SINAMICS: PROFINET connection with LabVIEW

SINAMICS / LabVIEW / V4.0

https://support.industry.siemens.com/cs/ww/en/view/99684399

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1 Introduction

1.1 Overview

Introduction

The application supports you when connecting SINAMICS converters with PROFINET interface to the LabVIEW software from National Instruments.

This facilitates cyclic I/O communication via any network interface of the PC being used. LabVIEW operates in this case as PROFINET controller.

Acyclic communication is also possible.

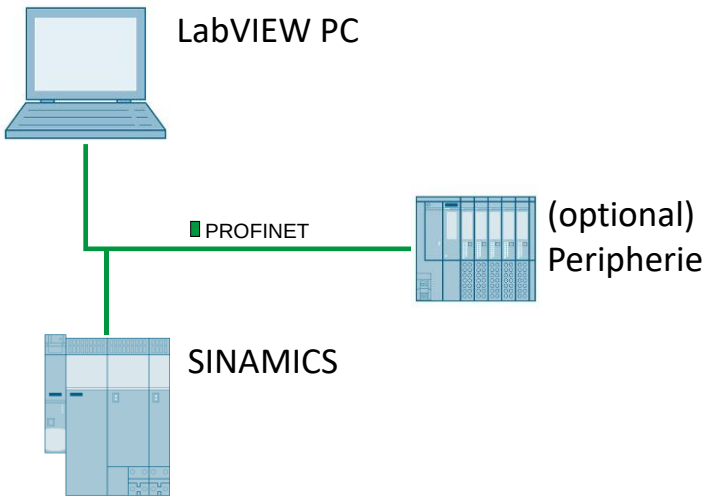
NOTE The application is primarily intended to control SINAMICS converters. (onboard interface X150 or CBE20)

However, all PROFINET I/O devices available in the hardware catalog of TIA Portal can be incorporated.

Overview of the automation task

The following diagram provides an overview of the connection.

Figure 1-1



1.2 Mode of operation

Schematic

The application comprises a DLL, which is integrated and executed in LabVIEW. This DLL provides communication functions with PROFINET I/O devices directly with LabVIEW.

Figure 1-2

Design

The DLL provided by the application is essentially based on the Siemens PROFINET driver for controllers.

An interface to the LabVIEW has been created via the IO base user programming interface.

For simpler handling, the application example VIs are provided for standard Siemens telegrams

- Standard telegram 1 (closed-loop speed control)
- Standard telegram 111 (Basic positioner operation)
- Free telegram configuration

their interface emulates 1:1 the SINAMICS telegram interface.

For acyclic communication, an example VI is provided to read/write parameters; this can be expanded when required.

Advantages

The application described here offers you the following advantages

- Shorter time and lower costs when implementing the solution
- Simple integration of the communication driver
- Simple control of SINAMICS drives from LabVIEW
- Integration of additional PROFINET IO devices in LabVIEW
- Connection via standard Ethernet interface

Restrictions

- IRT not possible
- Fixed send cycle time of 32ms
- SINAMCIS is not configurable with Startdrive

Knowledge required

It is assumed that readers have basic knowledge about LabVIEW. Examples showing the integration into LabVIEW are provided; however, the user is responsible for the integration in his application.

Further, it is assumed that readers are knowledgeable about configuring PROFINET nodes in the TIA Portal, as well as commissioning SINAMICS converters and STARTER / SCOUT.

1.3 Components used

Validity

This application is valid for

- LabVIEW since version 2013
- SINAMICS drives since firmware V4.5
- TIA Portal since V12

Required software

- WinPcap v4.1.3: https://www.winpcap.org/default.htm
- Microsoft Visual C++ Redistributable: https://support.microsoft.com/en-us/help/2977003/the-latest-supported-visual-c-downloads

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

Table 1-1

Component	Number	Article number	Note
SINAMICS S120 CU320-2 PN	1	6SL3040-1MA01-0AA0	Firmware V5.2 HF1
Demo case	1		Servo axis with DRIVE-CLiQ
TIA portal	1		V15.1 TRIAL[1]
STARTER	1		V5.3 [2]

[1] https://support.industry.siemens.com/cs/ww/en/view/109759618

[2] https://support.industry.siemens.com/cs/ww/en/view/26233208

This application example consists of the following components:

Table 1-2

Component	File name	Note
LabVIEW library	99684399_PNIO_LIB_v4_0.zip	
TIA project	99684399_TIA_Project.zip	V15.1
STARTER project	99684399_STARTER_Project.zip	V5.3
Documentation	99684399_SINAMICS_LabView_connection_v4_0_en.pdf	

2 Engineering

2.1 Topology

Following diagram shows the topology of the application. The components LabVIEW PC and SINAMICS S120 must be connected via PROFINET.

Figure 2-1

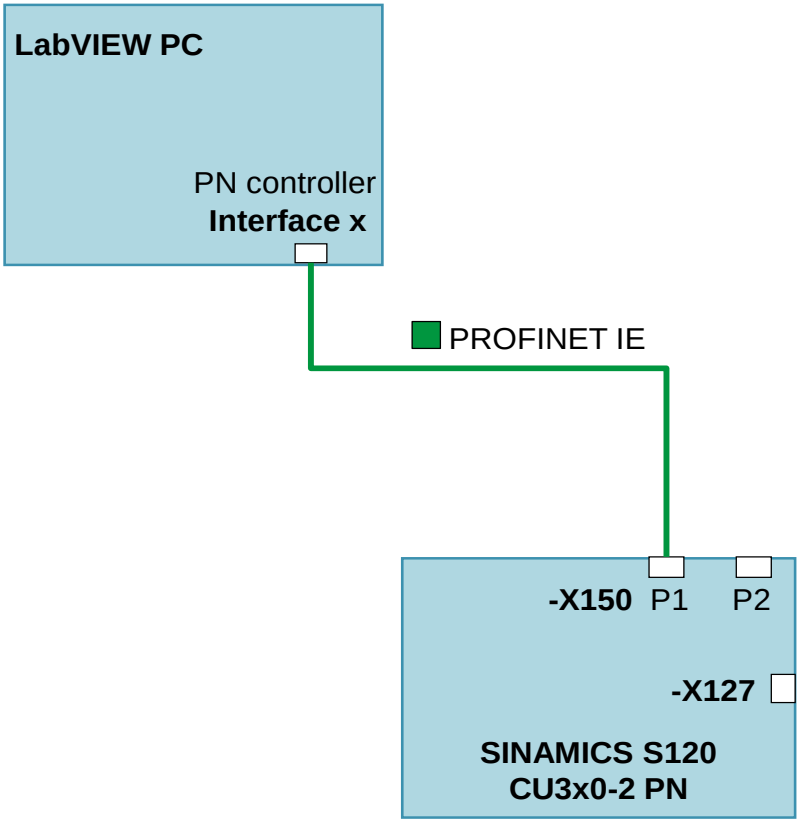


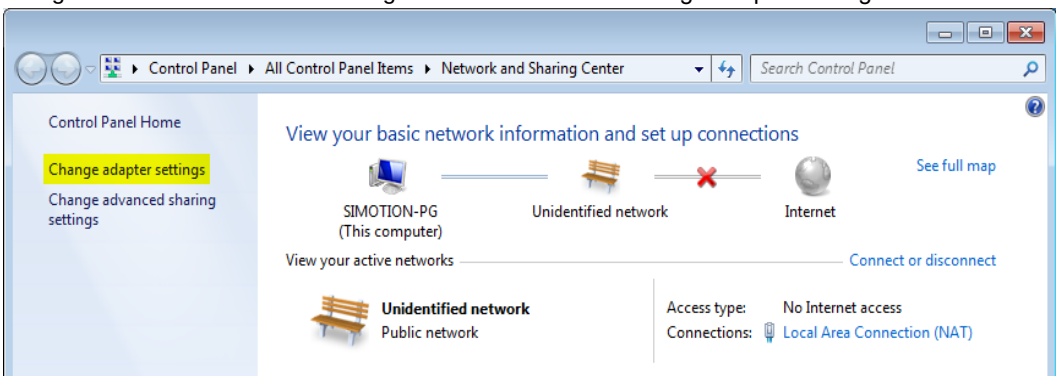
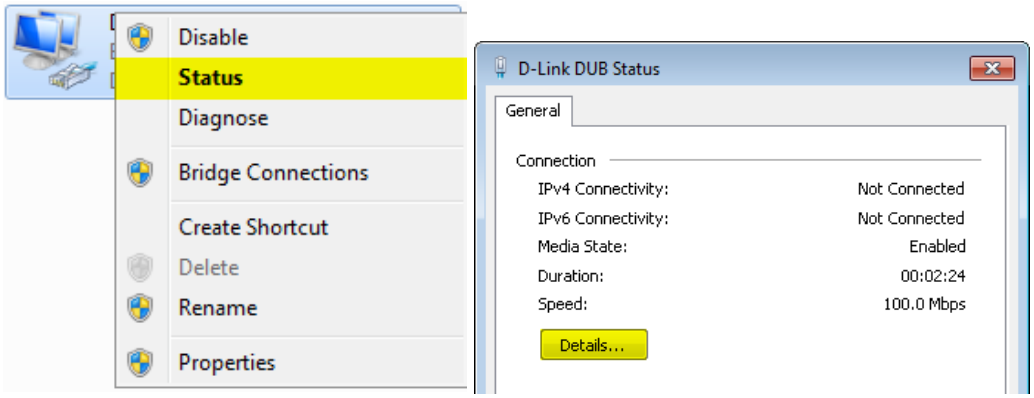
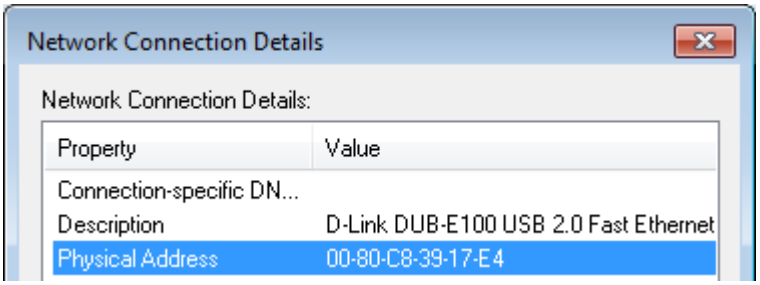
Table 2-1

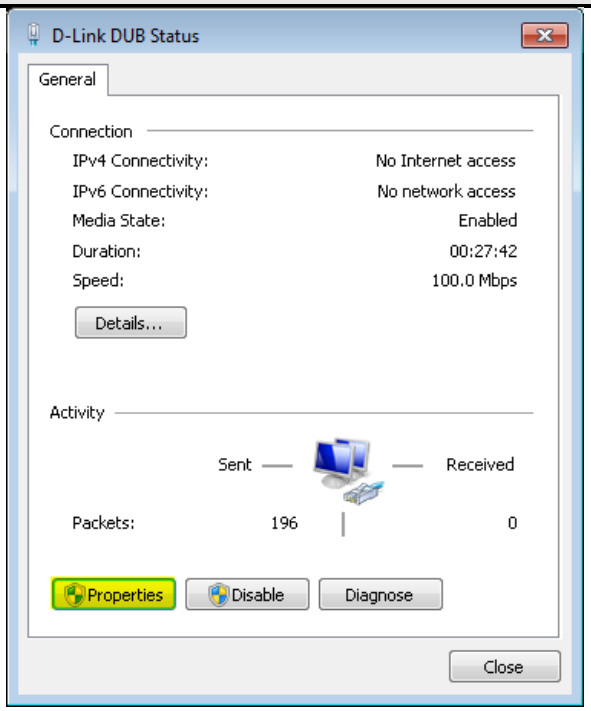
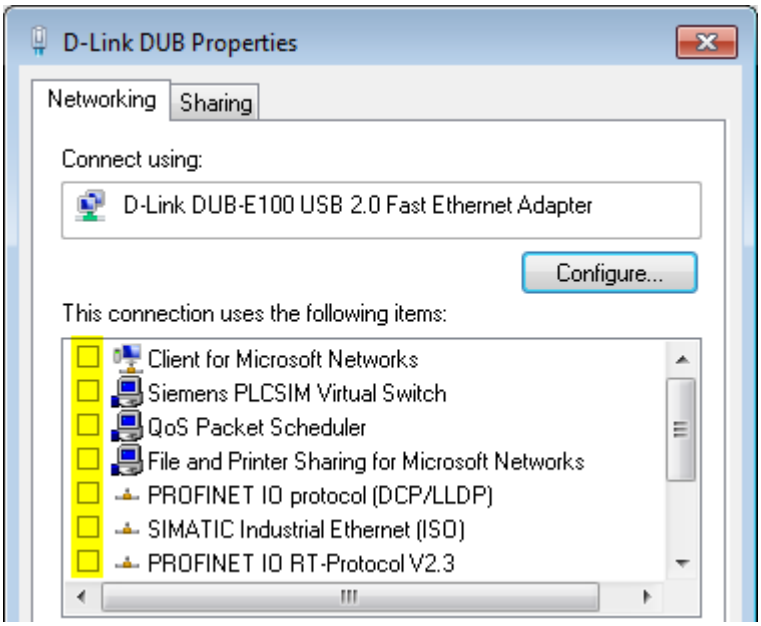
No.	Action
1.	Connect the LabVIEW PC interface with the PROFINET interface -X150 Port1 or Port2 of the SINAMICS **Note:** The interface X127 of the SINAMICS is not a PROFINET interface and can only be used to go online with STARTER.
2.	If a second interface is available on the the LabVIEW PC connect it with the desired interface of the SINAMICS to go online with STARTER. Alternatively use another Engineering PC to connect with the SINAMICS. See also chapter 3.4 PCs and Connections

2.2 Configuration

2.2.1 Configuration of the LabVIEW Ethernet interface

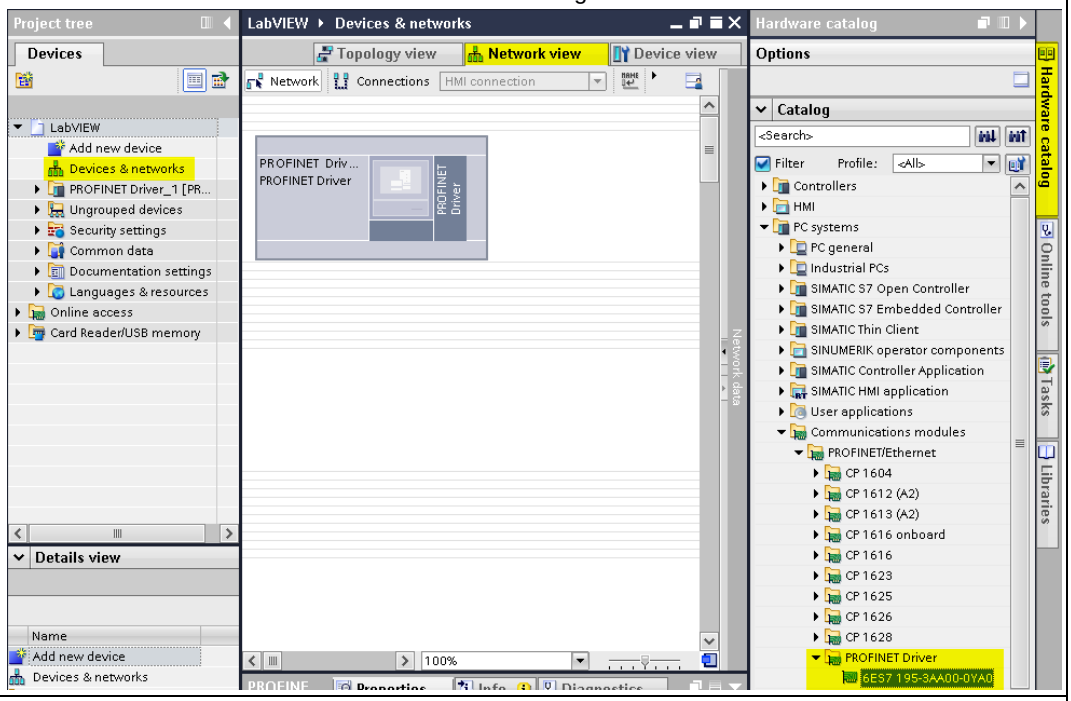
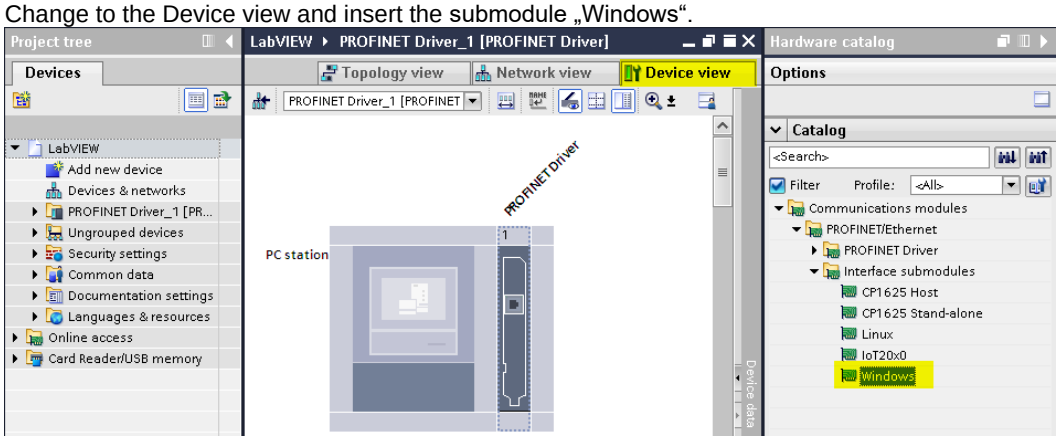
Table 2-2

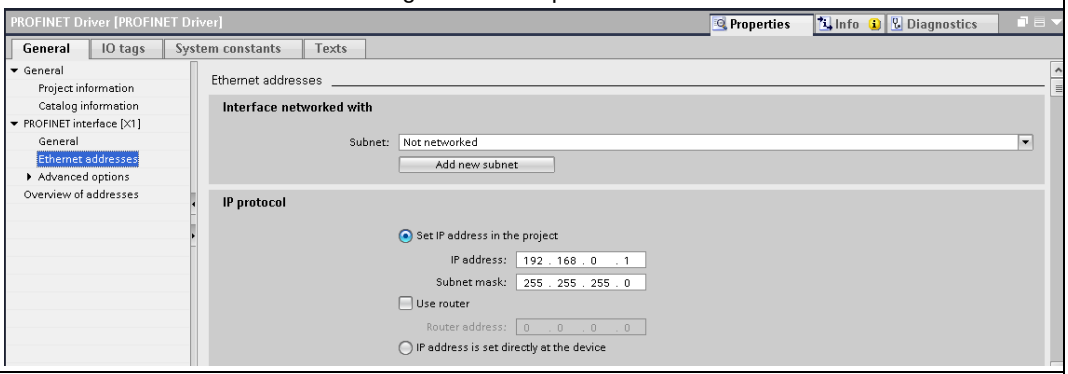
No.	Action
1.	The MAC address of the Ethernet interface selected for PROFINET communication must be obtained. In this regard the PC must be connected with the SINAMICS and the SINAMICS must be turned on.
2.	Navigate to the Network and Sharing Center and click on “Change adapter settings”. 
3.	Open the „Status“ of the interface and click on “Details..” 
4.	Copy the MAC address and save it for the later use with LabVIEW. 
5.	Now disable all items of the interface. Click on „Properties“.

No.	Action
	 Disable all items: 
6.	This interface is now prepared to work with LabVIEW. **Note:** For the connection with the SINAMICS via STARTER either a second interface or another Engineering-PC is needed. See also chapter: 3.4 PCs and Connections

2.2.2 Configuration of the PROFINET Driver

Table 2-3

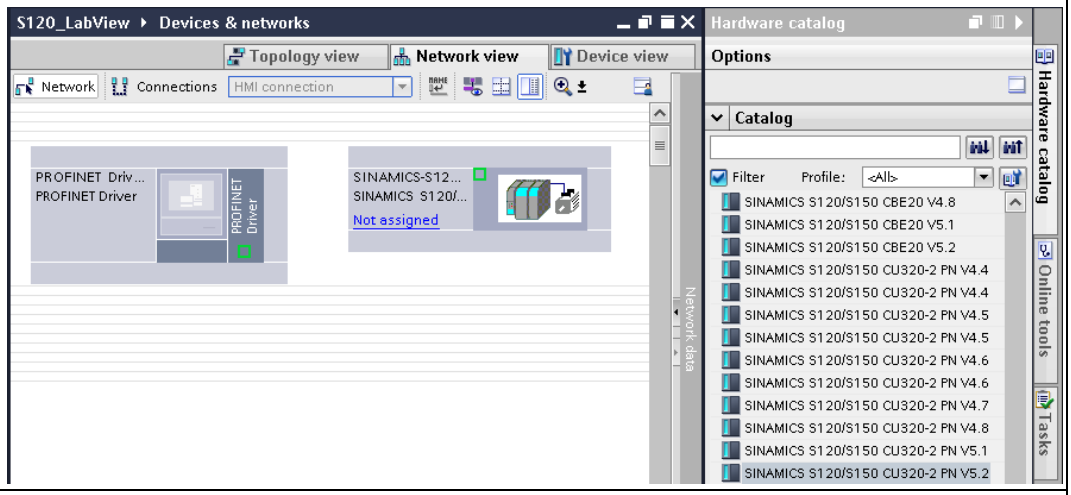
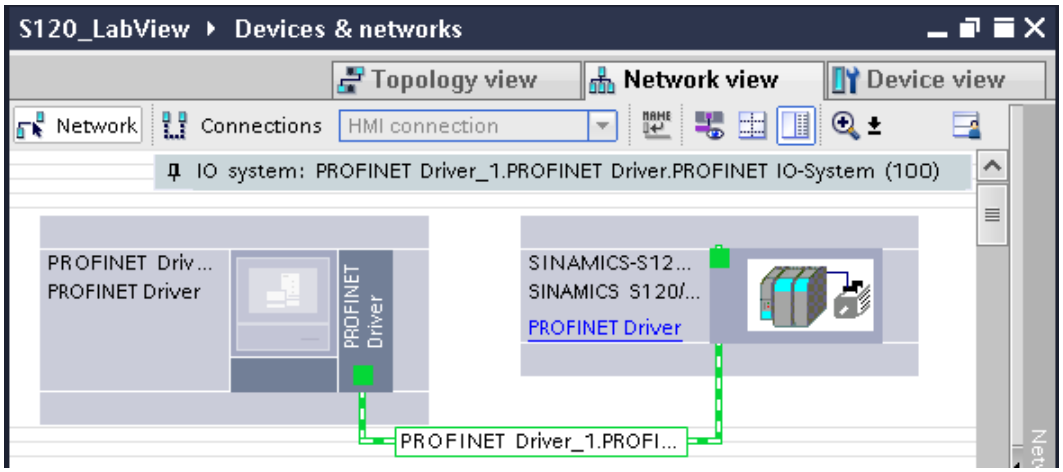
No	Action
1.	Create a new TIA Portal project and navigate to the Network view.
2.	Insert the PROFINET Driver with the hardware catalog. 
3.	Change to the Device view and insert the submodule „Windows“. 

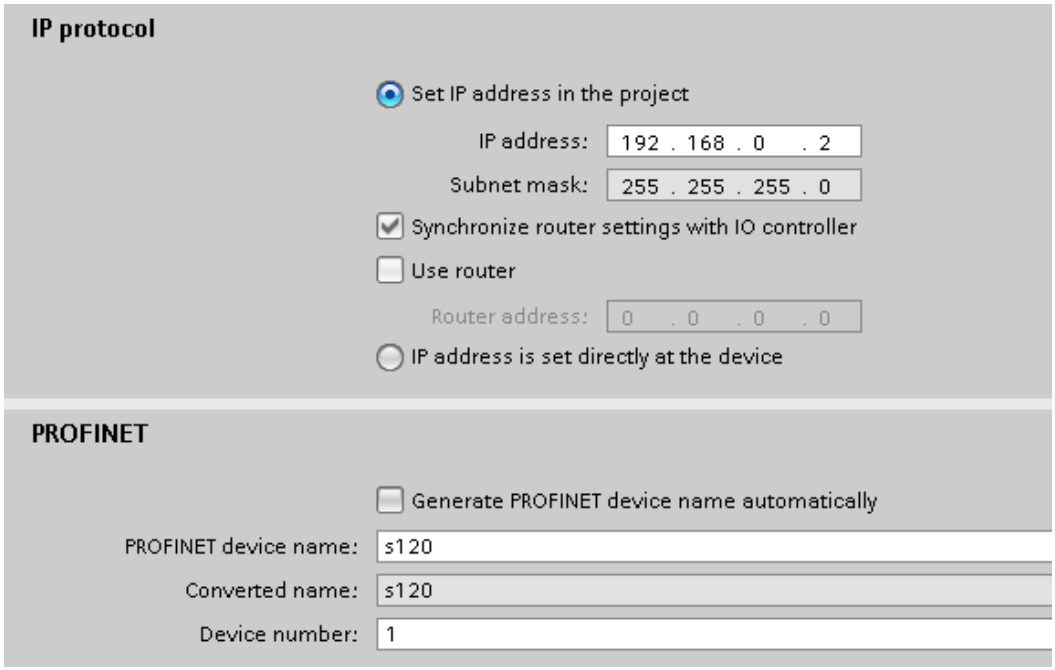
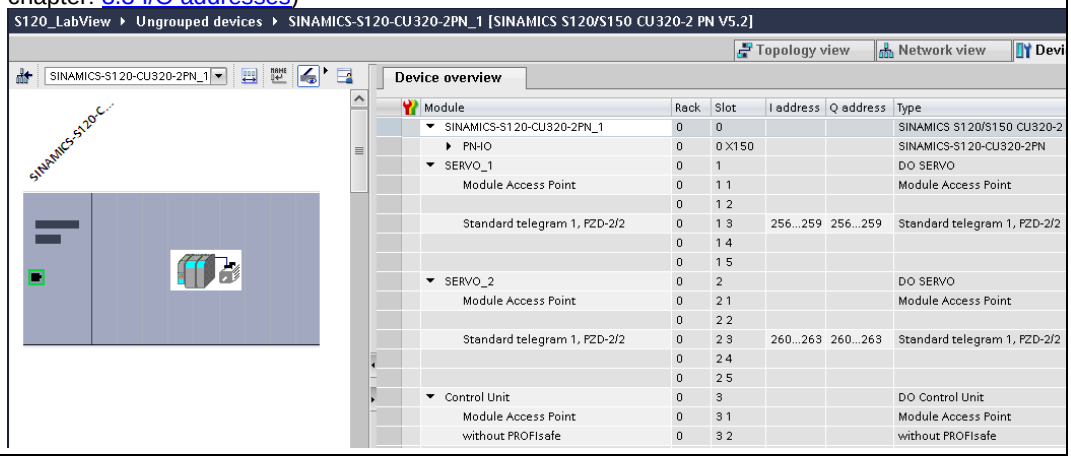
4.	If desired the IP address can be changed in the Properties 
5.	The PROFINET Driver is successfully configured.

2.2.3 Configuration of the SINAMICS drive

The SINAMICS drive is configured with the hardware catalog.

Table 2-4 Configuration with GSD file

No	Action
1.	Insert the SINAMICS S120 in the Network view with the hardware catalog. Additional Devices > PROFINET IO > Drives > SIEMENS AG > SINAMICS 
2.	Drag & drop a connection from the SINAMICS interface to the PROFINET Driver interface. 

No	Action
3.	Navigate into the properties of the SINAMICS interface and assign the desired IP address. e.g.: default setting: 192.168.0.2 Also set the PROFINET device name: e.g.: s120 
4.	Navigate to the device view and configure the SINAMICS with the necessary modules and submodules. The configuration must match the project in STARTER (see also chapter: 3.5 Telegrams and drive objects). Also assign the desired I/O addresses of the telegrams. (see also chapter: 3.3 I/O addresses) 

2.2.4 Compiling of the configuration

Table 2-5

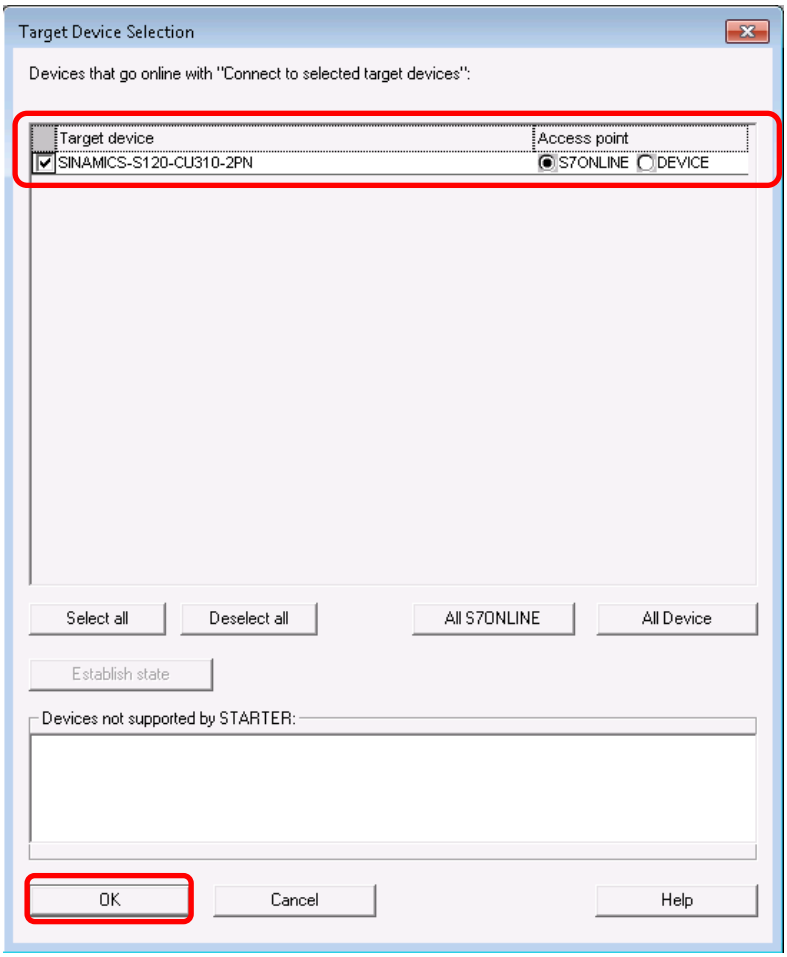
No	Action
1.	Save and compile the project: 
2.	When compiling a XML configuration file will be created in the project path automatically. This file is necessary for LabVIEW.

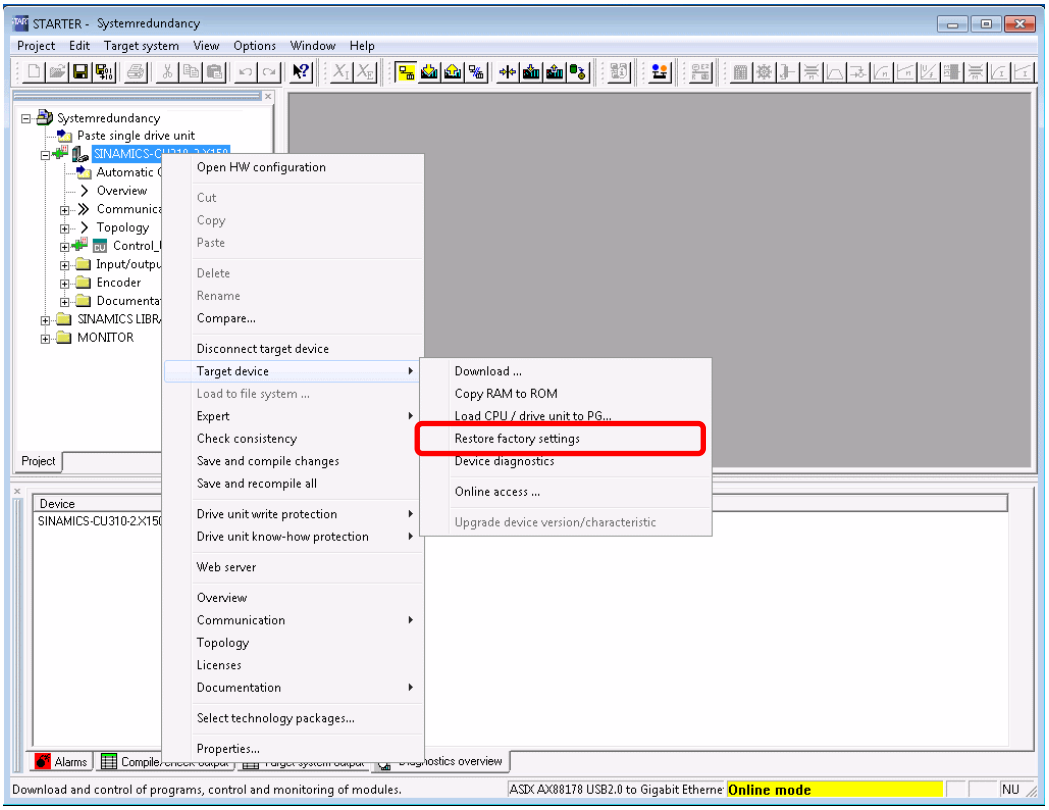
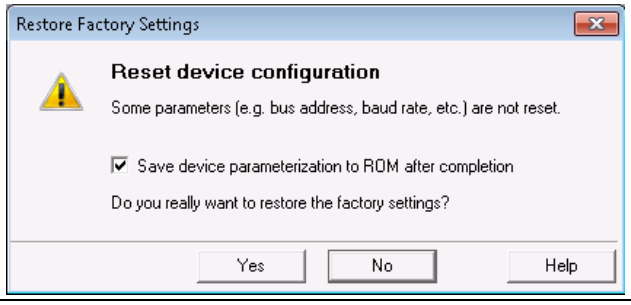
2.2.5 Project of the SINAMICS drive

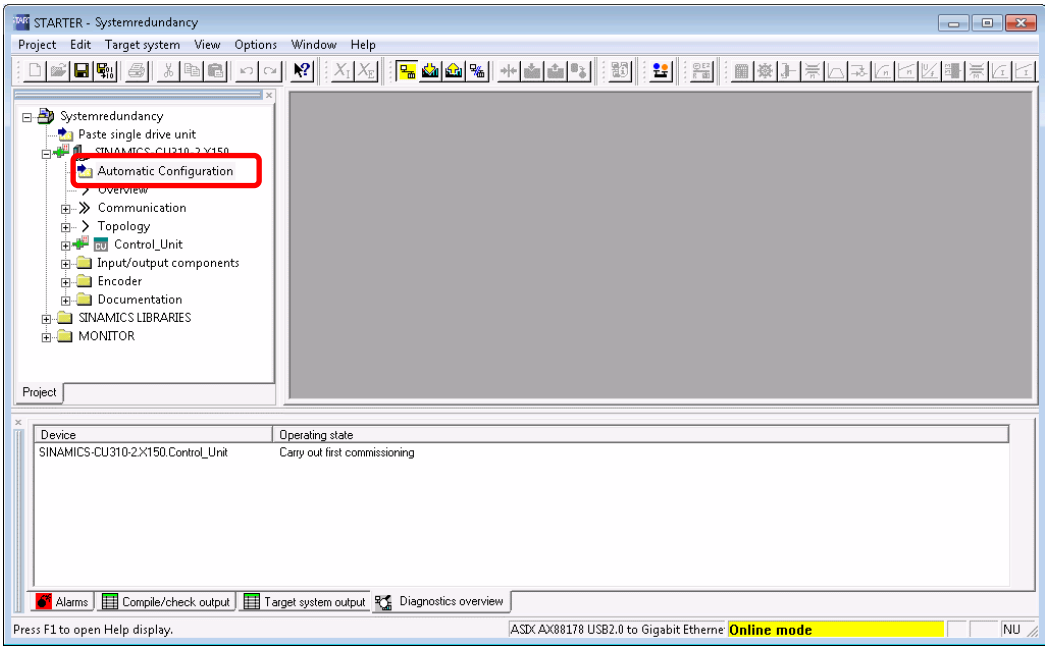
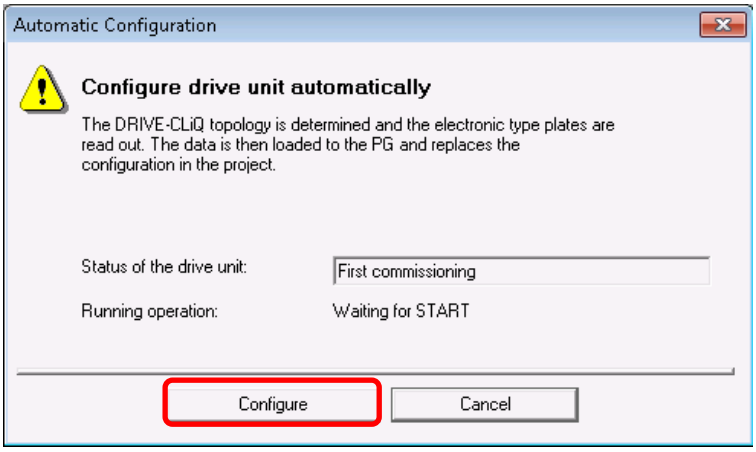
The standard configuration of the SINAMICS drive with the STARTER engineering system is shown below.

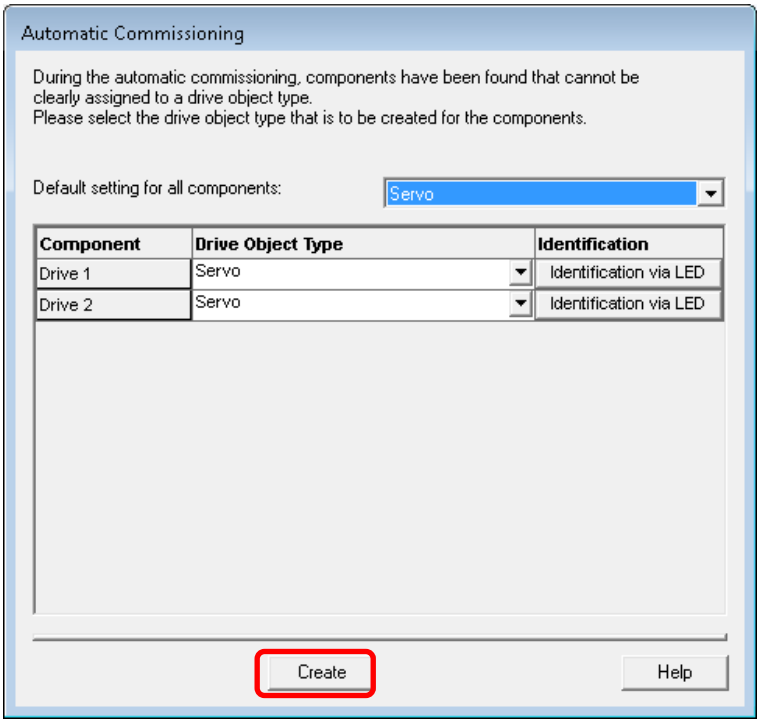
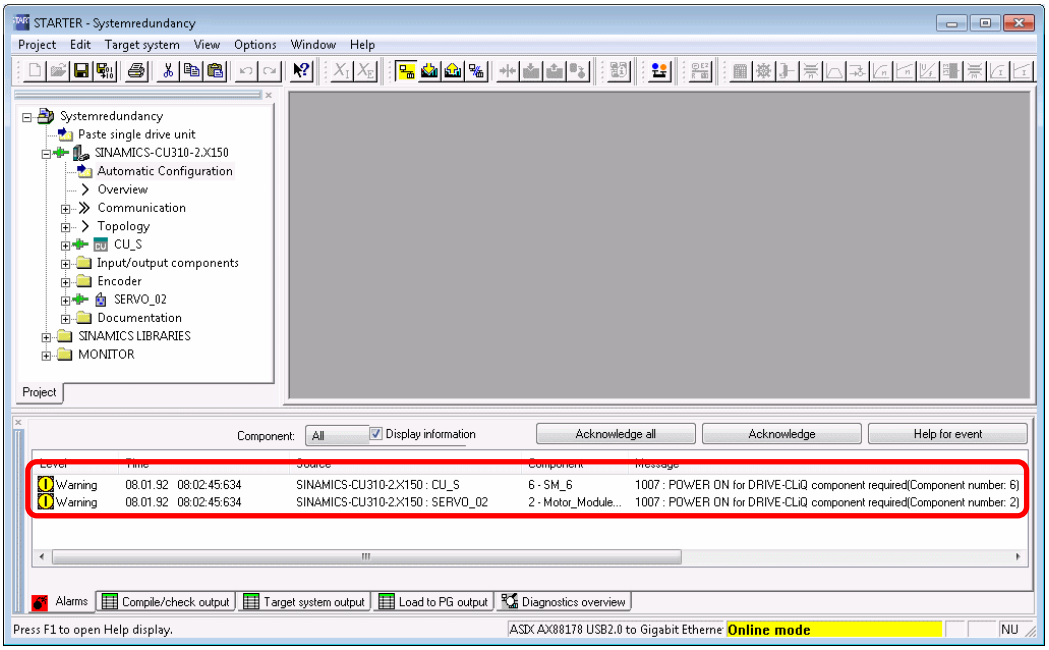
Table 2-6 SINAMICS STARTER configuration

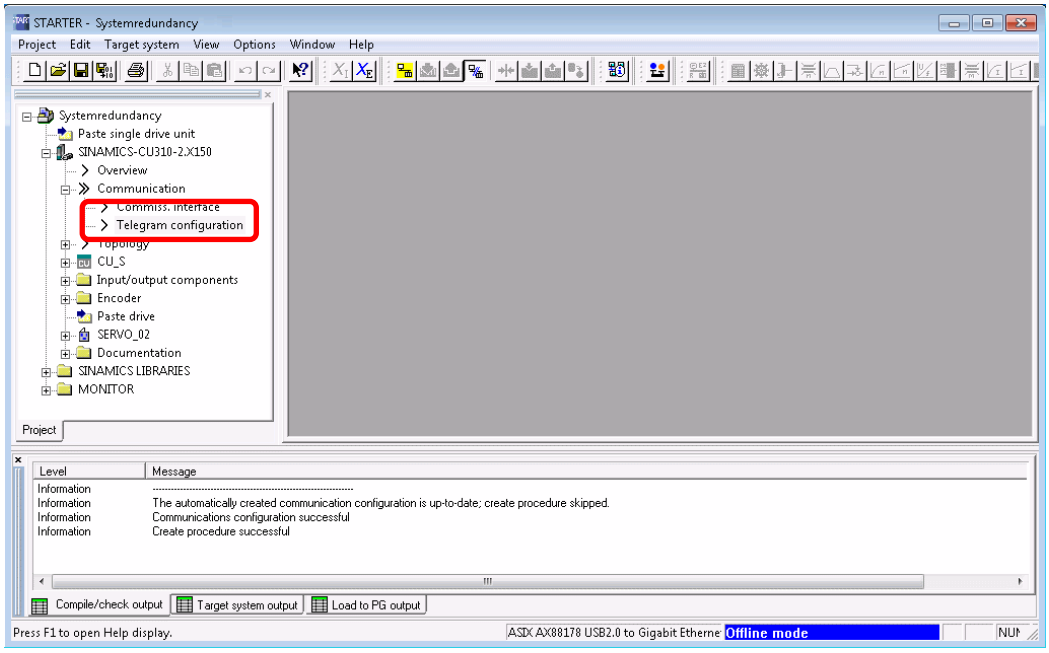
1.	Insert a single drive unit: SINAMICS S120 CU320-2PN Establish an online connection to the SINAMICS drive.  **Note** To establish an online connection, the network card of the engineering PC being used must be in the same IP subnet as the target device. Ensure that this precondition is complied with 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`

2.	Select the configured SINAMICS drive (set the checkmark in the checkbox) and confirm your selection by pressing the "OK" button. 

3.	After this, restore the factory settings at the SINAMICS (if not already done). 
4.	Confirm the following message with "Yes". The drive is then reset to the factory settings. 

5.	Afterwards carry out the automatic configuration of the drive. 
6.	Start the configuration by pressing the "Configure" button. The DRIVE-CLiQ topology of the drive is read out. 

7.	Servo motors are used in the SINAMICS training case. 
8.	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  **Note** **Before** "Power OFF/ON" execute the "RAM to ROM" function at the drive to save the previous configuration in a non-volatile way.

9.	Go offline and open the drive telegram configuration using the menu item "Communication > Telegram configuration". 
10.	The following telegrams are used for cyclic communication between the controller and drive in the sample project: • SERVO_1 Standard telegram 111, Length 12/12 • SERVO_2 Standard telegram 1, Length 2/2 • CU_S Free telegram configuration with BICO, Length 0/0 Set these telegrams in the drive telegram configuration. IF1: PROFIdrive PZD telegrams | IF2: PZD telegrams Communication interface: PROFINET - Control Unit onboard (isochronous) The PROFIsafe communication is performed via this interface The PROFIdrive telegrams of the drive objects are transferred in the following order: **The input data corresponds to the send and the output data of the receive direction of the drive object.** **Master view:**

Object	Drive object	-No.	Telegram type		Input data Length	Output data Length
1	SERVO_1	2	SIEMENS telegram 111, PZD-12/12		12	12
2	SERVO_2	3	Standard telegram 1, PZD-2/2		2	2
3	Control_Unit	1	Free telegram configuration with BICO		0	0
DOs that are not assigned to a slot. (No cyclic data exchange)						

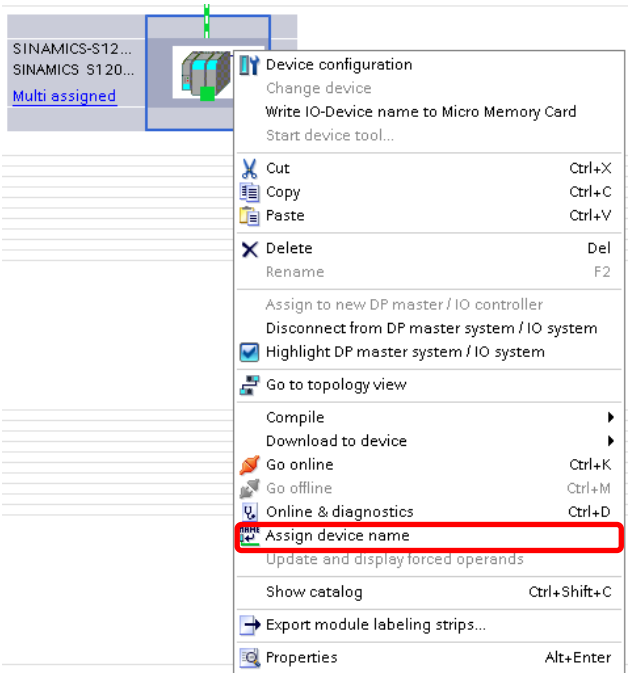
11.	Save and compile the configuration 
12.	Establish an online connection with the drive. 
13.	Download to the SINAMICS drive. 
14.	Execute the "RAM to ROM" function in the drive to save its configuration in a non-volatile way. 
15.	The communication between the SIMATIC CPU and SINAMICS drive has therefore been configured.

2.3 Commissioning of the sample project

Commissioning of the sample project

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

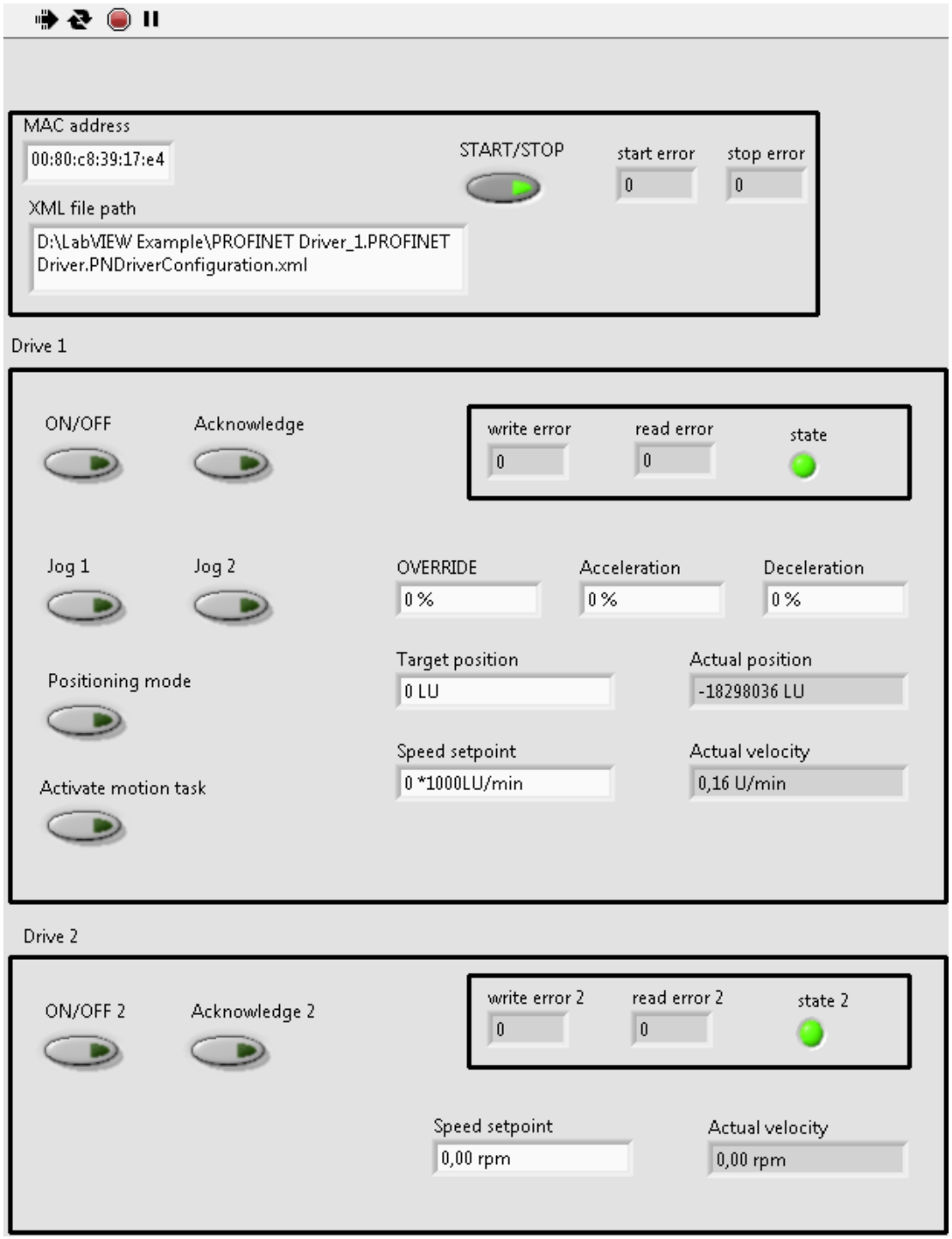
Table 2-7

1.	All hardware components are available and interconnected.
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 TIA Portal V15.1 and open the TIA sample project from the zip archive “99684399_TIA_Project.zip".
5.	Assign the SINAMICS drive the PROFINET device name. Navigate therefore to the network view and right click the SINAMICS > Assign device name 
6.	Search for the device, select it and click on “Assign name”
7.	Start the STARTER engineering system and open the STARTER sample project from the zip archive ”99684399_STARTER_Project.zip“
8.	Establish an online connection with the SINAMICS drive: 
9.	Download the configuration of the drive into the target device. 
10.	Then execute the "`RAM to ROM`" function. 
11.	Copy the folder “PNIO” from the zip archive “99684399_PNIO_LIB_v4_0.zip“ into the “user.lib” folder of the installed LabView version. E.g.: „C:\Program Files(x86)\National Instruments\LabView 2017\user.lib”. Then start the LabView library “PNIO.lvlib”
12.	The sample project is now ready for operation.

2.4 Operation

In this chapter the operation of the LabVIEW VIs is explained.

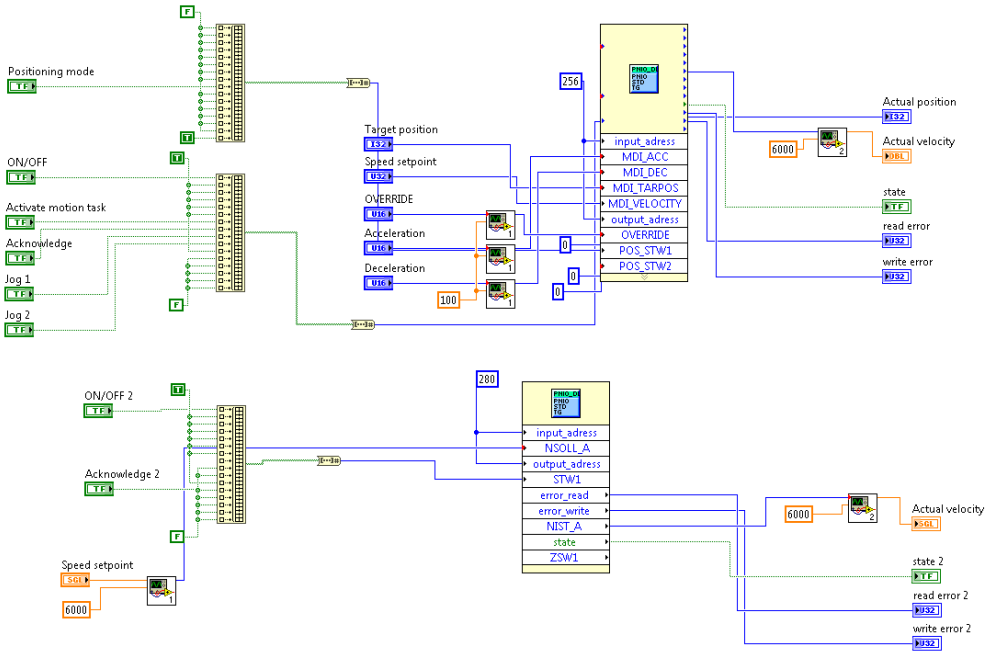
Figure 2-2



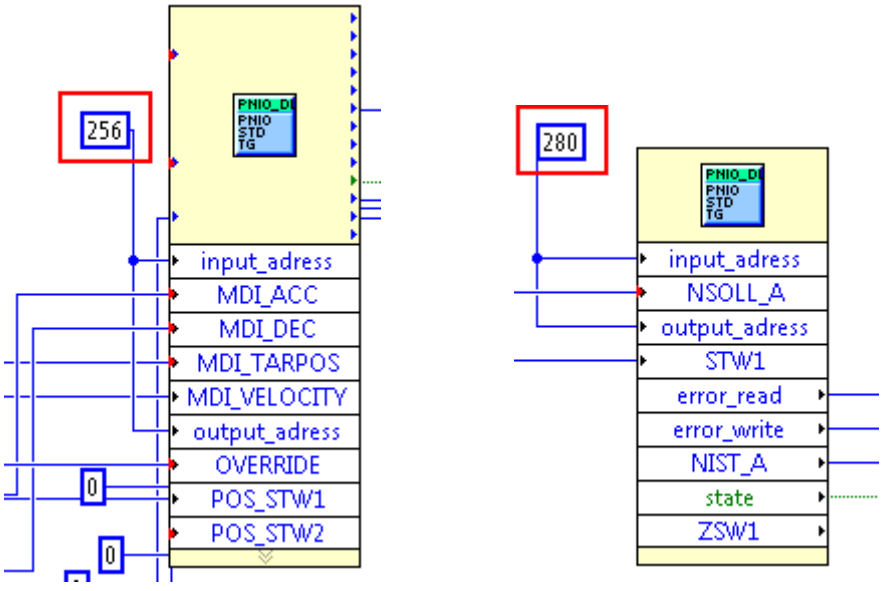
As shown in the diagram, the user interface comprises 3 components:

- The first component is used to operate the PROFINET controller.
- The second component is used to operate the basic positioner via direct setpoint input/MDI (upper axis of the S120 demonstration case).
- The third component is used to operate the speed-controlled axis (lower axis of the S120 demonstration case)

A section of the program code behind the user interface – the LabVIEW block diagram – is shown in the following figure:



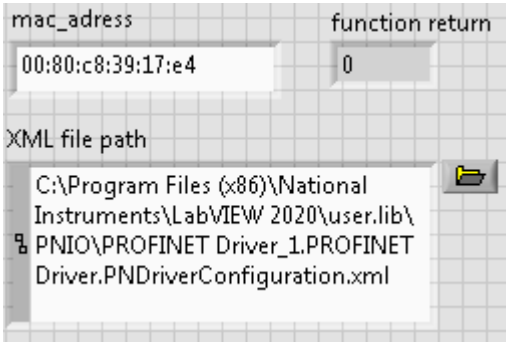
The calls of the two VIs "PNIO_STD_111.vi" and "PNIO_STD_TG1.vi" can be identified in the block diagram. These make up the composition of the telegram and transfer the data to the DLL. The entry fields with a red border are used to enter the I/O addresses, set in the TIA Portal for the I/O devices. These do not have to be changed to use the application example.



2.4.1 Starting the PROFINET Controller

The following steps are required to activate the PROFINET controller (corresponds to the RUN state of an S7-PLC):

Table 2-8

No	Action
1.	Enter the MAC address of the network interface. The MAC address must be entered in the following format: 00:ab:00:ab:00:ab The individual groups are separated by a colon, lowercase letters are used. Choose the path of the XML file created with compiling the TIA project. e.g. 
2.	Set switch "Start" of the LabVIEW user interface to "ON"
3.	Start the execution of the VI If all of the components have been correctly connected and commissioned, a value of 0 is displayed in field "start_error". The status fields "state" and "state2" of the drives are green, and the fault fields of the drives also indicate a value of 0x0h. (It can take some time to establish communications to the drive device. During this time, fault 0x301h may be displayed. This disappears as soon as the connection has been established to the IO device).

2.4.2 Operating the basic positioner of the upper drive

The application example involves operating the basic positioner with the most necessary operating functions via direct setpoint input/MDI. Other functions can also be used; however, in this case, a dedicated virtual instrument must be programmed.

The following table lists the various ways in which the application example can be operated:

Table 2-9

No.	Action	Remark
1.	Press the "ON/OFF" button	Switch on and switch off the drive object using OFF1.
2.	Press the "Acknowledge" button	Acknowledge active faults in the drive object
3.	Press the "Jog 1" button	Jogging in direction 1 with the jog velocity set in the drive object
4.	Press the "Jog 2" button	Jogging in direction 2 with the jog velocity set in the drive object
5.	Press the "Positioning mode" button	Changing the positioning type "ON" = absolute positioning
6.	Press the "Activate traversing task" button	Starting a traversing task
7.	"OVERRIDE" entry field	Setting the velocity override
8.	"Acceleration" entry field	Scaling factor of the acceleration set in the drive object
9.	“Deceleration" entry field	Scaling factor of the deceleration set in the drive object
10.	"Target position" entry field	Entry of the target position in LU
11.	"Speed setpoint" entry field	Enter the desired traversing velocity in 1000 LU/min

2.4.3 Operating the speed setpoint of the lower drive

The application example involves operating the lower drive by entering a speed setpoint. The following table lists the various ways in which the application example can be operated:

Table 2-10

No.	Action	Remark
1.	Press the "ON/OFF" button	Switch on and switch off the drive object using OFF1.
2.	Press the "Acknowledge" button	Acknowledge active faults in the drive object
3.	"Setpoint speed" entry field	Enter the required setpoint speed in rpm

2.4.4 Acyclic reading and writing of parameters

The structure of the VI example "PNIO_DPV1.vi" for acyclic communication is shown in this section, and its operation explained.

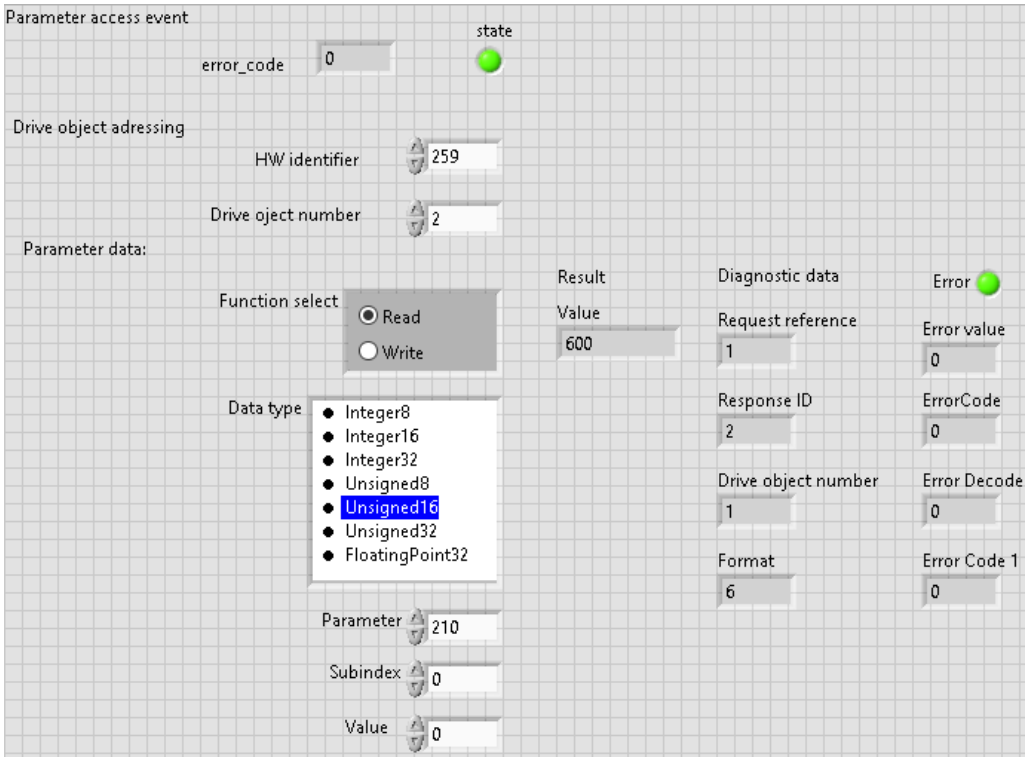
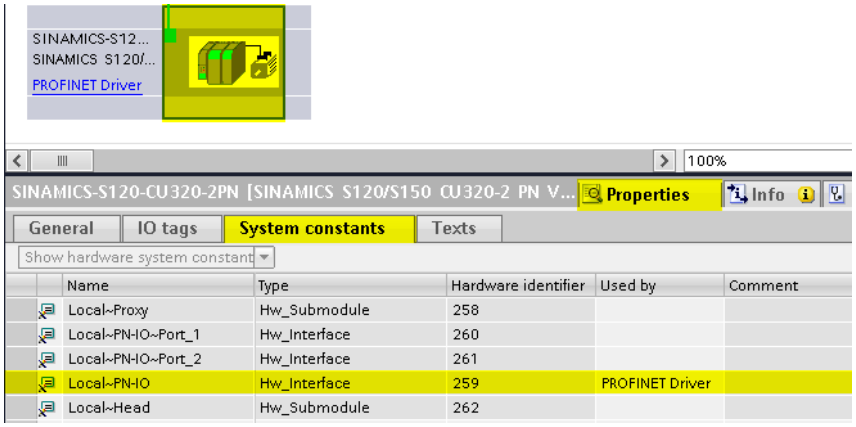
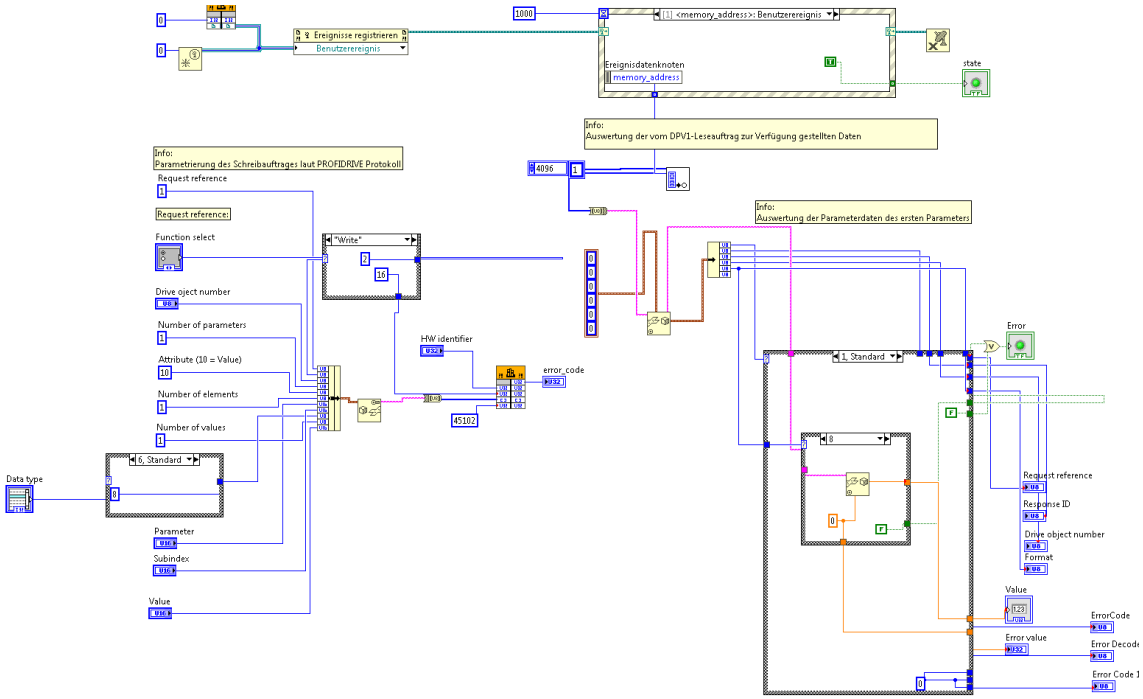


Table 2-11

Input	Description
HW identifier	The HW identifier identifies the drive. It can be found in TIA Portal: 
Drive object number	Number assigned in the drive for the drive object
Function select	Selection whether to read or write parameter
Data type	Selection of the data type of the parameter
Parameter	Number of the parameter to be accessed
Subindex	Subindex of the parameter to be accessed
Value	Value to be written to the parameter

A section of the program code behind the user interface – the LabVIEW block diagram – is shown in the following figure:

Figure 2-3



The read/write task is started with the specified data by executing the VI example.

The read data are evaluated and displayed.

All the data required for assembling the data block and the data types used can be taken from the "Sinamics S120 Function Manual Drive Functions" documentation that was mentioned previously.

3 Additional information

3.1 Functionality of the basic functions

The complete functionality of the application is provided by the DLL, which is integrated into LabVIEW. The functions contained in the DLL control the initialization of the IO controller and the data transfer.

To use these functions, preconfigured VIs are available for LabVIEW; they correctly call the DLL functions, and can be integrated in the actual LabVIEW user program.

The function and interface of each VI are described in the following sections.

Configuration information

When compiling the communication VIs for the complete PROFINET network, it must be ensured that the PROFINET controller is first started, and this must be executed again before closing the application.

In between opening and closing the PROFINET controller, the communication VIs must be cyclically called (e.g. in a loop).

The functionality and the interface of the application example is described in the following sections.

3.1.1 Program details about the blocks

Program details about the block Start.vi

This function initializes the PROFINET controller. The Ethernet interface to be used is selected using the MAC address of the interface

Table 3-1 – Interface of the VI

Name	Type	Data type	Function
MAC address	Input	char[]	MAC address of the Ethernet interface
XML path	Input	char[]	Absolute path of the xml file
error_code	Output	uint_32	Error number

Program details about the block Stop.vi

This function stops the execution of the PROFINET controller.

Table 3-2 - Interface of the VI

Name	Type	Data type	Function
error_code	Output	uint_32	Error number

Program details about the block PNIO_STD_TG1.vi

This function is used for communication based on "Standard telegram 1".

Table 3-3 – Interface of the VI

Name	Type	Data type	Function
input_adress	Input	uint_32	Start address of the input memory area
output_adress	Input	uint_32	Start address of the output memory area
STW1	Input	uint_16	Control word 1
NSOLL_A	Input	uint_16	Speed setpoint
ZSW1	Output	uint_16	Status word 1
NIST_A	Output	uint_16	Actual speed
state	Output	bool	Read/write status
error_read	Output	uint_32	Occurred error when reading
error_write	Output	uint_32	Occurred error when writing

Program details about the block PNIO_STD_TG111.vi

This function is used for communication based on "Standard telegram 111".

Table 3-4 - Interface of the VI

Name	Type	Data type	Function
input_adress	Input	uint_32	Start address of the input memory area
output_adress	Input	uint_32	Start address of the output memory area
STW1	Input	uint_16	Control word 1
POS_STW1	Input	uint_16	Pos. control word 1
POS_STW2	Input	uint_16	Pos. control word 2
STW2	Input	uint_16	Control word 2
OVERRIDE	Input	uint_16	Scaling factor (100% = 0x4000)
MDI_TARPOS	Input	uint_32	Setpoint position
MDI VELOCITY	Input	uint_32	Set velocity
MDI_ACC	Input	uint_16	Acceleration
MDI_DEC	Input	uint_16	Deceleration
user_write	Input	uint_16	User defined word
ZSW1	Output	uint_16	Status word 1
POS_ZSW1	Output	uint_16	Pos. status word 1

Name	Type	Data type	Function
POS_ZSW2	Output	uint_16	Pos. status word 2
ZSW2	Output	uint_16	Status word 2
MELDW	Output	uint_16	Message word
XIST_A	Output	uint_32	Actual position
NIST_B	Output	uint_32	Actual speed
FAULT_CODE	Output	uint_16	Error code
WARN_CODE	Output	uint_16	Alarm code
user_read	Output	uint_16	User defined word
state	Output	bool	Read/write status
error_read	Output	uint_32	Occurred error when reading
error_write	Output	uint_32	Occurred error when writing

Program details about the block PNIO_FREE_TG.vi

This function is used for communication based on "Free telegram configuration with BICO".

Table 3-5 – Interface of the VI

Name	Type	Data type	Function
input_adress	Input	uint_32	Start address of the input memory area
output_adress	Input	uint_32	Start address of the output memory area
number_bytes	Input	uint_32	Number of bytes to be written
data_write	Input	uint_8 [ ]	Data to be written
data_read	Output	uint_8 [ ]	Read data
state	Output	bool	Read/write status
error_read	Output	uint_32	Occurred error when reading
error_write	Output	uint_32	Occurred error when writing

Program details about the block PNIO_READ.vi

This function is used to read from a PROFINET IO device.

Table 3-6 – Interface of the VI

Name	Type	Data type	Function
input_adress	Input	uint_32	Start address of the input memory area
number_bytes	Input	uint_32	Number of bytes to be read
data_read	Output	uint_8 [ ]	Read data
state	Output	bool	Read status
error_write	Output	uint_32	Occurred error when reading

Program details about the block PNIO_WRITE.vi

This function is used to write to a PROFINET IO device.

Table 3-7 – Interface of the VI

Name	Type	Data type	Function
output_adress	Input	uint_32	Start address of the input memory area
number_bytes	Input	uint_32	Number of bytes to be written
data_write	Input	uint_8 [ ]	Data to be written
state	Output	bool	Write status
error_write	Output	uint_32	Occurred error when writing

Program details about the block DESCALE_SGL.vi

This VI descales a word value (e.g. speed) to 0x4000h.

Table 3-8 - Interface of the VI

Name	Type	Data type	Function
Input	Input	int16	Scaled value
Reference value	Input	float	Reference value, used as basis for scaling
Output	Output	float	Descaled value

Program details about the block DESCALE_DBL.vi

This VI descales a double word value (e.g. speed) to 0x40000000h.

Table 3-9 - Interface of the VI

Name	Type	Data type	Function
Input	Input	int32	Scaled value
Reference value	Input	double	Reference value, used as basis for scaling
Output	Output	double	Descaled value

Program details about the block SCALE_SGL.vi

This VI scales a word value (e.g. speed) to 0x4000h.

Table 3-10 - Interface of the VI

Name	Type	Data type	Function
Input	Input	uint_16	Unscaled value
Reference value	Input	float	Reference value, used as basis for scaling
Output	Output	uint_16	Scaled value

Program details about the block PNIO_ParameterAccess.vi

This VI is used to read/write parameters acyclically.

Table 3-11 - Interface of the VI

Name	Type	Data type	Function
hw_identifier	Input	uint_32	HW Identifier
write_length	Input	uint_32	Length of the data
data_write	Input	uint_8 [ ]	Data
data_record_index	Input	uint_32	Data record index

3.2 Diagnostics

Error list

In the following table most occurring error numbers are listed. (for the complete list see chapter: 4.1 Error list)

Table 3-12

Error number	Description
0x201	Unknown handle See Error number 0x201
0x301	Device data not available because controller has no connection to the device. See Error number 0x301
0x309	Wrong calling sequence See Error number 0x309
0x30B	Unknown address See Error number 0x30B
0x3FF	Critical error See Error number 0x3FF
0x401	The MAC address could not be found See Error number 0x401
0x402	The XML file could not be opened See Error number 0x402

Error number 0x201

Check if you have started the PN controller first with the “Start.vi” and created therefore a handle before executing another VI.

Error number 0x301

The PN controller has no connection to the PN device.

1. Please make sure that an Ethernet cable is connected from the LabVIEW PC interface to the PROFINET interface of the device. See also chapter 3.4 PCs and Connections
2. Check if you have assigned the correct PROFINET device name to the device. The device name configured in TIA Portal must match the actual name. See also chapter: 3.7 Assign PROFINET device name
3. Check the correct drive object sequence in STARTER and TIA Portal. See also chapter 3.5 Telegrams and drive objects

Error number 0x309

The VIs are called in a wrong sequence. Only call the Start.vi once  to start the PN controller.

Error number 0x30B

Wrong I/O addresses have been used. Please check the addresses entered in the VI. These addresses must match the I/O addresses in TIA portal. See also chapter

3.3 I/O addresses

Error number 0x3FF

Please check if you have configured the SINAMICS with a GSDML file. Startdrive is not supported.

Error number 0x401

There has no interface been found with the entered MAC address.

1. Please check the entered MAC address:

   e.g. 00:ab:00:ab:00:ab

   The individual groups are separated by a colon, lowercase letters are used.
2. If the MAC address was entered correctly then re-install WinPCap.

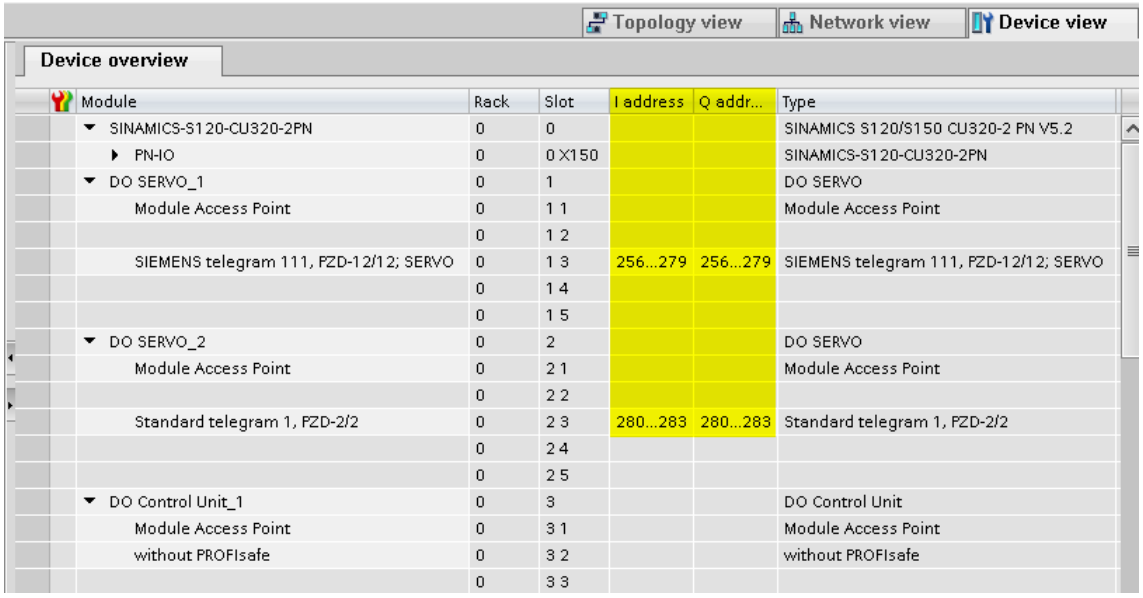
Error number 0x402

The XML file could not be found. Check the entered path and file name.

3.3 I/O addresses

In the device view of the SINAMICS in TIA portal the I/O addresses of the telegrams can be configured freely. These addresses are used in LabVIEW and must match. After changing the addresses in TIA portal, the xml file must be created again by compiling the project and the PN controller must be started with the new xml file.

Figure 3-1 I/O addresses in TIA portal



Module	Rack	Slot	I address	Q addr...	Type
SINAMICS-S120-CU320-2PN	0	0			SINAMICS S120/S150 CU320-2 PN V5.2
PN-IO	0	0 X150			SINAMICS-S120-CU320-2PN
DO SERVO_1	0	1			DO SERVO
Module Access Point	0	1 1			Module Access Point
	0	1 2			
SIEMENS telegram 111, PZD-12/12; SERVO	0	1 3	256...279	256...279	SIEMENS telegram 111, PZD-12/12; SERVO
	0	1 4			
	0	1 5			
DO SERVO_2	0	2			DO SERVO
Module Access Point	0	2 1			Module Access Point
	0	2 2			
Standard telegram 1, PZD-2/2	0	2 3	280...283	280...283	Standard telegram 1, PZD-2/2
	0	2 4			
	0	2 5			
DO Control Unit_1	0	3			DO Control Unit
Module Access Point	0	3 1			Module Access Point
without PROFIsafe	0	3 2			without PROFIsafe
	0	3 3			

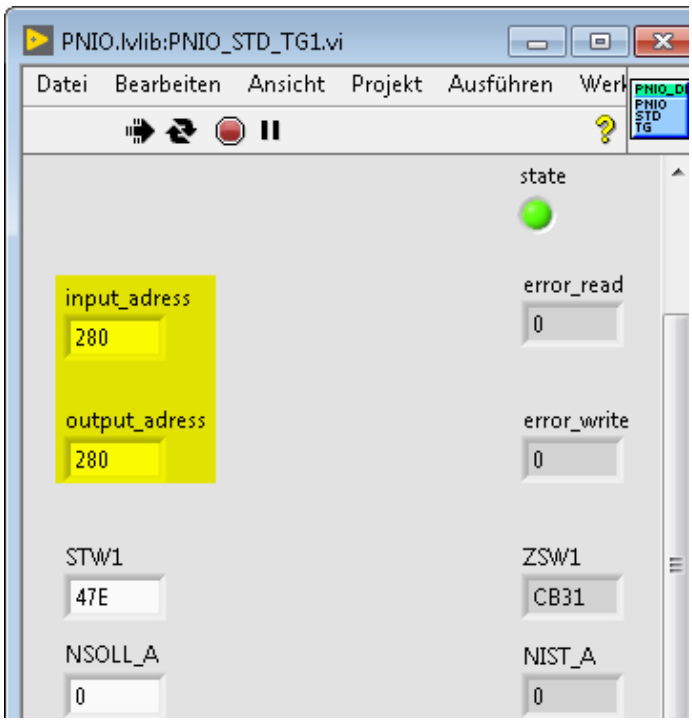
In this example:

SERVO_1 is using the start addresses *256*.

SERVO_2 is using the start addresses *280*.

These addresses are used in the VI of LabVIEW:

Figure 3-2 I/O addresses in LabVIEW



3.4 PCs and Connections

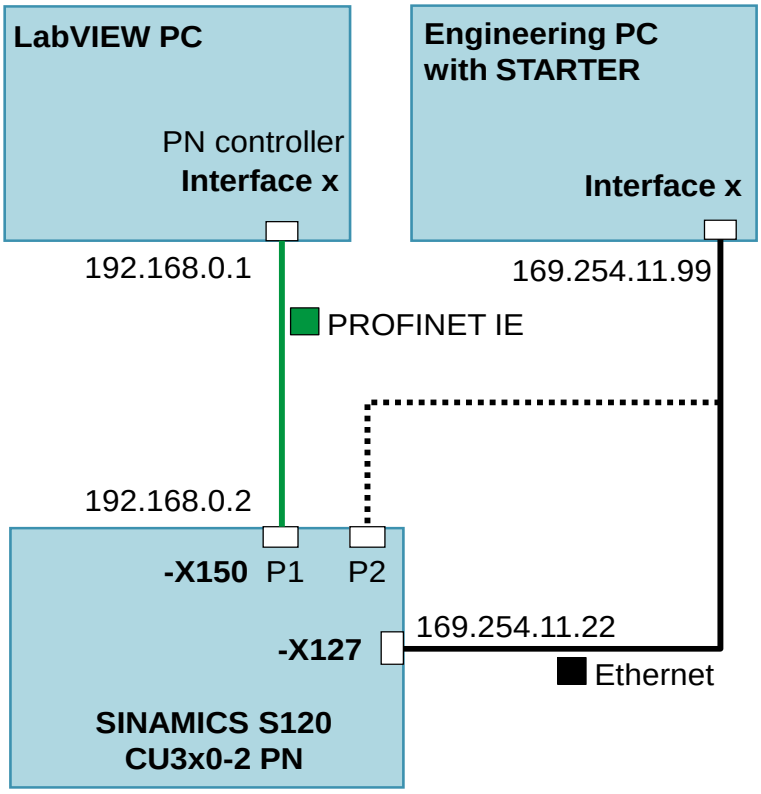
Two PCs with one Ethernet interface each

One PC is used for LabVIEW the second one is used for STARTER.

For the connection with STARTER either the second SINAMICS interface X127 can be used or the second port of X150.

See also Figure 3-5 PROFINET interface X150 and Ethernet interface X127 of the CU320-2PN

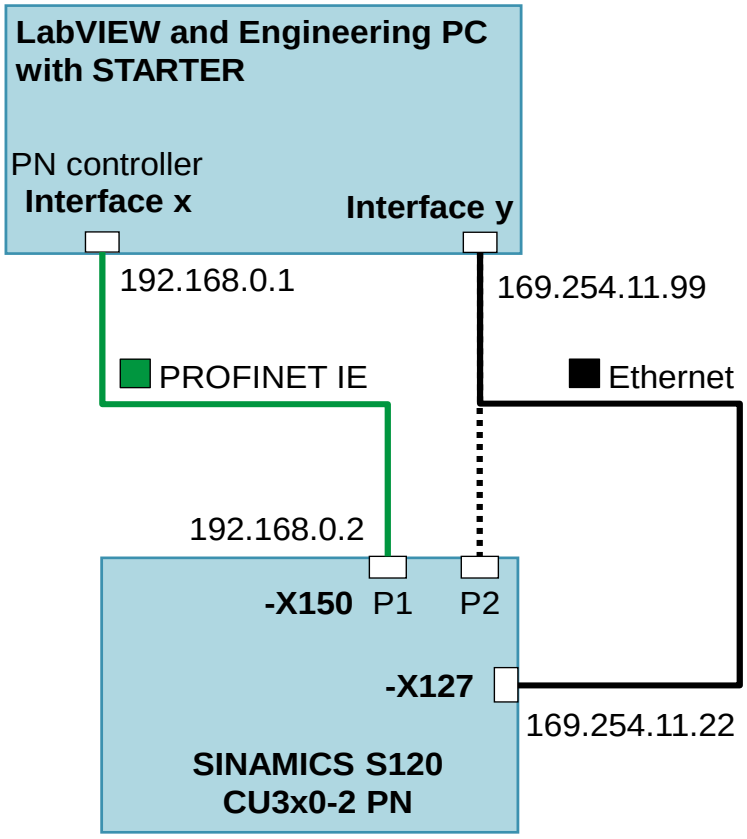
Figure 3-3 Connections with 2 PCs and one interface respectively



One PC with two Ethernet interfaces

One interface can be used for STARTER and the other one for LabVIEW.

Figure 3-4 Connection with one PC and two interfaces

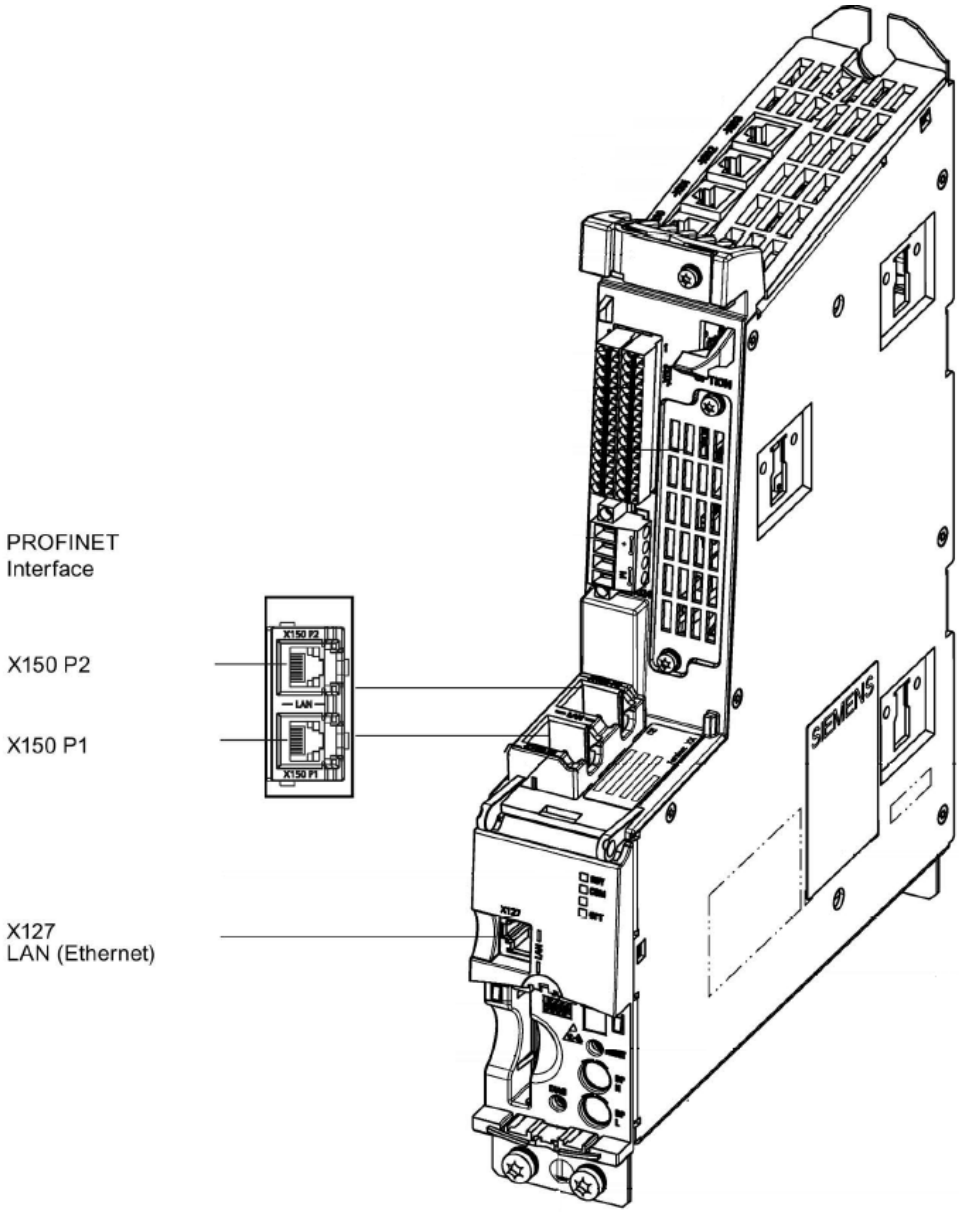


One PC with one Ethernet interface (not recommended)

The commissioning of the SINAMICS must be done first and then the items of the interface can be deactivated as described in chapter 2.2.1 Configuration of the LabVIEW Ethernet interface to use it with LabVIEW.

Afterwards there is no online connection with STARTER possible.

Figure 3-5 PROFINET interface X150 and Ethernet interface X127 of the CU320-2PN



NOTE The LabVIEW PC must be connected with the PROFINET interface X150.

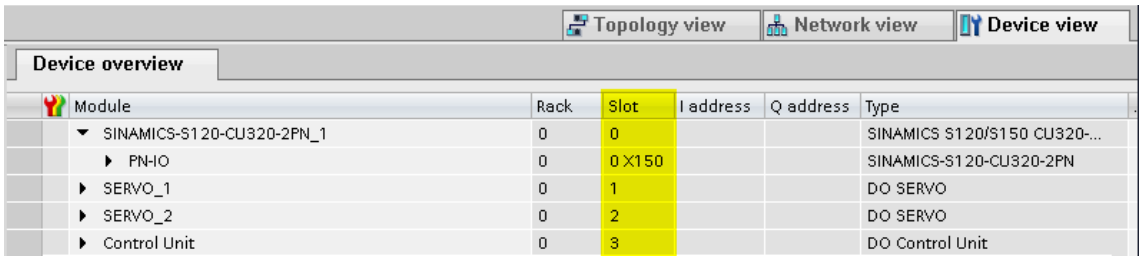
3.5 Telegrams and drive objects

In TIA portal the SINAMICS is configured with a device description file (GSDML). It is important that the configuration in TIA portal and STARTER matches.

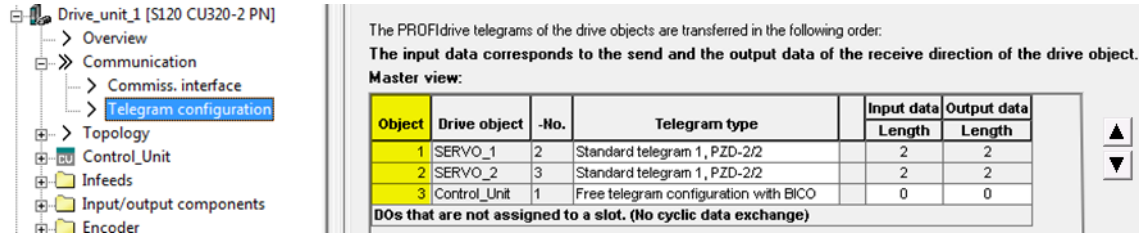
Example for the drive object sequence

The drive object sequence is freely editable and can be configured in TIA portal and in STARTER. But the sequence must match in both tools!

In TIA portal the „Slot“-number is relevant:



This corresponds the „Object“ in STARTER:



The drive object sequence can be edited with the arrows on the right side in STARTER.

Table 3-13 Drive object sequence

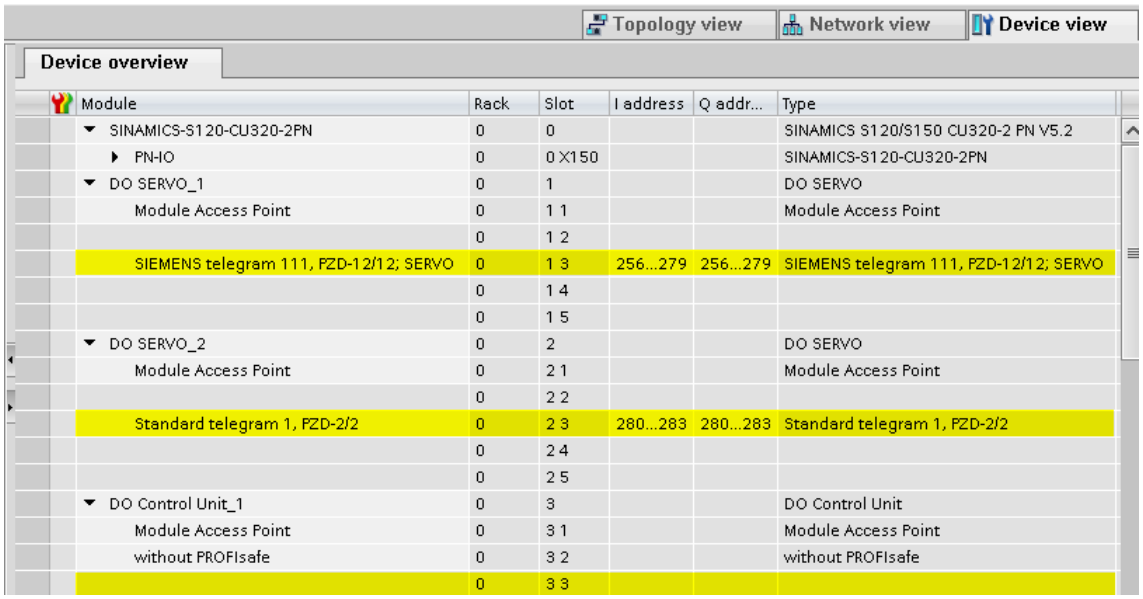
TIA-Portal: Slot	STARTER: Object	Drive object
1	1	SERVO_1
2	2	SERVO_2
3	3	Control Unit

Telegrams

A telegram can be configured for each drive object in STARTER.

Object	Drive object	-No.	Telegram type	Input data Length	Output data Length
1	SERVO_1	2	SIEMENS telegram 111, PZD-12/12	12	12
2	SERVO_2	3	Standard telegram 1, PZD-2/2	2	2
3	CU_S	1	Free telegram configuration with BICO	0	0
DOs that are not assigned to a slot. (No cyclic data exchange)					

In TIA portal the same telegrams must be configured:



Module	Rack	Slot	I address	Q addr...	Type
SINAMICS-S120-CU320-2PN	0	0			SINAMICS S120/S150 CU320-2 PN V5.2
PN-IO	0	0 X150			SINAMICS-S120-CU320-2PN
DO SERVO_1	0	1			DO SERVO
Module Access Point	0	1 1			Module Access Point
	0	1 2			
SIEMENS telegram 111, PZD-12/12; SERVO	0	1 3	256...279	256...279	SIEMENS telegram 111, PZD-12/12; SERVO
	0	1 4			
	0	1 5			
DO SERVO_2	0	2			DO SERVO
Module Access Point	0	2 1			Module Access Point
	0	2 2			
Standard telegram 1, PZD-2/2	0	2 3	280...283	280...283	Standard telegram 1, PZD-2/2
	0	2 4			
	0	2 5			
DO Control Unit_1	0	3			DO Control Unit
Module Access Point	0	3 1			Module Access Point
without PROFIsafe	0	3 2			without PROFIsafe
	0	3 3			

NOTE If a drive object does not have a telegram configured (Free telegram configuration with BICO and length 0/0) it can be left empty in TIA portal or an empty submodule can be added in the sub slot.

3.6 Go online

TIA Portal

You can't go online on the PROFINET Driver in TIA Portal. The TIA Portal project only serves the purpose of compiling the xml-file for the PN controller in LabVIEW.

TIA Portal can however also be used to assign the PROFINET device name to a PROFINET device (e.g. SINAMICS drive). See chapter 3.7 Assign PROFINET device name

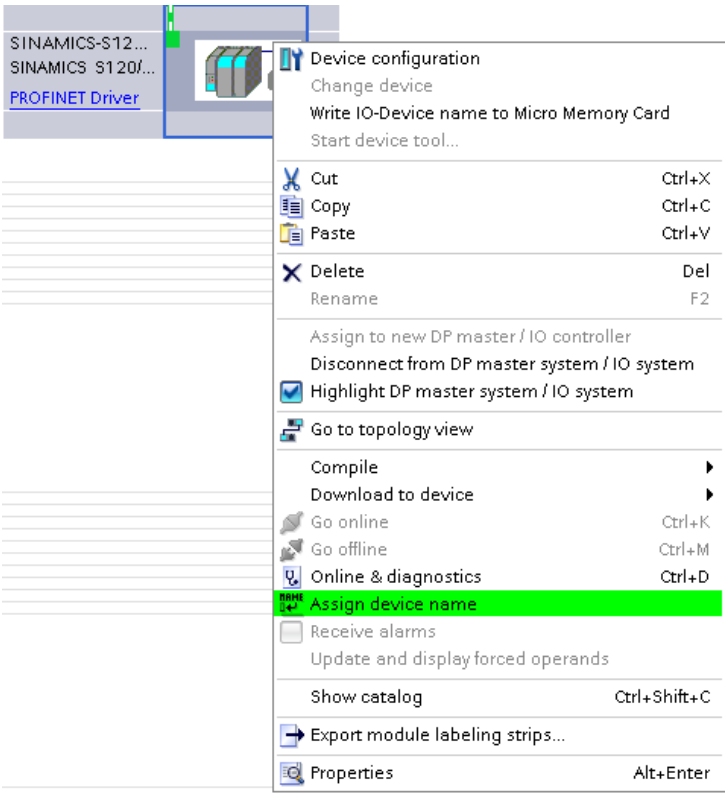
STARTER

With STARTER it is possible to establish an online connection with the SINAMICS.

3.7 Assign PROFINET device name

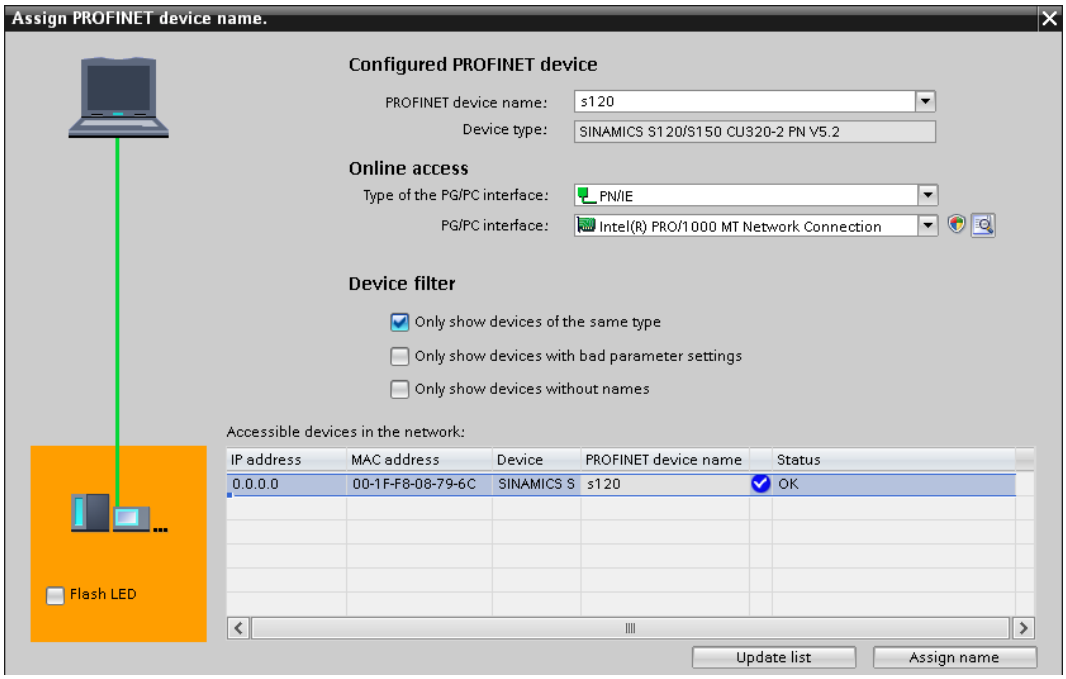
In TIA Portal the device name can be assigned to the PROFINET device in the network view. Therefore, right click the PN device and choose the menu item “Assign device name”.

Figure 3-6 Assign device name



Search for the device and assign the configured PROFINET device name if it doesn’t match.

Figure 3-7 Dialog: Assign device name



Alternatively, the tool PRONETA can be used:

https://support.industry.siemens.com/cs/ww/en/view/67460624

3.8 License

A runtime license is required for the PN driver if the PN driver does not run on SIMATIC hardware.

However, the capability of executing the application example is not influenced by the license.

For license conditions see:
https://support.industry.siemens.com/cs/ww/en/view/109760216

4 Appendix

4.1 Error list

Table 4-1 Error list

Error name	Error code	Description
PNIO_OK	0x00000000	Success
PNIO_WARN_IRT_INCONSISTENT	0x00000010	IRT Data may be inconsistent
PNIO_WARN_NO_SUBMODULES	0x00000011	No submodules to be updated
PNIO_WARN_LOCAL_STATE_BAD	0x00000012	data was written with local state PNIO_S_BAD, because not all components of splitted module have local state PNIO_S_GOOD
PNIO_WARN_NO_DECENTRALIOSYSTEM	0x00000013	No decentral io system is found in the configuration
PNIO_ERR_PRM_HND	0x00000101	Parameter handle is illegal
PNIO_ERR_PRM_BUF	0x00000102	Parameter buffer is NULL-Ptr
PNIO_ERR_PRM_LEN	0x00000103	Parameter length is wrong
PNIO_ERR_PRM_ADD	0x00000104	Parameter address is wrong
PNIO_ERR_PRM_RSTATE	0x00000105	Parameter remote state is NULL-Ptr
PNIO_ERR_PRM_CALLBACK	0x00000106	Parameter cbf is illegal
PNIO_ERR_PRM_TYPE	0x00000107	Parameter type has no valid value
PNIO_ERR_PRM_EXT_PAR	0x00000108	Parameter ExtPar has no valid value
PNIO_ERR_PRM_IO_TYPE	0x00000109	Parameter PNIO_ADDR::IODataType is wrong
PNIO_ERR_PRM_CP_ID	0x0000010A	Parameter CpIndex is wrong, probably driver is not loaded
PNIO_ERR_PRM_LOC_STATE	0x0000010B	Parameter IOlocState has no valid value
PNIO_ERR_PRM_REC_INDEX	0x0000010C	Parameter RecordIndex has no valid value
PNIO_ERR_PRM_TIMEOUT	0x0000010D	Parameter timeout has no valid value
PNIO_ERR_PRM_DEV_ANNOTATION	0x0000010E	Parameter annotation has no valid value

Error name	Error code	Description
PNIO_ERR_PRM_DEV_STATE	0x0000010F	Parameter state has no valid value
PNIO_ERR_PRM_PCBF	0x00000110	Parameter pCbf has no valid value
PNIO_ERR_PRM_MAX_AR_VALUE	0x00000111	Parameter MaxAR has no valid value
PNIO_ERR_PRM_ACCESS_TYPE	0x00000112	Parameter AccessType has no valid value
PNIO_ERR_PRM_POINTER	0x00000113	An invalid pointer was passed
PNIO_ERR_PRM_INVALIDARG	0x00000114	An invalid argument was passed
PNIO_ERR_PRM_MEASURE_NUMBER	0x00000115	Wrong Measure number in cycle statistics, must be -1 (actual measure) up to 49
PNIO_ERR_PRM_CYCLE_OFFSET	0x00000116	Wrong offset for cycle info buffer (must be 0 to 19)
PNIO_ERR_PRM_ROUTER_ADD	0x00000117	Address used by io router
PNIO_ERR_PRM_IP	0x00000118	Parameter IP has no valid value
PNIO_ERR_PRM_NOS	0x00000119	Parameter NoS has no valid value
PNIO_ERR_PRM_NOS_LEN	0x0000011A	Parameter length is wrong
PNIO_ERR_WRONG_HND	0x00000201	Unknown handle
PNIO_ERR_MAX_REACHED	0x00000202	Maximal number of opens reached; close unused applications
PNIO_ERR_CREATE_INSTANCE	0x00000203	Fatal error, reboot your system
PNIO_ERR_MODE_VALUE	0x00000204	Parameter mode has no valid value
PNIO_ERR_OPFAULT_NOT_REG	0x00000205	Register OPFAULT callback before register STARTOP callback
PNIO_ERR_NEWCYCLE_SEQUENCE_REG	0x00000206	Register NEWCYCLE callback before register STARTOP callback
PNIO_ERR_NETWORK_PROT_NOT_AVAILABLE	0x00000207	Network protocol not available, check card configuration
PNIO_ERR_RETRY	0x00000208	Pnio stack not available, try again later
PNIO_ERR_NO_CONNECTION	0x00000301	Device data not available, because device is not connected to controller
PNIO_ERR_OS_RES	0x00000302	Fatal error, no more operation

Error name	Error code	Description
		system resources available
PNIO_ERR_ALREADY_DONE	0x00000303	Action was already performed
PNIO_ERR_NO_CONFIG	0x00000304	No configuration for this index available
PNIO_ERR_SET_MODE_NOT_ALLOWED	0x00000305	PNIO_set_mode not allowed, use PNIO_CEP_MODE_CTRL by PNIO_controller_open
PNIO_ERR_DEV_ACT_NOT_ALLOWED	0x00000306	PNIO_device_activate not allowed, use PNIO_CEP_MODE_CTRL by PNIO_controller_open
PNIO_ERR_NO_LIC_SERVER	0x00000307	License server not running, check your installation
PNIO_ERR_VALUE_LEN	0x00000308	Wrong length value
PNIO_ERR_SEQUENCE	0x00000309	Wrong calling sequence
PNIO_ERR_INVALID_CONFIG	0x0000030A	Invalid configuration, check your configuration
PNIO_ERR_UNKNOWN_ADDR	0x0000030B	Address unknown in configuration, check your configuration
PNIO_ERR_NO_RESOURCE	0x0000030C	No resource too many requests been processed
PNIO_ERR_CONFIG_IN_UPDATE	0x0000030D	Configuration update is in progress or CP is in STOP state, try again later
PNIO_ERR_NO_FW_COMMUNICATION	0x0000030E	No communication with firmware, reset cp or try again later
PNIO_ERR_STARTOP_NOT_REGISTERED	0x0000030F	No synchronous function allowed, use PNIO_CEP_SYNC_MODE by PNIO_controller_open or PNIO_device_open
PNIO_ERR_OWNED	0x00000310	Interface-submodule cannot be removed because it is owned by an AR
PNIO_ERR_START_THREAD_FAILED	0x00000311	Failed to start thread, probably by lack of pthread resources
PNIO_ERR_START_RT_THREAD_FAILED	0x00000312	Failed to start realtime thread, probably you need root capability to do it

Error name	Error code	Description
PNIO_ERR_DRIVER_IOCTL_FAILED	0x00000313	Failed to ioctl driver, probably API version mismatch
PNIO_ERR_AFTER_EXCEPTION	0x00000314	exception occurred, save exception info (see manual) and reset cp
PNIO_ERR_NO_CYCLE_INFO_DATA	0x00000315	No cycle data available
PNIO_ERR_SESSION	0x00000316	Request belongs to an old session
PNIO_ERR_ALARM_DATA_FORMAT	0x00000317	Wrong format of alarm data
PNIO_ERR_ABORT	0x00000318	Operation was aborted
PNIO_ERR_CORRUPTED_DATA	0x00000319	Data are corrupt or have wrong format
PNIO_ERR_FLASH_ACCESS	0x0000031A	Error by flash operations
PNIO_ERR_WRONG_RQB_LEN	0x0000031B	Wrong length of request block at firmware interface, firmware not compatible to host sw
PNIO_ERR_NO_RESET_VERIFICATION	0x0000031C	Reset request was sent to firmware, but firmware rut up can't be verified
PNIO_ERR_SET_IP_NOS_NOT_ALLOWED	0x0000031D	Setting IP and/or NoS is not allowed
PNIO_ERR_INVALID_REMA	0x0000031E	Rema data is not valid
PNIO_ERR_NOT_REENTERABLE	0x0000031F	The function is not reenterable
PNIO_ERR_INVALID_STATION	0x00000320	Station not configured as optional
PNIO_ERR_INVALID_PORT	0x00000321	Port not configured as programmable peer
PNIO_ERR_NO_ADAPTER_FOUND	0x00000322	No ethernet adapter found
PNIO_ERR_ACCESS_DENIED	0x00000323	Access denied
PNIO_ERR_INTERNAL	0x000003FF	Fatal error, contact SIEMENS hotline
PNIO_ERR_MAC_ADRESS_NOT_FOUND	0x00000401	The entered MAC-address could not be found
PNIO_ERR_XML_NOT_FOUND	0x00000402	The XML-File cannot be opened

4.2 Service and support

Industry Online Support

Do you have any questions or need assistance?

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

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

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

Technical Support

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

SITRAIN – Training for Industry

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

For more information on our offered trainings and courses, as well as their locations and dates, refer to our web page:
www.siemens.com/sitrain

Service offer

Our range of services includes the following:

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

You can find detailed information on our range of services in the service catalog web page:
support.industry.siemens.com/cs/sc

Industry Online Support app

You will receive optimum support wherever you are with the "Siemens Industry Online Support" app. The app is available for Apple iOS, Android and Windows Phone:
support.industry.siemens.com/cs/ww/en/sc/2067

4.3 Application support

Siemens AG
Digital Industries Division
Factory Automation
Production Machines
DI FA PMA APC
Frauenauracher Str. 80
91056 Erlangen, Germany

mailto: profinet.team.motioncontrol.i-dt@siemens.com

4.4 Links and literature

Table 4-2

No.	Topic
\1\	Siemens Industry Online Support https://support.industry.siemens.com
\2\	Link to this entry page of this application example https://support.industry.siemens.com/cs/ww/en/view/99684399
\3\	SINAMICS S120 Function manual drive functions https://support.industry.siemens.com/cs/ww/en/view/109763287

4.5 Change documentation

Table 4-3

Version	Date	Modifications
V1.0	08/2014	First version
V2.0	01/2015	Extension with acyclic communication
V3.0	09/2019	Extension, Revision
V4.0	07/2020	Update to PN driver V2.1, Revision