ABSOLUTE ROTARY ENCODER WITH PROFINET-IO-INTERFACE
USER MANUAL

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1. Introduction

This manual describes the implementation and configuration of an absolute rotary encoder with PROFINET interface. The device fulfills the requirements of a PROFINET IO device with RT (real time) or IRT (isochronous real time) classification.

1.1 Absolute rotary encoder

The basic principle of an absolute rotary encoder can either be:

- The optical sampling of a transparent code disc in the case of an optical encoder
- The evaluation of a turning magnetic field induced by a magnet, in case of a magnetic encoder.

The absolute rotary encoder has a maximum resolution of 65,536 steps per revolution (16 bits). The multi-turn versions can detect up to 16,384 revolutions (14 bits) for optical encoders, 32,768 (15 bits) for magnetic ones. Therefore, the largest resulting resolution is 30 bits = 2^{30} = 1,073,741,824 steps. The standard single-turn version has 13 bits, the standard multi-turn version 25 bits.

For further information about the function principle or the setup of a PROFINET network please, refer to https://www.profibus.com/ .

1.2 PROFINET technology

PROFINET is an Industrial Ethernet standard merging plant automation with other enterprise IT resources.
It provides comparable functionality to PROFIBUS with techniques used by engineering, IT, and management personnel.
Established IT standards are employed as basis of communication: TCP, UDP, IP. XML is used as description language for device profiles (GSDML files).
Two ways of using PROFINET are available: PROFINET IO, similar to PROFIBUS DP as a distributed I/O system and PROFINET CBA as a modular component-based system for larger systems.
PROFINET offers scalable communication for different applications in industrial automation:

- PROFINET NRT (non-real time) is suited for non-time-critical process automation with clock rates of roughly 100 msec.
- PROFINET RT (real time) offers a communication channel with optimized performance (10 ms clock rate) for most factory automation tasks
- PROFINET IRT (isochronous real time) employs special communication hardware to enable clock rates of less than 250 µs and a jitter precision of less than 1 µsec. This channel is mainly of use for motion control applications.

PROFINET IO uses a view of distributed I/O similar to PROFIBUS DP. IO controllers (e.g. PLCs) run an automation program, IO devices (e.g. absolute encoders) are remotely assigned field devices, and IO supervisors (e.g. programming devices) are used for commissioning and diagnostics.

The engineering of PROFINET IO is done in a similar way to PROFIBUS. The field buses (i.e. Ethernet topologies) are assigned to control systems during configuration. The IO device is configured in the actual system based on the contents of its GSDML file.
After completion of the engineering the installer loads the data for the expansion into the IO controller (PLC) and the IO controller assumes data exchange with the IO device.

An IO device is addressed within PROFINET (and possibly by external IT components) through its IP address.

Data can be exchanged from the IO controller to the IO device (and vice versa) cyclically (for process data). Apart from this, parameter data can be exchanged acyclically during engineering of the IO device or by the use of PLC programming blocks.

1.3 Features of the Encoder

- Cycle time up to 250µs
- Fractional scaling
- MRP / MRPD
- Profinet Encoder Profile V4.2
- Compatible to Encoder Profile V4.0/V4.1
- Integrated Boot loader for customer firmware upgrades
- Round axis (Endless shaft)
- Neighborhood detection
- Engineering identification call
- Different filters for velocity
- Diagnosis LEDs
- Warnings (synchronization, master's sign of life, preset, temperature)
- …

See the full list on page 13

2. Installation

The rotary encoder is connected by a 4 pin M12 connector for the power supply and two 4 pins, D-Coded M12 connector for the data.

2.1 Electrical Connection

The Encoder uses a second D-coded connector and provides integrated switch functionality. The mounting description can be found on or in the packaging.

Connector Ethernet

4 pin female, D-coded

Pin Number	Signal
1	Tx +
2	Rx +
3	Tx -
4	Rx -

Table 1: Pin assignment Ethernet connector

Connector power supply

4 pin male, A-coded

Pin Number	Signal
1	US (10 - 30 V DC)
2	N.C.
3	GND (0V)
4	N.C.

Table 2: Pin assignment connector power supply

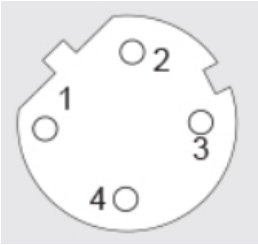


Figure 2: Connector Ethernet

Figure 1: Connector power supply

2.2 Ethernet cables

2.2.1 RJ45 – M12 crossed

Signal	RJ45 Pin	M12 Pin
Tx+	1	2
Tx-	2	4
Rx+	3	1
Rx-	6	3

Table 3: Ethernet cable RJ45-M12 crossed

2.2.2 RJ45 – M12 straight

Signal	RJ45 Pin	M12 Pin
Tx+	1	1
Tx-	2	3
Rx+	3	2
Rx-	6	4

Table 4: Ethernet cable RJ45-M12 streight

2.2.3 M12 – M12 crossed

Signal	M12 Pin	M12 Pin
Tx+	1	1
Tx-	2	2
Rx+	3	3
Rx-	4	4

Table 5: Ethernet cable M12-M12 crossed

2.3 Diagnostic LEDs

LED	Color	Description for LED = on
Active1	Yellow	Incoming and outgoing traffic at port 1
Link1*	Green	Link to another Ethernet component via port 1
Active2	Yellow	Incoming and outgoing traffic at port 2
Link2*	Green	Link to another Ethernet component via port 2
Stat1	Different	Status 1, details see next table
Stat2	Different	Status 2, details see next table

* Flashes with 2Hz if engineering identification call is activated and link connection is available

Table 6: Diagnostic LEDs

2.4 Status LED indication

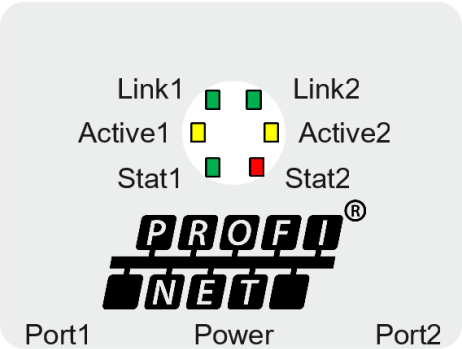


Figure 3: Label LEDs+connector

Status 1 *Bicolour*	**Status 2** *Bicolour*	**Meaning**	**Cause**
Off	Off	No power	Fuse blown or cable defect
Red	Green	No connection to other device Criteria: no data exchange	- Bus disconnected - IO-Controller not available / switched off / not in run
Blinking [1)] Red	Green	Parameterization fault, no data exchange Criteria: connection available. However, the slave did not switch to the data exchange mode.	- Slave not configured yet or wrong configuration - Wrong station address assigned (but not outside of the permitted range) - Actual configuration of the slave differs from the nominal configuration
Green	Red	System Failure, fault pending in the encoder application process	Diagnosis of class fault exists, device in data Exchange mode.
Green	Orange	System Warning, warning pending in the encoder application process	Diagnosis of class warning exists and no fault diagnosis of class fault exists, device in data Exchange mode.
Green	Green	Data exchange. Slave and operation ok.	

Table 7: Status LED indication

1) The blinking frequency is 0.5 Hz. Minimal indication time is 3 sec.

2.5 Instructions for mechanical installation and electrical connection of the rotary encoder

The following points should be observed:

- Do not drop the encoder or expose it to excessive vibrations. The encoder is a precision device.

- Do not open the encoder housing. If the device is opened and closed again, it can be damaged, and dirt may enter the unit.

- The encoder shaft must be connected to the shaft to be measured through a suitable coupling (full shaft version). This coupling is used to dampen vibrations and imbalance on the encoder shaft and to avoid inadmissible high forces. Suitable couplings are available from Hohner Automation.

- Although Hohner Automation absolute encoders are rugged, when used in tough ambient conditions, they should be protected against damage using suitable protective measures. The encoder should not be used as handles or steps.

- Only qualified personnel may commission and operate these devices. These are personnel who are authorized to commission, ground and tag devices, systems and circuits according to the current state of safety technology.

- It is not permitted to make any electrical changes to the encoder.

- Route the connecting cable to the angular encoder at a considerable distance or completely separated from power cables and their noise. Completely shielded cables must be used for reliable data transfer and good grounding must be provided. Cabling, establishing and interrupting electrical connections may only be carried-out when the equipment is powered-off. Short-circuits, voltage spikes etc. can result in erroneous functions and uncontrolled statuses which can even include severe personnel injury and material damage.

- The encoder should have got a large-area connection to the protection element. If the flange doesn't have a good electrical connection to the machine – i.e. plastic mounting device – then use for example a 30cm long and 2cm wide copper tape to get the PE connection.

- Before powering-up the system, check all the electrical connections. Incorrect connections can cause severe personnel injury and material damage.

3. Device configuration

3.1 Standardization

This actual generation of PROFINET devices is based on the Encoder Profile V4.2 (PNO No. 3.162). With this standardization it is possible to substitute all products that fulfill the specification (see the next figure).

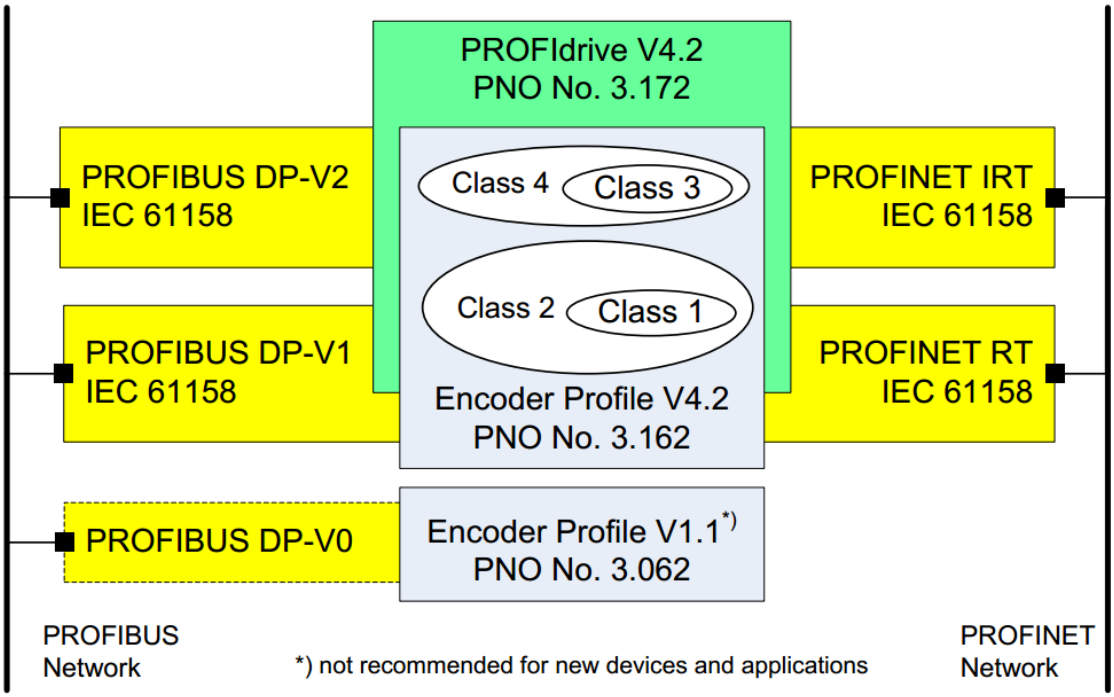


Figure 4: Profile overview

3.2 Encoder Features

- Communication interface PROFINET IO V2.33
- Cycle time ≥ 250µs
- MRP for RT and MRPD for IRT
- Class 4 (IRT)
- Class 3 (IRT)
- Class 1, Class 2 (RT or IRT)
- Neighborhood detection
- Engineering identification call
- Support of encoder profile V4.2
- Support of encoder profile telegrams 81, 82, 83, 84, 86, 87, 88, 89
- Support of vendor-specific telegram 860, 862
- Support of PROFIdrive parameter channel
- Velocity-value with configurable filtering and units
- Acceleration-value
- Endless shaft (round axis) functionality
- Fractional scaling
- PROFIdrive fault buffer (inclusive i.e. Overtemperature warning)
- Operating time counter
- Bootloader

3.3 Encoder functions

Function	Telegram									
	81	82	83	84	86	87	88	89	860	862
Preset, easy configurable	-	-	-	-	✓	✓	✓	✓	✓	✓
Preset value 64 bit	-	-	-	✓	-	-	✓	✓	-	-
Velocity signal 16 bit	-	✓	-	-	-	-	-	-	-	-
Velocity signal 32 bit	-	-	✓	✓	✓	-	✓	✓	✓	✓
Velocity measuring unit + filter	-	✓	✓	✓	✓	-	✓	✓	✓	✓
Acceleration signal 32 bit	-	-	-	-	-	-	-	-	-	✓
Round axis (Endless shaft)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Non-integer scaling factor	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Code sequence	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Scaling function control	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
G1_XIST1 Preset control	✓*/-	✓*/-	✓*/-	✓*/-	-	-	-	-	-	-
Overtemperature warning	✓	✓	✓	✓	-	-	-	✓	-	-
Alarm channel control	✓	✓	✓	✓	-	-	-	-	-	-
PROFIdrive fault buffer	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PROFIdrive parameter channel	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Maximum Master Sign-Of-Life failures	✓	✓	✓	✓	-	-	-	✓	-	-
Class 1	-	-	-	-	✓	✓	✓	✓	✓	✓
Class 2	-	-	-	-	✓	✓	✓	✓	✓	✓
Class 3	✓	✓	✓	✓	-	-	-	-	-	-
Class 4	✓	✓	✓	✓	-	-	-	-	-	-

Table 8: Encoder functions

* Only in Profile 4.0 + 4.1

Encoder class	Description
1	Standard Encoder (position actual value) with preset functionality. Isochronous mode is possible, but with Sign-Of-Life only in Telegram 89.
2	Class 1 Encoder with additional base mode parameter access, speed actual value and additional scaling functionality
3	Isochronous mode operation Encoder with base mode parameter access and PROFIdrive Position Feedback interface. Isochronous mode is supported.
4	Class 3 Encoder with additional Scaling and Set-/Shift home position functionality.

Table 9: Encoder Class overview

3.4 Signal list for cyclic data transmission

Signal No.	Significance	Abbreviation	Length (bit)	Sign
3	Master's sign-of-life	STW2_ENC	16	-
4	Slave's sign of life	ZSW2_ENC	16	-
6	Velocity value A	NIST_A	16	✓
8	Velocity value B	NIST_B	32	✓
9	Control word	G1_STW	16	-
10	Status word	G1_ZSW	16	-
11	Position value 1	G1_XIST1	32	-
12	Position value 2	G1_XIST2	32	-
39	Position value 3	G1_XIST3	64	-
82	Preset control word 31 bits + trigger bit included	G1_XIST_PRESET_B	32	-
83	Preset control word 64 bits	G1_XIST_PRESET_C	64	-
84	Preset control word 32 bits	G1_XIST_PRESET_B1	32	-
--	Acceleration value	Acceleration	32	✓
--	Temperature value	Temperature	32	✓

Table 10. Signal list for cyclic data transmission

3.4.1 Format of actual position values

G1_XIST1 and G1_XIST2 are the actual position values in binary. For absolute encoders one format example is given below. **NOTE:** the alignment in the data-frame (left or right-aligned) is considered for each individual resolution.

Example: 25 bit Multi-turn absolute encoder (8192 steps per revolution, 4096 distinguishable revolutions).

- All values are presented in binary format G1_XIST2 displays the error telegram instead of the right aligned position value if error occurs.
- The shifting factors in P979 "sensor format" display the actual format. P979, Subindex 4 (Shift factor for G1_XIST2) = 0
- The settings in the Encoder parameter data affect the position value in both G1_XIST1 and G1_XIST2.

Case Encoder Profile 4.0*

- The default setting is G1_XIST1 left aligned.
- P979, Subindex 3 (Shift factor for G1_XIST1) = 32 – Total resolution (next binary value)
- G1_XIST1 send values independent Bit 10 in stw2 and Bit 13 in g1_stw1

Case Encoder Profile 4.1/4.2

- The default setting is G1_XIST1 right aligned.
- G1_XIST1 is a 32-bit counter which takes over the absolute position value from G1_XIST2 after power-on. After increasing maximum counter value start again with 0 or after 0 decreasing to the maximum counter value
- P979, Subindex 3 (Shift factor for G1_XIST1) = 0
- G1_XIST1 send values independent Bit 10 in stw2 and Bit 13 in g1_stw1

* Profile 4.0 realized with GSDML-V2.2-Hohner-XX10-PFN-20100808

Error codes in G1_XIST2

According to the definition of the PROFIdrive sensor channel state machine in PROFIdrive profile specific error codes are sent in G1_XIST2 in telegram 81-84 if an error in the sensor channel occurs. The Table 11 shows all defined error codes for the sensor channel state machine. In case of multiple errors, the error code of the most severe error is posted in G1_XIST. Details can you find in the Profidrive Profile on page 132.

G1_XIST2	Meaning	Explanation
0x0001	Sensor group error	Error in the processing of the sensor signal which causes an invalid Gx_XIST (e.g. electronic malfunction, invalid sensor signal input, …)
0x0003	Failure parking sensor	Error because of not possible transition to SD12 (parking). This may be e.g. because the drive is currently running (state S4) and the motor measurement system is forced to parking.
0x000A	Abort absolute value transmission	Absolute value track of encoder not readable
0x0F01	Command not supported	Error because of not supported optional function (e.g. shift/preset home position)
0x0F02 *	Master's sign of life fault	The number of permissible failures of the master's life sign was exceeded.
0x0F04 *	Synchronisation fault	The number of permissible failures for the bus cycle signal was exceeded.
0x0F05 *	Over temperature fault	The maximum operating temperature of the sensor was exceeded.

Table 11: Error codes in G1_XIST2

* not in encoder profile 4.2

M = Distinguishable Revolutions (Multi-turn value)

S = Pulses (Single-turn steps per revolution)

* values for a scaled value of Multi-turn = 12 bit and Single-turn = 13 bit

Absolute value in G1_XIST1 for Encoder Profile 4.0*

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
M	M	M	M	M	M	M	M	M	M	M	M	S	S	S	S	S	S	S	S	S	S	S	S	S							

“Absolute value” in G1_XIST1 for Encoder Profile 4.1+4.2

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	S	S	S	S	S	S	S	S	S	S	S	S	S

Absolute value in G1_XIST2*

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
							M	M	M	M	M	M	M	M	M	M	M	M	S	S	S	S	S	S	S	S	S	S	S	S	S

G1_XIST3: For 64bit position values is the G1_XIST3 available. The binary value will transmit right aligned and without shifting factor.

IO Data	1	2	3	4
Format	64 bit position value			

3.4.2 Encoder control word (STW2_ENC)

4-Bit-counter left justified. The master application starts the sign of life with any value between 1 and 15. The master increases the counter in every cycle of the master application. Valid values for the master's sign of life are 1 to 15, "0" indicates an error and is left out in normal operation.

		Implementation		
Bit	**Function**	**Class 3 + 4**	**Tel. 89**	**Tel. 81 - 84**
0	XIST_PRESET_CONTROL	-	✓	-
1…6	Reserved, currently not used	-	-	-
7	Fault Acknowledge	-	✓	
8…9	Reserved, currently not used	-	-	-
10	Control by PLC	✓	✓	✓
11	Reserved, currently not used	-	-	-
12…15	Controller Sign-Of-Life	✓	✓	✓

Bit	**Value**	**Significance**	**Comments**
0	1	Preset Trigger 0->1	The leading edge of this bit is the trigger for setting the preset value out of G1_XIST_PRESET_x as new actual position. The result from this operation is a shifted position actual value, a new internally stored position offset value and a leading edge of ZSW2_ENC.bit0 as corresponding acknowledgement.
	0	Idle	Before starting of a new preset set operation (preset cycle), the controller has to reset this bit to 0.
7	1	Fault Acknowledge 0->1	The current fault situation in the fault buffer is acknowledged with a leading edge.
	0	Keine Bedeutung	
10	1	Control by PLC	Control via interface, EO IO Data is valid.
	0	No control by PLC	EO IO Data not valid; except Sign-Of-Life.
12…15		Controller Sign-Of-Life	Send continuous count value from 0 (1) to 15

Table 12: Encoder control word (STW2_ENC)

3.4.3 Encoder status word (ZSW2_ENC)

4-Bit-counter, left justified. The slave application starts the sign of life with any value between 1 and 15 after successful synchronization to the clock pulse. The counter is increased by the slave application in every DP-cycle. Valid values for the slave's sign of life are 1 to 15, "0" indicates an error and is left out in normal operation.

		Implementation		
Bit	**Function**	**Class 3+4**	**Class 1+2, Tel. 89**	**Tel. 81 - 84**
0	XIST_PRESET_ACK	-	✓	-
1	XIST_VALID	-	✓	-
2	NIST_VALID	-	✓	-
3	Fault Present / No Fault	✓	✓	✓
4…6	Reserved, currently not used	-	-	-
7	Warning Present / No Warning	✓	✓	✓
8	Reserved, currently not used	-	-	-
9	Control requested	✓	✓	✓
10…11	Reserved, currently not used	-	-	-
12…15	Encoder Sign-Of-Life	✓	✓	✓

Bit	Value	Significance	Comments
0	1	Preset Acknowledge (0 -> 1)	The preset value was set as new position actual value signal, which is acknowledged with a leading edge of this bit; the new position offset value is stored or will be stored in the Encoder in a non-volatile way
	0	Idle	The encoder position offset value (from the last preset process) was stored in the encoder and the encoder is now ready for a new preset set operation (preset cycle)
1	1	G1_XISTx position actual value in XISTx is valid	This bit shows if there is a valid position actual value in the corresponding signals XISTx of a Class 1 or Class 2 telegram. Note that this bit is used only for the Class 1 and Class 2 telegram 89.
	0	No Fault	This bit is valid only for the Class 1 and Class 2 telegram 89
2	1	NISTx speed actual value in XISTx is valid	This bit shows if there is a valid speed actual value in the corresponding signals NISTx of a Class 1 or Class 2 telegram. Note that this bit is used only for the Class 1 and Class 2 telegram 89.
	0	No Fault	This bit is valid only for the Class 1 and Class 2 telegram 89. If the encoder doesn't support a speed actual value this bit is always false.
3	1	Fault Present	At least one Fault (Fault object) is present/active in the EO. This means that one or more actual values are invalid or have to be considered as invalid. As a consequence at least one bit in P65 001[2] is set and at least one fault is registered in the Diagnosis ASE and entered to the fault buffer. If the fault cause is removed and all EO functionality back in operation again, than the fault present bit is cleared automatically. See chapter 3.11.16.2
	0	No Fault	
7	1	Warning Present	At least one Warning (Warning object) is present/active in the EO. This means that one or more critical limits are reached but all encoder functionality is still operable according to it's specification. Also all actual values are valid. As a consequence at least one bit in P65 001[4] is set and at least one warning is registered in the Diagnosis ASE and entered to the fault buffer. If the warning cause is removed, than the warning present bit is cleared automatically. See chapter 3.11.16.1
	0	No Warning	
9	1	Control requested	The automation system is requested to assume control
	0	No control by PLC	EO IO Data is not valid. Except Sign-Of-Life
12…15		Encoder Sign-Of-Life	Send back continuous Controller Sign-Of-Life (counting value from 0 to 15)

Table 13: Encoder status word (ZSW2_ENC)

3.4.4 Encoder control word (G1_STW)

Bit	Value	Function	Comments
0.. 10			Reserved, currently not used
11	0/1	"Home position mode"	Specifies if the position value shall be set to a previously programmed absolute value or shifted by this value. 0: set home position / preset (absolute) 1: shift home position / preset (relative = offset)
12	1	Set preset / request shift	Preset (resp. shift) is set when changing this Bit to "1" (rising edge). Default preset value (shift): 0 **Warning:** After setting the preset the offset will be save in the nonvolatile memory. In this 5-10ms the encoder will not send position values.
13	1	Request absolute value cyclically	Request of additional cyclic transmission of the absolute actual position in G1_XIST2. If no other data needs to be transferred due to commands or errors the absolute position value will be transmitted automatically.
14	1	Activate parking sensor	If the "activate parking sensor" bit is set, the encoder transmits no error messages.
15	1	Acknowledging a sensor error	Request to acknowledge / reset a sensor error

Table 14. Encoder control word (G1_STW)

3.4.5 Encoder status word (G1_ZSW)

Bit	Value	Meaning	Comment
0 .. 10			Reserved, currently not used
11		Acknowledgement sensor error in process	Is set if the reset of a sensor error (after acknowledging) takes longer than one bus cycle.
12	1	Set preset / shift reference point executed	Acknowledgement for "set preset / request shift"
13	1	Transmit absolute value cyclically	Acknowledgement for "request absolute value cyclically"
14	1	Parking sensor activated	Acknowledgement for "activate parking sensor". The encoder transmits no error messages.
15	1	Sensor error	Indicates a sensor error. A device specific error code is transmitted in G1_XIST2.

Table 15: Encoder status word (G1_ZSW)

3.4.6 Sensor preset control word 31 bit + trigger bit (G1_XIST_PRESET_B)

Bit	Value	Meaning	Comment
0…30		Sensor preset value	Preset value (31 bit) for G1_XIST1 in the format/resolution of G1_XIST1.
31		Preset control	Control bit to enter the preset mode. 1: enable preset. In preset mode the preset value is taken as actual value and the offset value is calculated. 0: preset mode not able. This bit is used as “Preset control” for Telegrams 86 and 87.

Table 16: Sensor preset control word 31 bit + trigger bit (G1_XIST_PRESET_B)

3.4.7 Sensor preset control word 64 bit (G1_XIST_PRESET_C)

Bit	Value	Meaning	Comment
0…62		Sensor preset value	Preset value (63 bit) for G1_XIST3 in the format/resolution of G1_XIST3
63		Preset trigger	Trigger bit to control the transfer of the preset value (0 → 1 edge).

Table 17: Sensor preset control word 64 bit (G1_XIST_PRESET_C)

3.4.8 Sensor preset control word 32 bit (G1_XIST_PRESET_B1)

Bit	Value	Meaning	Comment
0…31		Sensor preset value	Preset value (32 bit) for G1_XIST2 in the format/resolution of G1_XIST2. Preset value will be activated via XIST_PRESET_CONTROL (Bit 0 in STW2_ENC)

Table 18: Sensor preset control word 32 bit (G1_XIST_PRESET_B1)

3.4.9 Sensor preset control word 32 bit (PRESET)

Bit	Value	Meaning	Comment
0…31		Sensor preset value	Preset value (32 bit) for G1_XIST1 in the format/resolution of G1_XIST1.

Table 19: Sensor preset control word 32 bit (PRESET)

3.5 Standard + manufacturer telegrams

Standard Telegram 81

IO Data (DWord)	1	2
Setpoint	STW2_ENC	G1_STW1

IO Data (DWord)	1	2	3	4	5	6
Actual value	ZSW2_ENC	G1_ZSW1	G1_XIST1		G1_XIST2	

Table 20: Standard Telegram 81

Standard Telegram 82

IO Data (DWord)	1	2
Setpoint	STW2_ENC	G1_STW1

IO Data (DWord)	1	2	3	4	5	6	7
Actual value	ZSW2_ENC	G1_ZSW1	G1_XIST1		G1_XIST2		NIST_A

Table 21: Standard Telegram 82

Standard Telegram 83

IO Data (DWord)	1	2
Setpoint	STW2_ENC	G1_STW1

IO Data (DWord)	1	2	3	4	5	6	7	8
Actual value	ZSW2_ENC	G1_ZSW1	G1_XIST1		G1_XIST2		NIST_B	

Table 22: Standard Telegram 83

Standard Telegram 84

IO Data (DWord)	1	2
Setpoint	STW2_ENC	G1_STW1

IO Data (DWord)	1	2	3	4	5	6	7	8	9	10
Actual value	ZSW2_ENC	G1_ZSW1	G1_XIST3				G1_XIST2		NIST_B	

Table 23: Standard Telegram 84

Standard Telegram 86

IO Data (DWord)	1	2
Setpoint	G1_XIST_PRESET_B	

IO Data (DWord)	1	2	3	4
Actual value	G1_XIST2		NIST_B	

Table 24: Standard Telegram 86

Standard Telegram 87

IO Data (DWord)	1	2
Setpoint	G1_XIST_PRESET_B	

IO Data (DWord)	1	2
Actual value	G1_XIST2	

Table 25: Standard Telegram 87

Standard Telegram 88

IO Data (DWord)	1	2	3	4
Setpoint	G1_XIST_PRESET_C			

IO Data (DWord)	1	2	3	4	5	6
Setpoint	G1_XIST_PRESET_C				NIST_B	

Table 26: Standard Telegram 88

Standard Telegram 89

IO Data (DWord)	1	2	3
Setpoint	STW2_ENC	G1_XIST_PRESET_B1	

IO Data (DWord)	1	2	3	4	5
Actual value	ZSW2_ENC	G1_XIST2		NIST_B	

Table 27: Standard Telegram 89

Manufacturer Telegram 860

IO Data (DWord)	1	2	3	4
Setpoint	Preset			

IO Data (DWord)	1	2	3	4	5	6	7	8
Actual value	Position				Velocity			

Table 28: Manufacturer Telegram 860

Manufacturer Telegram 862

IO Data (DWord)	1	2	3	4
Setpoint	Preset			

IO Data (DWord)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Actual value	Position				Velocity				Acceleration				Temperature			

Table 29: Manufacturer Telegram 862

With telegram 86, 87, 88, 860 and 862 it is not necessary to set special bits to get cyclic data transmission. It is very easy to set a defined Preset value during the running of the PLC. The velocity value uses the format that is defined in the Velocity measuring unit.

We recommended strongly to use telegram 89 according the combination of easy Preset setting and Life-Sign-Counter for isochronous operation.

Example for Telegram 860 and 862:

Output Data (Output data from Controller to Encoder): 4 Bytes	
Preset - 32 Bit Unsigned Integer	
Bit 31	Bit 30 .....Bit 0
Preset Control	Preset value < Total Resolution

3.6 Configuration principale

The rotary encoder with PROFINET interface can be programmed according to the needs of the user. The GSDML file pertaining to the rotary encoder must be installed on the PLC via the engineering software tool.

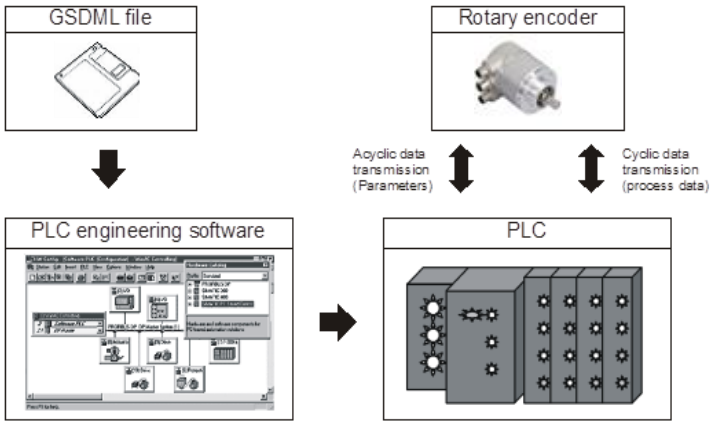


Figure 5: Configuration principle

3.7 Rotary encoder functionalities overview

Function	Communication channel
Position value	Cyclic input (IO device -> IO controller)
Preset	Cyclic output (IO controller -> IO device)
Coding sequence	Acyclic input/output
Scaling function	Acyclic input/output
Master's sign-of-life	Cyclic input (IO device -> IO controller)

3.8 Rotary encoder functions – data format

PROFINET IO devices are set up in modules. Each module can be plugged in physical and/or logical slots. These are subdivided into sub slots individually to accommodate further data hierarchy. One sub slot can contain several cyclic input/output channels as well as acyclic record channels (used for parameters).

There are two versions of PLC available. Some of them support only one sub slot. Other ones i.e. S7 400 support several sub slots. To work with both PLCs there are in the GSDML-file for Encoder profile 4.1 two directories: "Standard" and "Standard, no PDEV".

Hohner Automation rotary encoders offer for the standard profile one slot (address #0) with one sub slot (address #0) for all device data for old PLC's that doesn't support several sub slots.

Device parameters are grouped together as records in the PROFINET interface. In chapter 3.9 are tables that gives an overview over addresses of Hohner Automation rotary encoder's data channels.

GSDML-File	Encoder profile version	Compatible to Type key
GSDML-V2.2-Hohner-xxx-20100808	4.0	xCx-EI[A/B/C]…
GSDML-V2.2-Hohner-xxx-20110801	4.1	xCx-EI[A/B/C]…
GSDML-V2.34-Hohner-…	4.2	xCx-EIC…

Table 30: GSDML-File

3.9 Parameter for Acyclic Data Transmission

The user parameter data is sent to the encoder in the start-up phase as a Record Data Object using the data record 0xBF00. For the mapping of the different encoder functions into the user data section of the Record Data Object. In addition to the parameter data configuration the encoder supports a number of PROFIdrive parameters and encoder specific parameters accessible via the Acyclic Data Exchange service.

Since the Hohner's GSDML version GSDML-V2.2-Hohner-XX10-20100808 it is possible to change the telegram type without changing the MAP parameters.

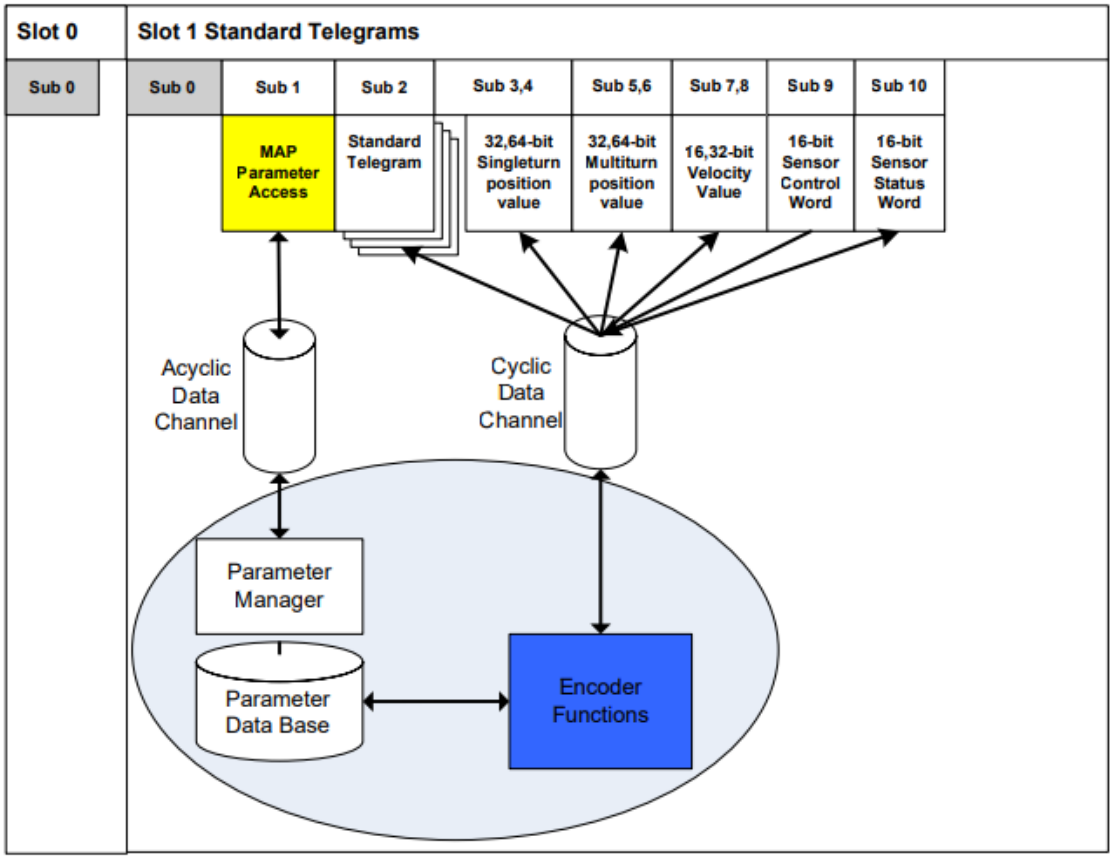


Figure 6: Slot model

3.9.1 Parameter-Model

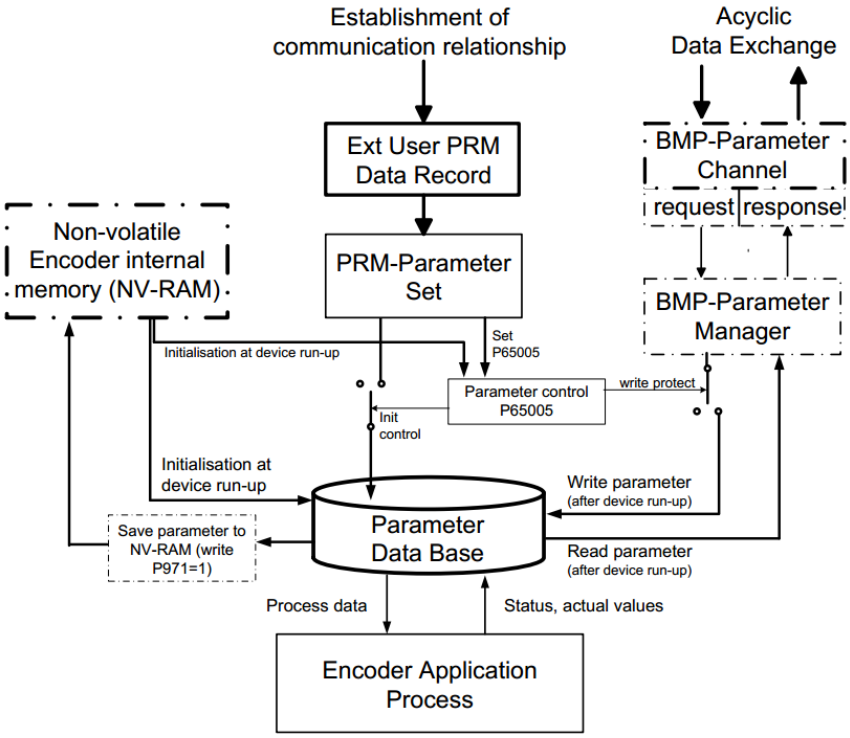


Figure 7: Parameter-Model

In example with Parameter 65 005 you can set that the parameters will not read out of the GSDLM file (Ext User PRM Data Record). You can define that they will read out after start-up directly from the Non-volatile memory of the encoder. But please note that you must handle these parameters - i.e. counting direction - after replacing the encoder manually.

Base Mode Parameter via GSD

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

Fractional Calculation

Fractional Calculation Control:	disable
Intended Pulses:	8192
Physical Pulses:	8192

Encoder parameter

Code sequence:	CW
Encoder Class 4 functionality:	enable
Preset affects XIST1:	disable
Scaling function control:	disable
Alarm channel control:	disable
Compatibility Mode V3.1:	disable
Encoder type:	Rotary
Scaling: Measuring units per Revolution:	8192
Scaling: Total measuring range:	8192
Tolerated sign of life faults:	1
Velocity measuring unit:	N2/N4
Velocity reference N2/N4 (R/min):	3000.0000
Velocity filter:	Normal

3.10 Programmable parameter access

The parameters in the parameter number range 9xx (Profidrive specific) and 65xxx (Encoder Profile specific) can be written and/or read via the Acyclic Data Exchange Service. The parameters are handled via the record data object with index 0xB02E. This can be used i.e. for defining a special Preset value for Telegram 81-84.

The record data request is available in two function blocks:

1.) SFB 52 “RDREC” (read record)
2.) SFB 53 “WRREC” (write record)

See in chapter 3.10.2 an example.

3.10.1 Supported PROFIdrive profile parameters

PNU	Parameter	Read only	Read/ Write	Description / Chapter
922	Telegram selection	✓		
925	Number of life sign failures that may be tolerated		✓	Value range: 0-65536 65536 deactivates the monitoring
944-952	PROFIdrive fault buffer	✓		3.11.17
964	Device identification	✓		Type, Software Version, Firmware Date: Year, Firmware Date: DDMM, Number of Encoder-Objects
965	Profile identification number	✓		3.11.15
970	Load command		✓	
971	Transfer into a non-volatile memory		✓	
972	Reset Encoder device	✓	✓	
974	Base Mode Parameter Access service identification	✓		
975	Encoder Object identification	✓		Vendor-ID, Encoder-Object Type, Software Version, Firmware Date: Year, Firmware Date: DDMM, Encoder Type Class, Encoder-Object Sub-Class, Encoder-Object-ID
979	Sensor format	✓		
980	Number list of defined parameters	✓		
60 000	N2/N4 velocity reference value	✓	✓	
60 001	Velocity value normalization	✓	✓	
65 000	Preset		✓	
65 001	Operating status	✓		
65 002	Preset value 64 bits	✓	✓	
65 004	Function control	✓	✓	
65 005	Parameter control	✓	✓	
65 006	Measuring units per revolution	✓	✓	
65 007	Total measuring range in measuring units	✓	✓	

PNU	Parameter	Read only	Read/ Write	Description / Chapter
65 008	Measuring units per revolution 64 bits	✓	✓	
65 009	Total measuring range in measuring units 64 bit	✓	✓	
65 010	Operating time	✓		The operating time counter is incremented every six minutes
65 011	Intended pulses	✓	✓	3.11.10
65 012	Physical impulses	✓	✓	3.11.10
65 013	Fractional calculation control	✓	✓	3.11.10
65 014	Velocity filter	✓	✓	3.11.13

Table 31: Supported PROFIdrive profile parameters

3.10.2 Record data request and respond

Input parameters for SFB 52 / SFB 53:

IN parameters	Type	Description
REQ	BOOL	REQ=1: Perform data record transmission
ID	DWORD	Logical address of Profinet IO (address based on configuration)
INDEX	INT	0xB02E
MLEN	INT	Maximum length of data record
RECORD (IN/OUT)	ANY	Record data request (see table 33) or response (see table 34)

Table 32: Input parameters for SFB 52 / SFB 53

Data format of the record data request

Byte	Name	Description	
0	Request reference	Unique identification for each request or response query. 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	
5	Number of elements	0x00	
6	Parameter number	High Byte	
7		Low Byte	
8	Subindex	High Byte	
9		Low byte	
10	Format	Data type: 0x41 Byte 0x42 Word 0x43 Double Word	Only for write access
11	Number of values	Number of values of Byte 12-…	
12-…	Values		

Table 33: Data format of the record data request

Data format of the record data response

Byte	Name	Description	
0	Request reference	Mirrored identification from request	
1	Request ID	0x01 Parameter read, successfully 0x81 Parameter read, not successfully 0x02 Parameter written, successfully 0x82 Parameter written, not successfully	
2	Axis	0x00	
3	Number of parameters	0x01	
4	Format	0x41 Byte 0x42 Word 0x43 Double Word 0x44 Error	Not present if write access is successful: In case of error Format = 0x44 Number of values = 1 Value = Error number according to PROFIdrive profile
5	Number of values	0x00	
6-…	Values / Error information	Parameter value, error number	

Table 34: Data format of the record data response

In the following table is an example for setting the Preset value to 10000 (=0x2710) via Parameter number 65 000

Table 35: Example set Preset via PNU 65 000

Byte	Value	Description
0	0x01	Request reference
1	0x02	Request ID (Write parameter)
2	0x00	Axis
3	0x01	Number of parameters
4	0x10	Attribute
5	0x00	Number of elements
6	0xFD	Parameter number 65 000
7	0xE8	
8	0x00	Subindex
9	0x00	
10	0x43	Format (Double Word)
11	0x01	Number of values
12	0x00	Value (MSB)
13	0x00	Value
14	0x27	Value
15	0x10	Value (LSB)

If the Preset value was set successfully the PLC will get the answer from the encoder:

Byte	Value	Description
0	0x01	Request reference
1	0x02	Request ID (Parameter written successfully)
2	0x00	Axis
3	0x01	Number of parameters

3.11 Rotary encoder function description

Details of these functionalities are available in the related chapters.

	Implementation				Description
Function	**Class 1**	**Class 2**	**Class 3**	**Class 4**	**Chapter**
Code sequence	✓	✓	-/✓*	✓	3.11.1
Class 4 functionality	-	-	✓	✓	3.11.2
G1_XIST1 Preset control	-	-	-/✓*	✓	3.11.3
Scaling function control	✓	✓	-/✓*	✓	3.11.4
Alarm channel control	✓	✓	✓	✓	3.11.5
V3.1 Compatibility mode	-	-	-/✓*	✓	3.11.6
Preset value	✓	✓	-/✓*	✓	3.11.7
Offset	✓	✓	-/✓*	✓	3.11.8
Scaling parameters	✓	✓	-/✓*	✓	3.11.9
Fractional scaling	✓	✓	-/✓*	✓	3.11.10
Sign-Of-Life supervision	-	-	-/✓*	✓	3.11.11
Velocity measuring unit	✓	✓	-/✓*	✓	3.11.12
Velocity filter	✓	✓	-/✓*	✓	3.11.13
Acceleration measuring unit	✓	✓	-/✓*	✓	3.11.14
Encoder Parameter control	✓	✓	-/✓*	✓	3.11.20
Round axis (Endless shaft)	✓	✓	✓	✓	3.11.15
Encoder Profile version	✓	✓	✓	✓	3.11.16
Warnings / Errors	✓	✓	✓	✓	3.11.17
PROFIdrive fault buffer	✓	✓	✓	✓	3.11.18
Media Redundancy Protocol MRP	✓	✓	✓	✓	3.11.19
'Bumpless' redundancy for IRT applications MRPD	-	-	✓	✓	3.11.19

* If Class 4 functionality is activated

Table 36: Rotary encoder function description

3.11.1 Code sequence

The "code sequence" parameter defines the counting direction of the position value. The code increases when the shaft is rotating clockwise (CW) or counter-clockwise (CCW) (view onto the shaft).

Code sequence	Direction of rotation when viewing the shaft	Code sequence
0 (default)	Clockwise (CW)	Increasing
1	Counter-clockwise (CCW)	Decreasing

3.11.2 Class 4 functionality

The parameter “Class 4 functionality” defines that the scaling, preset and code sequence affects the position value in G1_XIST1, G1_XIST2 and G1_XIST3.

Class 4 control	Class 4 function
0 (default)	Deactivated
1	Activated

3.11.3 Preset control for G1_XIST1

The parameter “preset control” defines the preset functionality in Telegram 81-84 for Encoder profile 4.1 and beginning with 4.2 only in Telegram 89. If parameter Class 4 is activated and Preset control is disabled, then the Preset will not be affected for G1_XIST1.

Preset control	Preset function
1	Preset does **not** affect G1_XIST1
0 (default)	G1_XIST1 is affected by a Preset command

3.11.4 Scaling function control

The parameter “scaling function control” enable / disenable the scaling function. If not, the physical position value is returned by the rotary encoder. This is only available if class 4 control is activated.

Scaling function control	Scaling function
0	Deactivated
1 (default)	Activated

3.11.5 Alarm channel control

This parameter enables/disables the encoder specific Alarm channel transferred as Channel Related Diagnosis. This functionality is used to limit the amount of data sent in isochronous mode. NOTE! This parameter is only supported in compatibility mode.

If the value is zero only the communication related alarms are sent via the alarm channel. If the value is one also Encoder profile specific Faults and Warnings are sent over the alarm.
In Encoder profile 4.2 it cannot be deactivated.

Alarm channel control	Alarm channel function
0 (default)	Deactivated
1	Activated

3.11.6 Compatibility mode

This parameter defines if the encoder should run in a mode compatible to Version 3.1 of the Encoder Profile. See next tables for an overview of the functions affected when the compatibility mode is enabled.

Function	Compatibility mode enabled (=0)	Compatibility mode disabled (=1)
Control by PLC (STW2_ENC)	Ignored; the Control word (G1_STW) and setpoint values are always valid. Control requested (ZSW2_ENC) is not supported and is set to 0	Supported
Use parameter “Maximum Master Sign-Of-Life failures"	Not supported via GSDML; P925 control the life sign monitoring	Supported
User parameter “Alarm channel control”	Supported	Not supported; the profile specific diagnosis via alarm channel is always active
G1_XIST1	Left aligned	Right aligned
P965 – Profile version	31 (V3.1)	41 (V4.1) or 42 (V4.2)

3.11.7 Preset value

3.11.7.1 Telegram 81-84

With the Preset value it is possible to adapt the encoder zero point to the zero point of the application. When using this function, the current encoder position value is set to the desired preset value. The integrated microcontroller calculates the internal offset value. It is stored in a non-volatile memory (~ 10 ms).

NOTE:

- Set Preset only in standstill! Otherwise the warning Preset failed set Bit 13 (speed to high).
- to activate the preset function, the bit 12 in the Sensor control word (G1_STW) must be flipped to 1 for sensor control and status words (G1_STW and G1_ZSW). In parameter P65 000 or P65 002 (64 bit) is the definition of the Preset value.
- Class 4 functionality must be enabled!
- If the Preset value is greater than the total resolution, then the warning Preset failed (preset value out of range) Bit 14 will be set

Parameter	Meaning	Data type
Preset value	Preset value will define with asynchronous data exchange. Default value = 0	Integer 32 or Integer 64

3.11.7.2 Telegram 86, 87, 88, 860, 862

With these telegrams it is easy to set a user defined preset value during the running application according to the Profibus functionality. The bit 31 (for Telegram 88 the bit 63) must be set the to “1” for the preset control words G1_XIST_PRESET_B or G1_XIST_PRESET_C then back to “0”. For a different preset value than 0 set the other bits.

Output Data (Output data from Controller to Encoder): 4 Bytes	
Preset - 32 Bit Unsigned Integer	
Bit 31	Bit 30 .....Bit 0
Preset Control	Preset value < Total Resolution

3.11.7.3 Telegram 89

a.) The Preset value will be defined according:

Output Data (Output data from Controller to Encoder): 4 Bytes
Preset - 32 Bit Unsigned Integer
Bit 31 .....Bit 0
Preset value < Total Resolution

b.) This Preset value will be activated via XIST_PRESET_CONTROL (Bit 0 in STW2_ENC)

c.) The preset value was set as new position actual value signal, which is acknowledged in XIST_PRESET_ACK (with a leading edge of bit 0 in ZSW2_ENC)

3.11.8 Offset value

The offset value is calculated in the preset function and shifts the position value with the calculated value.

3.11.9 Scaling parameters

The Scaling parameters will be used to change the resolution. This parameter will only affect the output values if scaling is activated.

Parameter#	Parameter	Meaning	Data type
65 006	Measuring units per revolution / Measuring step	Single turn resolution in steps	Unsigned 32
65 007	Total measuring range in measuring units	Total measuring range measuring steps	Unsigned 32
65 011	Intended Pulses	Intended total measuring range measuring steps	Unsigned 32
65 012	Physical Pulses	Physical total measuring range measuring steps	Unsigned 32
65 013	Fractional Calculation Control	Switch between standard and fractional scaling. Details are described in chapter 3.11.10	Unsigned 32
65 008	Measuring units per revolution 64 bit	The single-turn resolution for rotary encoders with a resolution exceeding 32 bits per revolution	Unsigned 64
65 009	Total measuring range in measuring units 64 bit	The total absolute measuring range for encoders with a range exceeding 32 bits	Unsigned 64

NOTE:
The parameters must fulfill the following formula:
Total measuring range in measuring units = Measuring units per revolution x Maximum number of revolutions of the encoder

This means that the Total measuring range in measuring units must be updated on each reduced Measuring units per revolution! Otherwise a parameterization fault stops the configuration!

3.11.10 Fractional scaling factor

With this new generation “C1” are three additional Parameters available:
“Intendend Pulses”, “Physical Pulses” and “Fractional Calculation Control“.

If “Fractional Calculation Control” is set to “1” then the scaled value will be used based on numerator divided by denominator:

$$\text{Scaling factor} = \frac{\text{"Intendend Pulses"}}{\text{"Physical Pulses"}}$$

Example:

The user wants the position value to increase by 400 steps over 3 revolutions ≙ 133.33 steps per revolution. It is not possible to set it via "Steps per revolution" (non-integer not accepted)

Solution:

$$\text{Scaling factor} = \frac{400\ \text{steps}}{8{,}192\frac{\text{steps}}{\text{revolution}} \times 3\ \text{revolutions}} = \frac{400}{24{,}576} = 0{,}0162760416666667$$

The denominator is the quotient of the physical pulses of the base sensor – i.e. see type key XX10-EIC1B-12**13**-… and the required revolutions.

Bits	Steps / Revolution
13	8192
16	65536

3.11.11 Max. Master Sign-Of-Life failures

With this parameter the number of allowed failures of the master's sign of life is defined.

Parameter	Meaning	Value
Maximum Master Sign-Of-Life failures	Number of permissible failures of the master's life sign via GSDML 255 deactivates the monitoring	0 … 255
	Number of permissible failures of the master's life sign via PNU 925 65536 deactivates the monitoring	0 … 65536

3.11.12 Velocity measuring units

This parameter defines the coding of velocity measuring units used to configure the values NIST_A and NIST_B.

With each cycle will calculate the velocity from the position value. The velocity precision is not depending of the cycle time.

Velocity measuring unit	Value
Steps/s	0
Steps/100ms	1
Steps/10ms	2
RPM	3
N2/N4 normalized	4

N2 / N4 normalization:

Velocity normalization is used often in applications with PROFIdrive devices. The velocity actual value in NIST is a percentage of the reference value.

The reference value can be programmed via GSDML setting or over Parameter 60 000. In addition, the controller can read out the parameterized or active reference value via parameter p2000. Adapt the reference value to the particular application in order to optimally utilize the value range.

– for N2, 4000 hex corresponds to a value of 100% of the reference value
– for N4, 4000 0000 hex corresponds to a value of 100 % of the reference value
– the value range extends from -200% up to +200%

MSB = 1 is a negative sign

MSB = 0 is a positive sign

3.11.13 Velocity filter

The velocity value can be used with three different exponential moving average filter types.

Default: Fine

Parameter	Meaning	Data type
Velocity filter	Select for the parameter Fine, Normal, Coarse	Integer 32

Ratio between old and actual velocity value:

Fine: 7:3

Normal: 96:4

Coarse: 996:4

3.11.14 Acceleration measuring unit

The unit of acceleration is fix °/s^2.

With each cycle will calculate the acceleration from the velocity value. The acceleration precision is not depending of the cycle time.

3.11.15 Endless Shaft (Round Axis)

In most encoders, the ratio “Total resolution” / “measuring units per revolution” must be an integer and it must a divider of the total number of revolutions. This means that i.e. 100 or 325 revolutions could create position jumps during the physical zero position. The following equation must apply:

4096 x measuring units per revolution / total resolution = integer

But Hohner’s Profinet encoders solve this problem automatically. The encoder checks if the parameters need the endless shaft and activates the functionality on its own.

Beginning with Encoder Profile 4.2 it is possible to use fractional scaling values. There could be set the values bases on counter und denominator. With this feature it is possible to use i.e. 400 Steps on three revolutions. For details see chapter 3.11.10

Note: The internal firmware routine only works if the encoder is operating. If the encoder is turned more than 1024 revolutions on resolution 12xx and 4096 on resolution 14xx without power supply this can lead to problems (the internal routine won’t work).

3.11.16 Encoder Profile version

The Encoder Profile Version is the version of the Encoder Profile document implemented in the encoder. This parameter could be read with parameter 965 and is not affected by the Compatibility mode settings.

Bits	Meaning
0-7	Profile Version, least significant number (value range: 0…99), decimal coding
8-15	Profile Version, most significant number (value range: 0…99), decimal coding
16-31	Reserved

3.11.17 Diagnosis parameter

3.11.17.1 Warnings

The parameter 65 001[4] shows the current status of all warnings. In the following table are all supported warnings:

Bit	Definition	= 0	= 1	Remedy
7	Invalid parameter setup in RAM	Valid	Invalid	The writing of encoder configuration parameters via the BMP parameter access mechanism has caused an invalid parameter set.
8	Communication	Communication ok	Communication warning	Check for quality of service in the communication system and for disturbances in the communication infrastructure.
10	Synchronization fault (IRT only)	Sync ok	Sync warning	Check for quality of service in the communication system and for disturbances which may cause a package drop or jitter of frames.
11	Master's sign of life (MSL) fault	MSL ok	MSL warning	Remedy: Check for quality of service in the communication system and for disturbances which may cause a package drop or jitter of frames.
12	Overspeed	No Overspeed	Overspeed warning	A critical speed limit for the encoder was exceeded. Operation of the encoder beyond this speed limit may cause position errors or may damage the encoder mechanical system.
13	Preset failed (speed to high)	Preset OK	Preset failed	The controller has to repeat the preset function again with axis in standstill
14	Preset failed (Preset value out of range)	Preset OK	Preset failed	Use a Preset value that is smaller than the scaled total resolution
15	Command not supported	Command ok	Wrong command	Use an allowed command
19	Overtemperature	Temperature ok	Overtemperature warning	Change the reason for this high temperature. If the temperature is decreasing under the value of "Temperature_Warning" (default = 80°C) then the bit will be set back automatically

Table 37: Definition warning bits

Hint:
Warnings are always displayed for at least 5s. See details in the following overview:

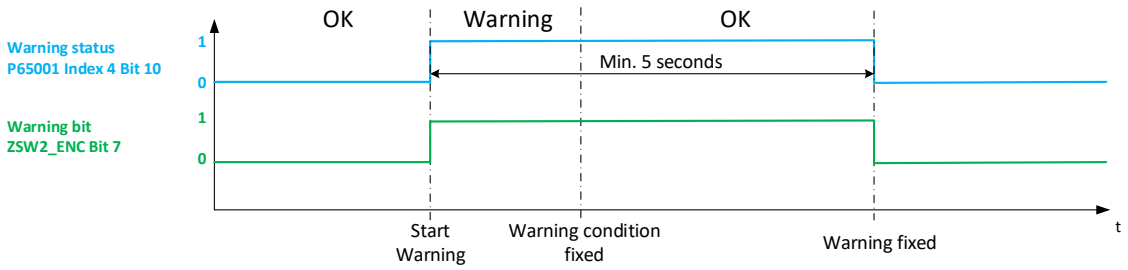


Figure 8: Warning Flow Diagram

3.11.17.2 Faults

The parameter 65 001[2] shows the current status of all warnings. In the following table are all supported warnings:

Bit	Definition	= 0	= 1	Remedy
0	Position error	Position ok	Position fault	Remove fault cause (e.g. exchange encoder, re-establish a correct power supply, …).
5	Commissioning diagnostics	Parameterization ok	Commissioning fault	Arrange a new valid parameter set for the encoder device and reboot the encoder.
6	Commissioning invalid scaling	Scaling parameter ok	Scaling parameter fault	Arrange a new valid parameter set for the encoder device and reboot the encoder.
8	Communication	No IOAR abort	IOAR aborted	After loss of communication the controller may start the IOAR again. If this is successful, the controller may continue the application if appropriate. Check for quality of service in the communication system and for disturbances which may cause excessive package drops or a broken line.

Bit	Definition	= 0	= 1	Remedy
10	Synchronization (only IRT)	No Sync fault	Sync fault	After loss of synchronization the encoder starts an automatic re-synchronization. If this is successful, the controller may continue the application if possible. Check for quality of service in the communication system and for disturbances which may cause a package drop or excessive jitter of frames.
11	Master's sign of life (only IRT)	No MSL fault	MSL fault	After loss of synchronization the controller may start an automatic Resynchronization. If this is successful, the controller may continue the application if possible.
19	Overtemperature	No Overtemperature fault	Overtemperature fault	Check encoder environmental operating conditions.
22	Memory error	No Memory fault	Memory fault	Replace the encoder device.

Table 38: Fault bit overview

Hint

Errors are always displayed for at least 5s. Confirmation can only be made after the time window has expired. See the example in the following overview:

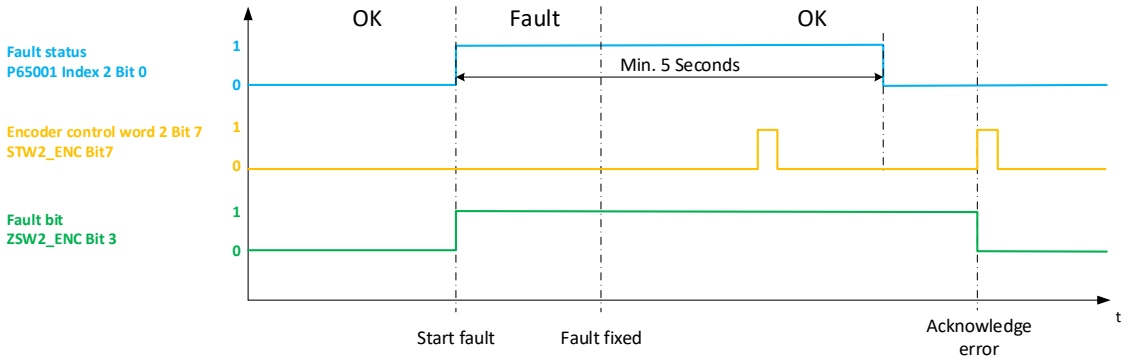


Figure 9: Error sequence diagram

3.11.18 PROFIdrive fault buffer

The PROFIdrive fault buffer offers a logbook functionality to the encoder diagnosis. The fault buffer is able to store a sequence of multiple faults per fault situation. For more details please check the PROFIdrive- and Encoder-Profile.

Fault Class#	Definition	Fault code (fault)	Fault code (warning)
0	Position error	0x100	-
5	Commissioning diagnostics	0x105	-
6	Commissioning invalid scaling	0x106	-
10	Synchronization (only IRT)	0x10A	-
11	Master's sign of life (only IRT)	0x10B	-
13	Preset failed (speed to high)	-	0x20D
14	Preset failed (preset value out of range)	-	0x20E
15	Command not supported	-	0x20F
19	Overtemperature	0x113	0x213

3.11.19 MRP / MRPD

PROFINET interface provides two media redundancy solutions:

- "**M**edia **R**edundancy **P**rotocol" (MRP) as non-seamless protocol
- "**M**edia **R**edundancy for **P**lanned **D**uplication" (MRPD), as seamless media redundancy concept.

MRP is the basic redundancy protocol for PROFINET and must be applied when PROFINET network ring structures are in operation. MRP is enough for standard real-time communication. MRPD is needed when one wants to use IRT.

The principle is as follows: when the ring topology is broken, the MRP-enabled device is able to re-route the data backwards, so it can reach the other devices of the ring. Please contact the supplier of the PLC which hardware is necessary from the controller side and the configuration.

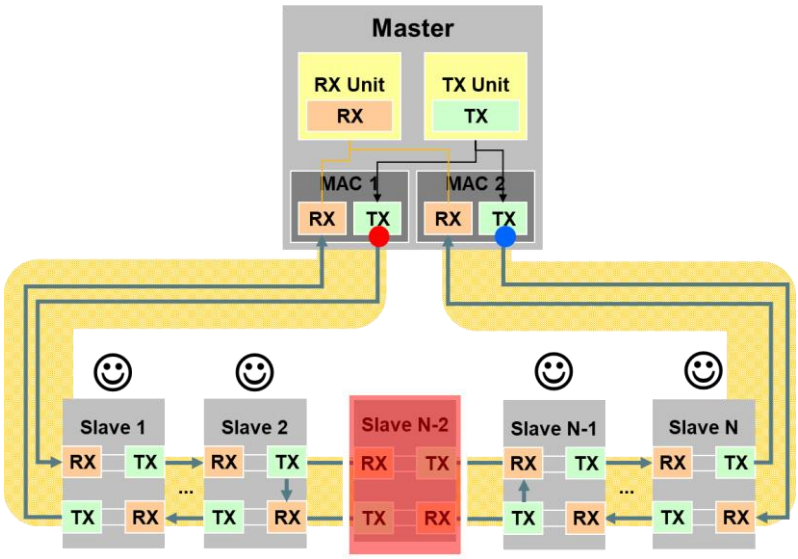


Figure 10: Explanation MRP/MRPD

3.11.19.1 MRP

The Medium Redundancy Protocol (MRP) is based on a ring topology and guarantees recovery times between 200 ms and 500 ms depending on the configuration. MRP uses a redundancy manager that closes the ring.

In the case of an error, the PROFINET connection is automatically reestablished by the redundancy manager via a second communication path. In this way, an error in the network can be bypassed while the system continues to run with a shock. It should be noted here that a PROFINET device failure may occur again after the error has been rectified, as the system switches over again.

Hints:

- MRP must be activated for all devices in the ring.
- All devices must be connected via their ring ports (typically port 1 and 2).
- The ring may consist of max. 50 devices.
- All devices in the ring belong to the same redundancy domain.
- At least one device in the ring is a media redundancy manager.
- All other devices in the ring are media redundancy clients.
- RT communication is interrupted (station failure) if the reconfiguration time of the ring is longer than the selected response monitoring time of the IO-Devices. If necessary, select a sufficiently long response monitoring time for the IO-Devices

3.11.19.2 MRPD

MRPD (Media Redundancy for Planned Duplication) is a method for bump less switching of IRT telegrams (high performance). Bump less switching is ensured by sending the cyclic IRT data via both communication paths in the ring. This means that, if there is no error in the network, the receiver receives the same IRT telegram twice. The first received IRT telegram is processed, the second one is rejected.

Requirements

- See MRP
- IRT (High Performance) must be activated on all participating devices.
- All participating devices must support MRPD, even the devices in the stall, which cyclically exchange IRT data with a ring component.

3.11.20 Encoder Parameter control (PNU 65 005)

a) If the “Parameter initialization control” = “PRM” then will be used parameters via PLC-project (based on GSDML). If the encoder will be replaced by a new one, then the necessary parameters are available directly after start-up.
If “P65 005 write protect” = “Write all” then it is possible during running Application to change the parameters too. But they will be overwritten after the PLC turn on or the encoder get a Power-on.
If “P65 005 write protect” = “Read only” then it is not possible to change the parameters during running Application.

b) If the “Parameter initialization control” = “NV-RAM” then the parameterization of the encoder is done out of the encoder internal non-volatile memory. For initial setup, it is possible to configure the parameterization of the non-volatile memory prior to first operation by connecting the new encoder to a configuring station (supervisor device).

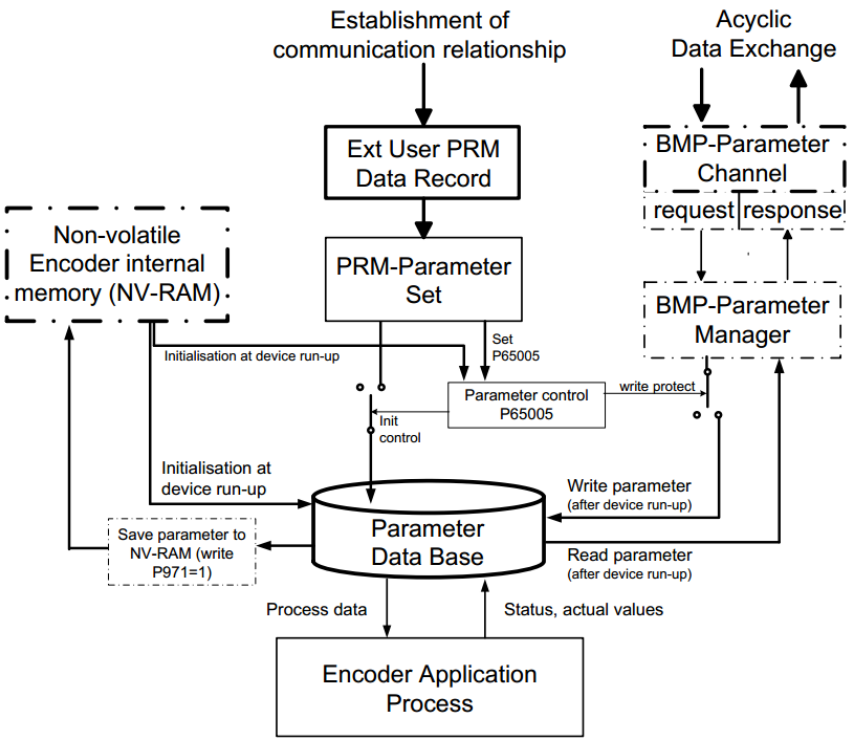


Figure 11: Parameter control PNU 65 005

3.11.20.1 Parameter initialization control

Parameter	Meaning	Value
PRM	Parameter will be used via PLC-project (based on GSDML)	0 (default)
NV-RAM	Parameter will be used only from the non-volatile memory of the encoder. If there is nothing saved, then the default parameter will be used.	1

3.11.20.2 Parameter write protect

Parameter	Meaning	Value
Write all	Online access on parameters via BMP parameter channel (all CRs) is read and write for all configuring parameters, but access to P65 005 (parameter control) is read only.	0 (default)
Read only	Online access on parameters via BMP parameter channel (all CRs) is read only for all configuring parameters.	1
Write Controller	Online access on parameters via BMP parameter channel is read and write for the controller communication relationships, but access to P65 005 (parameter control) is read only. For all Supervisor communication relationships, the access is read only.	2
Write Supervisor	Online access on parameter via BMP parameter channel is read and write for the Supervisor communication relationships, but access to P65 005 (parameter control) is read only. For all Controller communication relationships, the access is read only.	3

3.11.20.3 Parameter 65 005 write protect

Parameter	Meaning	Value
Write all	Online access on p65 005 and p971 via BMP parameter channel (all CRs) is read and write	0 (default)
Read only	Online access on p65 005 and p971 via BMP parameter channel (all CRs) is read only.	1

3.11.20.4 Reset control write protect

Parameter	Meaning	Value
Write all	Online access on P972 via BMP parameter channel (all CRs) is read and write. Reset control via p972 is enabled.	0 (default)
Read only	Online access on P972 via BMP parameter channel (all CRs) is read only. Reset control via P972 is disabled.	1

The configuring station establishes a supervisor application relation (AR) to the encoder and writes the configuring parameters to the encoder. For saving and protection of the parameterization, the supervisor sets P65 005 for “P65 005 write protect“ and then starts the transfer of the parameters to the encoder NV-RAM by writing of P971=1. If the saved parameterization shall be protected against changes via the BMP parameter channel, “P65 005 parameter write protect” can be set to “read only”.

4. Configuring with STEP7

In the following chapter the configuration of the Hohner encoder with the configuration tool Hardwaremanager STEP 7 is shown as an example. In this example STEP 7 Version 5.4 SP4 and the CPU 315-2PN/DP or Simotion Scout with single axis controller D410 (PROFINET controller integrated) are used. This example is made for encoder series [O/U]CD-EIB1… For the hardware version [O/U]CD-EIC1… with MRP features the configuration for TIA is available in chapter 6. If there are questions about other software tools please contact the manufacturer.

4.1 Installing the GSDML file

If Hohner encoders are used for the first time it is necessary to install the GSDML file to import encoder parameterization into the hardware catalogue of the tool:
Choose “Install GSD File...” in the “HW Config”-window of the project (menu item “Options”) and select the GSDML-file.

The GSDML file is supplied by Hohner. In order to represent the encoder with a bitmap in STEP7 the bitmap file will be installed automatically with the GSDML file – both files must be in the same directory. The main number of the “Software Release” in the GSDML file and the Firmware must be the same, i.e. 12.xx.

After the successful installation of the GSDML file the Hohner encoder can be found in the hardware catalog under “PROFINET-IO” – “Additional Field Devices” – “Encoders” – “Hohner XCD”.

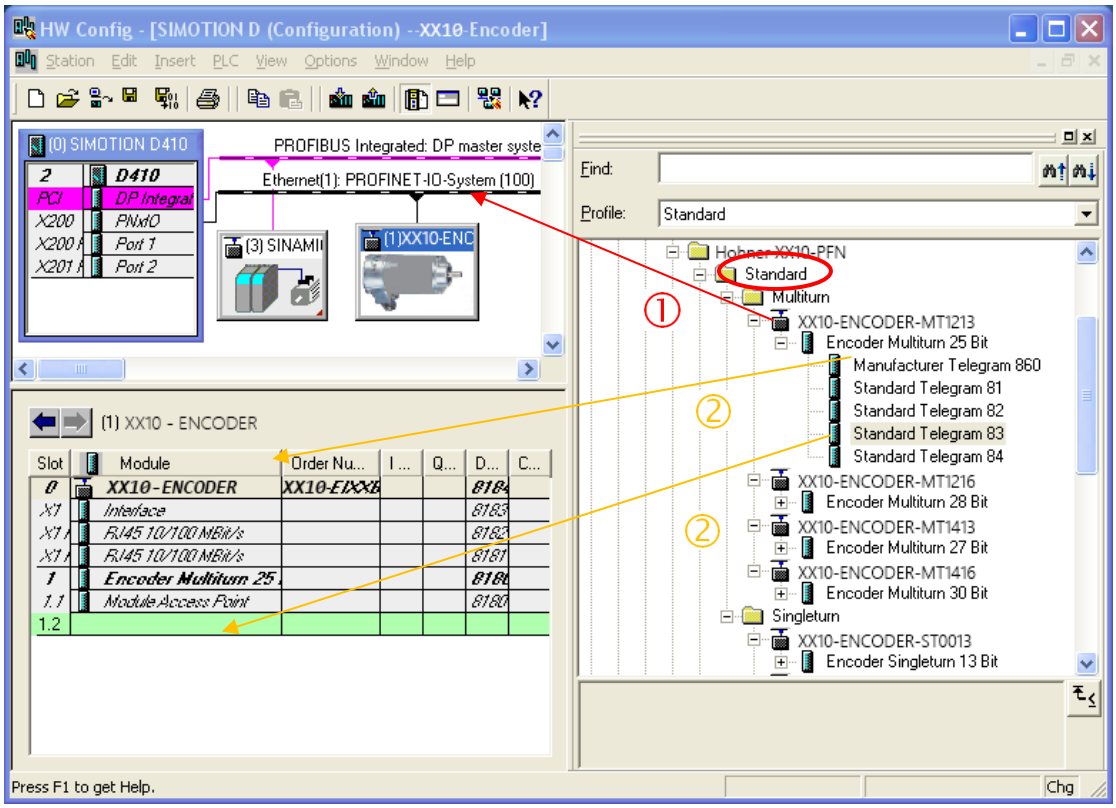
(Possibly, you need to update the hardware catalog by choosing “Options” -> “Update catalog”).

4.2 Engineering a Hohner encoder into a STEP7 project

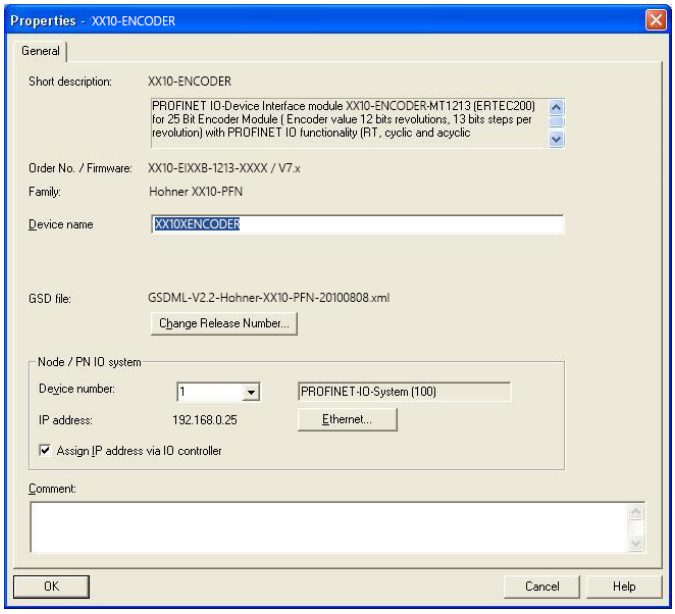
To engineer the rotary encoder into a project, drag the device “XX10 HOHNER…” on to an existing PROFINET ethernet network (or choose the network and double-click the “XCD encoder” icon). See the red arrow. Then move the telegram to the free slot (orange arrow).

Standard Encoder with PDEV

Asynchronous + RT- + IRT-Communication for Controller which supports IRT functionality (Standard)



Double-click the rotary encoder icon to set communication parameters that the PLC will use. Set a device name and by clicking “Ethernet” the IP address of the Hohner Automation encoder. Also, under the “IO cycle” tab, set the desired update time.



The device name and IP address now have to be set physically within the rotary encoder. Connect the PLC and rotary encoder via ethernet and switch them on. Click “PLC” -> “Ethernet” -> “Edit Ethernet Node” and click “Browse” for accessible ethernet nodes in the new window. STEP7 will scan for devices on Ethernet and will display them in a window. The rotary encoder should be displayed under the device type “Hohner XCD”. Select this entry and click “Flash” to have the identification LED flash with 2 Hz. Click “OK” to take the MAC address of the chosen device to the previous window and select “Use IP parameters”. The MAC address is available on the type label on the bottom left (see picture below). Enter the IP address (and subnet mask) for the encoder that you previously assigned and click “Assign IP configuration”. Also, enter the device name previously chosen in the text field “Device name” and click “Assign Name”.

Please note:

If more than one rotary encoder is used in the same PROFINET network, each encoder must have a different name and each encoder must be assigned its name before another is connected to the network.

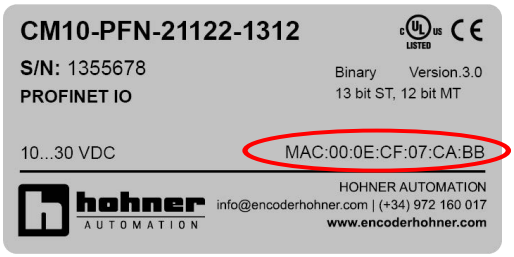
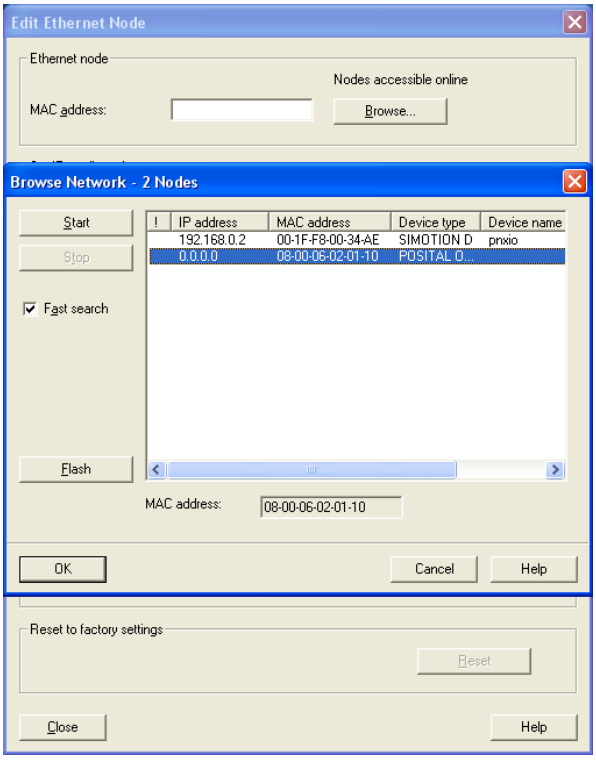
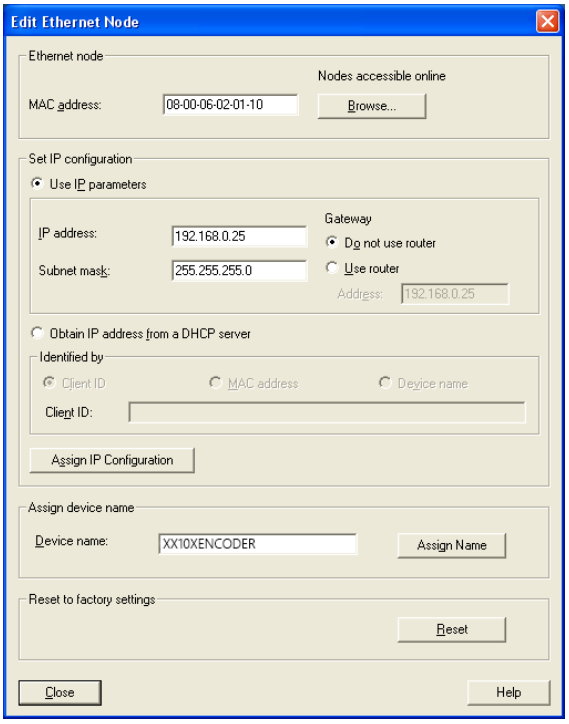


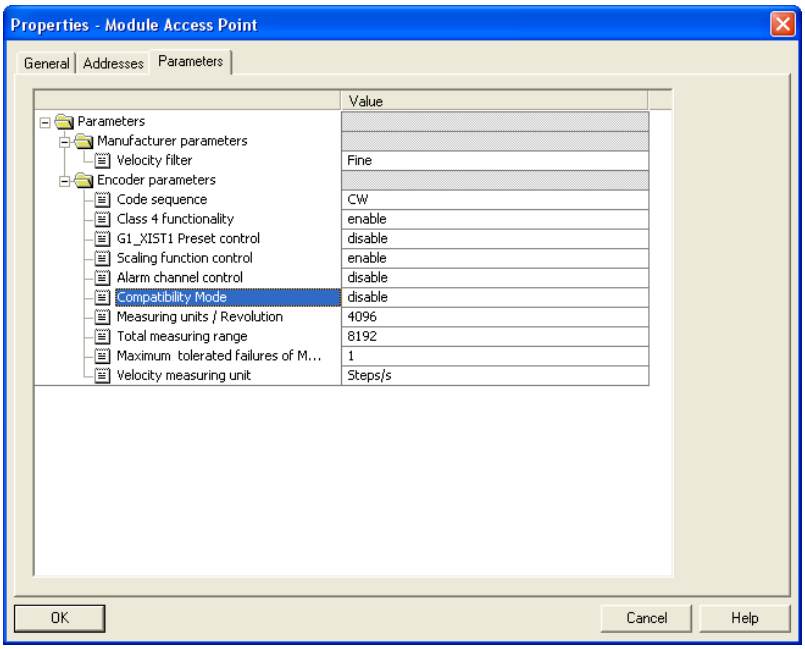
Figure 12: Type label with MAC-Address





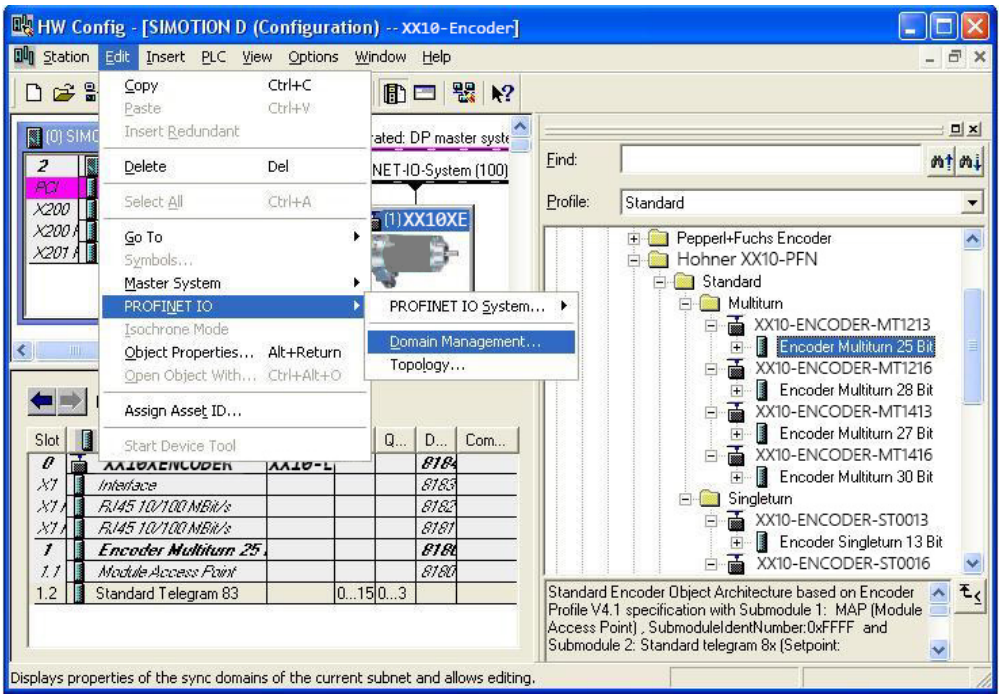
4.3 Module Access Point Parameter setup :

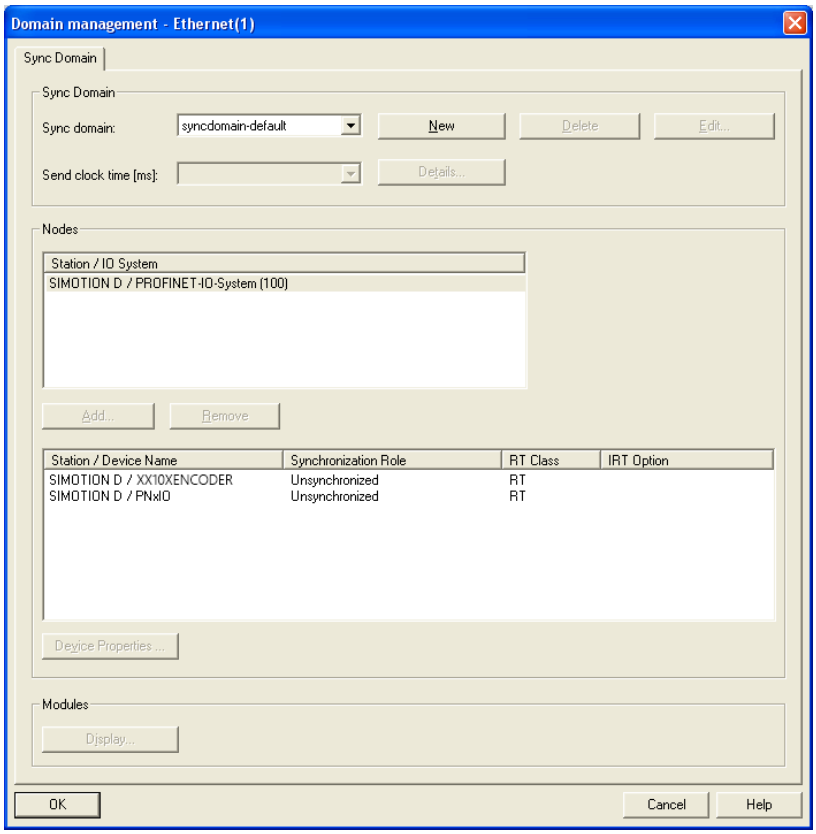
A double click on the Module Access Point will open the window with the list of parameters. This parameters will transmit to the encoder on each start of the PLC.



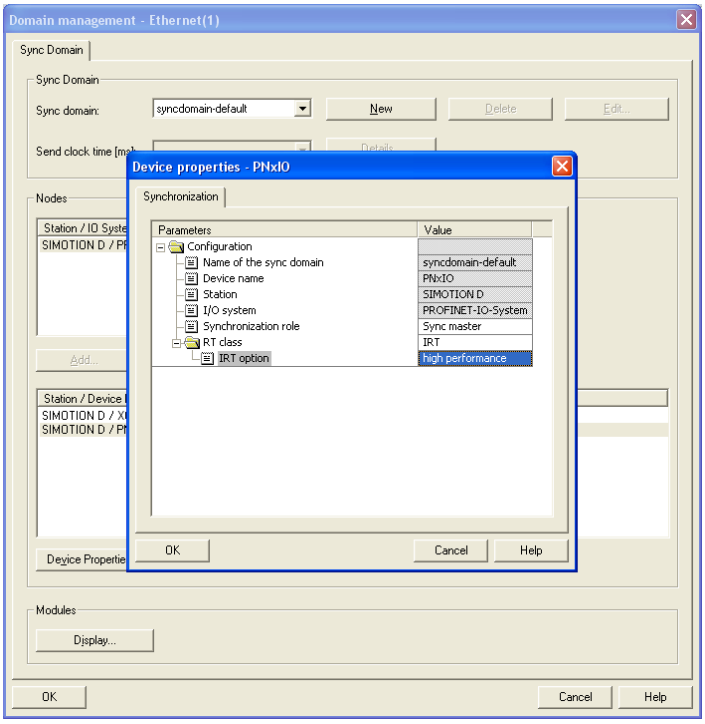
4.4 HW Config IRT-Setup:

On the next screenshots are the necessary steps available for an IRT communication.

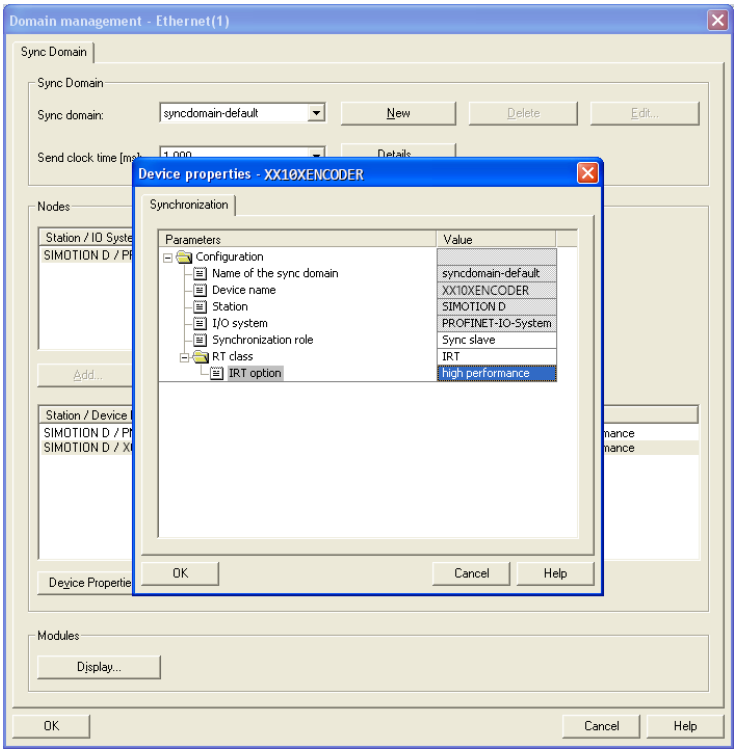




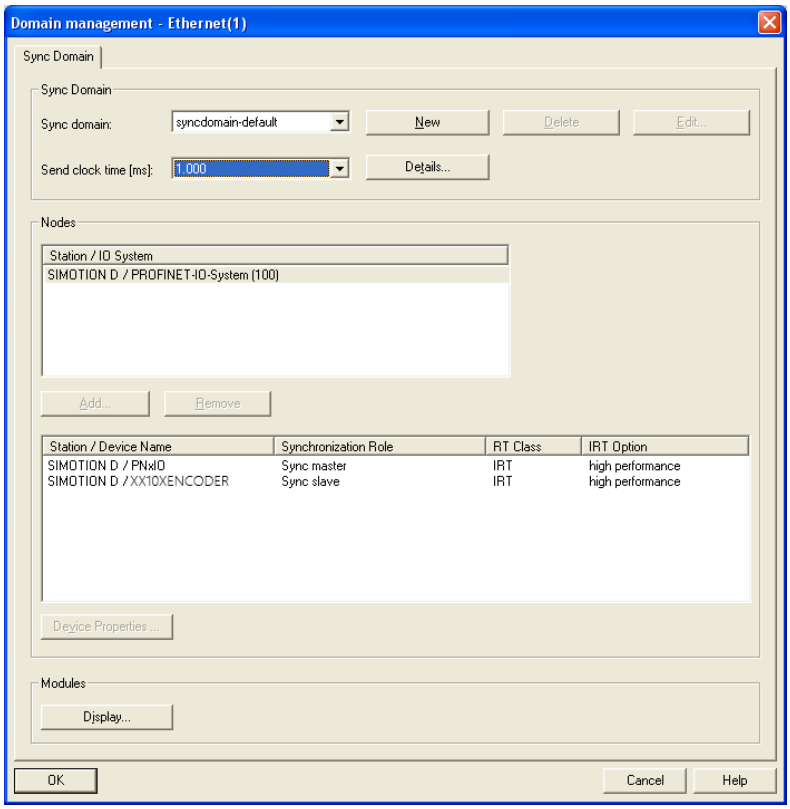
IRT- Domain Management **Controller**



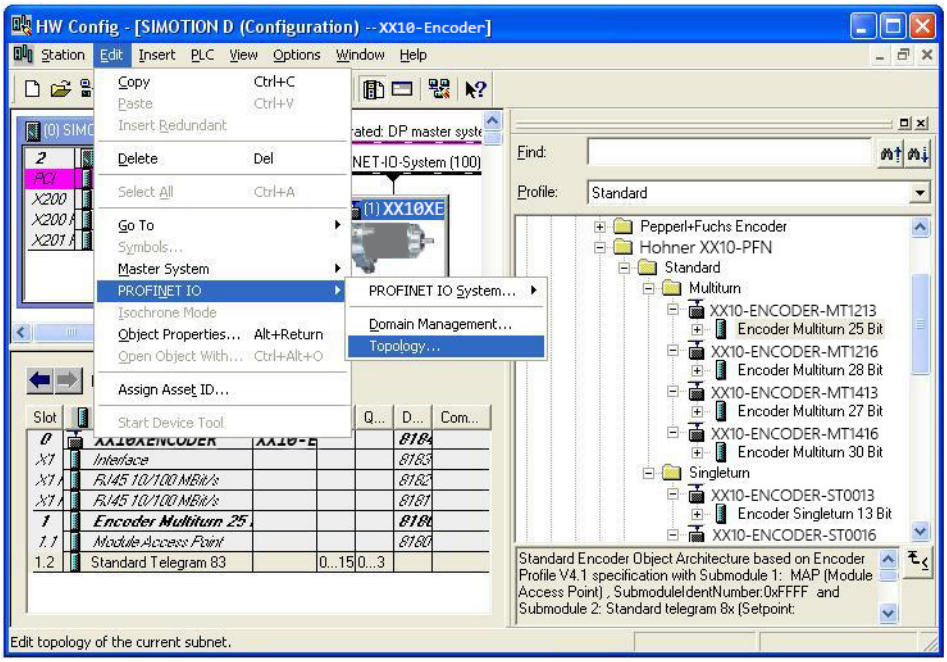
IRT- Domain Management **Encoder**:



Sync Clock:


Domain management - Ethernet(1)
Sync Domain
Sync Domain
Sync domain:
syncdomain-default
New
Delete
Edit...
Send clock time [ms]:
1.000
Details...
Nodes
Station / IO System
SIMOTION D / PROFINET-IO-System (100)
Add...
Remove
Station / Device Name
Synchronization Role
RT Class
IRT Option
SIMOTION D / PNxIO
Sync master
IRT
high performance
SIMOTION D / XX10XENCODER
Sync slave
IRT
high performance
Device Properties ...
Modules
Display...
OK
Cancel
Help

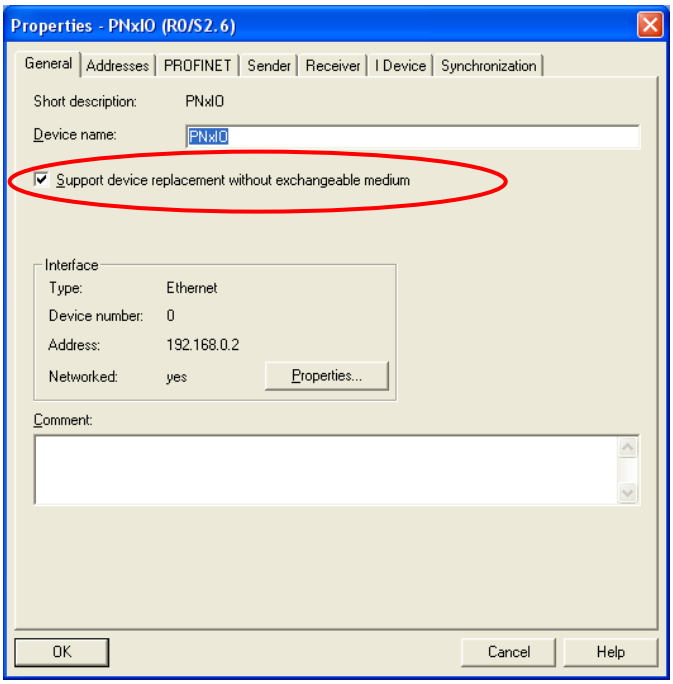
4.5 IRT-Topology...



4.6 LLDP (Link Layer Discovery Protocol)

The Link Layer Discovery Protocol allows replacing a device of the Profinet-network. The partner port before and behind of the replaced device save relevant information so that no additional configuration is necessary.

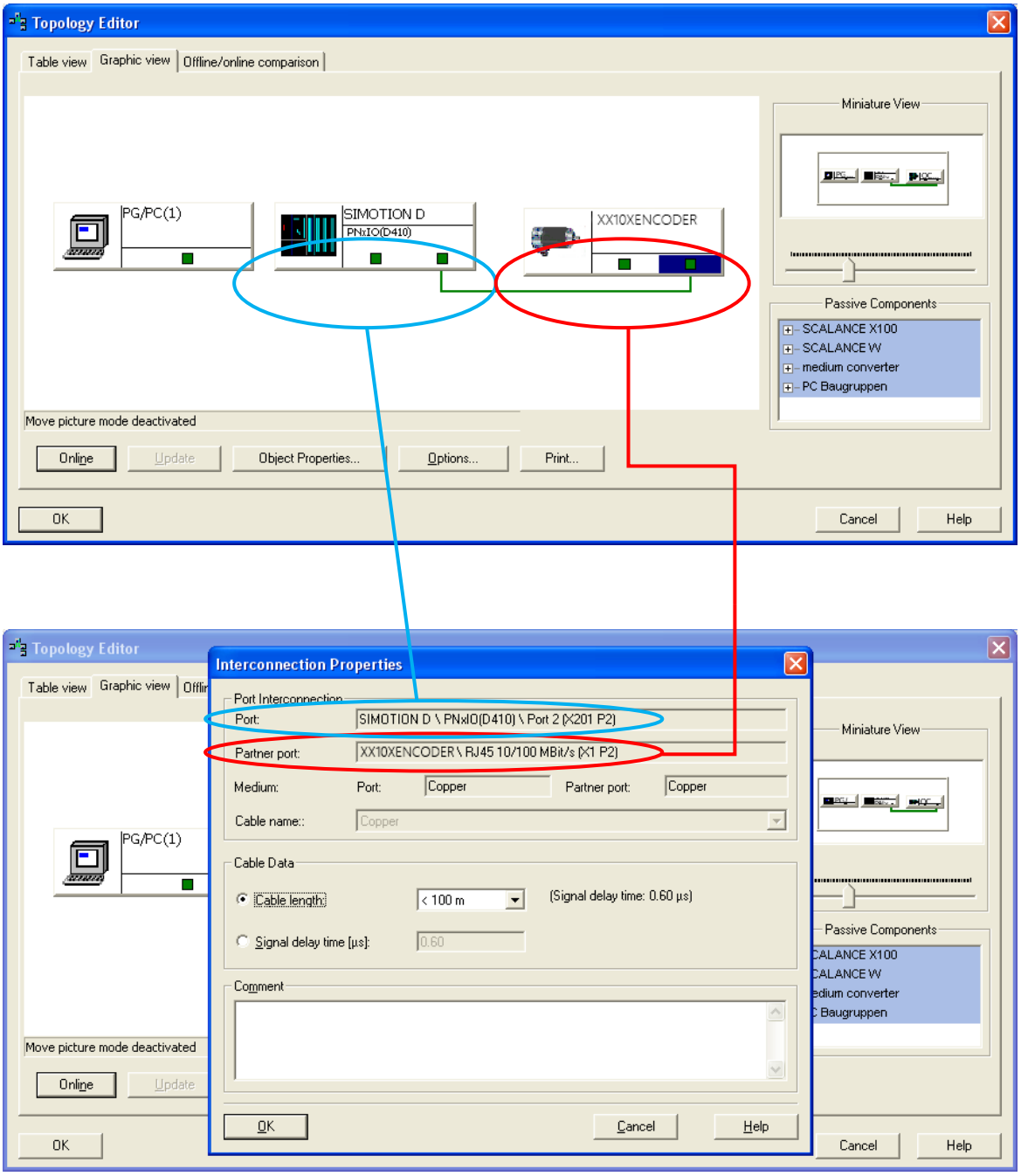
But to activate "**Support Device replacement without replacement medium"** the related box must be ticked in Object Properties Interface under the General tab. Another name of this functionality is "Neighborhood detection".



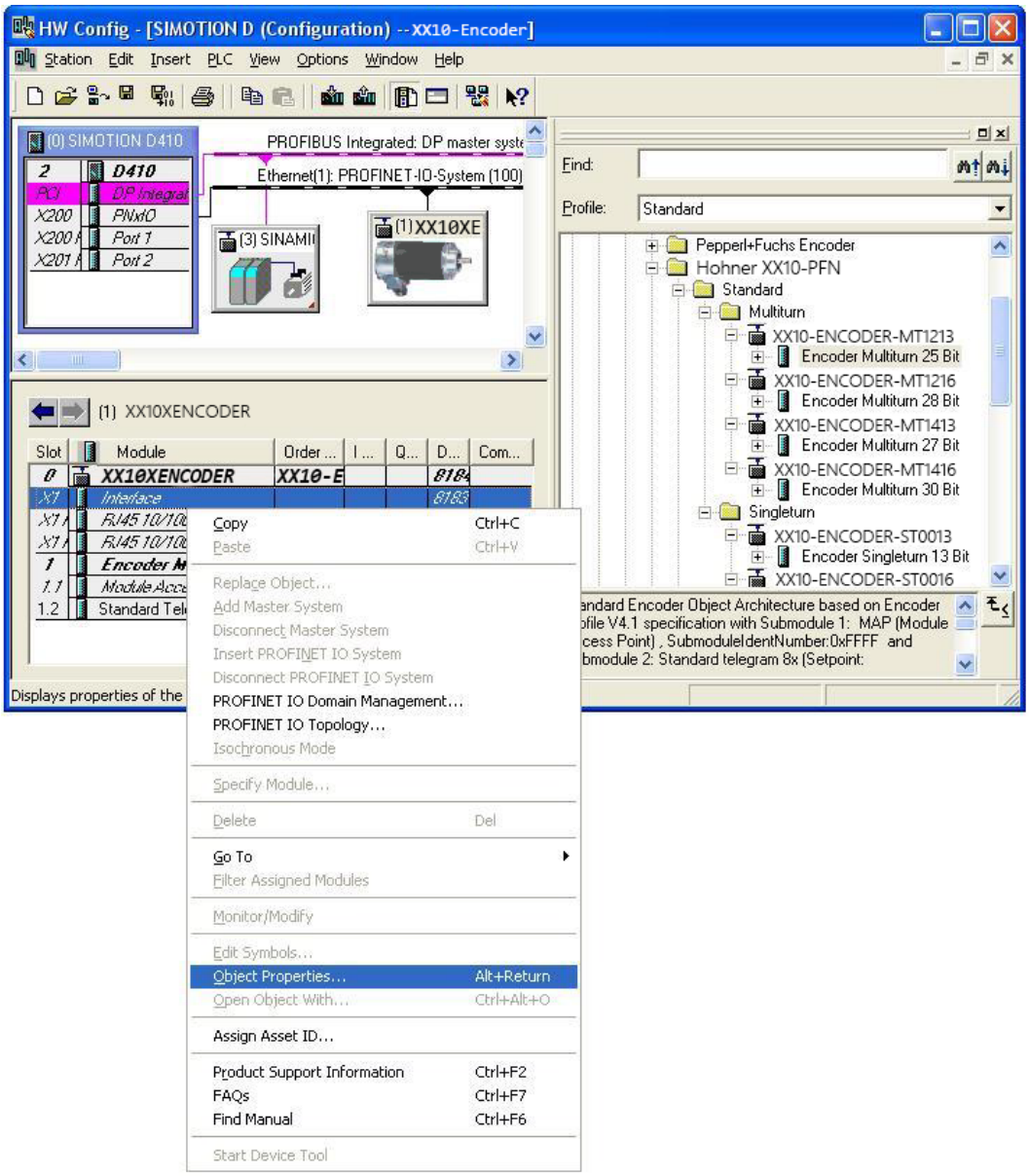
Topology-setup

To fulfill the “Neighborhood detection” it is necessary to use for the replaced encoder the same port assignment.

In the following example is Port 2 of the PLC and Port 2 of the encoder connected. If the encoder will be replaced, then the same configuration is necessary. Otherwise the PLC detect that the configuration is not equal to the online connection.

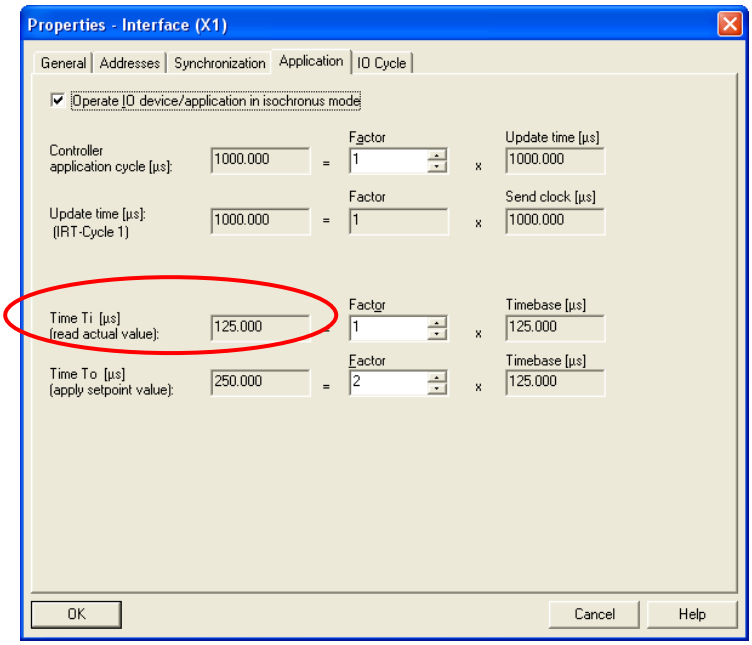


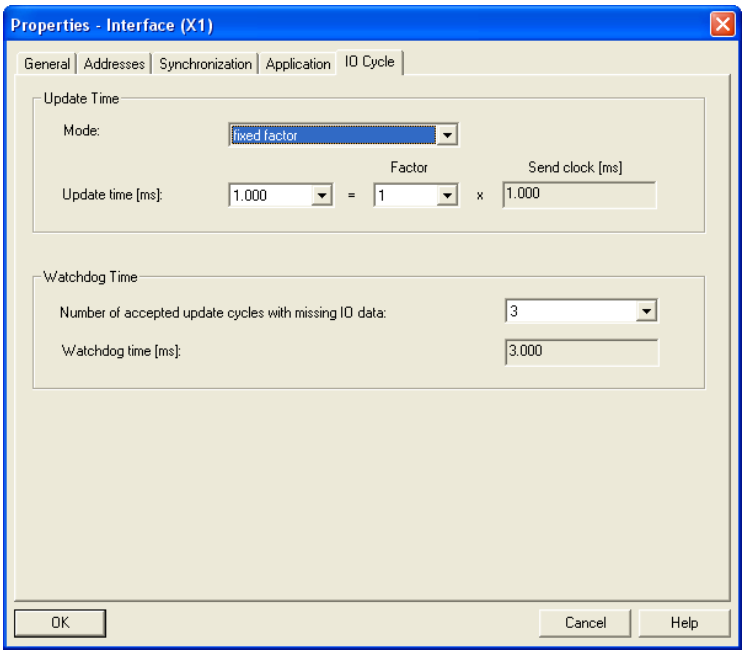
IRT- Encoder Interface X1 Dialog:



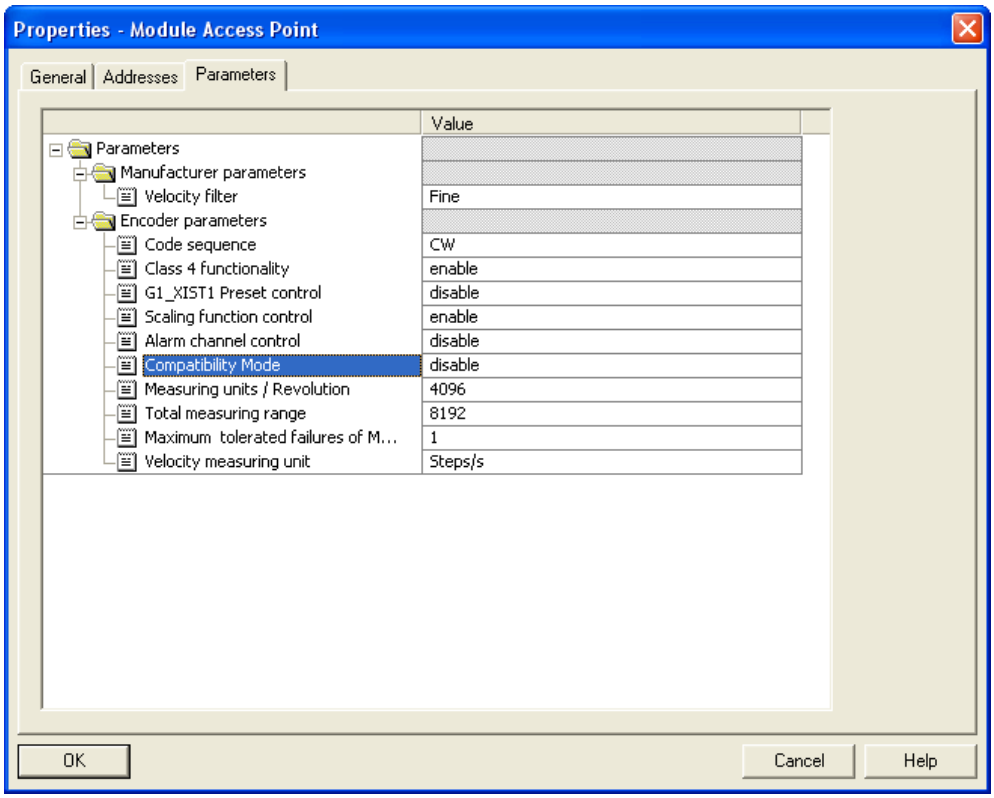
IRT- Encoder interface X1 Tab Application:

The minimum time for **Ti** is 125µs.





IRT- Sign-Of-Life in Dialog Module Access Point Slot 1 Subslot 1: Only for IRT applications



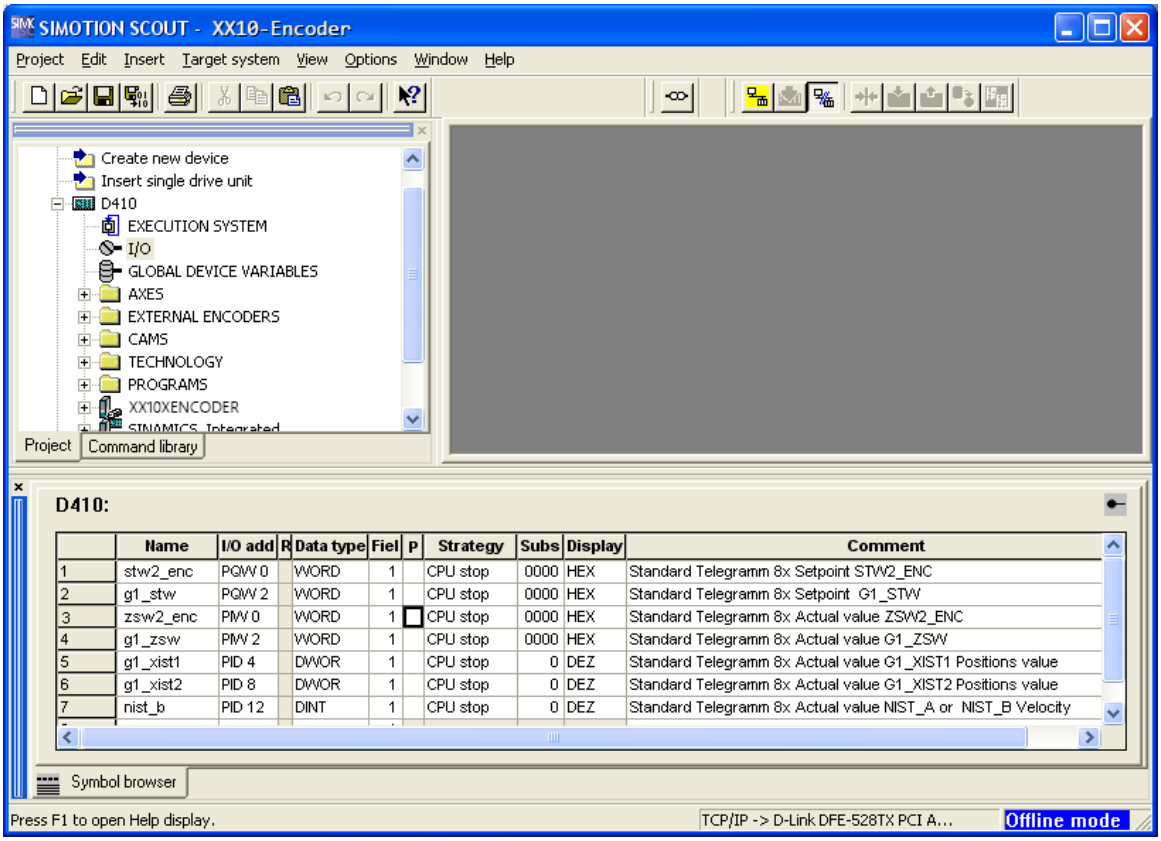
Controller Life Sign Monitoring:

- IRT- Sign-Of-Life Monitoring *active*:
  Compatibility mode disable

- IRT- Sign-Of-Life Monitoring *not active*:
  Compatibility mode enable

4.7 SIMOTION SCOUT

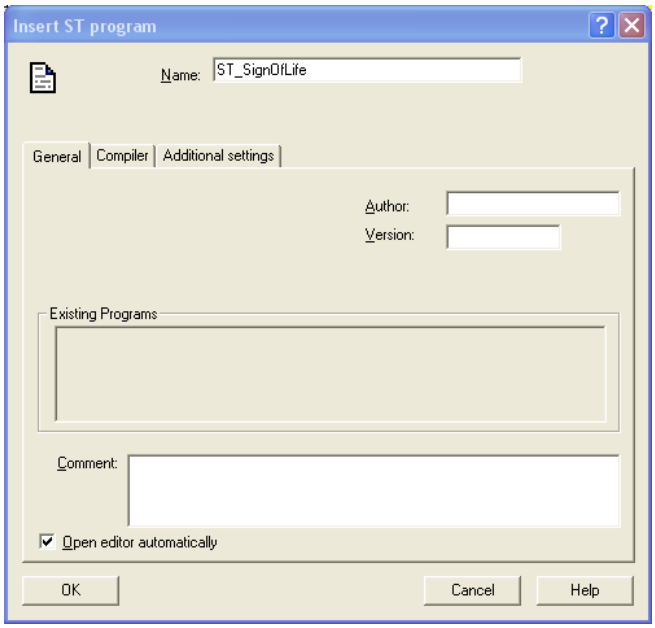
IO- Create IO table

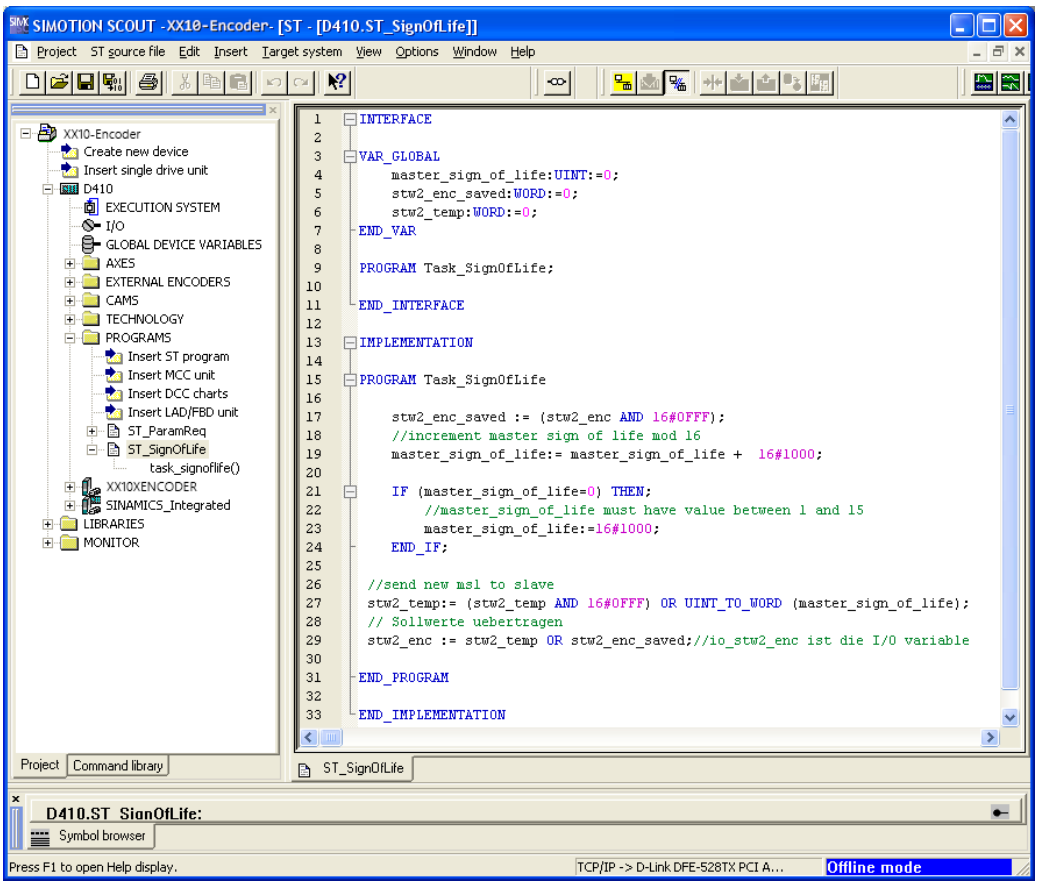


	Name	I/O add	R	Data type	Fiel	P	Strategy	Subs	Display	Comment
1	stw2_enc	PQW 0		WORD	1		CPU stop	0000	HEX	Standard Telegramm 8x Setpoint STW2_ENC
2	g1_stw	PQW 2		WORD	1		CPU stop	0000	HEX	Standard Telegramm 8x Setpoint G1_STW
3	zsw2_enc	PIW 0		WORD	1		CPU stop	0000	HEX	Standard Telegramm 8x Actual value ZSW2_ENC
4	g1_zsw	PIW 2		WORD	1		CPU stop	0000	HEX	Standard Telegramm 8x Actual value G1_ZSW
5	g1_xist1	PID 4		DWOR	1		CPU stop	0	DEZ	Standard Telegramm 8x Actual value G1_XIST1 Positions value
6	g1_xist2	PID 8		DWOR	1		CPU stop	0	DEZ	Standard Telegramm 8x Actual value G1_XIST2 Positions value
7	nist_b	PID 12		DINT	1		CPU stop	0	DEZ	Standard Telegramm 8x Actual value NIST_A or NIST_B Velocity

SIMOTION SCOUT IRT Setup:
Sign-Of-Life Monitoring for Motion synchronous Application

Creating Sign-Of-Life Program: Insert ST Program

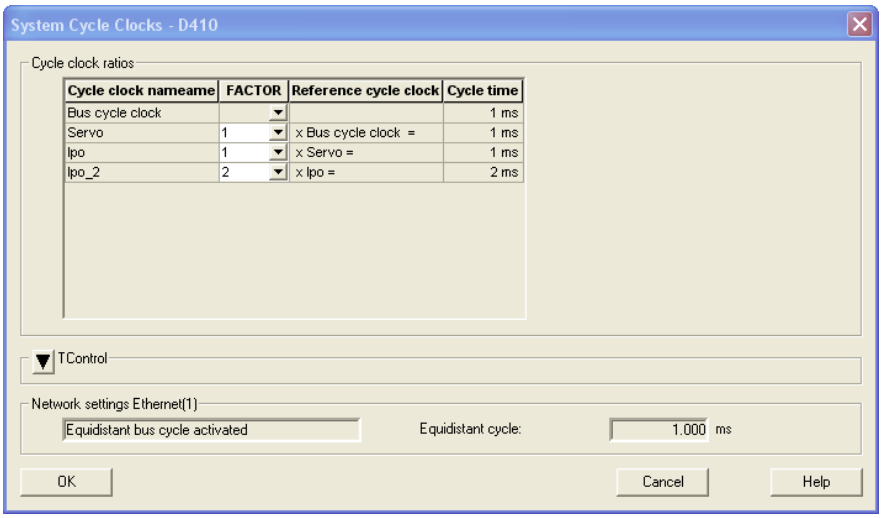




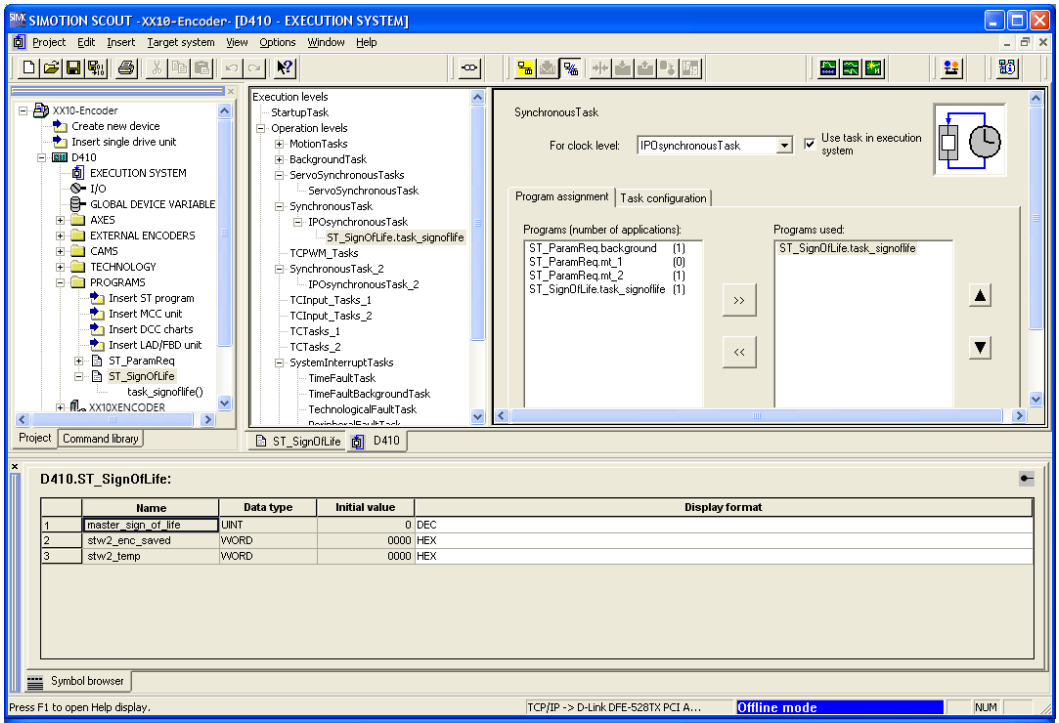
ST-SignOfLife Code edit

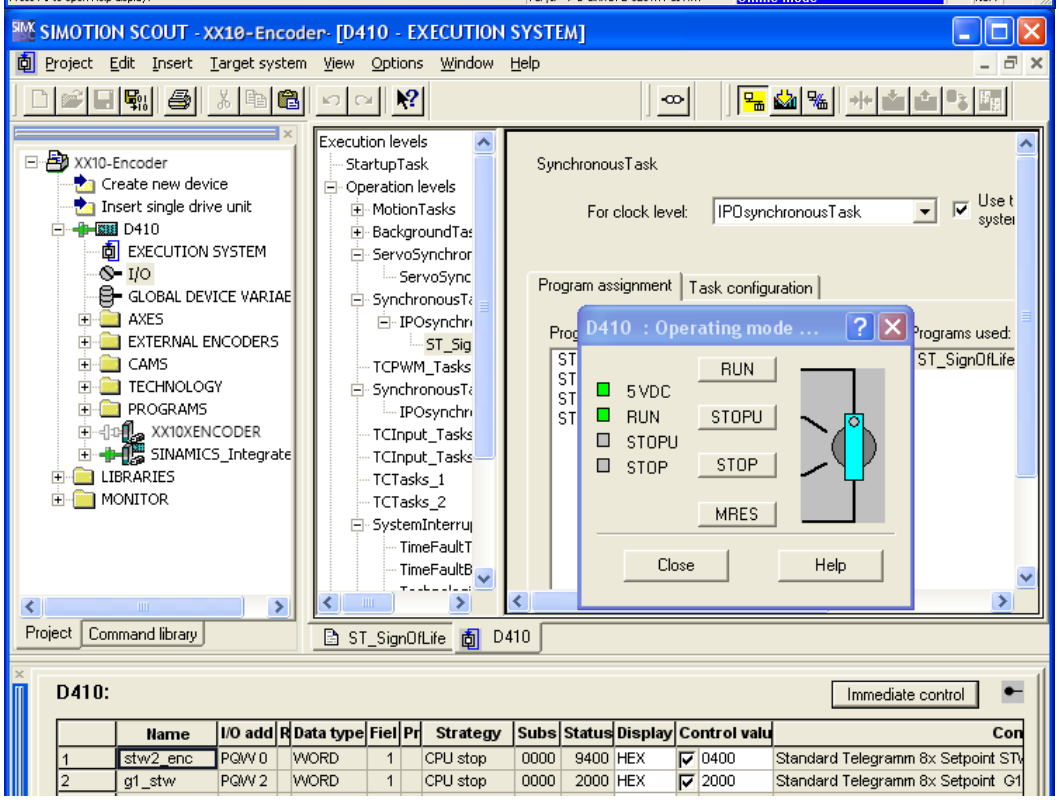
```
INTERFACE

VAR_GLOBAL
    master_sign_of_life:UINT:=0;
    stw2_enc_saved:WORD:=0;
    stw2_temp:WORD:=0;
END_VAR

PROGRAM Task_SignOfLife;

END_INTERFACE

IMPLEMENTATION

PROGRAM Task_SignOfLife

    stw2_enc_saved := (stw2_enc AND 16#0FFF);
    //increment master sign of life mod 16
    master_sign_of_life:= master_sign_of_life +  16#1000;

    IF (master_sign_of_life=0) THEN;
        //master_sign_of_life must have value between 1 and 15
        master_sign_of_life:=16#1000;
    END_IF;

 //send new msl to slave
 stw2_temp:= (stw2_temp AND 16#0FFF) OR UINT_TO_WORD
(master_sign_of_life);
 // Sollwerte uebertragen
 stw2_enc := stw2_temp OR stw2_enc_saved;
//io_stw2_enc ist die I/O variable

END_PROGRAM

END_IMPLEMENTATION
```

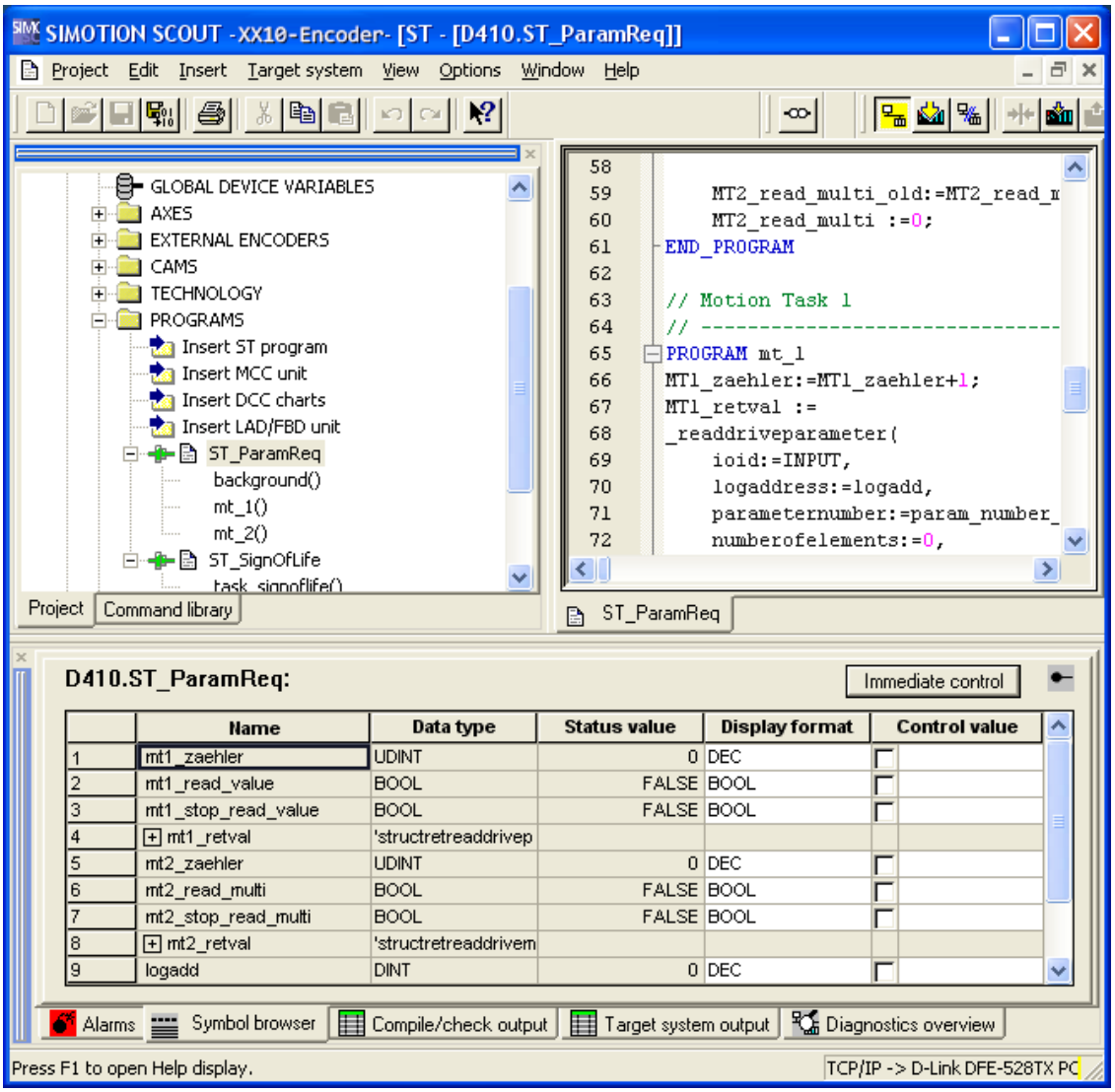
Simotion System clock setup:



Append SignOfLife-Program on IPOSynchronous task:



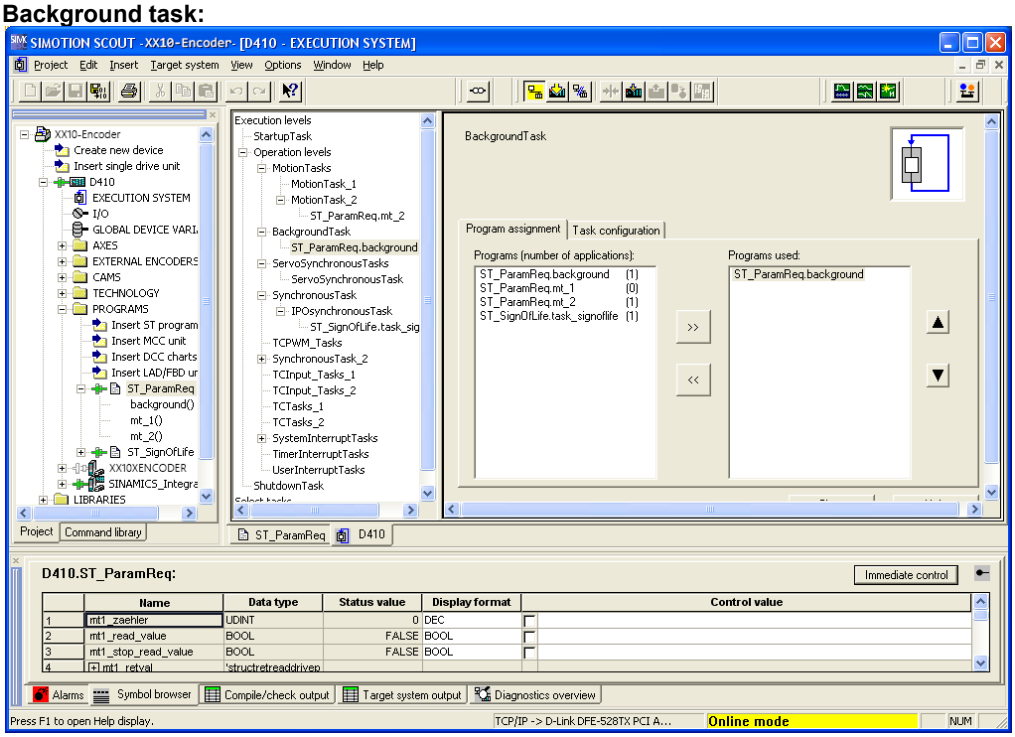



SIMOTION SCOUT -XX10-Encoder- [ST - [D410.ST_ParamReq]]
Project Edit Insert Target system View Options Window Help
GLOBAL DEVICE VARIABLES
AXES
EXTERNAL ENCODERS
CAMS
TECHNOLOGY
PROGRAMS
Insert ST program
Insert MCC unit
Insert DCC charts
Insert LAD/FBD unit
ST_ParamReq
background()
mt_1()
mt_2()
ST_SignOfLife
Project
Command library
58
59 MT2_read_multi_old:=MT2_read_m
60 MT2_read_multi :=0;
61 END_PROGRAM
62
63 // Motion Task 1
64 // ----------
65 PROGRAM mt_1
66 MT1_zaehler:=MT1_zaehler+1;
67 MT1_retval :=
68 _readdriveparameter(
69 ioid:=INPUT,
70 logaddress:=logadd,
71 parameternumber:=param_number_
72 numberofelements:=0,
ST_ParamReq
D410.ST_ParamReq:
Immediate control
Name
Data type
Status value
Display format
Control value
1 mt1_zaehler UDINT 0 DEC
2 mt1_read_value BOOL FALSE BOOL
3 mt1_stop_read_value BOOL FALSE BOOL
4 mt1_retval 'structretreaddrivep
5 mt2_zaehler UDINT 0 DEC
6 mt2_read_multi BOOL FALSE BOOL
7 mt2_stop_read_multi BOOL FALSE BOOL
8 mt2_retval 'structretreaddrivem
9 logadd DINT 0 DEC
Alarms
Symbol browser
Compile/check output
Target system output
Diagnostics overview
Press F1 to open Help display.
TCP/IP -> D-Link DFE-528TX PC

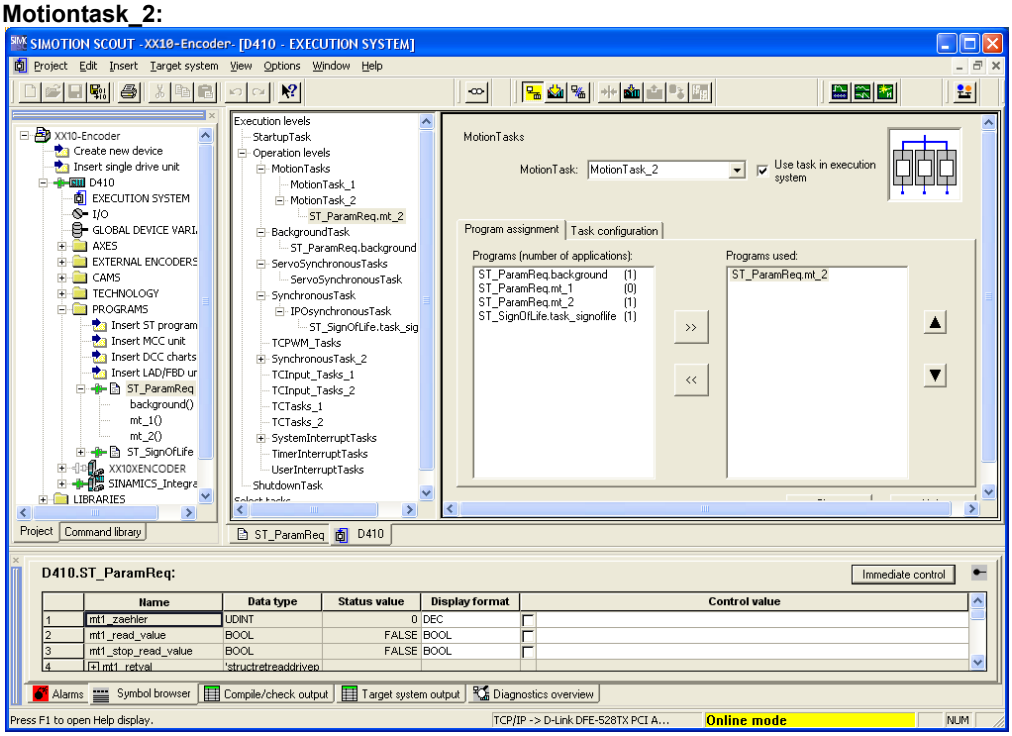
```
// PROGRAM mt_1 Read Single parameter
// PROGRAM mt_2 Read Multi parameter

INTERFACE
  PROGRAM background;
  PROGRAM mt_1;
  PROGRAM mt_2;

 END_INTERFACE

IMPLEMENTATION

VAR_GLOBAL
   //Parameter lesen
   MT1_zaehler:UDINT:=0;
   MT1_read_value:BOOL:=0;
   MT1_stop_read_value:BOOL:=0;
   MT1_retval:StructRetReadDriveParameter;

   MT2_zaehler:UDINT:=0;
   MT2_read_multi:BOOL:=0;
   MT2_stop_read_multi:BOOL:=0;
   MT2_retval:StructRetReadDriveMultiParameter;

   //Parameteraufträge allgemein
   logadd:DINT:=0;
   param_number_single:UDINT:=0;
   param_number_multi:ARRAY [0..38] OF UDINT;
   number_of_param:UDINT:=3;

END_VAR


PROGRAM Background

   VAR
      MT1_read_value_old:BOOL:=0;
      MT2_read_multi_old:BOOL:=0;
   END_VAR

   IF (MT1_read_value=1 AND MT1_read_value_old=0) THEN
      MT1_stop_read_value:=0;
      _starttask(MotionTask_1);
   END_IF;

   MT1_read_value_old:=MT1_read_value;

   number_of_param:=3;
   param_number_multi[0]:=927;
   param_number_multi[1]:=65000;
   param_number_multi[2]:=971;

   IF (MT2_read_multi=1 AND MT2_read_multi_old=0) THEN
      MT2_stop_read_multi:=0;
      _starttask(MotionTask_2);
```

```
    END_IF;

    MT2_read_multi_old:=MT2_read_multi;
    MT2_read_multi :=0;
END_PROGRAM

// Motion Task 1
// ------------------------------------------------------------
PROGRAM mt_1
MT1_zaehler:=MT1_zaehler+1;
MT1_retval :=
_readdriveparameter(
    ioid:=INPUT,
    logaddress:=logadd,
    parameternumber:=param_number_single,
    numberofelements:=0,
    subindex:=0,
    nextcommand:=WHEN_COMMAND_DONE,
    commandid:=(_getCommandID())
);
IF MT1_stop_read_value=0 THEN
    _restarttask(MotionTask_1);
ELSE
    MT1_read_value:=0;
END_IF;
END_PROGRAM

// Motion Task 2 ------------------------------------------------------------
PROGRAM mt_2
MT2_zaehler:=MT2_zaehler+1;

MT2_retval :=
_readdrivemultiparameter(
    ioid:=INPUT,
    logaddress:=logadd,
    numberofparameters:=number_of_param,
    parameternumber:=param_number_multi,
    nextcommand:=WHEN_COMMAND_DONE,
    commandid:=(_getCommandID())
);

//MT2_read_multi:=0;
IF MT2_stop_read_multi=0 THEN
    _restarttask(MotionTask_2);
ELSE
    MT2_read_multi:=0;
END_IF;
END_PROGRAM

END_IMPLEMENTATION
```

Background task:



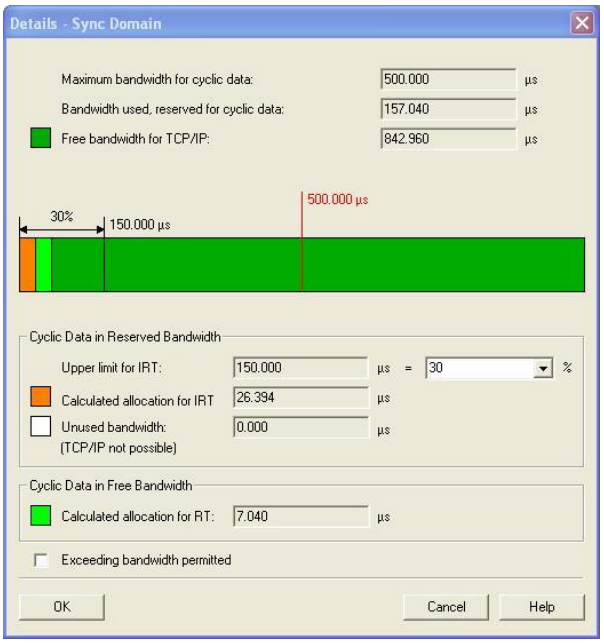
Motiontask_2:



5. IRT communication

5.1 IRT settings

It is possible to set the upper limit for IRT transmission. In chapter 4.5 is a configuration example for Step 7 available.



5.2 Configuration of Sign-Of-Life errors

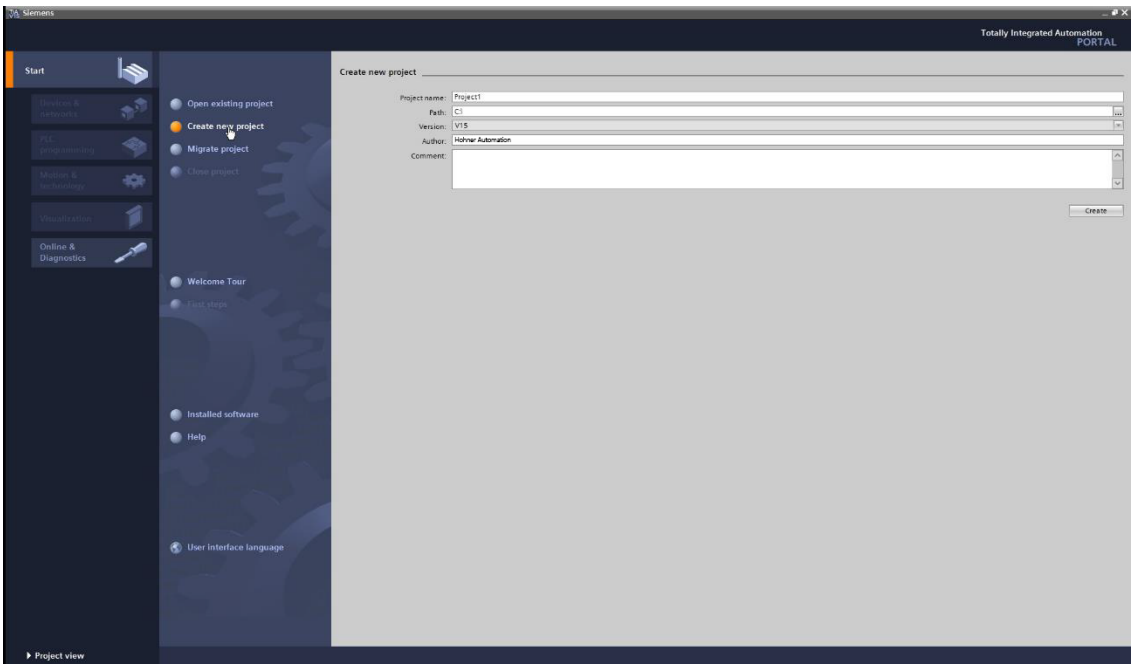
The maximal allowed Sign-Of-Life errors can be defined via the GSDML configuration or via Parameter P925. For details please check the related Encoder Profile.

5.3 Error codes in Diagnosis parameter

Please check chapter 3.11.16.

6. Configuring with TIA-Portal

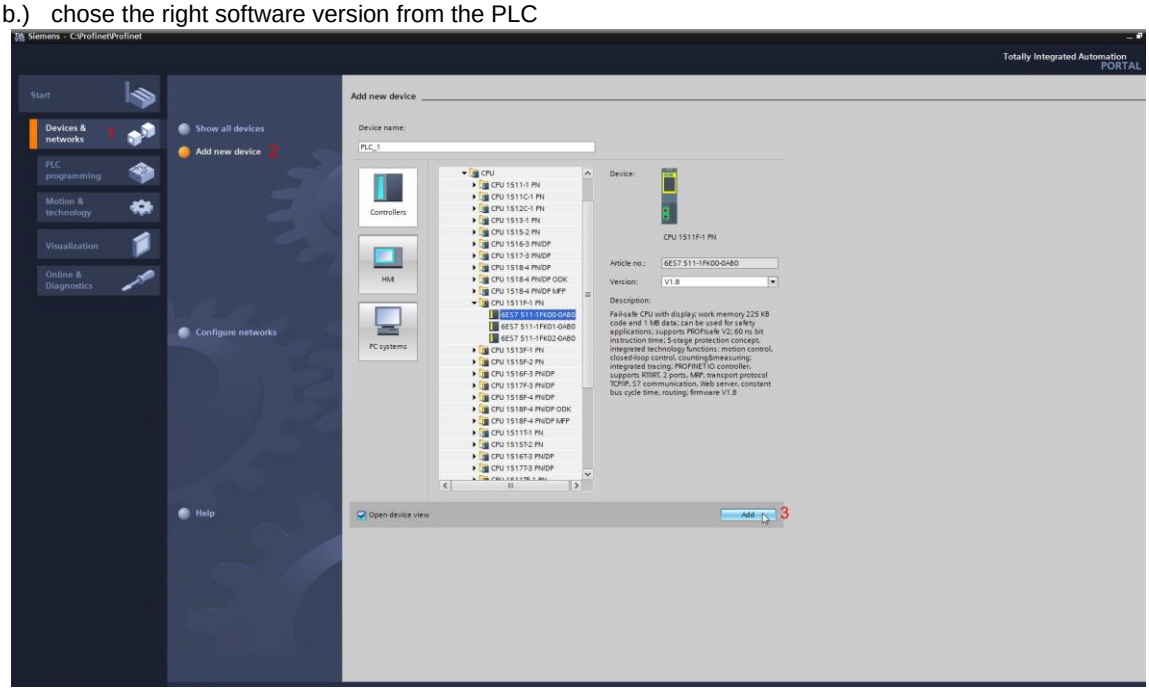
6.1 Create a new Project



6.2 Add device

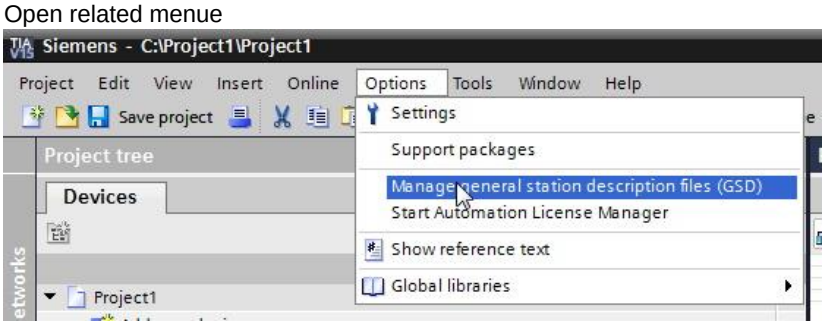
a.) chose the needed PLC

b.) chose the right software version from the PLC

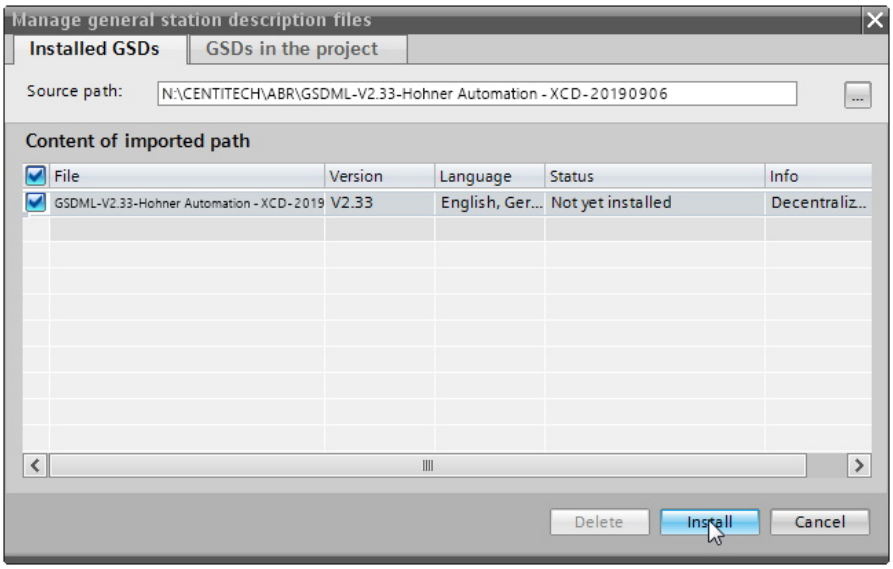


6.3 Install GSD file (only one time necessary)

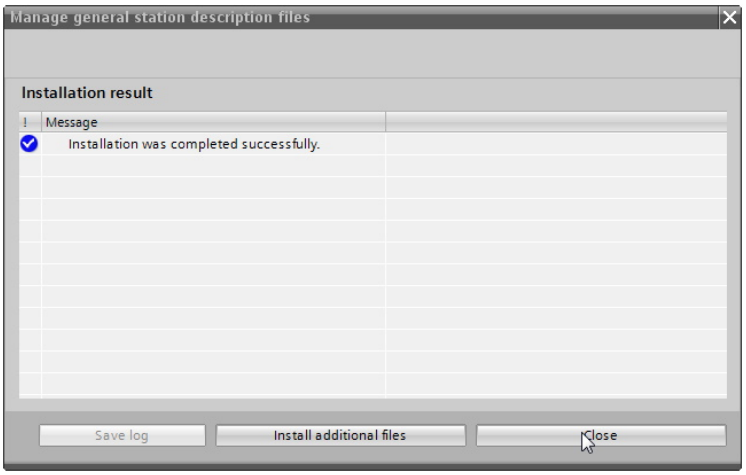
6.3.1 Open related menue



6.3.2 Select the related GSD file

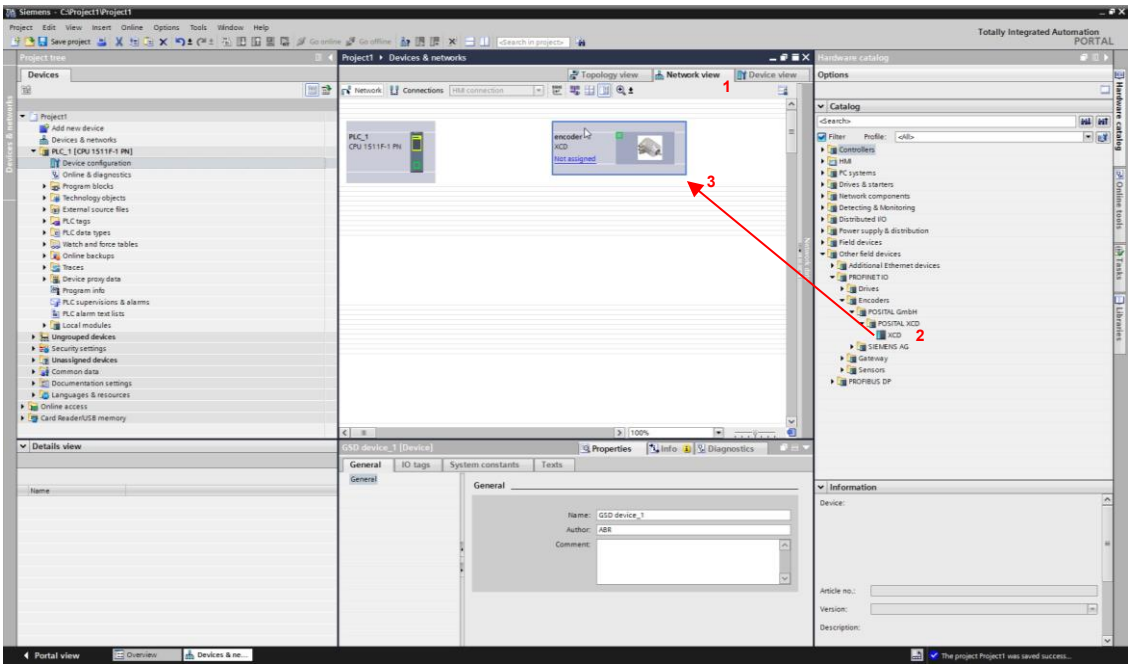


6.3.3 Install

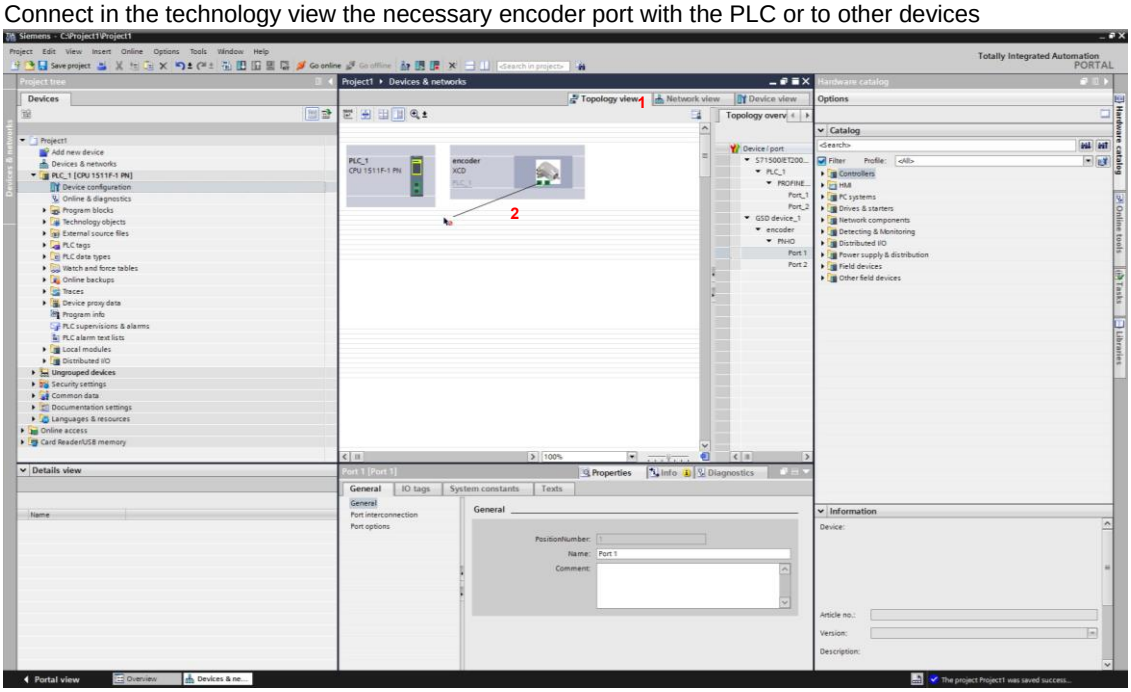


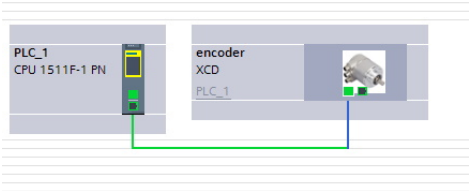
6.4 Encoder project

6.4.1 Add encoder to network

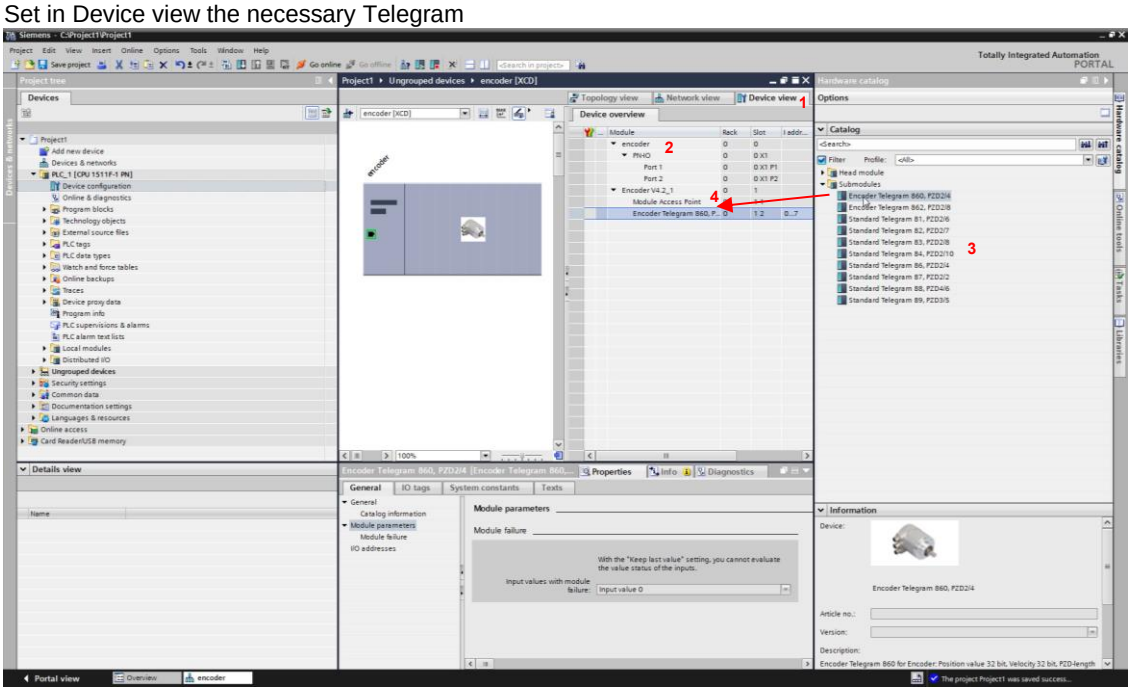


6.4.2 Connect in the technology view the necessary encoder port with the PLC or to other devices

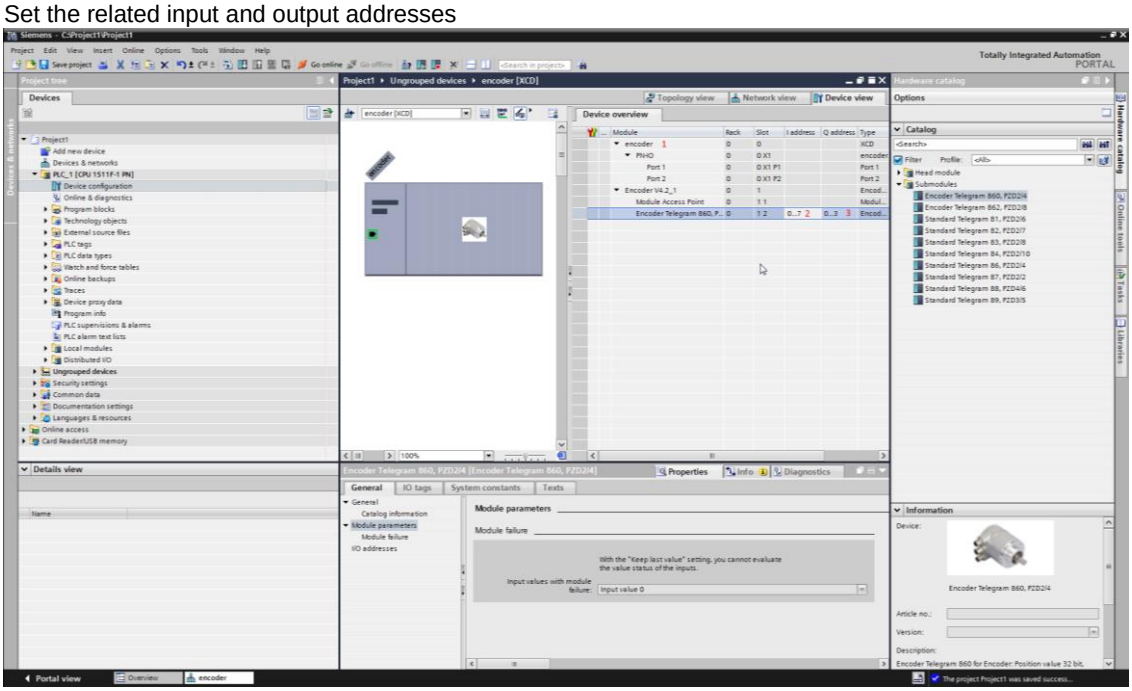




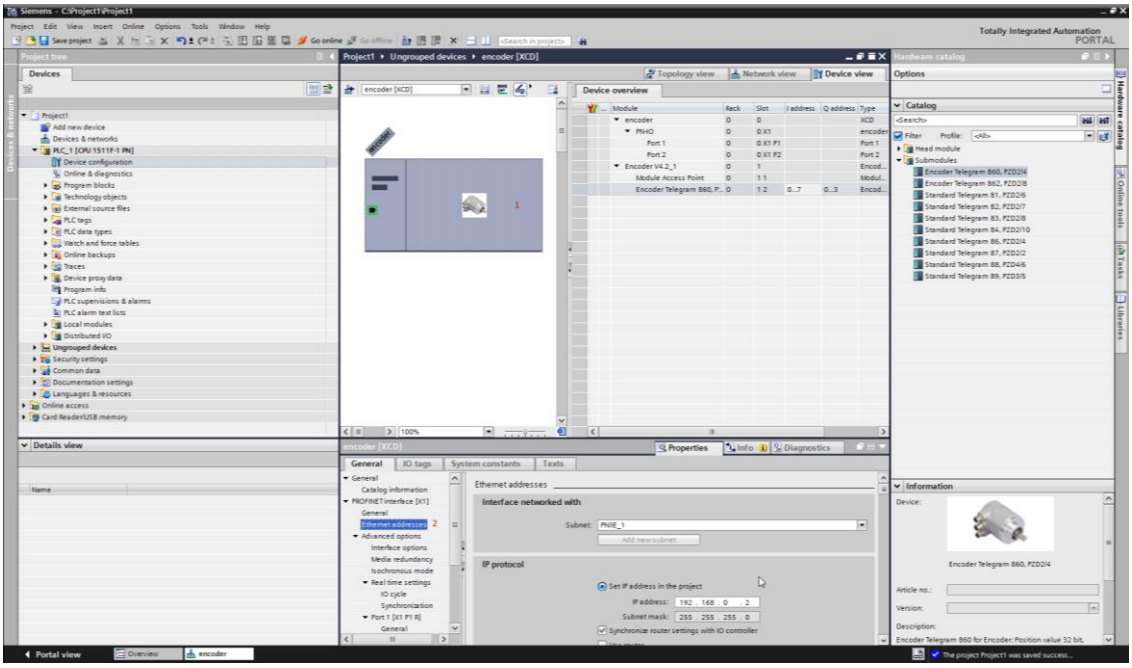
6.4.3 Set in Device view the necessary Telegram



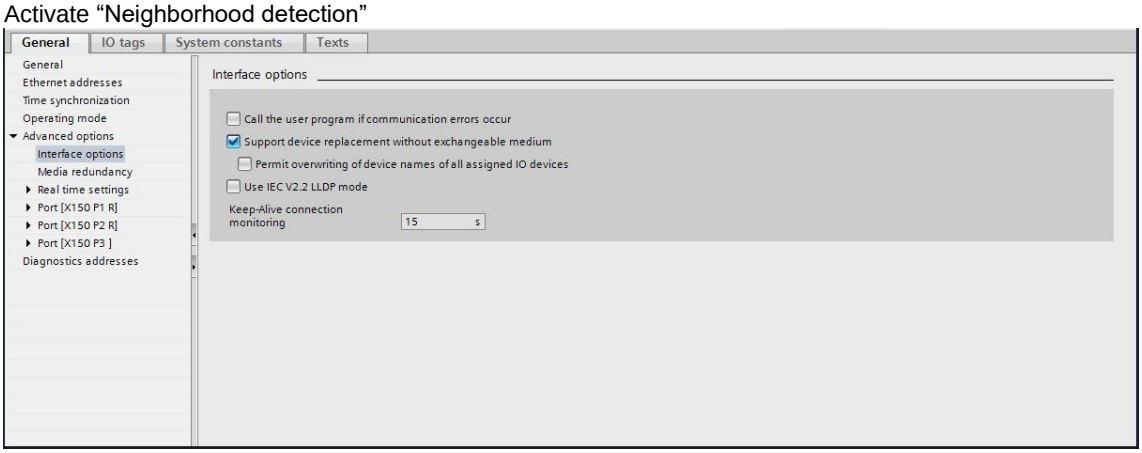
6.4.4 Set the related input and output addresses



6.4.5 Set the IP-Address

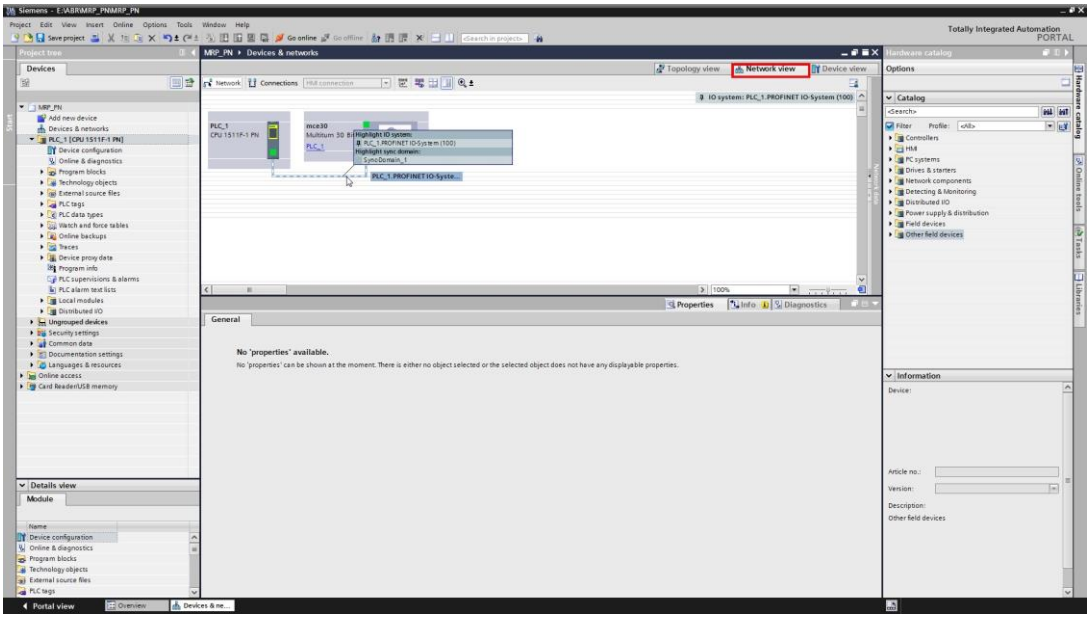


6.5 Activate “Neighborhood detection”

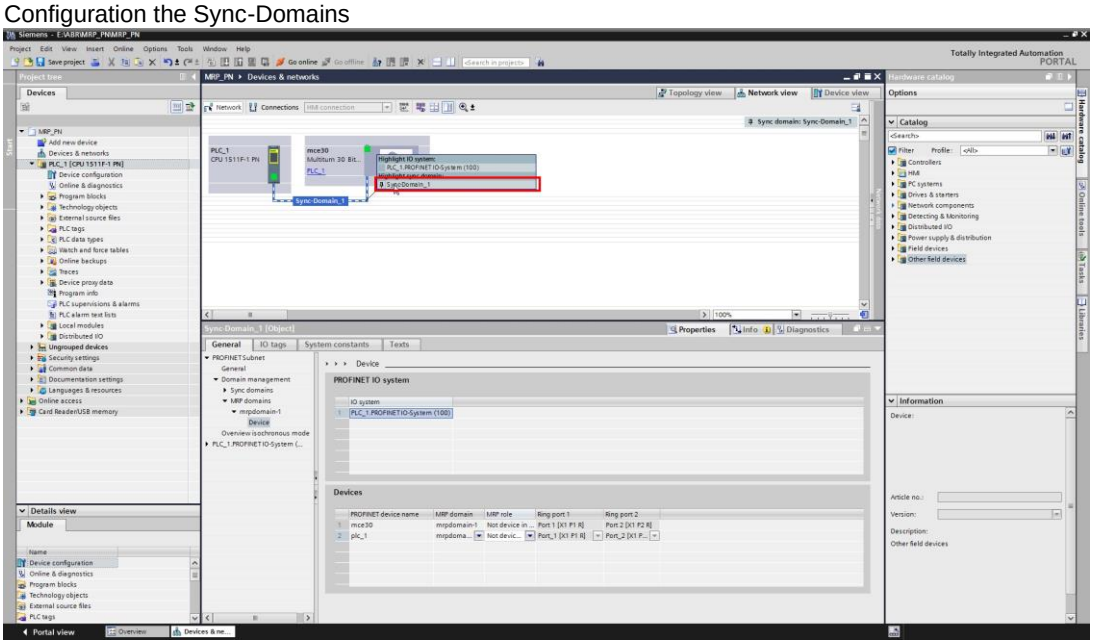


6.6 Configuration MRP (only if required)

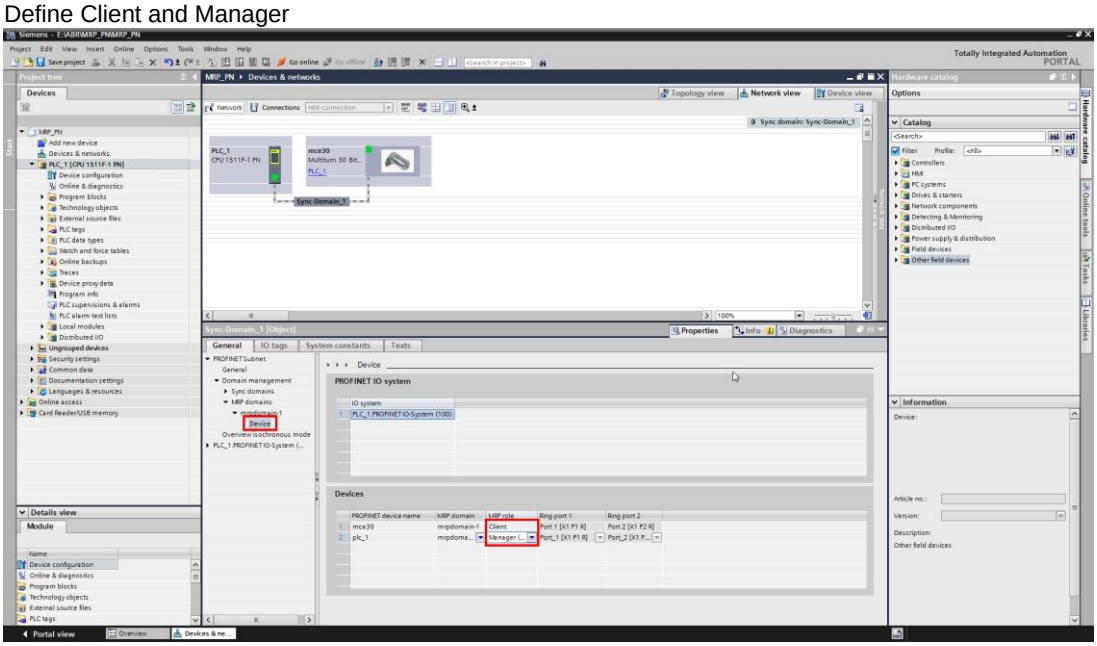
6.6.1 Select the network



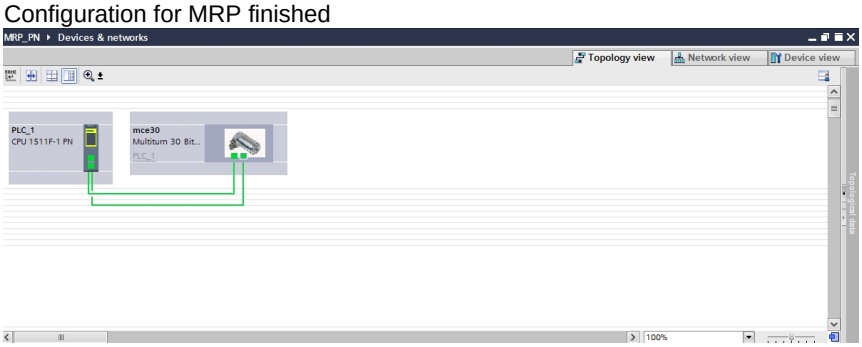
6.6.2 Configuration the Sync-Domains



6.6.3 Define Client and Manager

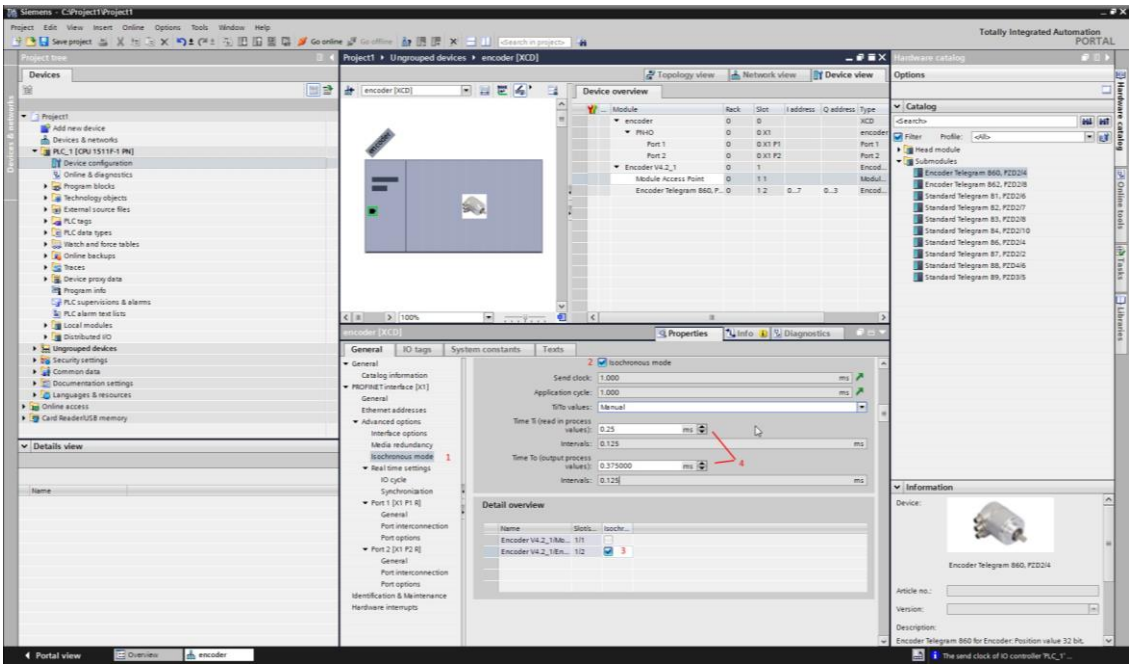


6.6.4 Configuration for MRP finished

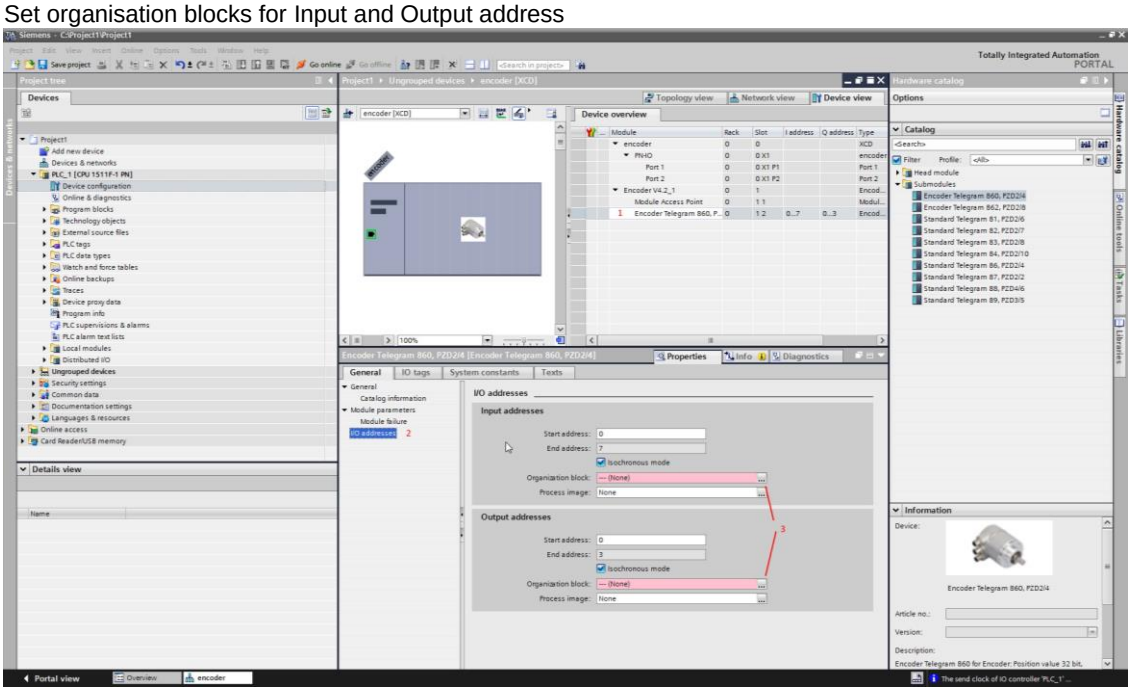


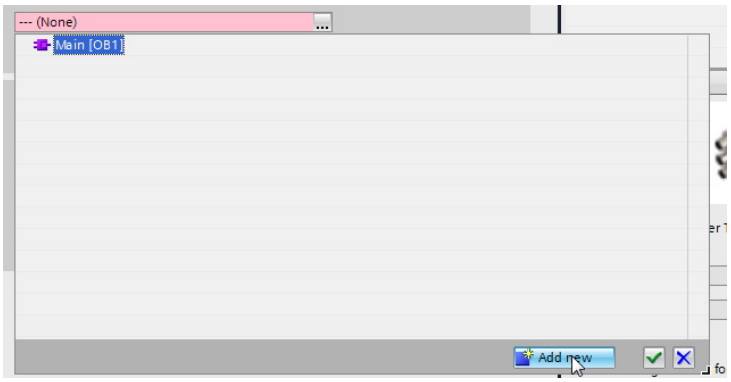
6.7 Set IRT settings (only necessary for isochronous operation)

6.7.1 Activate Isochronous mode and set Ti and To

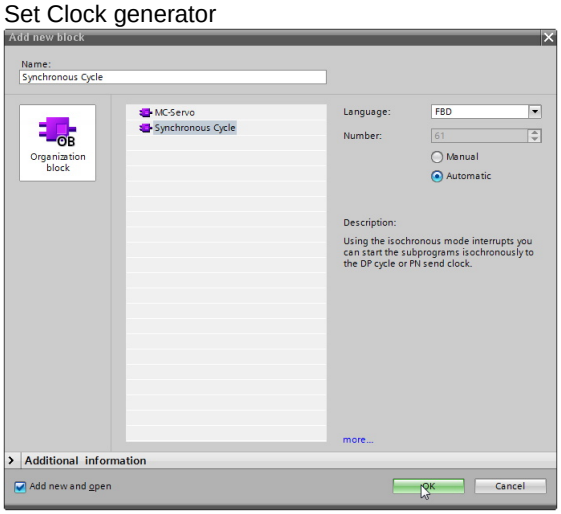


6.7.2 Set organisation blocks for Input and Output address

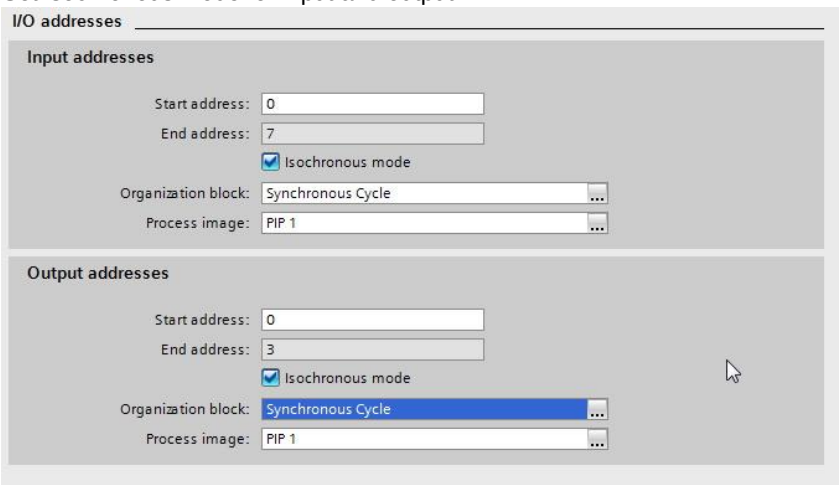




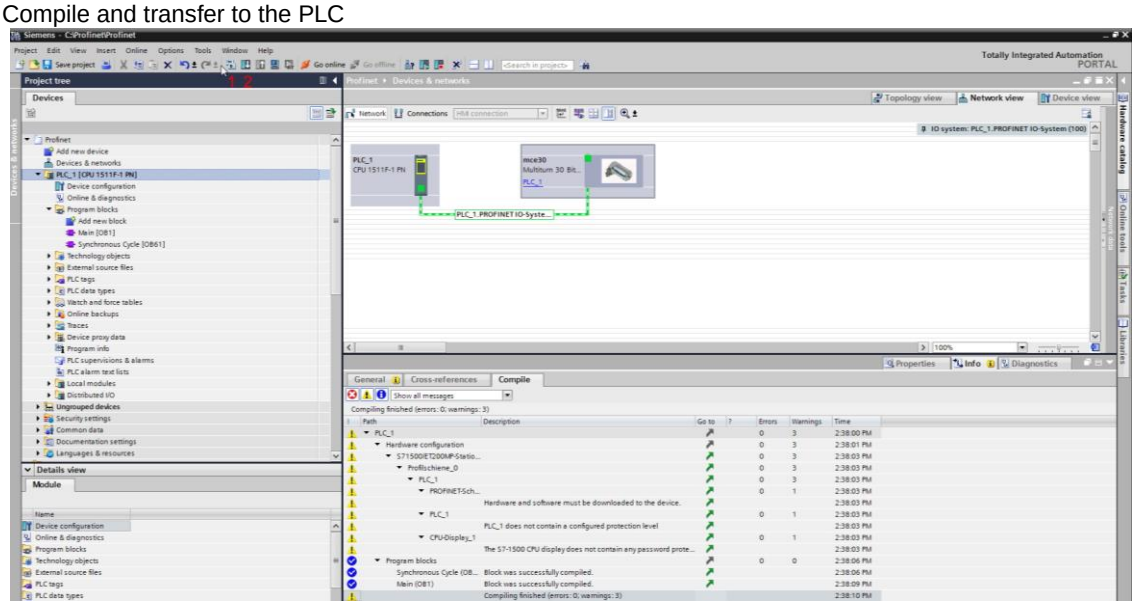
6.7.3 Set Clock generator



6.7.4 Set isochronous mode for input and output

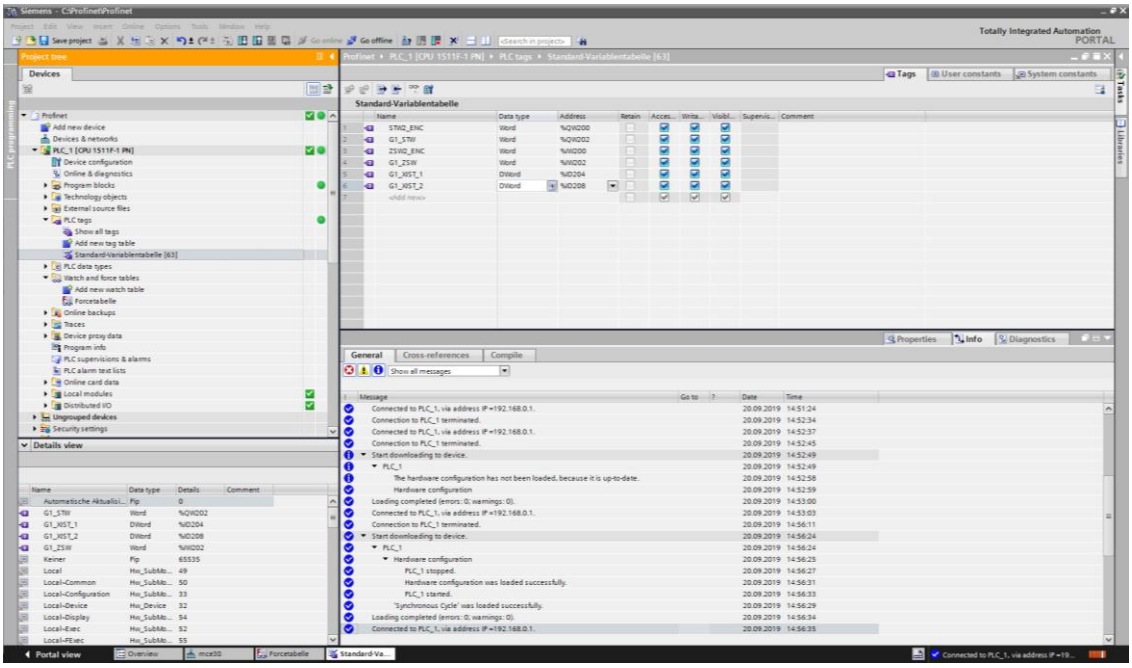


6.8 Compile and transfer to the PLC

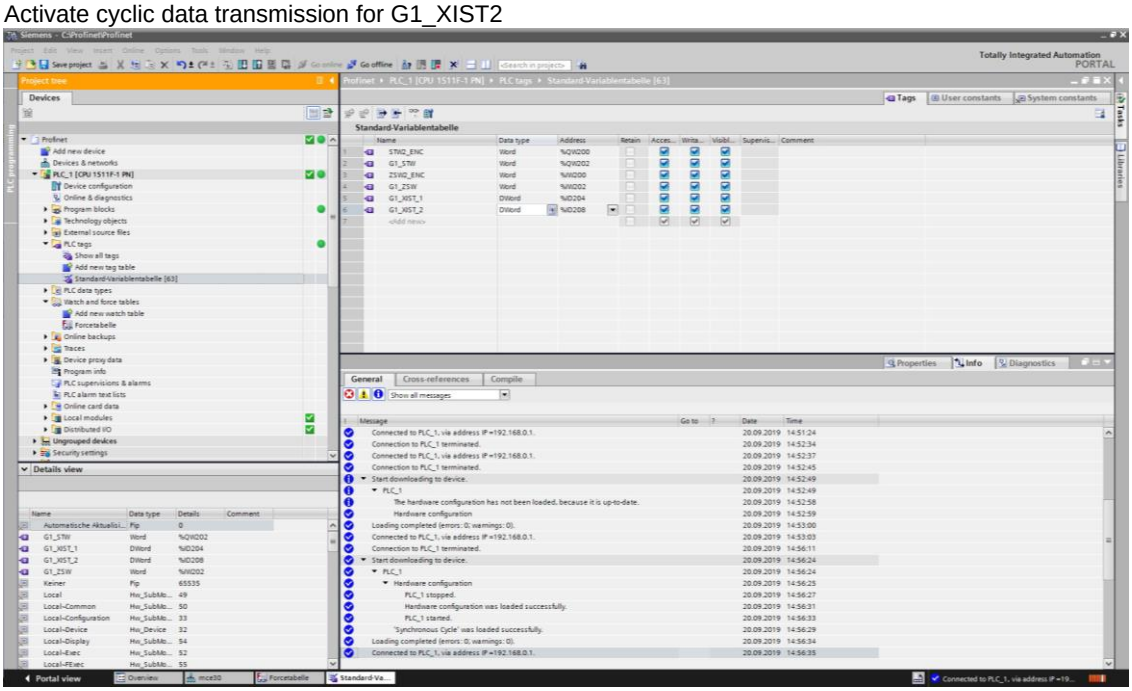


6.9 Read out and set parameters

6.9.1 Create variable list

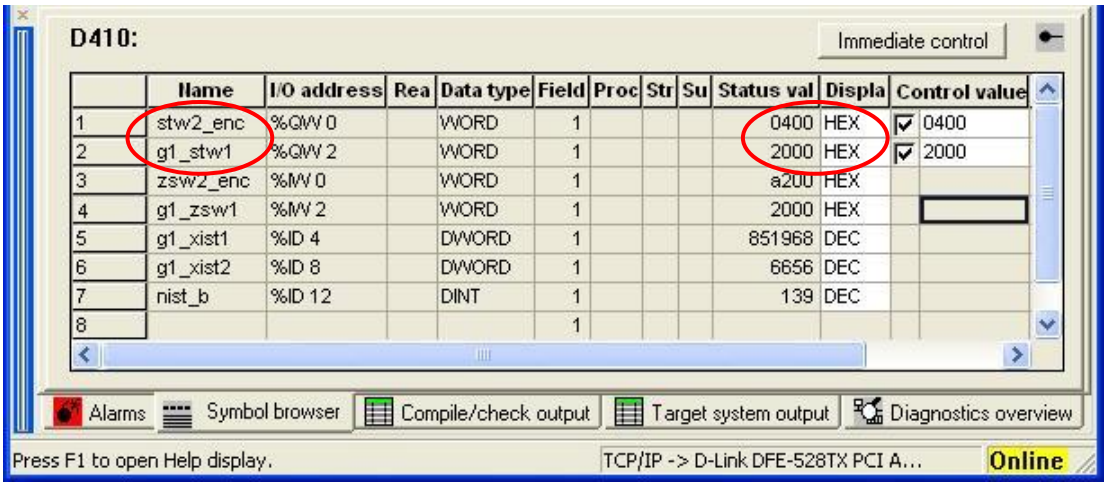


6.9.2 Activate cyclic data transmission for G1_XIST2



7. FAQ

1. **Question:** Why don't I get back position values in G1_XIST2 (Telegram 81-84)?
   Answer: According the encoder profile it is necessary to set Bit 10 to "1" in STW2 and Bit 13 in G1_STW1. See the next hardcopy. Or an error is given and is not confirmed.



	Name	I/O address	Rea	Data type	Field	Proc	Str	Su	Status val	Displa	Control value
1	stw2_enc	%QW 0		WORD	1				0400	HEX	☑ 0400
2	g1_stw1	%QW 2		WORD	1				2000	HEX	☑ 2000
3	zsw2_enc	%IW 0		WORD	1				a200	HEX	
4	g1_zsw1	%IW 2		WORD	1				2000	HEX	
5	g1_xist1	%ID 4		DWORD	1				851968	DEC	
6	g1_xist2	%ID 8		DWORD	1				6656	DEC	
7	nist_b	%ID 12		DINT	1				139	DEC	
8					1						

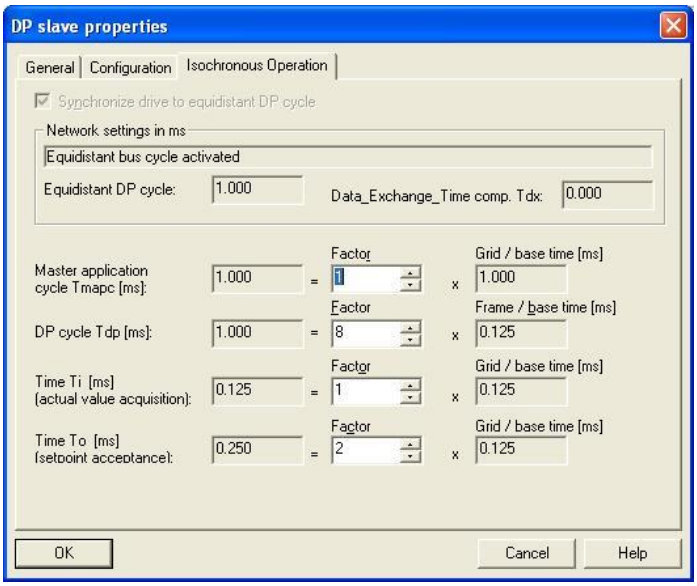
2. **Question:** Why don't work the neighboring detection?
   Answer: The encoder supports the LLDP protocol. But it is necessary to use the newest version of Step 7, TIA or Simotion Scout. The flag "Device replacement without replacement medium" must be active in the Properties window under General.

3. **Question:** What is to do if one encoder has to replace by a new one?
   Answer: See answer 2 or set the device name according chapter 6.3.

4. **Question:** In the application we are using a single-turn encoder. Can this be replaced by a multi-turn encoder too and what is to be done?
   Answer: There is nothing to do. A multi-turn can substitute a single-turn automatically.

5. **Question:** What is the easiest way to set the preset value?
   Answer: Use Telegram 86, 87, 88, 100, 101 or 860. See chapter 3.11.7.2 about Preset setting.

6. **Question:** Why can't I set the preset value or the other parameters?
   Answer: Only if class 3 or 4 is activated it is possible to set the parameters. If necessary, it is important to use class 4 or to activate the class 4 functionalities in the Hardware Manager.



7. **Question:** When using the D410 the error "Synchronization error between Profibus and Profinet" popped up. What can we do?
   Answer: Both systems have to use the same cycle time. If the Profinet cycle time is 1ms then Profibus must use the same one. See the next screenshot for 1ms settings.

8. **Question:** What is the different between Encoder Profile 4.0 and 4.1?
   Answer:

	4.0	4.1
G_XIST1	Position value, left aligned	Counter value, right aligned
GSDML	GSDML-V2.2-Hohner Automation-xxx-20100808	GSDML-V2.2-Hohner Automation-xxx-20110801
MAP Parameter	Must be reconfigured after changing the telegram	Remain when the telegram is changed

Table 39: Difference between Encoder Profile 4.0 and 4.1

9. **Question:** What is the different between Encoder Profile 4.1 and 4.2?
   Answer:

Function	Profile 4.1	Profile 4.2
Number of DAPs in the GSDML file	6: Singleturn and Multiturn, each of them for resolutions 13, 14 and 16 bits.	1: General for all resolutions
Support of only one subslot	Standard, no PDEV	-
Telegrams	81, 82, 83, 84 and 860	81, 82, 83, 84, 86, 87, 88, 89, 860, and 862
MRP / MRPD	Not Supported	Supported
Overtemperature Warning	Not Supported	Supported
Fractional scaling factor	Not Supported	Supported

Table 40: Difference between Encoder Profile 4.1 and 4.2

10. **Question:** Position jump after power-up
    Answer: If the encoder has according the type label i.e. 1216 for revolution and resolution then it is important to use in Encoder profile 4.1 the related DAP and not i.e. the DAP 1213.

8. Technical data, accessories and type keys

These data are available on our online datasheet. You can download it free of charge from the Hohner Automation website.

9. Glossary

Term	Explanations
10Base-T	Transmission line with 10 Mbit data transmission rate
100Base-T	Transmission line with 100 Mbit data transmission rate
Auto crossing	Allow to use straight or crossover wiring
Auto negotiation	Is an Ethernet procedure by which two connected devices choose common transmission parameters, such as speed and duplex mode
Baud rate	Transmission rate; it displays the transmission bits per second
Binary	Numeric system with value 0 or 1
CAT5	Terminations for transmission rates up to 100 Mbit
DAP	**D**evice **a**ccess **p**oint
DO	**D**rive **O**bject
EMC	**E**lectro**m**agnetic **c**ompatibility, there are rules to verifying devices
EO	**E**ncoder **O**bject
Ethernet	Ethernet is a computer network technology based on frames
Endless shaft	(Round axis) Solve the problem with not binary values for revolutions
Fast Ethernet	Transmission technology with 100 Mbit transmission rate
Flash	Internal memory, saved data will be available after power down
GSD	**G**eneric **S**tation **D**escription, Contains all available parameters, classes, …
GSDML	**G**eneric **S**tation **D**escription **M**arkup **L**anguage for Profinet: XML based description language. Contains all available parameters, classes, …
Implicit Messaging	IO Connection: communication between controller and device
Input Data	Data, which a device cyclically sends to the controller
IP-Address	Allow a logic addressing from computer in a network
IO Data	For Devices, all Input and Output Data (cyclic transmission)
IRT flex	Former name for the IRT synchronization “High Flexibility”
IRT top	Former name for the IRT synchronization “High Performance”
Isochronous mode	Communication system service for clock cycle synchronism which generates a constant (timing) bus cycle with a clock cycle signal at the start of the cycle
LLDP	**L**ink **L**ayer **D**iscovery **P**rotocol
MAC Address	Worldwide explicit address of a device. The encoder uses three MAC Addresses: one for internal interface and two for the ports. The basic MAC Address is available on the type label.
Mbit	Transmission rate or baud rate, million bits per second

Term	Explanations
MAP	**M**odule **A**ccess **P**oint. This MAP Sub module contains at least the mandatory Parameter Access Point (PAP) which is mapped to a dedicated Record Data Object
Non-Volatile memory	A special memory where parameter could be saved during power-down time
OSI-Model	The **O**pen **S**ystem **I**nterconnection reference model is an open layer model for the organization of a communication.
Output Data	Data, which a device cyclically receives from the controller and which it outputs to the device application or the peripherals
PDEV	**P**hysical **dev**ice. Not all PLC's support several sub slots. Then select in the product tree "Standard, no PDEV" in the GSDML-file for Encoder ProfileV4.0 or V4.1.
PNU	**P**arameter **nu**mber
Round Axis	See -> Endless shaft
Switch	A switch is an electronic device to connect computers e.g. network segments in a local network. Unlike a hub, a switch uses stacks to avoid network collisions.
TCP	The **T**ransmission **C**ontrol **P**rotocol is a connection orientated transmission protocol, in a network
UCD	Acronym: **U**LTRA**C**O**D**E, name of an encoder series with a magnetically base sensor manufactured by Hohner Automation
UDP	**U**ser **D**atagram **P**rotocol is utilized to send data that does not need to be transferred in a reliable way

Table 41: Glossary

10. Revision index

Revision	Date	Revision
First release	2020-05-14	1.00

Table 42: Revision index