEP 7 SIMATIC Manager engineering system.
5.	Retrieve the sample project `"38844967_SIMATIC_SINAMICS_PN_RT_V2_0.zip"`.
6.	Open the HW Config of the SIMATIC CPU.
7.	Download the HW Config and all blocks from the block container into the controller.
8.	Carry out a node initialization of the SINAMICS drive. To do this, change to HW Config of the controller and select the PROFINET network. Using the menu item `"PLC > Ethernet > Assign Device Name…"` open the window to assign a name.

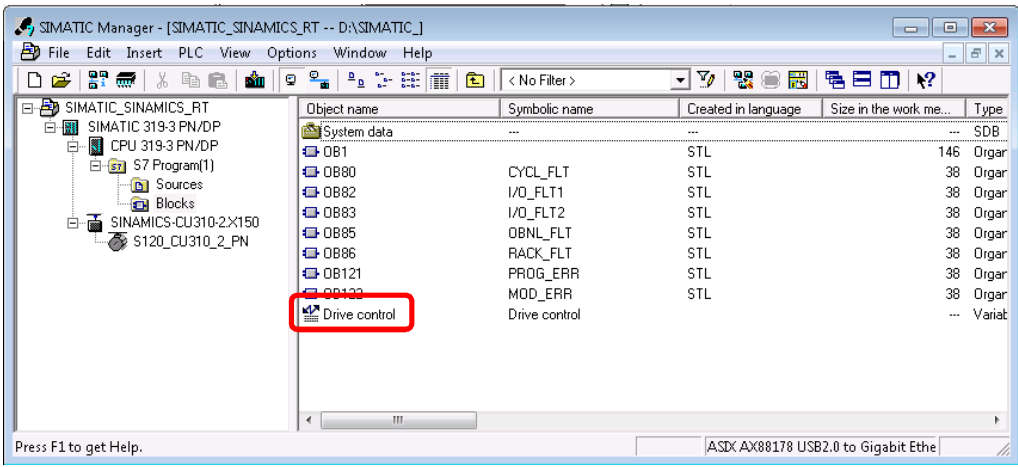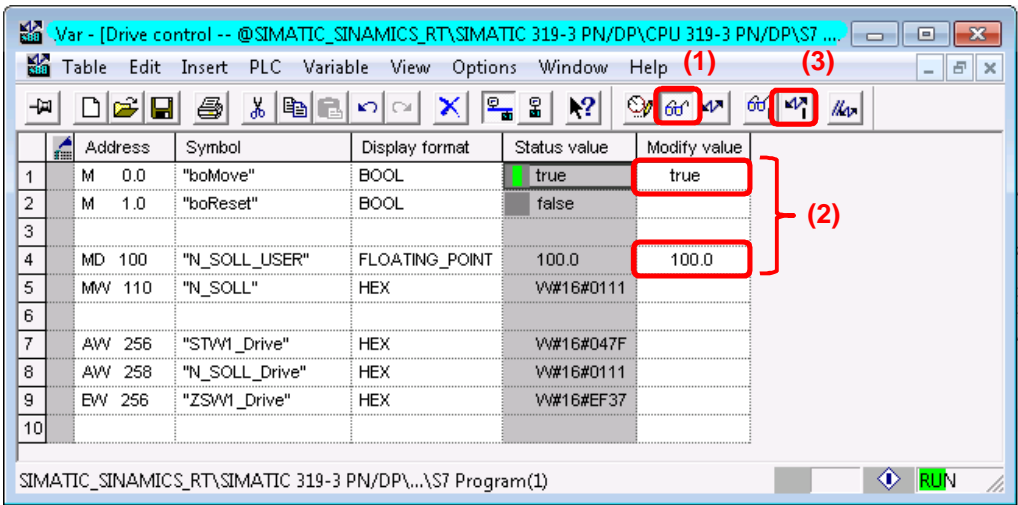| No.	Action
9.	Select the device name configured in HW Config using the drop-down menu (1). Then select the SINAMICS drive from the list of available devices (2) and assign the device name using the `"Assign name"` (3) button. **Note** Only IO devices are listed here. IO controllers receive their device name by downloading the HW Config.
10.	As an alternative, the Primary Setup Tool (PST) can also be used to perform the node initialization. The PST can be downloaded at the following link. http://support.automation.siemens.com/WW/view/en/19440762
11.	Start the STARTER engineering system from the project in the SIMATIC Manager.
12.	Establish an online connection with the SINAMICS drive.
13.	Download the configuration of the drive into the target device.
14.	Then execute the `"RAM to ROM"` function.
15.	The sample project is now ready for operation.

6 Operating the sample project

6.1 Overview

The sample project is operated using the variable table "Drive control" of the SIMATIC CPU in the SIMATIC Manager.

Here, the user can enter the setpoint speed for the servo motor as well as switching the motor on and off. Possibly upcoming faults of the servo motor can also be acknowledged.

6.2 Operation

Table 6-1

No.	Action
1.	Open the variable table "Drive control", which is located in the block container of the SIMATIC CPU.
2.	In the variable table, switch to the online view using button "Monitor variable" (1). Then enter the required speed setpoint in column "Modify value" into flag double word MD100 (unit: rpm) and the value "true" or "1" into flag M0.0 (2). Activate the values by using the button "Activate modify values" (3).

No.	Action
3.	The speed "N_SOLL_USER" entered by the user is scaled according to the definitions of the PROFIdrive profile and entered at the servo motor as speed setpoint. Further, the required releases are set in control word 1 ("STW1") of the drive to move it. **Note** The speed setpoint can also be changed if the servo motor is already in operation, i.e. flag "boMove" is set.
4.	By setting flag "boReset", possible faults present at the servomotor can be acknowledged. **Note** Pending faults can be acknowledged only when the servomotor is not operational, i.e. the "boMove" flag must not be set! Further it should be noted that flag "boReset" is not automatically reset to the value "0". This must be done manually after the acknowledgement of the faults!

7 References

Table 7-1

	Topic	Title
\1\	Siemens Industry Online Support	http://support.automation.siemens.com
\2\	Download page of the article	http://support.automation.siemens.com/WW/view/en/38844967
\3\	SINAMICS S120/S150	http://support.automation.siemens.com/WW/view/en/68041075 (List Manual 2013)

8 Contact

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9 History

Table 9-1

Version	Date	Revision
V1.0	12/2006	First Edition
V2.0	01/2014	Revised edition, adaptation to the new hardware and software