JOHANNES **HÜBNER**
G I E S S E N

ideas and solutions

Operating and configuration manual

UO-EPN-2 PROFINET module
PROFINET IO interface

U-ONE® Fibre optic
Universal rotary encoder system – generation II

**Read the operating and configuration manual before assembly,
before starting installation and or any other work!
Store the manual for future use!**

Manufacturer / author

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1 General information

1.1 Information on the operating and configuration manual

This operating and configuration manual provides important information for using the UO-EPN-2 function module. It must be read carefully before beginning any work and observed. The UO-EPN-2 function module is referred to in the following documentation as the EPN.

Furthermore, the local accident prevention regulations and general safety regulations applicable for the area where the device will be used must be observed.

1.2 Scope of delivery

The operating and configuration manual is included in the scope of delivery for the function module.
The scope of delivery for the EPN also includes the software & support USB stick.

1.3 Explanation of symbols

Warning notices in this operating and configuration manual are designated using symbols. Information is proceeded by signal words which express the extent of the danger involved. Always comply with these notices, and use caution to avoid accidents, personal injury and property damage.

⚠	**WARNING!** Indicates a potentially hazardous situation that could lead to death or severe injury if it is not avoided.

⚠	**CAUTION!** Indicates a potentially hazardous situation that could lead to minor or slight injuries if it is not avoided.

!	**CAUTION!** Indicates a potentially hazardous situation that could lead to property damage if it is not avoided.

ⓘ	**NOTE!** Emphasises useful tips and recommendations, and provides information useful for efficient, smooth operation.

1.4 Warranty and liability

Only the "General Terms and Conditions" of the company Johannes Hübner Fabrik elektrischer Maschinen GmbH apply. These will be provided to the operator at the latest when the order is confirmed or when the contract is concluded. All warranty and liability claims for personal injury and property damage are excluded, and the operator's operating permit will be null and void if one or more of the following apply:

- Failure to observe the operating and configuration manual.
- Improper use of the function module.
- Improper assembly, installation, commissioning and programming of the function module.
- Operating the function module despite technical defects.
- Independently carrying out mechanical or electrical modifications to function modules.
- Independently carrying out repairs.
- Catastrophes due to external interference or force majeure.
- Use of non-qualified personnel.
- Opening the function module.

1.5 Organisational measures

- The operating and configuration manual must always be stored easily within reach in the area where the function module is used.
- In addition to the operating and configuration manual, general statutory and other binding regulations on accident prevention and environmental protection must be observed. Operators must be trained on these regulations.
- Applicable national, local, and system-specific provisions and requirements must be observed.
- The operator is obligated to inform personnel of special operating considerations and requirements.
- The type plate and any prohibitions or notice signs adhered to the function modules must always be legible.
- Repairs may only be carried out by the manufacturer, or by an agency or individual authorised by the manufacturer.

1.6 Copyright protection

	NOTE!
ⓘ	Content information, texts, drawings, images, and other illustrations are copyright protected and subject to industrial property rights. Copying of any kind not associated with use of the function module is prohibited without a written declaration from the manufacturer. Violations will result in claims for damages.

1.7 Warranty provisions

Warranty provisions are outlined in the manufacturer's General Delivery Conditions.

1.8 Customer service

Contact persons are available by phone, fax, or e-mail for technical questions. See the manufacturer's address on page 2.

2 Basic safety information

> **DANGER!**
> This section provides an overview of all significant safety aspects necessary to protect personnel and ensure safe, fault-free operation of the function module. Failure to observe this information may result in significant danger.

2.1 Responsibility of the operator

The function module is used in commercial areas. The operator of the function modules, therefore, is subject to statutory occupational safety requirements and the safety, accident prevention and environmental regulations applicable to the areas in which the function modules are used.

2.2 Selecting and qualifying personnel; basic obligations

- All work on the function module may be carried out only by qualified personnel. Qualified personnel are personnel with the training, experience, and instruction, as well as expertise on relevant standards, specifications, accident prevention regulations and operating circumstances necessary to carry out the required work, and who have been authorised to do so by the persons responsible for the safety of the system. They are able to identify and avoid potential hazards.

- In addition, please see standards VDE 0105-100 and IEC 60364 for the definition of "qualified personnel" (reference, e.g. Beuth Verlag GmbH, VDE-Verlag GmbH)

- Responsibilities for assembly, installation, commissioning and operation must be clearly defined. Personnel who are receiving instruction or training must be supervised.

2.3 Proper use

The system manufacturer must review whether the properties of the function module fulfil the safety requirements in its specific application. The system manufacturer is responsible for use of the function module and for deciding whether to use the module. Function modules are designed for unsupervised, continuous operation.

Proper use also includes:

- observing all information in this operating and configuration manual
- observing type plates and any prohibition or information signs
- observing the operating manual of the machine or system manufacturer.
- operating the function module within the limits stipulated in the technical data
- not engaging in improper use.

2.4 Improper use

	WARNING!
⚠	Danger of death, physical injury and property damage due to improper use of the function module! In particular, the following uses are prohibited: ● Use in environments with an explosive atmosphere. ● Use in environments with radioactive radiation. ● Use on ships. ● Use for medical purposes.

2.5 Safety information

	WARNING! CAUTION! NOTE!
⚠ !	Destruction, damage or impairment of the function of the function module! ● Only complete wiring work and only connect or disconnect electrical connections when the module is powered down. ● Review any potential hazards due to interactions with other systems and devices currently installed in the surrounding area, or which are to be installed. The user is responsible for taking relevant measures. ● Cables used must be suitable for the temperature range. ● Defective function modules may not be operated. ● Opening function modules is prohibited. ● The type plates specify the technical properties of the function modules. If a type plate is no longer legible, or if a type plate is missing entirely, the function module may not be operated. Contact Hübner Service (see page 2).

	NOTE!
ⓘ	**Disposal:** If the function module needs to be disposed after its service life, applicable national regulations must be observed.

3 Assembly

3.1 Safety information

	WARNING!
⚠️	● Assembly and disassembly may only be carried out by qualified personnel. Observe the safety information in section 2. ● In general, the requirements and acceptance conditions for the system as a whole must be observed.

	DANGER! CAUTION!
⚠️❗	**Danger of death, severe physical injury and/or property damage due to deactivating safety functions, caused by an unsecured shaft drive!** ● In general, the requirements and acceptance conditions for the system as a whole must be observed.

3.2 Basic regulations

	WARNING!
⚠️	● Power and signal lines must be installed separately. ● Observe the manufacturer's information when installing converters, shielding on power lines between the frequency converter and motor. ● Ensure the energy supply is sufficient for the application.

3.3 Replacing the function module

When replacing function modules, observe the following:

• The new function module must have the same item no. (ID) as the old one.

• When recommissioning the replaced function module, a secure test run must be completed first to ensure it functions correctly.

4   Technical data and functions

4.1   Type plate

The following image shows an example of a type plate.
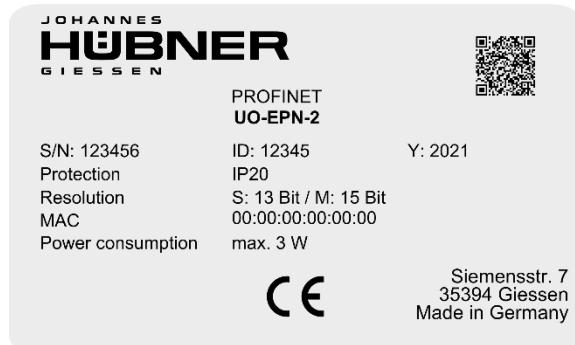
Fig. 4-1: Type plate (example)

The type plate is located on the outside of the housing, and includes the following information:

- Manufacturer
- Type, year of construction
- CE mark
- Serial number (S/N)
- Protective class
- ID number
- Liquidation
- MAC address

4.2 Type key

UO-EPN-2

EPN function module

Variation 2
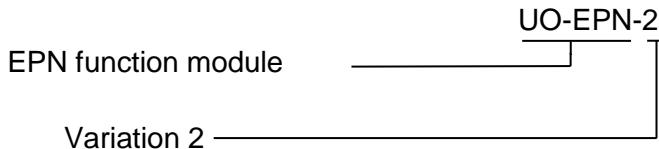
4.3   Technical data

Information	Value
Supply voltage	Delivered to the SCU module via the bus connector
Module power intake	< 4 W
Protective class in accordance with DIN EN 60529	IP20 for switch cabinet installation IP rating of the switch cabinet: ≥ IP54
Single-turn resolution	≤ 13 Bit (8192 steps / revolution)
Multi-turn resolution	≤ 15 Bit (32768 revolutions)
PROFINET IO interface	in accordance with IEC 61158 and IEC 61784
Encoder profile	No. 3.162 Version 4.2, Class 2
Conformance Class	B, C
Physical Layer	PROFINET 100Base-TX, Fast Ethernet, ISO/IEC 8802-3
Cycle time	≥ 500 µs (IRT / RT)
Transmission rate	100 MBit/s
Transmission	CAT-5 cable, shielded (STP), ISO/IEC 11801
Preset write cycles	≥ 100 000 000
Connection	RJ45 plug
Wiring diagram	PN165-414
Elevation above sea level	≤ 3000 m

4.4 Operating statuses and displays
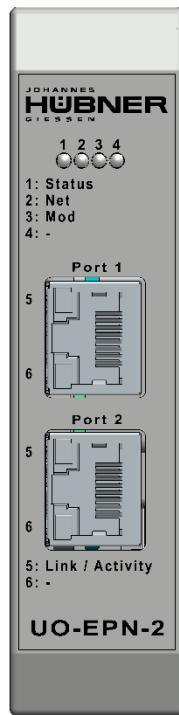
4.4.1 Module status display

Operating status	Status LED	Bus status
Start	flashing yellow/green 2 Hz	not ready for operation
Normal	green	ready for operation
Bootloader	flashing yellow/red 1 Hz	not ready for operation
Warning	flashing yellow 1 Hz	ready for operation
Error	red	error

4.4.2 Bus status indicator

	on		off		flash
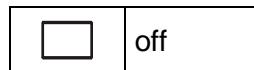
Network status (Net)

	Offline
	Online (RUN)
1x flash	Online (STOP)
	Used by the projecting tool to identify a device in the network
	Internal error in the communication module (combined with the Mod LED)
1 x flash	Device name not set
2 x flash	IP address not set
3 x flash	Configuration error

Module status (Mod)

	Not initialized (no voltage / SETUP state / NW_INIT state)
	Normal operation
1 x flash	Diagnosis event present
	Internal error in the communication module (combined with the Net LED)
	Exception error
/	Firmware update of the communication module, switching the voltage off during the process can lead to permanent module damage.

PORT 1

	No Ethernet connection
	Ethernet connection set up
	Data transmission TxD/RxD

PORT 2

☐	No Ethernet connection
▮	Ethernet connection set up
▣	Data transmission TxD/RxD

Electrical connection

An Ethernet cable with RJ45 plug must be used for the PROFINET wiring. The module has an integrated switch functionality.

5   PROFINET IO – commissioning

5.1   PROFINET IO

Important information on commissioning is provided in the
PROFINET commissioning guidelines, order no.: 8,081

This and further information on the PROFINET is available from the office of the PROFIBUS user organisation:

PROFIBUS Nutzerorganisation e.V.	
Haid-und-Neu-Str. 7	Phone: + 49 721 96 58 590
D-76131 Karlsruhe	Fax: + 49 721 96 58 589
www.profibus.com	E-mail: germany@profibus.com

5.1.1   Device classes

The following device classes are differentiated in a PROFINET IO system:

- **IO-Controller**
  For example, a PLC that addresses the connected IO device.

- **IO-Device**
  Decentrally located field device (measurement system) that is assigned to one or more IO controllers and transmits alarms in addition to process and configuration data.

- **IO-Supervisor** (Engineering Station)
  A programming device or industrial PC that has access to all process and parameter data at the same time as the IO controller.

5.1.2   Device description file (XML)

The GSDML file and associated bitmap file are part of the measurement system: *" GSDML-V2.42-HUEBNER-AMPN-current date.xml"*.

The files are included on the software and support USB stick. This is part of the delivery.

5.1.3   Device identification

Each PROFINET-IO device has a device identification. This consists of a company designation, vendor ID, and a manufacturer-specific part, the device-ID. The vendor ID is assigned by the PNO; this ID is **0x024A** for Johannes Hübner - Fabrik elektrischer Maschinen GmbH, and the device ID is **0x03E9**.

The planned device identification is reviewed during start-up, in order to detect errors in the project planning.

5.1.4 Address assignment

Parameter	Standard value	Description
MAC address	–	The measurement system has a stored *MAC address* upon delivery as a standard feature. This is printed on the device's type plate, e.g. "00:03:12:04:00:60", and cannot be modified.
Device type	AMPN	The name of the device type is "AMPN" and cannot be changed.
Device names	–	Before an IO device can be addressed by an IO controller, it must have a *device name*, since the IP address is permanently assigned to the device name. The IO controller can also assign IP addresses to IO devices during start-up according to their device names. The advantage of this process is that names are easier to handle than complex IP addresses. Assigning a device name to a specific IO device is comparable to setting the PROFIBUS address for a DP Slave. The measurement system does not have any stored device names upon delivery, or after a reset. The measurement system can only be addressed by an IO controller after a device name is assigned using the engineering tool, for instance to transmit project planning data (such as the IP address) during start-up, or for user data exchange during cyclical operation. The name is assigned before commissioning by the engineering tool via the DCP protocol used as a standard on PROFINET-IO field devices.
IP address	0.0.0.0	The measurement system does not have a stored IP address upon delivery, or after a reset. Standard value: "0.0.0.0"
Subnet mask	0.0.0.0	The measurement system does not have a stored subnet mask upon delivery, or after a reset. Standard value: "0.0.0.0"

Process for assigning device names and addresses to an IO device:

– Determine the device name, IP address, and subnet mask. However, this may also be done automatically depending on the configuration of the IO controller.

– The device name is assigned to an IO device (MAC address) – transmit the device name to the device

– Load project plan to the IO controller

– The IO controller assigns IP addresses to the device names during start-up. Assignment of IP addresses can also be switched off; in this case, the available IP address in the IO device is used.

5.2   Start-up on the PROFINET IO

Following a successful start-up, IO devices will independently begin data transmission. A PROFINET-IO communication relationship always follows the provider-consumer model. During cyclical transmission of the measured value, the IO device is the provider of the data, while the IO controller (such as a PLC) is the consumer. The transmitted data is always assigned a status (good or bad).

5.3   Configuration

The following applies:

- Flow of input data: Device → Host
- Flow of output data: Host → Device

5.3.1 Encoder features

– Communication interface PROFINET IO V2.33
– Cycle time ≥ 500µs
– MRP for RT
– Class 1, Class 2 (RT or IRT)
– Neighbourhood detection
– Identification request
– Support of the encoder profile V4.2
– Support of the profile telegrams 81, 82, 83, 84, 86, 87, 89
– Support of the manufacturer-specific telegrams 860
– Bootloader

5.3.2 Structure of the standard telegrams

Use of the telegrams 86, 87, 89 or 860 is recommended, since it is easy to transmit the preset value and set the preset here. In addition, it is not necessary to set various bits in order to activate the cyclical data.

Telegram 81

Input data

Word	Byte	Bit	Input data	
1	X+ 0..1	2^0-2^{15}	Encoder status word 2 (ZSW2_ENC)	Unsigned 16
2	X+ 2..3	2^0-2^{15}	Sensor status word 1 (G1_ZSW)	Unsigned 16
3	X+ 4..7	2^0-2^{31}	Current position counted (G1_XIST1)	Unsigned 32
4				
5	X+ 8..11	2^0-2^{31}	Current position absolute (G1_XIST2)	Unsigned 32
6				

Output data

Word	Byte	Bit	Output data	
1	X+ 0..1	2^0-2^{15}	Encoder control word 2 (STW2_ENC)	Unsigned 16
2	X+ 2..3	2^0-2^{15}	Sensor control word (G1_STW)	Unsigned 16

Telegram 82

Input data

Word	Byte	Bit	Input data	
1	X+ 0..1	2^0-2^{15}	Encoder status word 2 (ZSW2_ENC)	Unsigned 16
2	X+ 2..3	2^0-2^{15}	Sensor status word 1 (G1_ZSW)	Unsigned 16
3	X+ 4..7	2^0-2^{31}	Current position counted (G1_XIST1)	Unsigned 32
4				
5	X+ 8..11	2^0-2^{31}	Current position absolute (G1_XIST2)	Unsigned 32
6				
7	X+ 12..13	2^0-2^{15}	Current velocity (NIST_A)	Signed 16

Output data

Word	Byte	Bit	Output data	
1	X+ 0..1	2^0-2^{15}	Encoder control word 2 (STW2_ENC)	Unsigned 16
2	X+ 2..3	2^0-2^{15}	Sensor control word (G1_STW)	Unsigned 16

Telegram 83

Input data

Word	Byte	Bit	Input data	
1	X+ 0..1	2^0-2^{15}	Encoder status word 2 (ZSW2_ENC)	Unsigned 16
2	X+ 2..3	2^0-2^{15}	Sensor status word 1 (G1_ZSW)	Unsigned 16
3	X+ 4..7	2^0-2^{31}	Current position counted (G1_XIST1)	Unsigned 32
4				
5	X+ 8..11	2^0-2^{31}	Current position absolute (G1_XIST2)	Unsigned 32
6				
7	X+ 12..15	2^0-2^{31}	Current velocity (NIST_B)	Signed 32
8				

Output data

Word	Byte	Bit	Output data	
1	X+ 0..1	2^0-2^{15}	Encoder control word 2 (STW2_ENC)	Unsigned 16
2	X+ 2..3	2^0-2^{15}	Sensor control word (G1_STW)	Unsigned 16

Telegram 84

Input data

Word	Byte	Bit	Input data	
1	X+ 0..1	2^0-2^{15}	Encoder status word 2 (ZSW2_ENC)	Unsigned 16
2	X+ 2..3	2^0-2^{15}	Sensor status word 1 (G1_ZSW)	Unsigned 16
3	X+ 4..11	2^0-2^{63}	Current position counted (G1_XIST3) The top 32 bits are always 0	Unsigned 64
4				
5				
6				
7	X+ 12..15	2^0-2^{31}	Current position absolute (G1_XIST2)	Unsigned 32
8				
9	X+ 16..19	2^0-2^{31}	Current velocity (NIST_B)	Signed 32
10				

Output data

Word	Byte	Bit	Output data	
1	X+ 0..1	2^0-2^{15}	Encoder control word 2 (STW2_ENC)	Unsigned 16
2	X+ 2..3	2^0-2^{15}	Sensor control word (G1_STW)	Unsigned 16

Telegram 86

Input data

Word	Byte	Bit	Input data	
1	X+ 0..3	2^0-2^{31}	Current position absolute (G1_XIST2)	Unsigned 32
2				
3	X+ 4..7	2^0-2^{31}	Current velocity (NIST_B)	Signed 32
4				

Output data

Word	Byte	Bit	Output data	
1	X+ 0..3	2^0-2^{31}	Preset value (G1_XIST_PRESET_B)	Unsigned 32
2				

Telegram 87

Input data

Word	Byte	Bit	Input data	
1	X+ 0..3	2^0-2^{31}	Current position absolute (G1_XIST2)	Unsigned 32
2				

Output data

Word	Byte	Bit	Output data	
1	X+ 0..3	2^0-2^{31}	Preset value (G1_XIST_PRESET_B)	Unsigned 32
2				

Telegram 89

Input data

Word	Byte	Bit	Input data	
1	X+ 0..1	2^0-2^{15}	Encoder status word 2 (ZSW2_ENC)	Unsigned 16
2	X+ 2..5	2^0-2^{31}	Current position absolute (G1_XIST2)	Unsigned 32
3				
4	X+ 6..9	2^0-2^{31}	Current velocity (NIST_B)	Signed 32
5				

Output data

Word	Byte	Bit	Output data	
1	X+ 0..1	2^0-2^{15}	Encoder control word 2 (STW2_ENC)	Unsigned 16
2	X+ 2..5	2^0-2^{31}	Preset value (G1_XIST_PRESET_B1)	Unsigned 32
3				

5.3.3 Structure of the manufacturer-specific telegrams

Telegram 860

Input data

Word	Byte	Bit	Input data	
1	X+ 0..3	2^0-2^{31}	Current position absolute (G1_XIST2)	Unsigned 32
2				
3	X+ 4..7	2^0-2^{31}	Current velocity (NIST_B)	Signed 32
4				

Output data

Word	Byte	Bit	Output data	
1	X+ 0..3	2^{31}	Trigger bit	Unsigned 32
		2^0-2^{30}	Preset value (G1_XIST_PRESET_B)	
2				

5.3.4 Format of the current position G1_XIST1 and G1_XIST2

- G1_XIST1 is a 32-bit counter in binary format which is loaded with the value of G1_XIST2 following switch-on.
- G1_XIST2 contains the current position value in binary format. The value range can be no larger than the resolution of the encoder (e.g. 2^{28} for 13-bit single-turn and 15-bit multi-turn).

The alignment of the data is right-justified.

In the event of an error, error codes are transmitted in G1_XIST2 in telegrams 81-84.

G1_XIST2	Meaning	Remark
0x0001	Sensor error	Error in position detection. The position data are invalid
0x0F01	Command not supported	

5.3.5 Format of the velocity NIST_A

Bit	Meaning	Remark
0…15	Velocity value 16 bit	Output in the parameterized format Increments per 1s Increments per 100ms Increments per 10ms Revolution per minute N2/N4

5.3.6 Format of the velocity NIST_B

Bit	Meaning	Remark
0…31	Velocity value 32 bit	Output in the parameterized format Increments per 1s Increments per 100ms Increments per 10ms Revolution per minute N2/N4

5.3.7 Format of the encoder status word 2 ZSW2_ENC

Bit	Meaning	Remark
0	Preset confirmation	0: ready for preset 0 → 1: preset process completed 1 → 0: preset finished and STW2_ENC.0 = 0
1	Validity of the position data	0: invalid 1: valid
2	Validity of the velocity value	0: invalid 1: valid
3	Error flag	0: no error 1: at least 1 error pending
4 … 6	Reserved	
7	Warning flag	0: no warning 1: at least 1 warning present
8	Reserved	
9	Control through PLC requested (not for V3.1 compatibility mode)	0: cyclical I/O data invalid in V3.1 compatibility mode always 0 1: control through PLC, I/O data are valid
10 … 15	Reserved	

5.3.8 Format of the status word sensor 1 G1_ZSW

Bit	Meaning	Remark
0 … 10	Reserved	
11	Feedback error acknowledgement	1: error acknowledgement in progress
12	Feedback preset function	0: preset not requested 1: preset workflow active
13	Feedback request position output via G1_XIST2	0: no output requested or error code is output 1: position is transmitted This is the confirmation for G1_STW.13
14	Feedback park mode	0: park mode off 1: park mode on This is the confirmation for G1_STW.14
15	Sensor error flag	0: no errors 1: sensor error present

5.3.9 Format of the preset G1_XIST_PRESET_B

Bit	Meaning	Remark
0…30	Preset value	Preset value for G1_XIST2 in the parameterized resolution
31	Trigger for preset execution	0: idle state 0 → 1: execute preset

5.3.10 Format of the preset G1_XIST_PRESET_B1

Bit	Meaning	Remark
0…31	Preset value	Preset value for G1_XIST2 in the parameterized resolution

5.3.11 Format of the control word 2 encoder STW2_ENC

Bit	Meaning	Remark
0	Preset trigger	0: normal state 0 → 1: request preset 1 → 0: after the preset process (ZSW2_ENC.0 = 1)
1 … 6	Reserved	
7	Error confirmation	0: normal state 0 → 1: Acknowledgement of the errors
8 … 9	Reserved	
10	Control through the PLC	0: no control through the PLC, the cyclical data are invalid 1: control through the PLC, I/O data are valid
11 … 15	Reserved	

5.3.12 Format of the control word sensor G1_STW2

Bit	Meaning	Remark
0 … 10	Reserved	
11	Preset mode	0: absolute (preset is set to this value) 1: relative (preset is displaced by this value)
12	Preset trigger	0: normal state 0 → 1: request preset
13	Request position output via G1_XIST2	0: no output of the position 1: position output activated
14	Park mode	0: normal operation 1: activate park mode (diagnoses are switched off)
15	Acknowledgement sensor error	0: normal state 1: acknowledge sensor error (error code in G1_XIST2 is deleted)

5.4 Programmable parameters

5.4.1 Access via GSD

The parameterization tool (e.g. TIA portal) can be used to access the base mode parameters.

Module parameters

Encoder Parameter control (P65005)

Parameter initialization control:	PRM (Parametrization)
Parameter write protect:	Write all
Parameter 65005 write protect:	Write all
Reset control write protect:	Write all

Encoder Parameter

Code sequence:	CW
Encoder Class 4 functionality:	enable
G1_XIST1 Preset control:	disable
Scaling function control:	disable
Alarm channel control:	enable
Compatibility Mode V3.1:	disable
Encoder type:	Rotary
Measuring units / Revolution:	8192
Total measuring range:	268435456
Velocity measuring unit:	RPM
Velocity reference value (N2/N4 R/min):	2000.000000
Preset value (P65000):	0

Parameter description in the Encoder Parameter control area (P65005)

5.4.1.1 Parameter initialization control

Parameter	Value	Meaning
PRM (parameterization)	0	The values parameterized in the configuration tool are used.
NV-RAM (non-volatile RAM)	1	The values stored in the NV-RAM are used.

5.4.1.2 Parameter write protect

Parameter	Value	Meaning
Write	0	The parameters can be read and written via the acyclic data traffic.
Read only	1	The parameters can be only be read via the acyclic data traffic.

5.4.1.3 Parameter 65005 write protect

Parameter	Value	Meaning
Write	0	Parameter 971 (Save parameters) can be read and written via the acyclic data traffic.
Read only	1	Parameter 971 (Save parameters) can only be read via the acyclic data traffic.

5.4.1.4 Reset control write protect

Parameter	Value	Meaning
Write	0	Parameter 972 (Reset) can be read and written via the acyclic data traffic.
Read only	1	Parameter 972 (Reset) can only be read via the acyclic data traffic.

Parameter description in the encoder parameter area

5.4.1.5 Code sequence

Parameter	Value	Meaning
Rising clockwise	0	The position value rises during clockwise rotation of the encoder shaft.
Falling clockwise	1	The position value rises during anti-clockwise rotation of the encoder shaft.

5.4.1.6 Encoder Class 4 functionality

Parameter	Value	Meaning
Disable	0	The functions direction of rotation, scaling and preset are blocked.
Enable	1	The functions direction of rotation, scaling and preset can be used.

5.4.1.7 G1_XIST1 Preset control

Parameter	Value	Meaning
Enable	0	The preset function also acts on XIST1.
Disable	1	XIST1 is not influenced by the preset function.

5.4.1.8 Scaling function control

Parameter	Value	Meaning
Disable	0	The scaling function is switched off.
Enable	1	The scaling function is switched on.

5.4.1.9 Alarm channel control

Parameter	Value	Meaning
Disable	0	The diagnosis is also transmitted via the alarm channel.
Enable	1	The diagnosis is also transmitted via the alarm channel. This only works together with "compatibility mode V3.1".

5.4.1.10 Compatibility mode V3.1

Parameter	Value	Meaning
Enable	0	The encoder works compatible with version 3.1 of the encoder profile. The "control through the PLC" bit is not heeded. P965 = 31
Disable	1	The "alarm channel control" bit is not heeded The "control through the PLC" bit is heeded. P965 = 42

5.4.1.11 Measuring units per revolution, total measuring range

These parameters are for the scaling function.
The following conditions apply for the values:
Total measuring range = selected measuring units per revolution x 2^n
n = selected multi-turn resolution (1 … 13)

5.4.1.12 Velocity measuring unit, velocity reference value (N2/N4 rpm)

Parameter	Value	Meaning
Steps/s	0	Output of velocity in the corresponding scaling
Steps/100ms	1	
Steps/10ms	2	
rpm	3	
N2/N4	4	Velocity output is the percentage of the current velocity to the parameterized reference value. N2: 0x4000 = 100% N4: 0x40000000 = 100% The value range can be ± 200%

5.4.1.13 Preset value (P65000)

The preset value for telegrams 81 – 84 is entered here.
If this is to be changed during operation, this must be done by means of acyclic access to parameter P65000.

Note:
Class 4 functionality must be switched on in order to be able to execute a preset.

5.4.2 Access via acyclic data

Access takes place via the "Acyclic Data Exchange Service". The parameters are addressed via the Record Data Object with the index 0xB 2E.
They can be read directly after writing. They are either active immediately or only after saving to the NV-RAM (PNU 971) and a subsequent reset (PNU 972).

Access to the parameters is possible using the function modules SFB 52 "RDREC" (read record) and SFB 53 "WRREC" (write record).

Data format:

Record-Data-Request (from PLC):

Byte	Name	Meaning	
0	Request reference	Clear identification for every request or response inquiry. Valid values: 0x01 to 0xFF	
1	Request ID	0x01: Read parameter 0x02: Write parameter	
2	Axis	0x00	
3	Number of parameters	0x01	
4	Attribute	0x10: Value 0x20: Description	
5	Number of elements	0x00:	
6	Parameter number	High-Byte	
7	Parameter number	Low-Byte	
8	Subindex	High-Byte	
9	Subindex	Low-Byte	
10	Format	Data format All valid data types are permitted. For example: 0x41 Byte 0x42 Word 0x43 Double word	For write access only
11	Number of values	Number of the following values (0 - 234)	
12-…	values		

Record-Data-Response (to PLC):

Byte	Name	Meaning	
0	Request reference	Mirrored identification from request	
1	Request ID	0x01: Read parameter successful 0x81: Read parameter not successful 0x02: Write parameter 0x82: Write parameter not successful	
2	Axis	0x00	
3	Number of parameters	0x01	
4	Format	All valid data formats For example: 0x41 Byte 0x42 Word 0x43 Double word 0x44 Error	Only present in the event of an error: Format = 0x44 Number of values = 1 Value = Error number (table 32 PROFIdrive profile)
5	Number of values	Number of the following values (0 - 234)	
6-…	Values / error info	Parameter value, error number	

Example set preset value via PNU 65000:

15000 (=0x3A98) selected as value.

Record-Data-Request (from PLC):

Byte	Value	Name
0	0x01	Request reference
1	0x02	Request ID
2	0x00	Axis
3	0x01	Number of parameters
4	0x10	Attribute
5	0x00	Number of elements
6	0xFD	Parameter number (65000 = 0xFDE8)
7	0xE8	
8	0x00	Subindex (0)
9	0x00	
10	0x43	Format
11	0x01	Number of values
12	0x00	Values (0x00003A98)
13	0x00	
14	0x3A	
15	0x98	

Record-Data-Request (from PLC):

Byte	Value	Name
0	0x01	Mirrored identification from request
1	0x02	Request ID
2	0x00	Axis
3	0x01	Number of parameters

5.4.3 Supported profile parameters

The parameters from the number range 9xx are specifically for the PROFIdrive profile.
The parameters from the number range 6xxxx are specifically for the encoder profile.

PNU	Parameter	Access	Activation
922	Telegram selection	Read	–
964	Device identification	Read	–
965	Profile identification	Read	–
971	Parameter saving	Read / write	Write
972	Reset / activation	Read / write	Write
974	BMP Access Identification	Read	–
975	Encoder Object Identification	Read	–
979	Sensor format	Read	–
980	Parameter list	Read	–
60000	Velocity reference value	Read / write	Save & reset
60001	Velocity measuring unit		
65000	Preset value	Read / write	Write
65001	Operating status	Read	–
65004	Function control	Read / write	Save & reset
65005	Parameter control	Read / write	Save & reset
65006	Scaling: measuring units per revolution	Read / write	Save & reset
65007	Scaling: total resolution	Read / write	Save & reset
65010	Operating time	Read	–

5.4.4 Telegram selection (PNU 922)

The selected telegram (81-890) is transmitted here.
Reference: Drive profile 6.3.4.4, page 118.

PNU	922
Meaning	Telegram selection
Data type	Unsigned 16
Access	Read

Value	Definition
81	Telegram 81
82	Telegram 82
…	…
860	Telegram 860

5.4.5 Device identification (PNU 964)

The information for the identification of the module in the network is transmitted here.
These values are fixed

PNU	964
Meaning	Device identification
Data type	Unsigned 16
Access	Read

Value	Definition
0	VendorID: 0x024A (Johannes Hübner)
1	DeviceID: 0x03E9
2	Firmware version
3	Firmware date (year): YYYY
4	Firmware date (day/month): DDMM

5.4.6 Profile identification (PNU 965)

The parameter "Encoder Profile Version" is transmitted here.

PNU	965
Meaning	Profile identification
Data type	OctedString 2
Access	Read

Value	Definition
0	Profile number: 61
1	Profile version: 31 (0x1F) / 42 (0x2A)

5.4.7 Parameter saving in NV-RAM (PNU 971)

With this parameter, the parameters currently set are transferred to the NV-RAM.
After the saving process the module resets the value to 0.

PNU	9271
Meaning	Saving of parameters to the non-volatile memory
Data type	Unsigned 16
Access	Read / write
Activation	With write access

Value	Definition
0	Default
1	Transfer parameter values to the NV-RAM

5.4.8 Reset / parameter activation (PNU 972)

This parameter triggers a device reset and the activation of the parameters.

PNU	972
Meaning	Device reset / parameter activation
Data type	Unsigned 16
Access	Read / write
Activation	With write access

Value	Definition
0	Default
1	Execute device RESET

5.4.9 Reset / parameter activation (PNU 974)

The parameter contains the information about the "Base Mode Parameter Access Points".

PNU	974
Meaning	Base Mode Parameter Access Identification
Data type	Array Unsigned 16
Access	Read

Subindex	Definition
0	Maximum block length: 0x00FO = 240 bytes
1	Multi-parameter access: 0x0001 = no multi-parameter access
2	Maximum latency period: 0x000 0 not specified

5.4.10 Device identification (PNU 975)

The parameter contains the information about the "Base Mode Parameter Access Points".

PNU	975
Meaning	Encoder Object Identification
Data type	Array Unsigned 16
Access	Read

Subindex	Definition
0	VendorID: 0x024A (Johannes Hübner)
1	Device type: 0x0001
2	Firmware version
3	Firmware date (year): YYYY
4	Firmware date (day/month): DDMM
5	Type class: 0x0005 (encoder)
6	Subclass 1: 0x3000
7	Drive object ID: 1

5.4.11 Sensor format (PNU 979)

The parameter contains the information about the encoder type, resolution set, shift factor and "Base Mode Parameter Access Points".

PNU	979
Meaning	Sensor format
Data type	Array Unsigned32
Access	Read

Subindex	Definition
0	Header Bits 0-3 = 2: Version of parameter structure (LSB) Bits 4-7 = 1: Version of parameter structure (MSB) Bits 8-11 = 1: Number of active sensor interfaces Bits 12-15 = 5: Number of assigned subindices Bits 16-31 = 0: Reserved
1	Encoder type Bit 0 = 0: Rotary encoder Bit 1 = 1: After voltage on, G1_XIST1 is loaded with the absolute value Bit 2 = 0: Only 32-bit position data available Bit 3-28 = 0: reserved Bit 29 = 0: Data in sensor interface (G1) substructure are static Bit 30 = 1: Validity of the data in G1 substructure is static Bit 31 = 1: Data in G1 substructure are valid
2	Single-turn resolution
3	Shift factor for G1_XIST1: 0
4	Shift factor for G1_XIST2: 0
5	Multi-turn resolution
6 - 30	Reserved (for sensors G2 and G3)

5.4.12 Parameter list (PNU 980)

The parameter contains all parameter numbers that are supported. The value 0 in a subindex marks the end of the list.

PNU	979
Meaning	List of the implemented parameters
Data type	Array Unsigned 16
Access	Read

Subindex	Definition
0	PNU 922, Telegram selection
1	PNU 964, Device identification
2	PNU 965, Profile identification
3	PNU 971, Parameter saving
4	PNU 972, Reset / parameter activation
5	PNU 974, BMP Access Identification
6	PNU 975, Encoder Object Identification
7	PNU 979, Sensor format
8	PNU 60000, Velocity reference value
9	PNU 60001, Velocity measuring unit
10	PNU 65000, Preset value (32-bit)
11	PNU 65001, Operating status
12	PNU 65004, Function control
13	PNU 65005, Parameter control
14	PNU 65006, Scaling: Measuring units / revolution
15	PNU 65007, Scaling: Overall resolution
16	PNU 65010, Operating time basic device

5.4.13 Velocity reference value (PNU 60000)

The parameter "Standardized reference value" is transmitted here.

PNU	60000
Meaning	Velocity reference value
Data type	Float32
Access	Read / write
Activation	PNU 972
Storage	PNU 971
Permissible values	-10000..10000

5.4.14 Velocity measuring unit (PNU 60001)

The parameter "Velocity unit" is transmitted here.

PNU	60001
Meaning	Velocity measuring unit
Data type	Unsigned 16
Access	Read / write
Activation	PNU 972
Storage	PNU 971

Value	Definition
0	Steps / s
1	Steps / 100 ms
2	Steps / 10 ms
3	Revolutions per minute
4	N2/N4 standardized

5.4.15 Preset value (PNU 65000)

Only the parameter "preset value" is transmitted here. The function "Set preset" is not executed.

PNU	65000
Meaning	Preset value
Data type	Integer32
Access	Read / write
Activation	With write access
Storage	PNU 971
Value	Default: 0

5.4.16 Operating status (PNU 65001)

The access type (read only) is also valid for the subindices.

PNU	65001
Meaning	Operating status
Data type	Array Unsigned32
Access	Read

Supported subindices:

Subindex	Definition
0	Block-Header
1	Operating status
2	Error
3	Supported errors
4	Warnings
5	Supported warnings
6	Encoder profile version
7	Operating time basic device (encoder)
8	Offset value
9	Scaling: Measuring units / revolution
10	Scaling: Overall resolution
11	Velocity measuring unit
12	Velocity reference value N2/N4

5.4.16.1 Block-Header (PNU 65001.0)

Version of the parameter structure.

Bit	Definition
0 – 15	Version number (0x0102)
16 – 23	Number of indices (18)
24 – 31	Reserved

5.4.16.2 Operating status (PNU 65001.1)

Settings of the bit-coded parameters.

Bit	Definition
0	Code sequence
1	Encoder Class 4 functionality
2	G1_XIST1 Preset control
3	Scaling function control
4	Alarm channel control
5	Compatibility mode V3.1
6	Encoder type (0, rotary encoder)
7 – 31	Reserved

5.4.16.3 Error (PNU 65001.2)

This parameter indicates the currently queued errors. In the event of an error, the corresponding bit is set. If the error is no longer present, the corresponding bit is automatically deleted. An error bit is set for at least 5s.

Only the supported errors are listed.

Bit	Definition
0	Position error
1-4	-
5	Parameterization error
6	Scaling error
7-15	-
16	Undervoltage (basis)
17	Overvoltage (basis)
18	-
19	Overtemperature (basis)
20-21	-
22	Storage error
23-24	-
25-31	Reserved

5.4.16.4 Supported errors (PNU 65001.3)

A 1 indicates a supported error from subindex 2.
Value = 0x004B0061

5.4.16.5 Warnings (PNU 65001.4)

This parameter indicates the currently queued warnings. In the event of an error, the corresponding bit is set. If the error is no longer present, the corresponding bit is automatically deleted. A warning bit (except for Bit 14, Preset) is set for at least 5s.

Only the supported warnings are listed.

Bit	Definition
0-6	-
7	Invalid parameters in RAM
8-11	-
12	Overspeed
13	-
14	Preset value outside the range
15	Command not supported
16-24	-
25-31	Reserved

5.4.16.6 Supported warnings (PNU 65001.5)

A 1 indicates a supported warning from subindex 4.
Value = 0x0000D080

5.4.16.7 Encoder Profile Version (PNU 65001.6)

Value = 0x00000402

5.4.16.8 Operating time basic device (PNU 65001.7)

The operating time of the basic device is transmitted here. The resolution is 0.1 hours.
Data type: unsigned32

5.4.16.9 Offset value (PNU 65001.8)

The offset value for the position calculation is transmitted here.

This offset value is calculated during execution of the preset function. It has the same scaling as the position value.
Data type: unsigned32

5.4.16.10 Measuring units / revolution (PNU 65001.9)

The parameter "Measuring units / revolution" is transmitted here.

This is set by the PLC at start-up or with an acyclic write command.
Data type: unsigned32

5.4.16.11 Overall resolution (PNU 65001.10)

The parameter "Overall resolution" is transmitted here.

This is set by the PLC at start-up or with an acyclic write command.
Data type: unsigned32

5.4.16.12 Velocity measuring unit (PNU 65001.11)

The parameter "Velocity measuring unit" is transmitted here.

This is set by the PLC at start-up or with an acyclic write command.

Value	Definition
0	Steps / s
1	Steps / 100 ms
2	Steps / 10 ms
3	Revolutions per minute
4	N2/N4 standardized

5.4.16.13 Velocity reference value N2/N4 (PNU 65001.12)

The system-related functions can be enabled or disabled individually here

5.4.17 Function control (PNU 65004)

The system-related functions can be enabled or disabled individually here.

Preset and scaling are only possible with "Class 4" functionality.

PNU	65001
Meaning	Function control
Data type	Unsigned32
Access	Read / write
Activation	PNU 972
Storage	PNU 971

Bit	Definition
0	*Code sequence* 0: rising if rotation clockwise (looking to the shaft) 1: falling if rotation anti-clockwise
1	*Encoder Class 4 functionality* 0: off 1: on
2	*G1_XIST1 Preset control* 0: on 1: off
3	*Scaling function control* 0: off 1: on
4	*Alarm channel control* This parameter switches transmission of the profile-specific diagnosis via the alarm channel on and off. It is only heeded in compatibility mode. 0: off (only communication-specific alarms) 1: on (all alarms and warnings)
5	*Compatibility mode V3.1* For details see: "Compatibility mode V3.1" 0: on 1: off
6	*Encoder type* *0: Rotary encoder*
7 – 31	Reserved

5.4.18 Parameter control (PNU 65005)

The initialization of the parameters in the start phase of the PLC can be defined here.

In the module start-up phase, the parameters from the NV-RAM (if invalid the default parameters) are loaded first. If the data block is then received by the PLC, bits 0-1 decide which data are used.

PNU	65001
Meaning	Parameter control
Data type	Unsigned 16
Access	Read / write
Activation	PNU 972
Storage	PNU 971

Bit	Definition
0 – 1	*Parameter initialization* 0: PRM Data Block (from PLC) 1: RAM Data (from the FRAM)
2 – 4	*Parameter write protect* 0: writeable 1: write protected
5	*Write protect for PNU 65001 and PNU 971* 0: writeable 1: write protected
6	*Write protect for PNU 972* 0: writeable 1: write protected
7 – 16	Reserved

5.4.19 Scaling, measuring units / revolution (PNU 65006)

PNU	65006
Meaning	Scaling, measuring units / revolution
Data type	Unsigned32
Access	Read / write
Activation	PNU 972
Storage	PNU 971
Permissible values	2 ... 8192

5.4.20 Scaling, overall resolution (PNU 65007)

PNU	65007
Meaning	Scaling, total resolution
Data type	Unsigned32
Access	Read / write
Activation	PNU 972
Storage	PNU 971
Permissible values	2 ... 268435456

5.4.21 Operating time basic device (PNU 65010)

The operating time of the basic device is transmitted here. The resolution is 0.1 hours.

PNU	65010
Meaning	Scaling, total resolution
Data type	Unsigned32
Access	Read

6 Configuration with TIA Portal

6.1 Preparation

1. **Create new project**
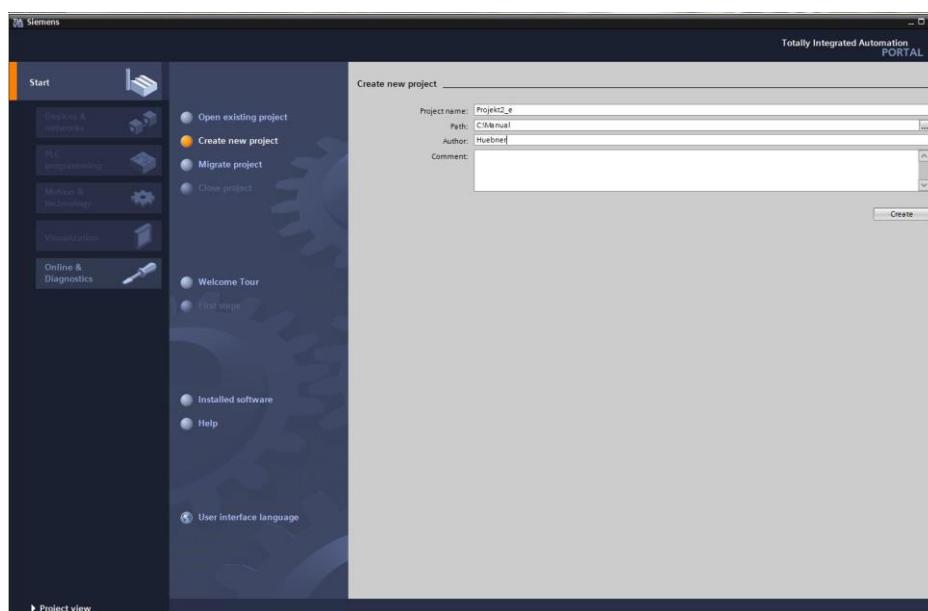
2. **Add new device**
   Select the suitable CPU here and add it.
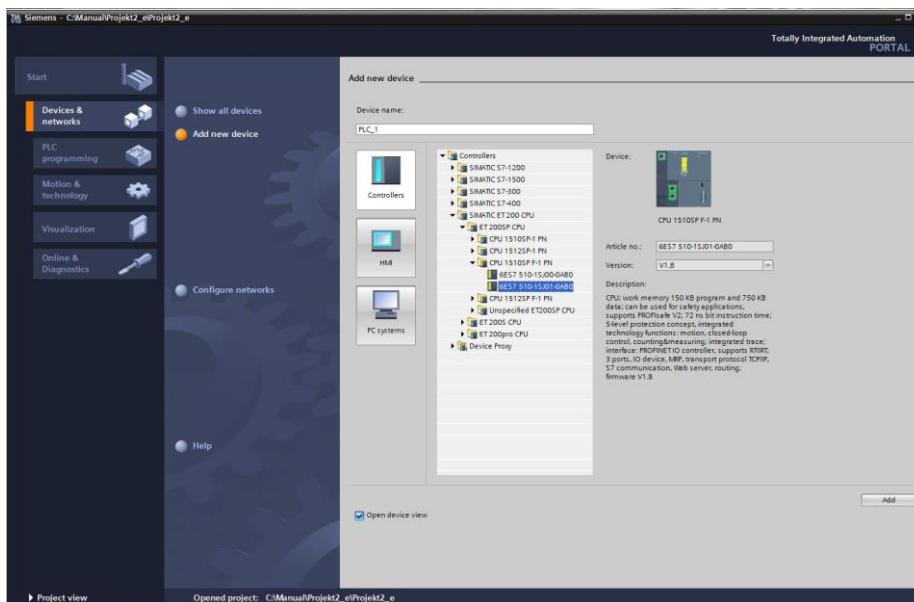
3. **Install the respective GSD file**
   This is only necessary if it is not already installed.
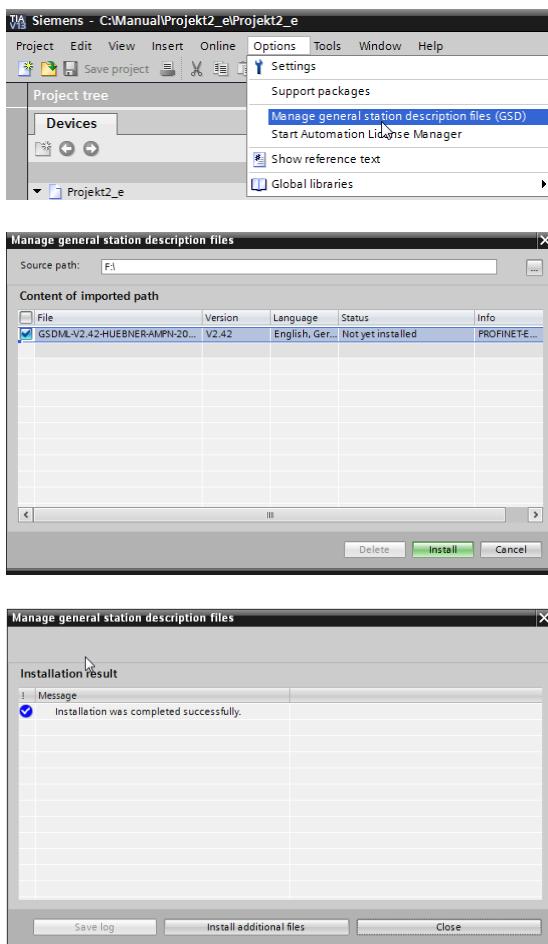
6.2 Create encoder project

1. **Position the encoder module**
   Activate the network view.
   Open the hardware catalogue as shown in the screenshot.
   Drag the encoder module into the network view.
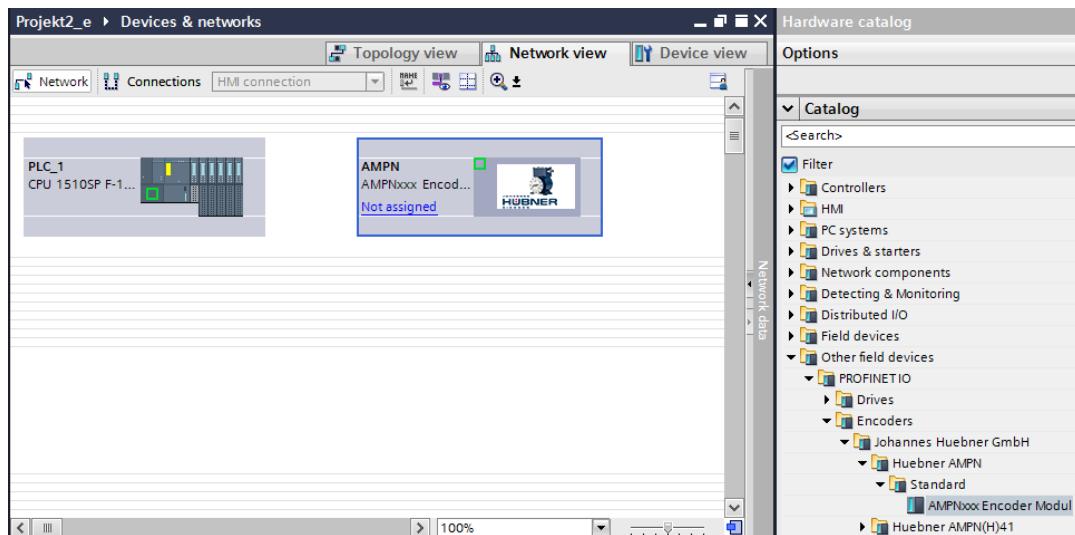
2. **Create network**
   Use the mouse to drag a connection from the network connection of the encoder to the network connection of the CPU.
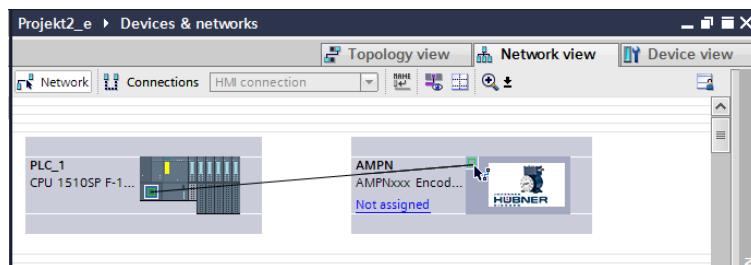
The connection is established and the network named.
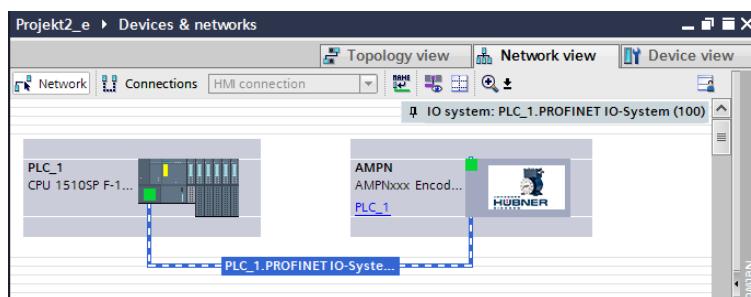
3. **Insert telegram**
Open the submodules in the hardware catalogue.
Select the required telegram and insert it into slot 1.2.

Note:
A telegram must be inserted otherwise no cyclic process data are available.
The encoder module then sends a corresponding error message.
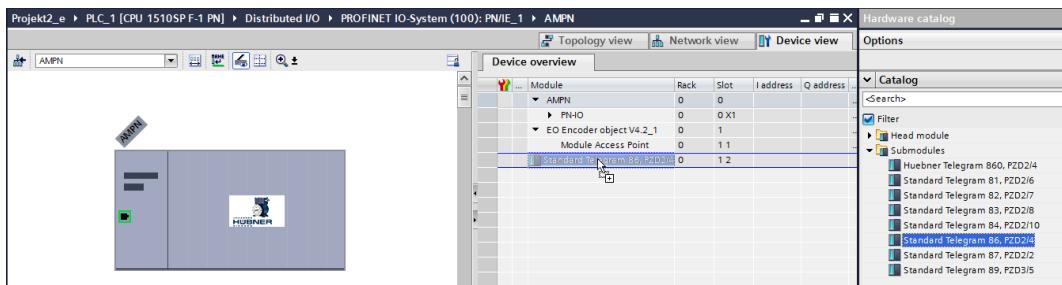
4. **Define I/O addresses**
Enter the required input and output addresses in the corresponding fields (only necessary if
the automatically assigned addresses are to be changed).
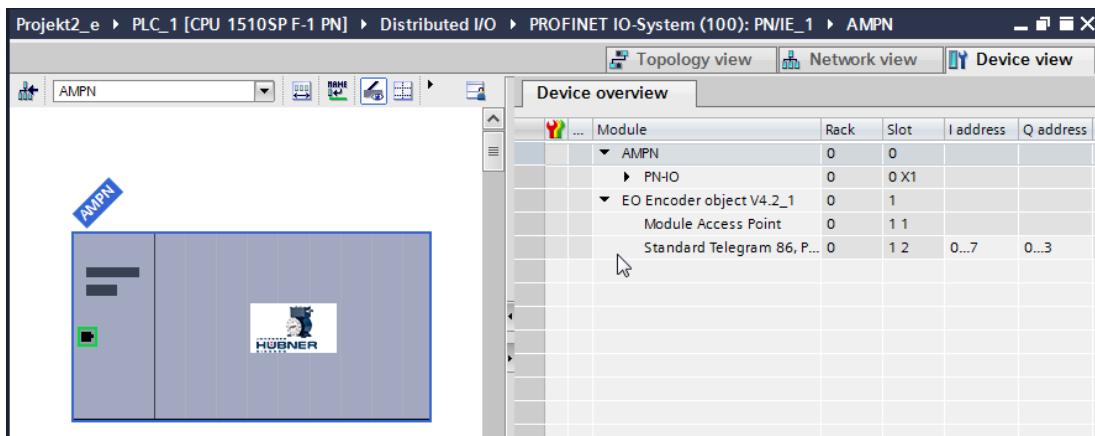
5. **Define name and IP address**
   The device name can be changed directly in the name field. The default name is AMPN.
   The IP address can be changed in the corresponding field (see screenshot).
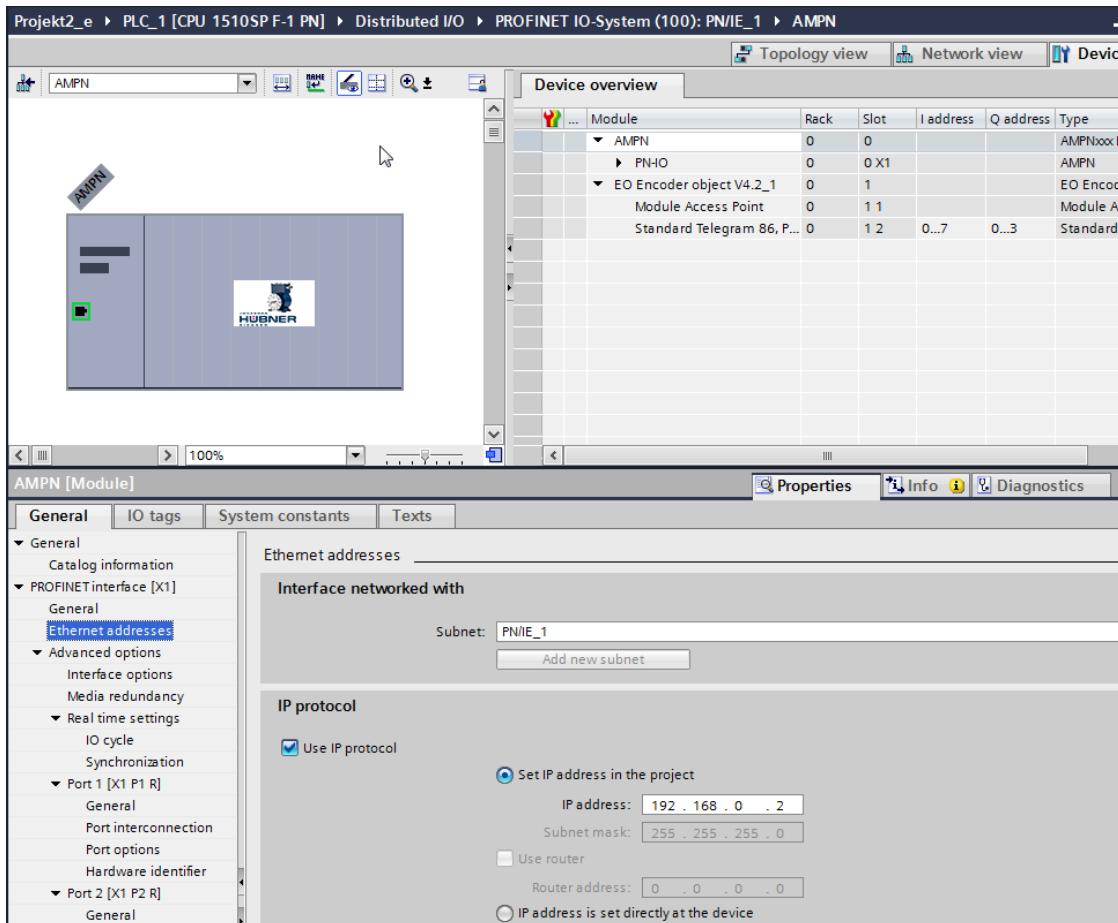
6. To transmit the changes, right-click the encoder module.
Select the menu item "Assign device name".
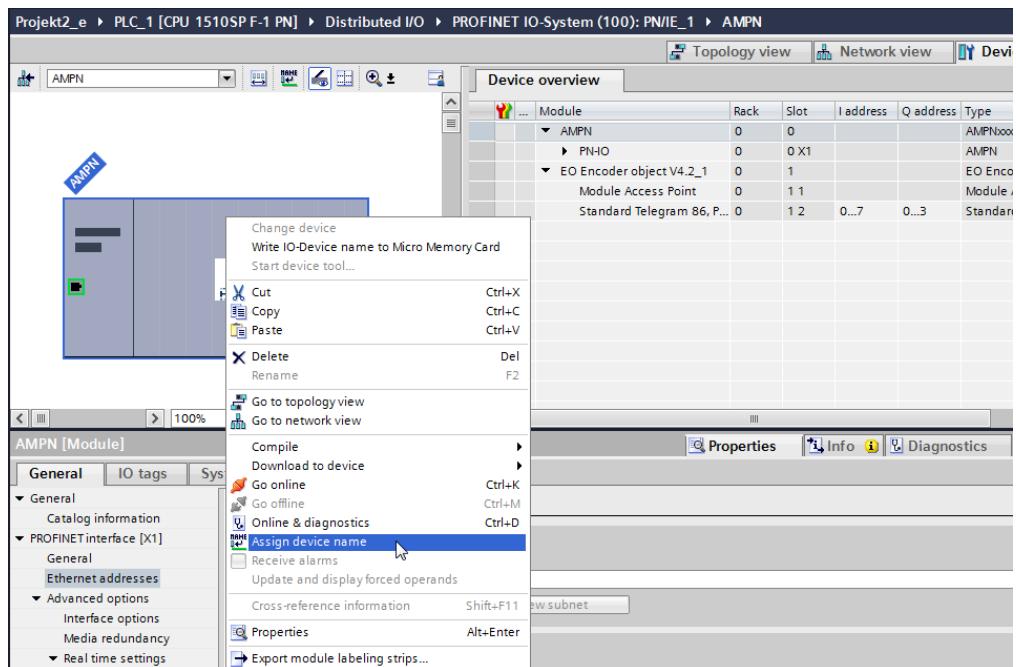
Assign the name.
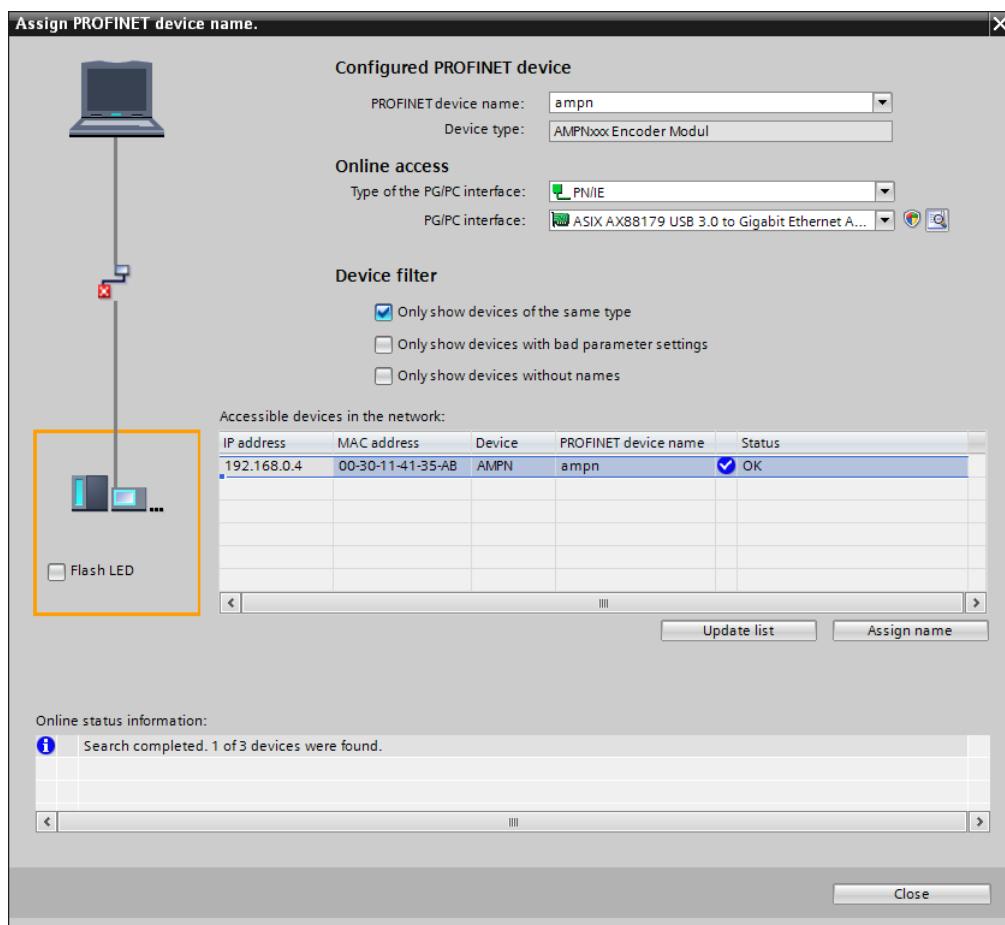
7. **Adapt module parameters**
   The module parameters can be changed in the device view.
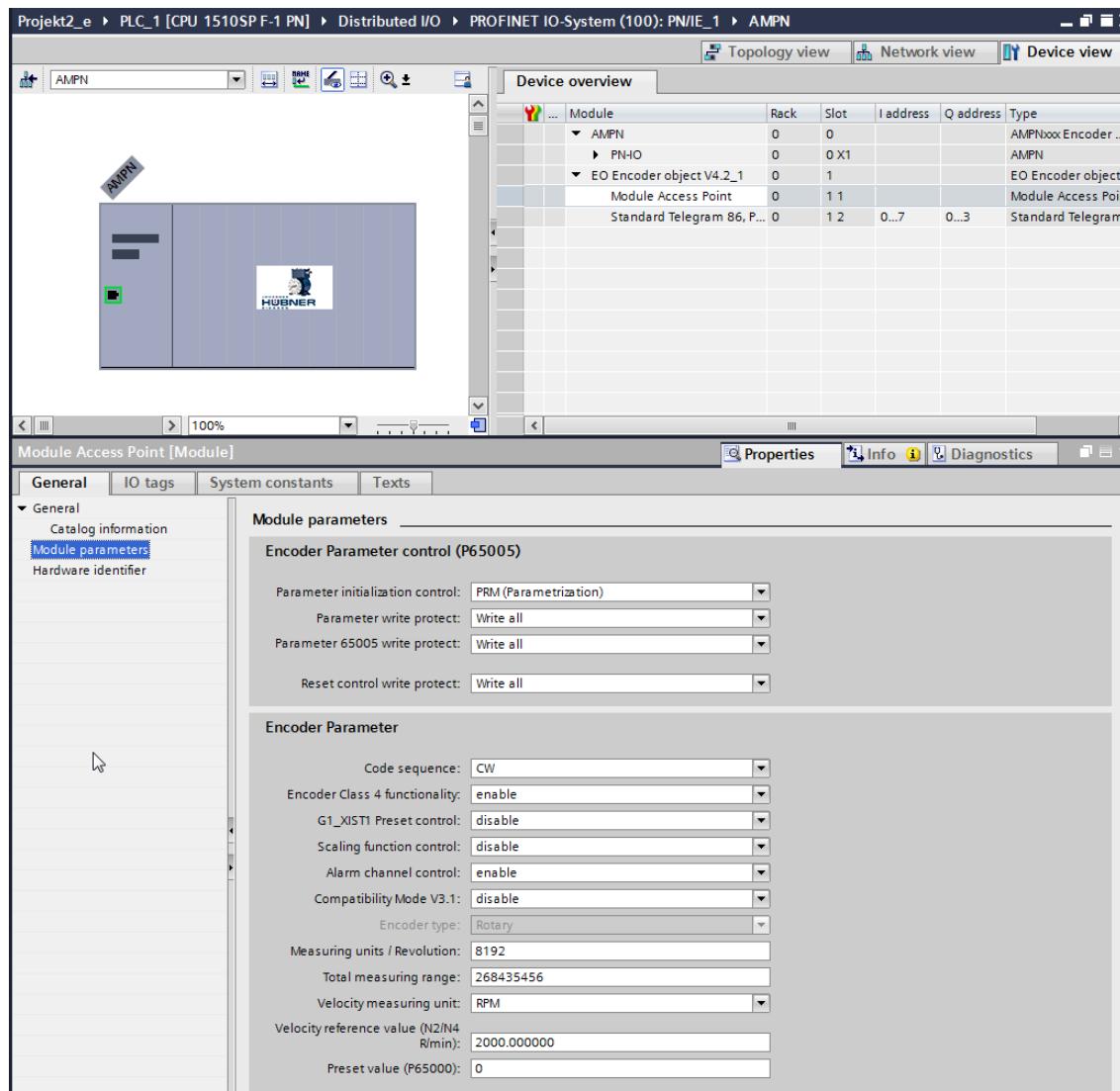
Note:
The following conditions apply for the overall resolution:

Total measuring range ≤ measuring units / revolution x 2^{15}

Multi-turn resolution = 2^n

To be able to use the scaling function, Class 4 functionality must be activated.

8. **Neighbourhood detection**
   To make simple device replacement possible, neighbourhood detection can be activated in the CPU.
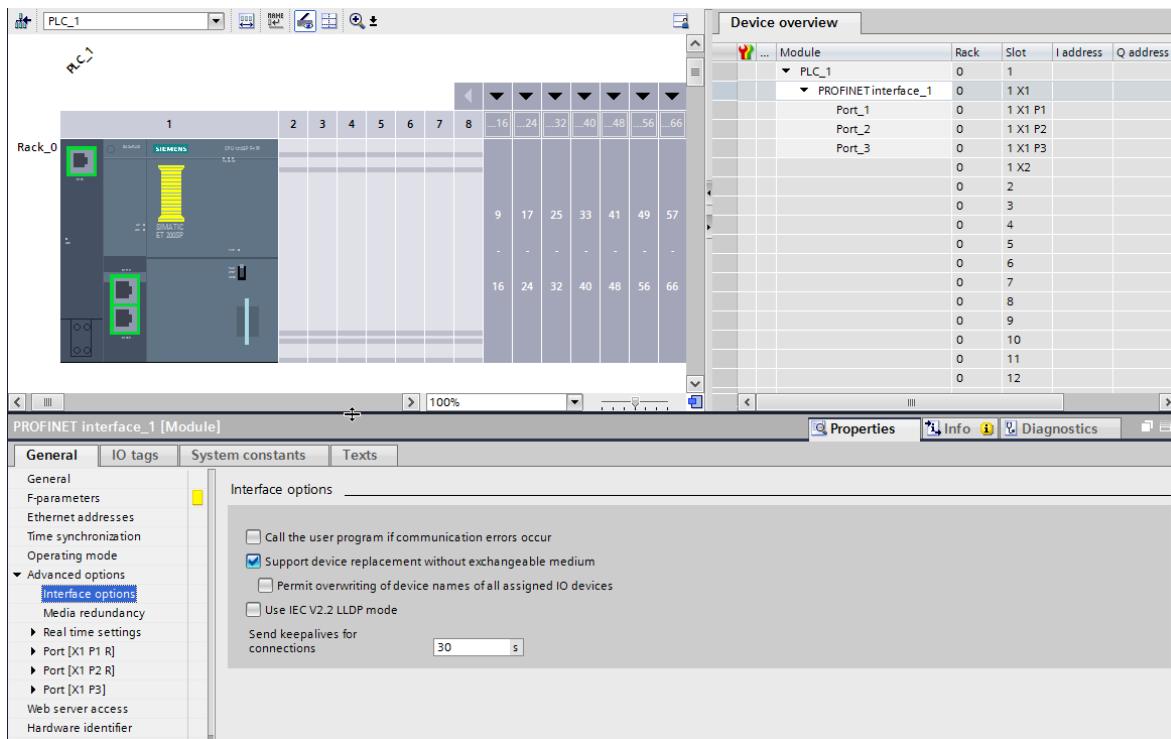
9. **MRP configuration**
   The following steps are necessary for configuration of the MRP:
   1. Select the network
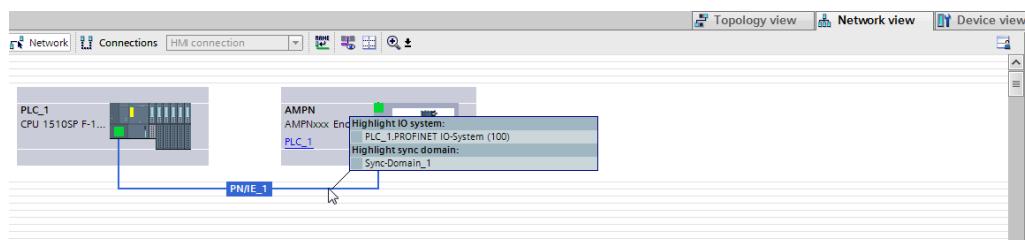
2. Define the Sync domain
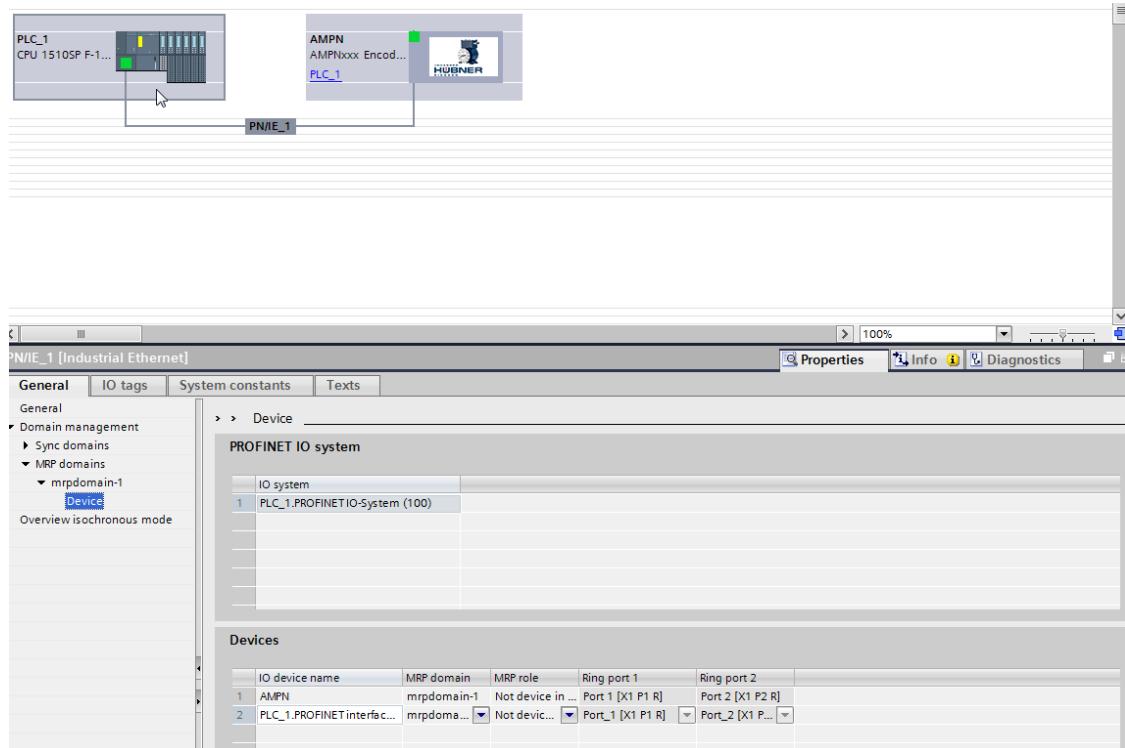
3. Define devices
Configure the PLC as Manager and the encoder module as Client (see screenshot).
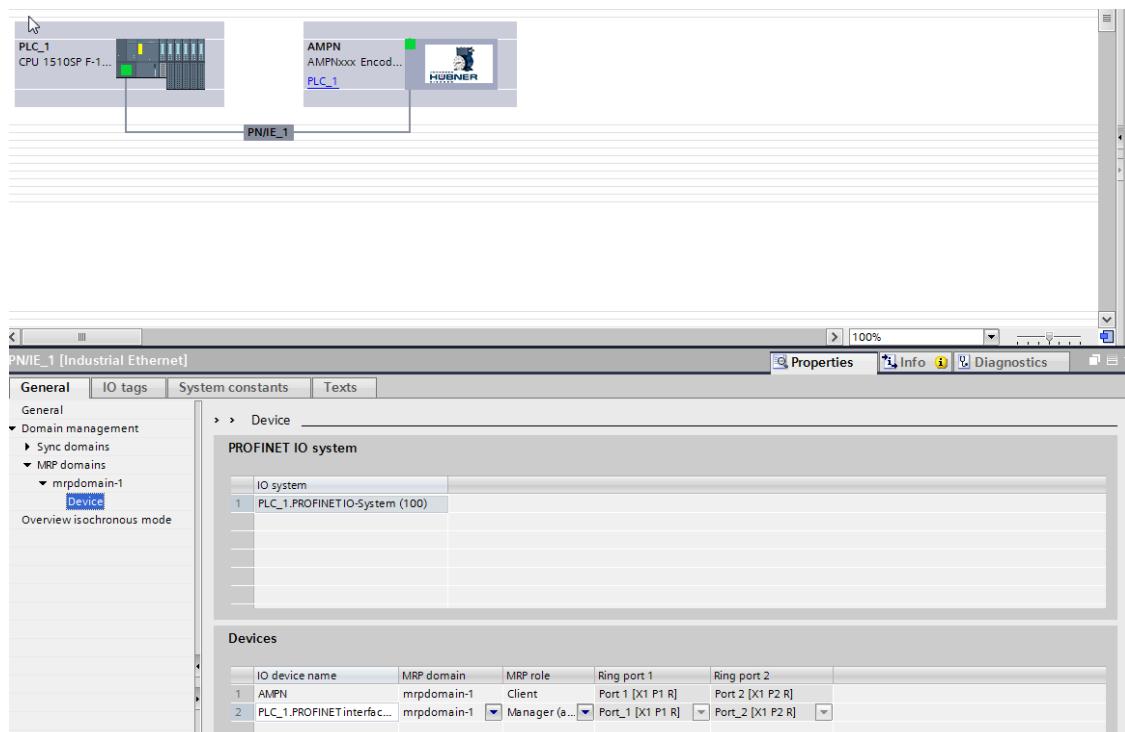
4. Connect up ports
   Connect up the partner ports in the topology view.
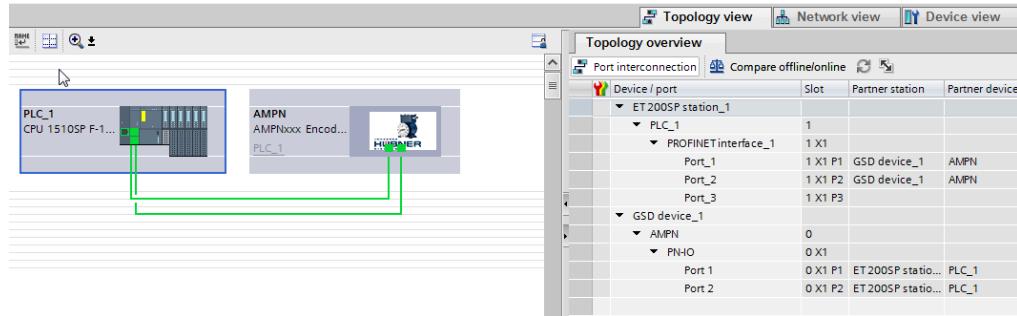
10. **IRT configuration**
    The encoder module can be operated in an IRT network. However, it cannot be synchro-nised.
    IRT can be enabled in the real time settings in the device view.
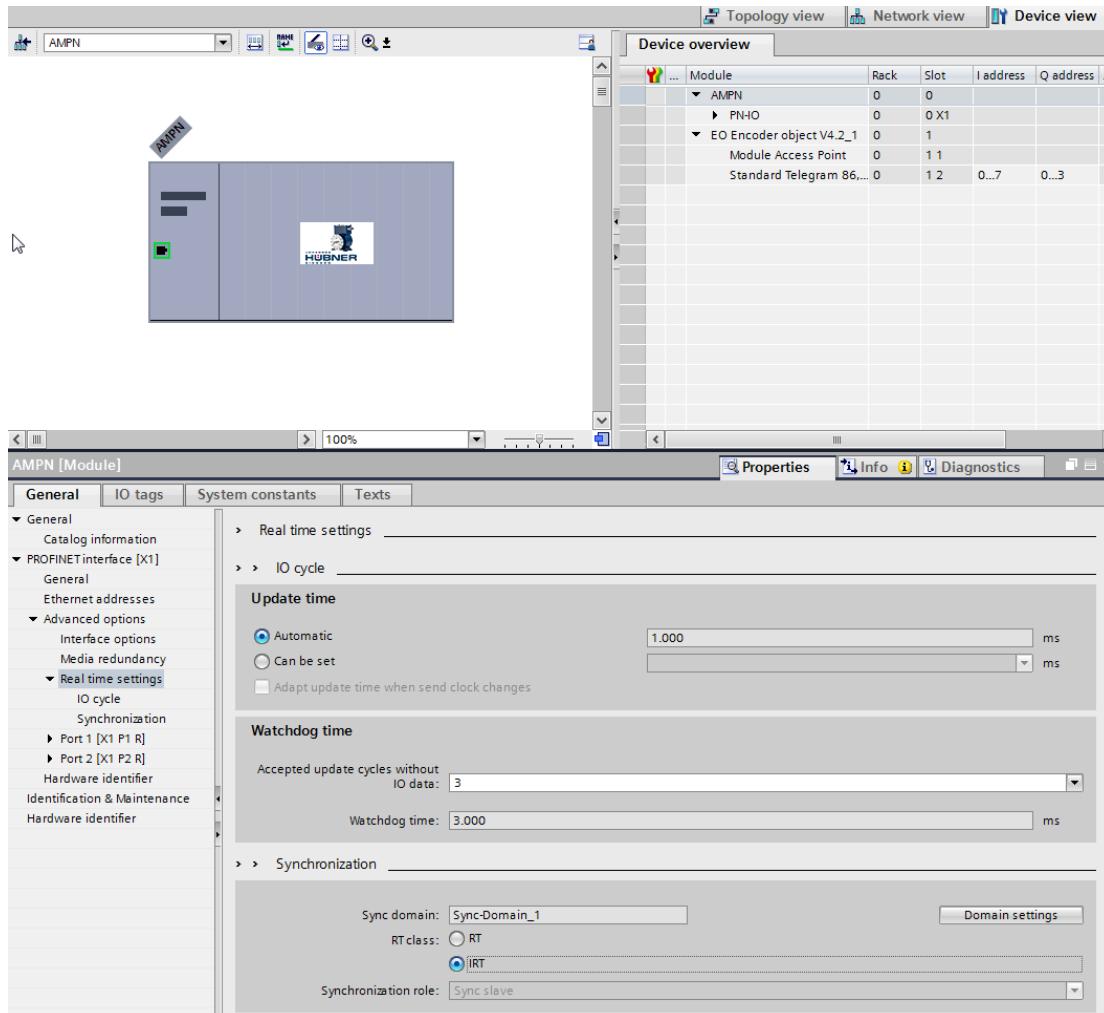
11. Transfer hardware configuration

Compile the configuration and load to the controller
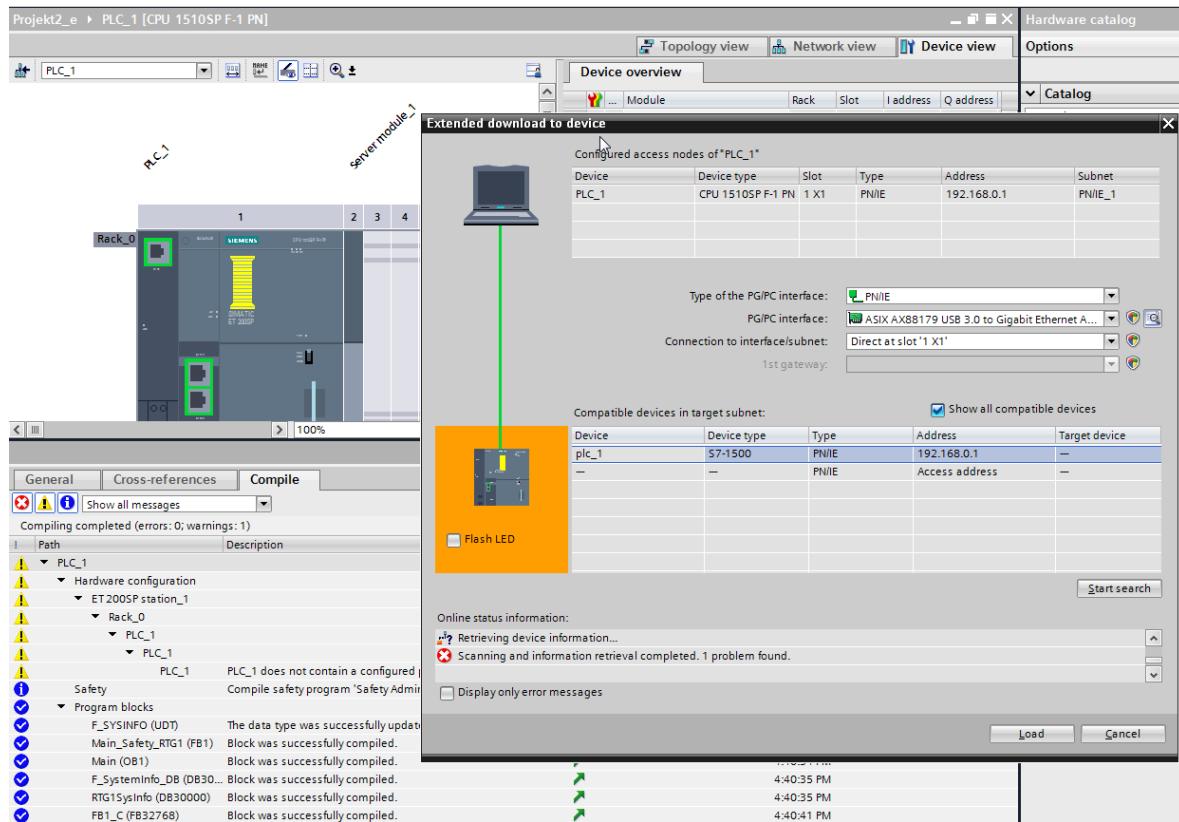
7 Transportation, packaging and storage

7.1 Transportation safety information

!	**CAUTION!** **Property damage due to improper transportation!** These symbols and information on the packaging must be observed: Do not throw, risk of breakage, protect against wetness

7.2 Incoming goods controlling

The delivery must be checked promptly for transportation damage and to ensure it is complete upon receipt.

If there is transportation damage, the carrier must be informed directly upon delivery (take photos as evidence).

7.3 Packaging (disposal)

Packaging will not be taken back, and must be disposed of according to applicable statutory specifications and local regulations.

7.4 Storing packages (devices)

	Protect against wetness! Protect packages against wetness, store in a dry and dust-free location.

In case of long storage times (> 6 months), we recommend packaging the devices in protective packaging (with desiccants).

7.5 Returning equipment (repair/goodwill/warranty)

Service inquiries (repair/goodwill/warranty) can be triggered directly using the following online form:

https://www.huebner-giessen.com/service-support/service/

You will also find the contact data for our Service department there, as well as questions and answers related to the processing.

Devices that have come into contact with radioactive radiation or materials will not be taken back. Devices that have come into contact with biological or chemical substances that could be hazardous to health must be decontaminated before they are returned.
A clearance certificate must be enclosed.

7.6 Disposal

The manufacturer is not obligated to take back the devices.
The module must be treated as special electronic waste and must be disposed of according to specific national law.
Local municipal authorities or speciality disposal companies can provide information on environmentally-appropriate disposal.

8 Documents

8.1 Dimensional drawing