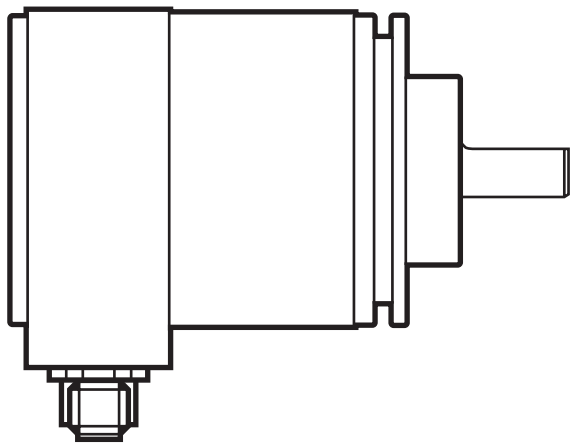
ifm electronic

CE

Device manual
ProfiNet encoder
efector400®

UK

RM30xx



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Contents

1 Preliminary note

1.1 Symbols used

► Instructions
> Reaction, result
[…] Designation of keys, buttons or indications
→ Cross-reference

Important note
Non-compliance can result in malfunction or interference.

Information
Supplementary note

1.2 Warning signs used

NOTE

Warning of damage to property.

1.3 Notes on this document

This document applies to encoders of the following type:

RM30xx (ProfiNet interface)

It is part of the device and contains information about the correct handling of the product.

This document is intended for qualified electricians. These specialists are people who are qualified by their training and their experience to recognise and to avoid possible hazards that may be caused during operation of the device.

► Read this document before using the device.

► Keep this document during the service life of the device.

► Observe these operating instructions.

► Adhere to the warning notes.

2 Safety instructions

Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or incorrect handling can affect the safety of operators and machinery.

The installation and connection must comply with the applicable national and international standards. Responsibility lies with the person installing the device. Only the signals indicated in the technical data or on the device label may be supplied to the connections or wires.

3 General information

3.1 Absolute encoder

The basic principle of an absolute encoder is the optical sampling of a transparent code disc which is fixed with the shaft to be measured.

The absolute encoder has a resolution of 8,192 steps per resolution (13 bits) at 4,096 revolutions (12 bits). This results in a maximum resolution of 33,554,432 steps (25 bits).

For further information about the function principle and setup of a ProfiNet network, please refer to
→ http://www.profibus.com/community/regional-pi-associations/germany

3.2 ProfiNet

ProfiNet is an industrial Ethernet standard merging plant automation with enterprise IT resources. ProfiNet provides comparable functionality to PROFIBUS with the additional possibility of firmware upgrades.

Established IT standards are employed as basis of communication:
UDP and 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 ms.
- ProfiNet RT (Real Time) offers a communication channel with optimised performance (10 ms clock rate) for most factory automation tasks.
- ProfiNet IRT (Isochronous Real Rime) supports communication clock rates around 1 ms and a jitter of less than 1 µs. This operating mode is mainly of use for motion control applications.

ProfiNet IO uses a view of distributed controllers similar to PROFIBUS DP. IO controllers (PLCs) run automation programs, 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 setup of ProfiNet IO is done similar to PROFIBUS. The fieldbuses (e.g. Ethernet topologies) are assigned to the control system during configuration. The IO device is configured based on the GSDML contents.

After completion of the setup the configuration data are loaded into the IO controller (PLC) and data exchange with the IO device takes place.

An IO device is addressed within ProfiNet (and also possibly by external Ethernet components) through its IP address.

Data can be transferred (process data) from the IO controller to the IO device (and vice versa) cyclically. Apart from this, acyclic parameters can be exchanged during setup of the IO device or by the use of PLC programming blocks during operation.

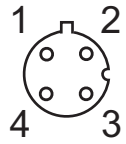
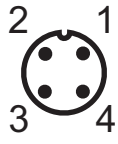
4 Functions and features

- Integrated bootloader for firmware upgrades
- Round axis functionality
- Neighbouring detection (when replacing the device)
- Device identification via LEDs
- Different filters for velocity
- ProfiNet encoder profile V4.0/V4.1

5 Electrical connection

▶ Disconnect power.
▶ Connect the device according to the indications on the type label.

5.1 Ethernet and power supply

	1: Tx + 2: Rx + 3: Tx - 4: Rx -		1: US (10 - 30 V DC) 2: not connected (n.c.) 3: GND (0 V) 4: not connected (n.c.)
Ethernet: 4 pin female, D-coded		Power supply: 4 pin male, A-coded	

5.2 Ethernet cables

5.2.1 RJ45 – M12 crossed

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

5.2.2 RJ45 – M12 straight

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

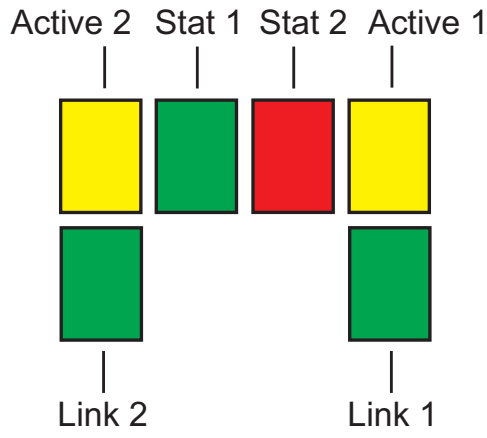
5.2.3 M12 – M12

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

6 LED indicators

6.1 Legend

☼	LED on / lit
✱	LED flashes
○	LED off



LED	Colour	Status / frequency	Description
Active 1	Yellow	☼	Data traffic on port 1

LED	Colour	Status / frequency	Description
Link 1	Green		Active link to other Ethernet components via port 1
Link 1	Green	 2 Hz	Identification call is activated and link connection is available
Active 2	Yellow		Data traffic on port 2
Link 2	Green		Active link to other Ethernet components via port 2
Link 2	Green	 2 Hz	Identification call is activated and link connection is available
Stat 1	Green		Status 1, details ⟶ Status LEDs
Stat 2	Red		Status 2, details ⟶ Status LEDs

6.2 Status LEDs

LED	Colour	Status / frequency	Description	Cause
Status 1	Green	○	No power	Fuse or cable defective
			No connection to control unit Criteria: no data exchange	– Bus disconnected – IO controller not available / switched off
		 0.5 Hz	Parameterization fault, no data exchange Criteria: data exchange correct. The slave did not switch to the [data exchange] mode.	– Slave not configured yet or wrong configuration – Wrong station address assigned (but not outside the permitted range) – Actual configuration of the slave differs from the desired configuration
			Data exchange Connected device and operation OK.	

LED	Colour	Status / frequency	Description	Cause
Status 1 (fault)	Red	○	No power	Fuse or cable defective
		☀	No connection to control unit Criteria: no data exchange	– Bus disconnected – IO controller not available / switched off
		✳ 0.5 Hz	Parameterization fault, no data exchange Criteria: data exchange correct. The slave did not switch to the [data exchange] mode.	– Slave not configured yet or wrong configuration – Wrong station address assigned (but not outside the permitted range) – Actual configuration of the slave differs from the desired configuration
		○	Data exchange Connected device and operation OK.	

7 Installation

► Disconnect power.

► Ensure that the machine stands still.

► The drive must not be started during installation.

► Do not hit the shaft; do not use a file or similar tool on the shaft: Risk of destruction!

This product is a precision measuring device. Therefore it has to be handled with care by trained staff. The following warnings apply to influences outside the limit values indicated in the product data sheet.

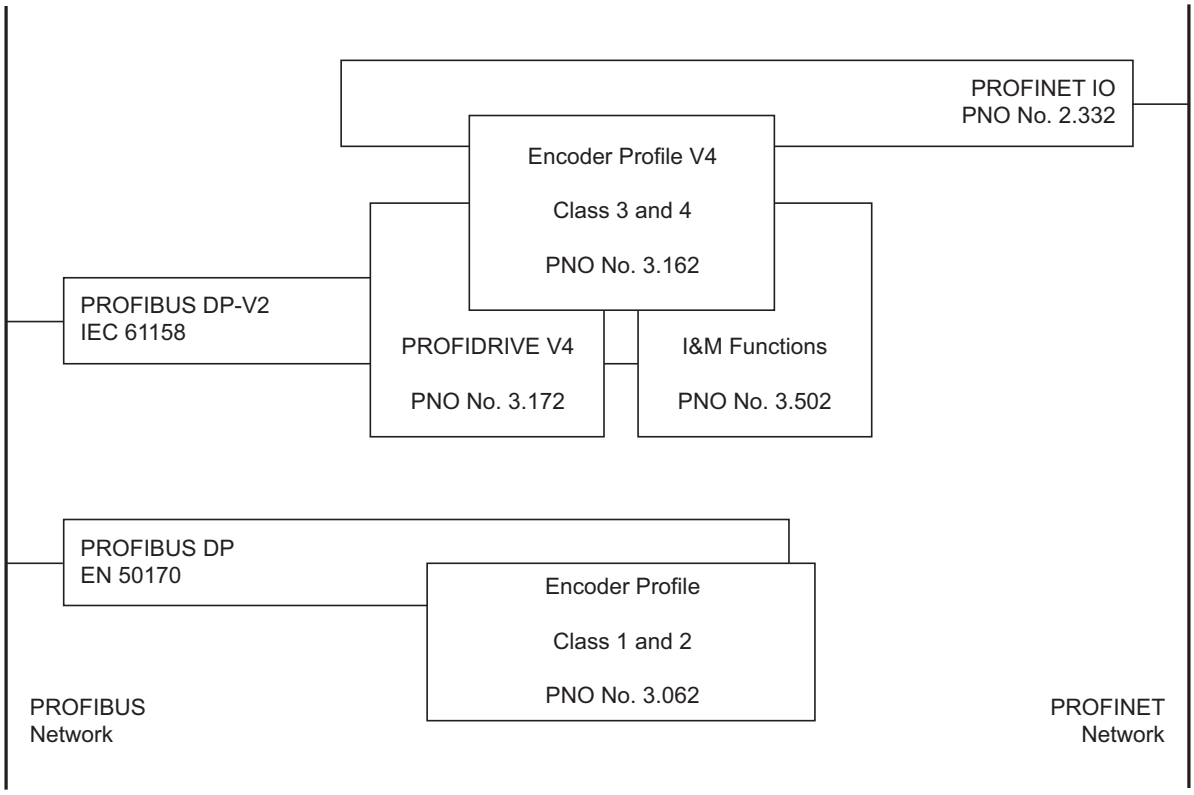
Damage to the product can be caused by:

- electrostatic discharge while touching the electronics
- too high forces on the shaft
- humidity and chemical liquids (do not connect any cables oriented upwards)
- extreme temperatures
- too high vibrations and shocks
- short circuit or too high an operating voltage
- impact, shock or any other physical forces

8 Device configuration

8.1 Standardisation

The current generation of ProfiNet encoders is based on the profile V4.0/V4.1 (PNO no. 3.162). With this standardisation it is possible to substitute all products that fulfil the specification.



8.2 Encoder classes

Application class	Description
3	Isochronous mode is not supported (RT)
4	Isochronous mode is supported (IRT)

8.3 Encoder functions

	Implementation	
Function	**Class 3**	**Class 4**
Code sequence	- / • *	•
Class 4 functionality	•	•
G1_XIST1 preset control	- / • *	•
Scaling function control	- / • *	•
Alarm channel control	•	•
Preset value	- / • *	•
Preset value (64bit)	-	-

	Implementation	
Function	**Class 3**	**Class 4**
Measuring units per revolution (32bit)	- / • *	•
Total resolution (32bit)	- / • *	•
Measuring units per revolution (64bit)	- / • *	•
Total resolution (64bit)	- / • *	•
Maximum master sign-of-life failures	- / • *	•
Velocity measuring unit	- / • *	•
Encoder profile version	•	•
Operating hours counter	-	-
Offset value	- / • *	•
Offset value at 64 bits	- / • *	•
Round axis function	•	•
Velocity filter	•	•
		* If class 4 functionality is activated

8.4 Signal list for cyclic data transmission

Signal no.	Meaning	Abbreviation	Length (bit)	Sign
3	Master's sign-of-life counter	STW2_ENC	16	-
4	Slave's sign-of-life counter	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	-
13	Position value 3	G1_XIST3	64	-

8.4.1 Format of position value

Note:

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

The alignment of the output format (left or right-aligned) remains constant and affects the actual resolution. The number of bits provided changes depending on the resolution.

Example
25 bit multiturn absolute encoder (8,192 steps per revolution, 4,096 revolutions).

All values are presented in binary format. If an error occurs, G1_XIST2 displays the error telegram instead of the right-aligned value.

The shifting factors in P979 "sensor format" display the current 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.

Absolute value in G1_XIST2

31...25	24...13	12...0
	M	S
	Distinguishable revolutions (multiturn value)	Pulses (singleturn steps per revolution)

Setting: encoder profile 4.0*

- By default, G1_XIST1 is left-aligned.
- P979, subindex 3 (shift factor for G1_XIST1) = 32 – total resolution (next binary value)
- G1_XIST1 transmits positions values independent of bit 10 in stw2 and bit 13 in g1_stw1.

Absolute value in G1_XIST1 for encoder profile 4.0

31...20	19...7	6...0
M	S	
Distinguishable revolutions (multiturn value)	Pulses (singleturn steps per revolution)	

Setting: encoder profile 4.1*

- By default, G1_XIST1 is right-aligned.
- A 32-bit counter starts with the absolute position value. After increasing to the maximum counter value, start again with 0 or decreasing from the max. counter value to 0.
- P979, subindex 3 (shift factor for G1_XIST1) = 0
- G1_XIST1 transmits positions values independent of bit 10 in stw2 and bit 13 in g1_stw1.

Absolute value in G1_XIST1 for encoder profile 4.1

31...13	19...0
M	S
Distinguishable revolutions (multiturn value)	Pulses (singleturn steps per revolution)

* Profile 4.0 is realised with GSDML-V2.2-IFM-RM30xx+RN30xx-20130802, profile 4.1 with newer data.

G1_XIST3

For 64-bit position values G1_XIST3 is available. The binary value is output right-aligned and without shifting factor.

IO data (DWord)	1	2	3	4
Format	64-bit position value			

8.4.2 Encoder control word (STW2_ENC)

4-bit counter, left-aligned. The master application starts the sign-of-life counter 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 counter are 1 to 15. "0" indicates an error and is left out in normal operation.

		Implementation	
Bit	**Function**	**Class 3**	**Class 4**
0...9	Reserved, currently not used	-	-
10	Control by PLC	•	•
11	Reserved, currently not used	-	-
12...15	Sign-of-life status indication	-	-

Bit	Value	Meaning	Comments
10	1	Control by PLC	Control via interface, IO data is valid
	0	No control via PLC	IO data is not valid, except sign-of-life
12...15		Controller sign-of-life	Continuously sends counting values from 0 to 15

8.4.3 Encoder status word (ZSW2_ENC)

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

		Implementation	
Bit	**Function**	**Class 3**	**Class 4**
0...8	Reserved, currently not used	-	-
9	Control requested	Mandatory	Mandatory
10...11	Reserved, currently not used	-	-
12...15	Encoder sign-of-life counter	-	Mandatory

Bit	Value	Meaning	Comments
9	1	Control requested	Control via interface, IO data is valid
	0	No control via PLC	IO data is not valid, except sign-of-life
12...15		Encoder Sign-of-life counter	Continuously sends counting values from 0 to 15

8.4.4 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 / shift request	Preset (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 saved in the EEPROM. In these 5-10 ms the encoder will not send position values.

Bit	Value	Function	Comments
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	"Parking sensor" activated	If the "parking sensor" bit is activated, the encoder transmits no error messages.
15	1	Acknowledgement of a sensor error	Request to acknowledge / reset a sensor error

8.4.5 Encoder status word (G1_ZSW)

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

8.5 Standard and vendor 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*	

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*

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*	

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*	

* Details on the variables → chapter 3.4

Vendor telegram 860

With this telegram it is not necessary to set special bits for a cyclic data transmission. In its functionality, it is similar to PROFIBUS and provides for easy configuration of the preset value during PLC operation. The velocity value uses the format that is defined in the velocity measuring unit.

If bit 31 is set to "1", the preset value will be adopted immediately. A further preset value can only be set if bit 31 is reset to "0".

- No control word
- No status word
- No status indication
- Output: 32 bit-unsigned preset value (bit 31 preset control, must be less than total resolution)
- Input: 32 bit-unsigned preset value + 32 bit-integer velocity value

Data input (from encoder to controller): 8 bytes	
Position value - 32-bit unsigned	Velocity value - 32-bit signed

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
MSB			LSB	MSB			LSB

Data output (from controller to encoder): 4 bytes	
Preset - 32-bit unsigned	
Bit 31	Bit 30 .....bit 0
Preset control	Preset value < Total resolution

9 Configuration principle

Encoders with ProfiNet interface can be programmed according to the needs of the user.

► The GSDML file of the encoder has to be installed in the PLC software tool.

9.1 Overview of encoder functions

Function	**Communication channel**
Position value	Cyclic input (IO device -> IO controller)
Preset	Cyclic output (IO controller -> IO device)
Code sequence	Acyclic input/output
Scaling function	Acyclic input/output

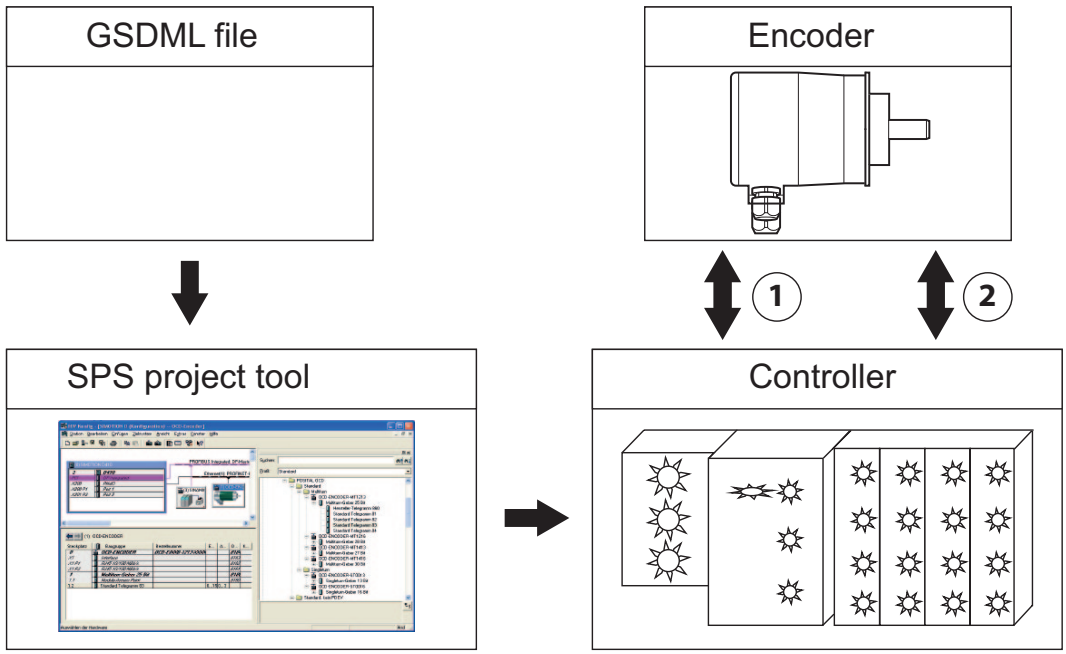
9.2 Encoder functions – Data format

ProfiNet IO devices are set up in modules. Each module can be assigned to slot. One sub slot can contain several cyclic input/output channels as well as acyclic record channels (required for parameters).

There are PLC versions from different manufacturers available. Some of them support only one sub slot. Others, e.g. S7 400, support several sub slots. To work with all PLCs there are two directories in the GSDML file: standard (for IRT) and "no PDEV".

ifm encoders offer for the standard profile one slot with one sub slot for all old PLCs that do not support several sub slots.

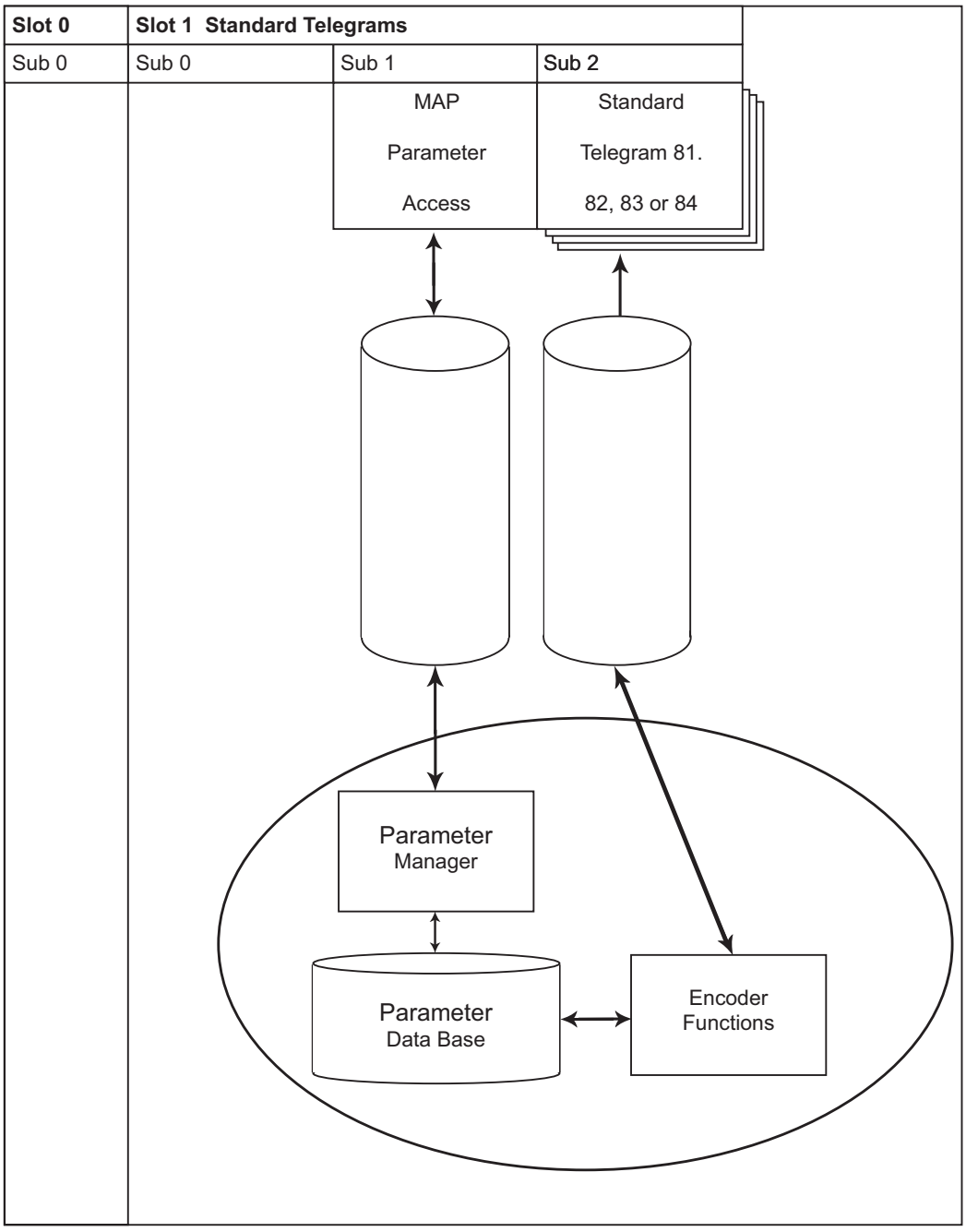
Device parameters are systematically grouped together in a table. The following tables give an overview of the ifm encoder functions.



1: Acyclic data transmission (parameters)
2: Cyclic data transmission (process data)

9.3 Parameters for acyclic data transmission

In the start-up phase the user parameters are sent to the encoder as data record object for mapping of the different encoder functions in the user data section (data record 0xBF00). In addition to the parameter "data configuration" the encoder supports a number of PROFIdrive parameters and encoder specific parameters via the acyclic data exchange service.
With GSDML version GSDML-V2.2-IFM-RM30xx+RN30xx-20130802, it is possible to change the telegram type without changing the MAP parameters.



9.3.1 Standard parameters

Function	Slot	Sub slot	Index	Offset	Length	IO
Code sequence	1	1	0xBF00	0.0	1 bit	-
Class 4 functionality	1	1	0xBF00	0.1	1 bit	-
G1_XIST1 preset control	1	1	0xBF00	0.2	1 bit	-
Scaling function control	1	1	0xBF00	0.3	1 bit	-
Alarm channel control	1	1	0xBF00	0.4	1 bit	-
Compatibility mode	1	1	0xBF00	0.5	1 bit	-
Measuring units per revolution	1	1	0xBF00	1	8 bytes	-
Total resolution	1	1	0xBF00	9	8 bytes	-
Maximum master sign-of-life failures	1	1	0xBF00	17	1 byte	-
Velocity unit	1	1	0xBF00	18	1 byte	-

9.3.2 Device parameters

Function	Slot	Sub slot	Index	Offset	Length	IO
Preset value	1	1	0xB02E	via parameter no. 65000		-

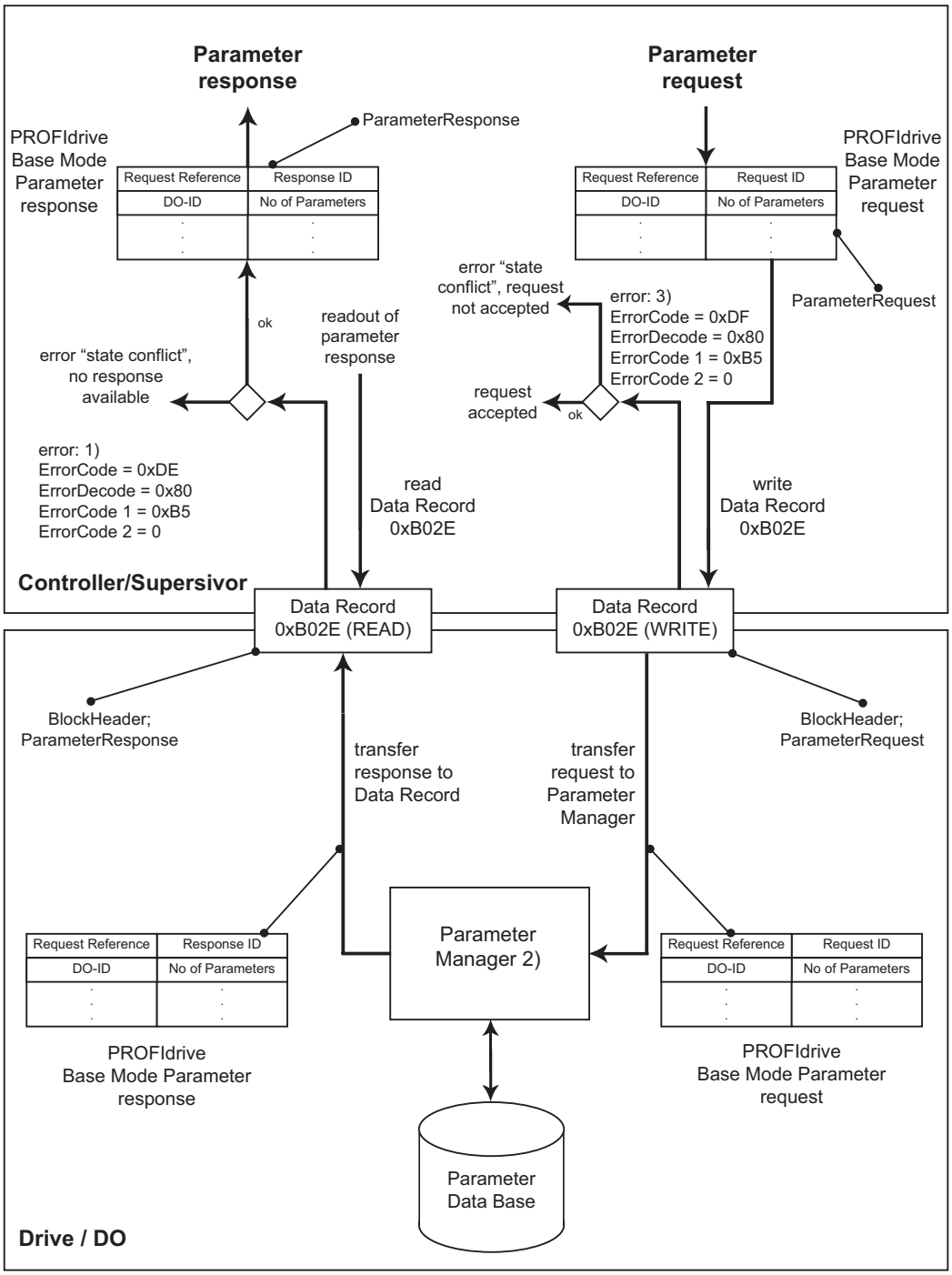
9.3.3 Vendor parameters

Function	Slot	Sub slot	Index	Offset	Length	IO
Preset value	1	1	0x1000	0	1 byte	-

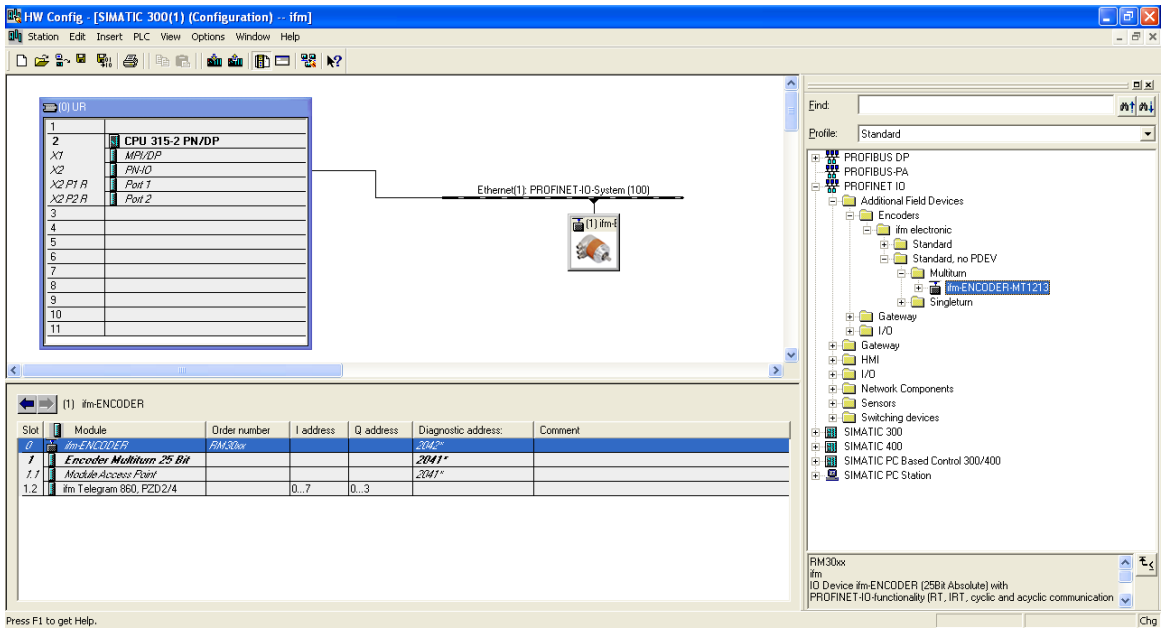
9.4 Supported parameters

Number	Parameter	Read only	Read/Write
922	Telegram selection	•	-
925	Number of tolerated sign-of-life failures	-	•
964	Device identification	•	-
965	Profile identification number	•	-
971	Transfer into EEPROM	-	•
975	DO identification	•	-
979	Sensor format	•	-
980	List of defined parameters	•	-
65000	Preset	-	•
65001	Operating status	•	-

Parameter model



Example of configuration according encoder profile V4.1



9.5 Encoder function description

	Implementation		Description chapter
Function	**Class 3**	**Class 4**	
Code sequence	- / • *	•	9.5.1
Class 4 functionality	•	•	9.5.2
G1_XIST1 preset control	- / • *	•	9.5.3
Scaling function control	- / • *	•	9.5.4
Alarm channel control	•	•	9.5.5
Compatibility mode	•	•	9.5.6
Preset value	- / • *	•	9.5.7
Preset value (64 bits)	-	-	-
Measuring units per revolution (32 bits)	- / • *	•	9.5.9
Total measuring range (32 bits)	- / • *	•	9.5.9
Measuring units per revolution (64 bits)	- / • *	•	-
Total measuring range (64 bits)	- / • *	•	-
Maximum master sign-of-life failures	- / • *	•	9.5.10
Velocity unit	- / • *	•	9.5.11
Encoder profile version	•	•	9.5.14
Operating hours counter	-	-	-
Offset value	- / • *	•	9.5.8
Offset value 64 bits	- / • *	•	-

	Implementation		Description chapter
Function	**Class 3**	**Class 4**	
Round axis functionality	•	•	9.5.13
Velocity filter	•	•	9.5.12
* If class 4 functionality is activated			

9.5.1 Code sequence

The parameter "code sequence" defines the counting direction of the position value. The value 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
922	Clockwise (CW)	Increasing
925	Counter-clockwise (CCW)	Decreasing

9.5.2 Class 4 functionality

The parameter "class 4 functionality" defines that scaling, preset and code sequence affect the position value in G1_XIST1, G1_XIST2 and G1_XIST3.

Class 4 control	Class 4 function
0 (standard)	Deactivated (disable)
1	Activated (enable)

9.5.3 Preset control for G1_XIST1

The parameter "preset control" defines the preset function. If parameter class 4 is activated and preset control is deactivated, then the preset value will not be affected in G1_XIST1.

Preset control	Preset function
0 (standard)	Preset does not affect G1_XIST1
1	Preset affects G1_XIST1

9.5.4 Scaling function control

The parameter "scaling function control" activates / deactivates the scaling function. If it is not activated, the physical position value is returned by the encoder. Scaling function control is only available when class 4 control is activated.

Scaling function control	Scaling function
0 (standard)	Deactivated

Scaling function control	Scaling function
1	Activated

9.5.5 Alarm channel control

The parameter "alarm channel control" defines the length of the diagnostic telegram. If the alarm channel is deactivated, then only the first 6 bytes of the diagnosis will be transmitted.

Alarm monitoring	Alarm function
0 (standard)	Deactivated
1	Activated

9.5.6 Compatibility mode

This parameter defines if the encoder should be executed in a mode compatible to version 3.1.

Overview of functions when compatibility mode is disabled

Compatibility mode	Compatibility function	Meaning
0	Activated	Compatible to encoder profile V3.1
1 (standard)	Deactivated	No downward compatibility

Function	Compatibility mode Active (=0)	Compatibility mode Active (=1)
Control by PLC (STW2_ENC)	Ignored; the control word (G1_STW) and setpoint values are always valid. Control request (ZSW2_ENC) is not supported and is set to 0	Supported
User parameter "maximum master sign-of-life failures"	Supported	Not supported; one sign-of-life failure is tolerated, P925 can optionally monitor the sign-of-life counter.
User parameter "alarm channel"	Supported	Not supported; the alarm channel function is active and monitored by PROFIdrive parameters.
P965 - profile version	31 (V3.1)	41 (V4.1)

9.5.7 Preset value

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 zero point shift. It is stored in the EEPROM (~ 10 ms).

Set preset only in standstill.

There is no preset activated when the preset value is written to the encoder.

The preset function is controlled by the bits in sensor control and status words (G1_STW and G1_ZSW). The preset value is used when a preset is requested by bit 12 of the sensor control (G1_STW).

Class 4 functionality must be enabled.

If the preset value is greater than the total resolution, then the error message 0x02 (lower or higher limit value exceeded) appears in the parameter response in base mode.

Parameter	Meaning	Data type
Preset value	Preset value is defined via asynchronous data exchange. Default value = 0	Integer 32

Example of parameter order for preset with record read-write for SIMATIC CPU300

```
RecordWriteData] = {
0x00,0x02,0x00,0x01,            // Header
0x10,0x00,0xFD,0xE8,0x00,0x00,  // Parameter address (preset)
0x43,0x01,0x00,0x00,0x00,0x64   // Parameter value (preset value=100=0x64h)
};
Meaning:
0x00,0x02,0x00,0x01,
  |  |   |     |-------  Number of parameters = 1
  |  |   |-------------  Axis no./DO-ID = 0
  |  |-------------------  Request ID        = 2 Change value
  |----------------------  Request reference

0x10,0x00,0xFD,0xE8,0x00,0x00, // Parameter address (preset)
  |  |   |   |   |  |---  Subindex  LOW byte
  |  |   |   |   |-------  Subindex HIGH byte
  |  |   |   |-------------  Parameter number (PNU) LOW byte
  |  |   |-----------------  Parameter number (PNU) HIGH byte
  |  |----------------------- Number of elements
  |--------------------------  Attributes

0x01,0x00,0x00,0x00,0x64  // Parameter value (preset value=100=0x64h)
  |  |   |   |   |  |---  Preset value LSB
  |  |   |   |   |-------  Preset value
  |  |   |   |-------------  Preset value
  |  |   |-----------------  Preset value MSB
  |  |----------------------  Number of values =1
  |--------------------------  Format: 0x43= DWord or integer 32bit

SIMATIC S7:
-SFB53
-FC x:

     CALL  "WRREC", DB53
      REQ   :=M41.7                  // activate sfb request
      ID    :=DW#16#0                // logical slot address -> adapt
      INDEX :=W#16#B02E                  // record index number
      LEN   := 16                 // data length in byte size of (RecordWriteData[])
      DONE  :=M41.1                  // request finished
      BUSY  :=M41.2                  // busy bit
      ERROR :=M41.3                  // error bit
      STATUS:=MD46                   // error number, if error bit = 1
      RECORD:= RecordWriteData       // record buffer address -> adapt
```

9.5.8 Offset value

The offset value is calculated in the preset function and exchanges the position value for the calculated value.

9.5.9 Scaling parameters

The scaling parameters are used to change the resolution. This parameter only refers to the output values if the scaling function is enabled.

Parameter	Meaning	Data type
Measuring units per revolution	Singleturn resolution in steps	Unsigned 32
Total measuring range in measuring units	Total measuring range	Unsigned 32

If the resolution per revolution is reduced, a skip in the position value may occur when crossing the physical zero point.

Reason: The position values exceed the real total resolution.

Use the formula below to avoid this problem:

Total resolution = desired measuring steps / revolution x revolutions

9.5.10 Maximum 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 sign-of-life counter	0 … 255 Standard =1

9.5.11 Velocity measuring units

This parameter defines the coding of velocity measuring unit used to configure the values NIST_A and NIST_B. Only telegrams 82-84 use the velocity outputs.

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

N2/N4: Velocity scaling used for PROFIdrive telegrams

The current velocity value in NIST is the share in per cent of the reference value. The reference value can be programmed with parameter P2000.

- N2 (NIST_A), 4000 hex corresponds to a value of 100% of the reference value
- N4 (NIST_B), 4000 0000 hex corresponds to a value of 100% of the reference value
- The value range is between -200% and +200%

MSB = 1 corresponds to a negative sign

MSB = 0 corresponds to a positive sign

9.5.12 Velocity filter

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

Parameter	Meaning	Data type
Velocity filter	Parameter selection: fine, normal, coarse	Integer 32

Ratio between old and current velocity:

- Fine: 7:3
- Normal: 96:4
- Coarse: 996:4

9.5.13 Endless shaft (round axis)

Normally the "total resolution" / "measuring units per revolution" must be an integer and the total resolution must fit an integer number of times into 8192 for an encoder with 13 bits per revolution. This means that e.g. 100 or 325 revolutions could cause troubles.
So the following equation must apply:

(4096 x measuring units per revolution) / total resolution = integer

But the ProfiNet encoder solves this problem automatically. The encoder checks whether the parameters need the endless shaft and activates this functionality independently.

The internal software routine only works if the encoder is in operation. If it is necessary to turn the encoder shaft more than 1,024 revolutions without power supply this can lead to problems (the internal routine will not work without power supply). With this function there will be saved additional values in the internal EEPROM.

9.5.14 Encoder profile version

The encoder profile version is implemented in the encoder. This parameter is not affected by the compatibility 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

10 Configuring with STEP7

In the following chapter the configuration of the ifm encoder with the configuration tool Hardwaremanager STEP 7 is shown exemplarily.

In this example STEP7 version 5.4 SP4 and the CPU 315-2PN/DP or Simotion Scout with single axis controller D410 (integrated ProfiNet controller) are used.

10.1 Installing the GSDML file

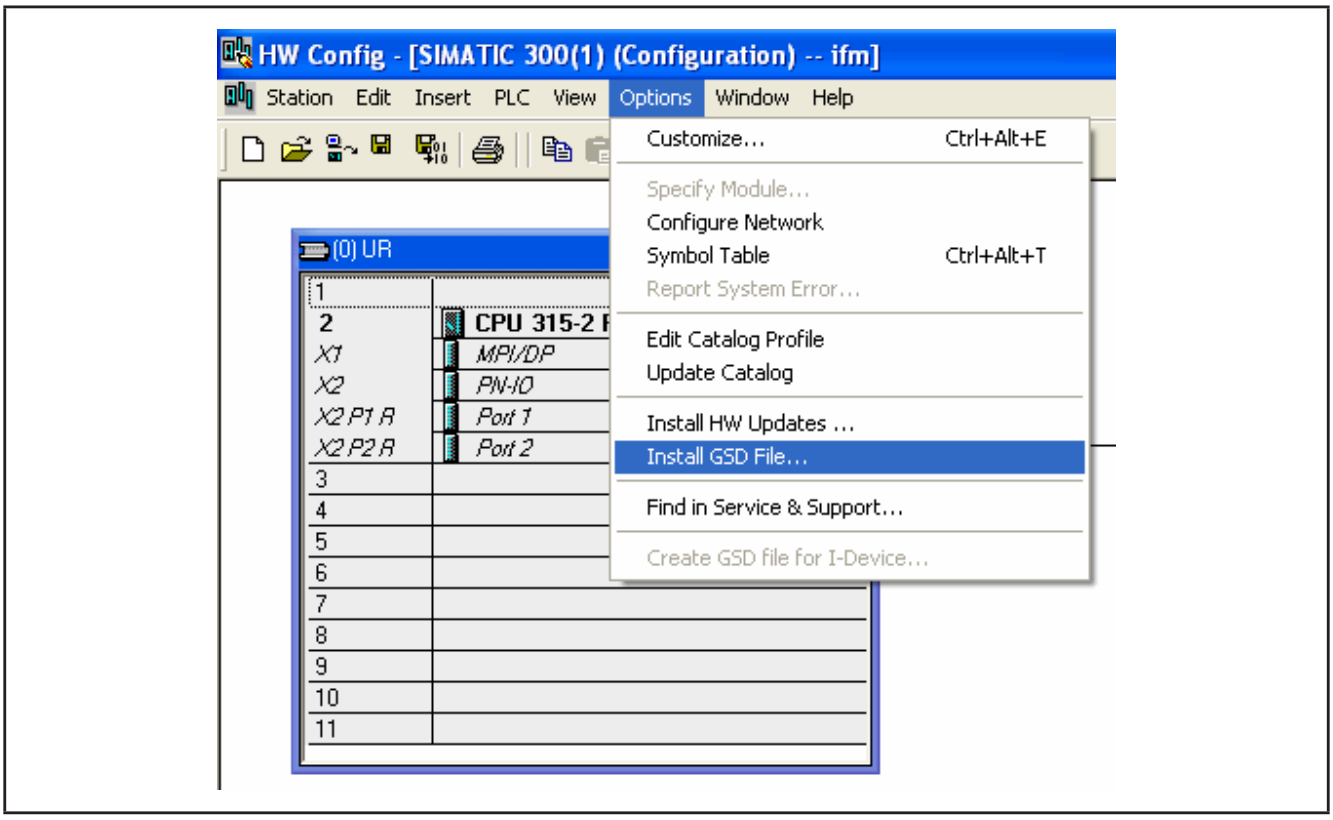
Prior to initial configuration of the system in the hardware configurator of the software, the GSD files of the encoder must be imported into the software.

Start the software and proceed as follows to import the above GSx files:

► Open new or existing project.

► Open hardware configurator.

Copy the required GSx file to the software via menu item [Options] → [Install GSD Files...].

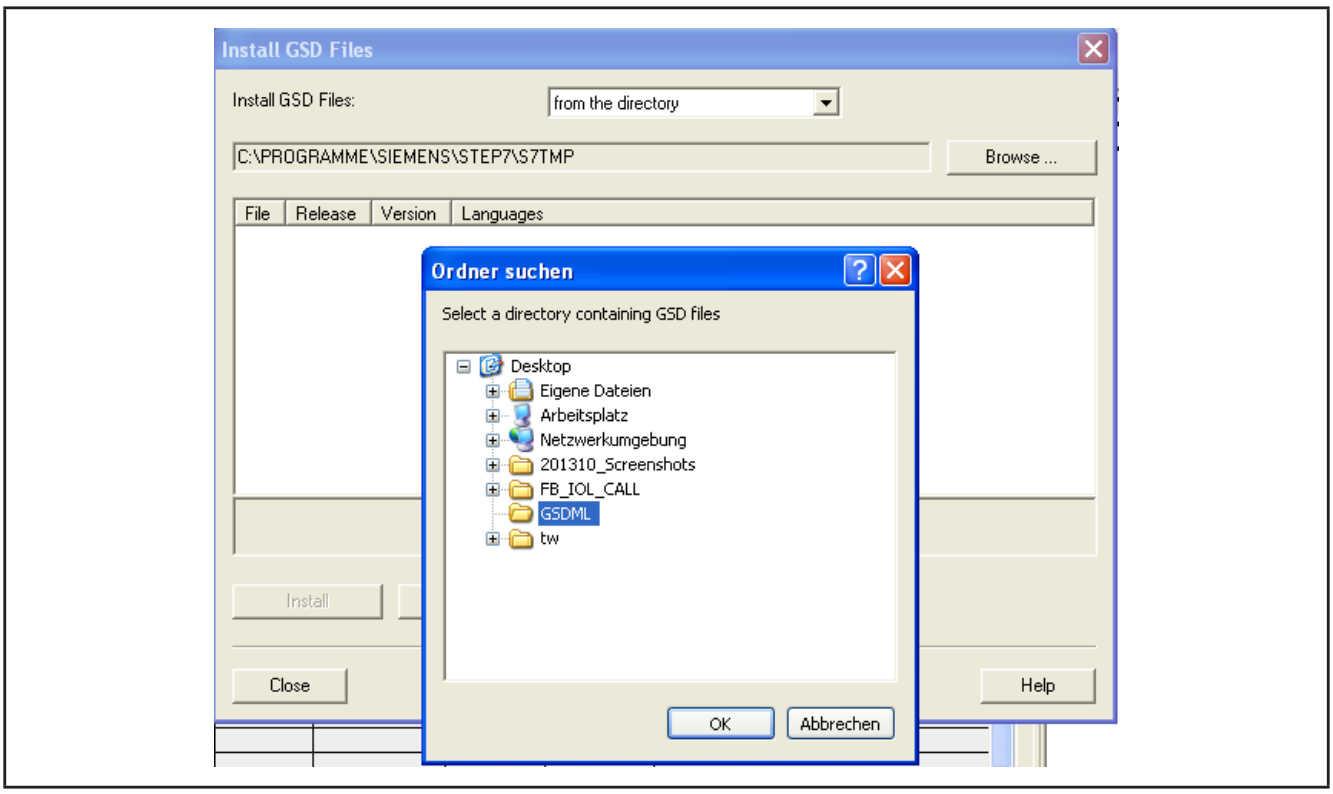


Importing a GSD file

The GSDML file is supplied by ifm (free of charge on www.ifm.com).

In order to display the encoder as a bitmap in STEP7 the file will be installed automatically with the GSDML file – both files must be in the same directory. The main software release number in the GSDML file and the firmware must be the same, e.g. 4.xx.

► Select the GSD file from the according source directory.



Selecting the GSD file from the directory

After correct import and an update of the hardware catalogue via [Options] → [Update catalog] the modules will be displayed as separate entries in the hardware catalogue.

The exact configuration procedure can be found in the operating manual which is supplied together with the software.

10.2 Adding an encoder to a STEP7 project

To add an encoder to a project, drag the device [OCD-ENCODER] to an existing ProfiNet Ethernet network (or choose the network and double-click the [OCD-Encoder] icon).

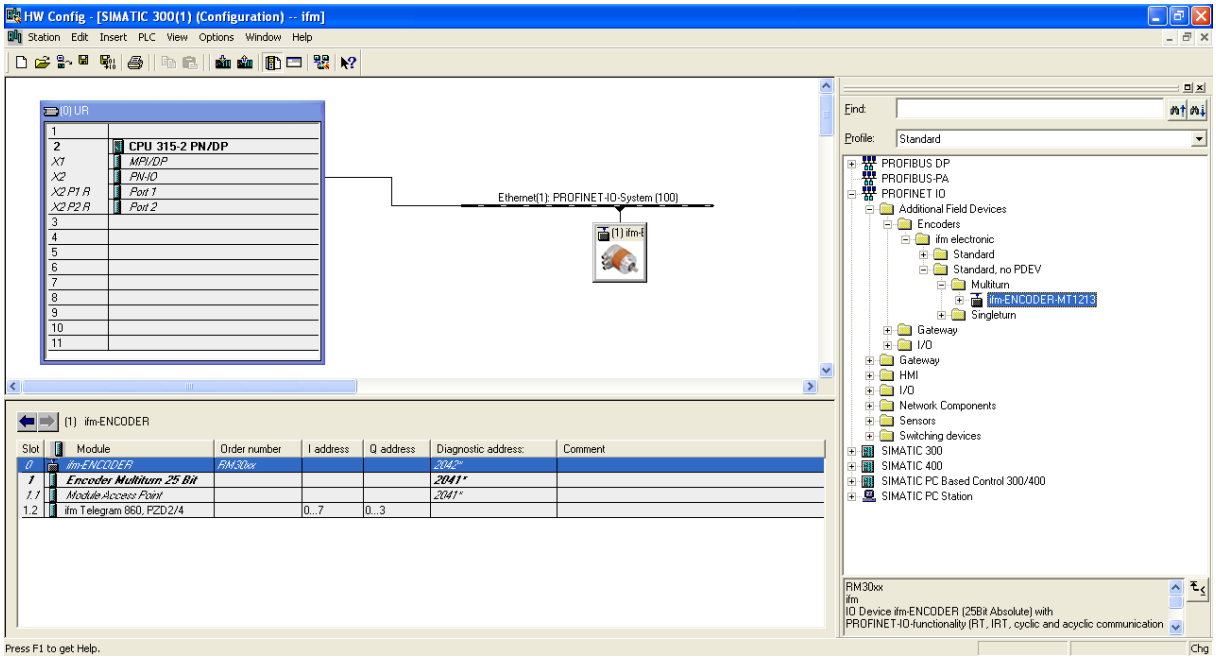
► Move the telegram to the free slot.

Encoder selection

– Standard encoder with PDEV (asynchronous + RT + IRT)
– Standard encoder without PDEV (asynchronous + RT)

10.2.1 Standard encoder without PDEV

Asynchronous + RT communication for controllers which do not support IRT functionality.

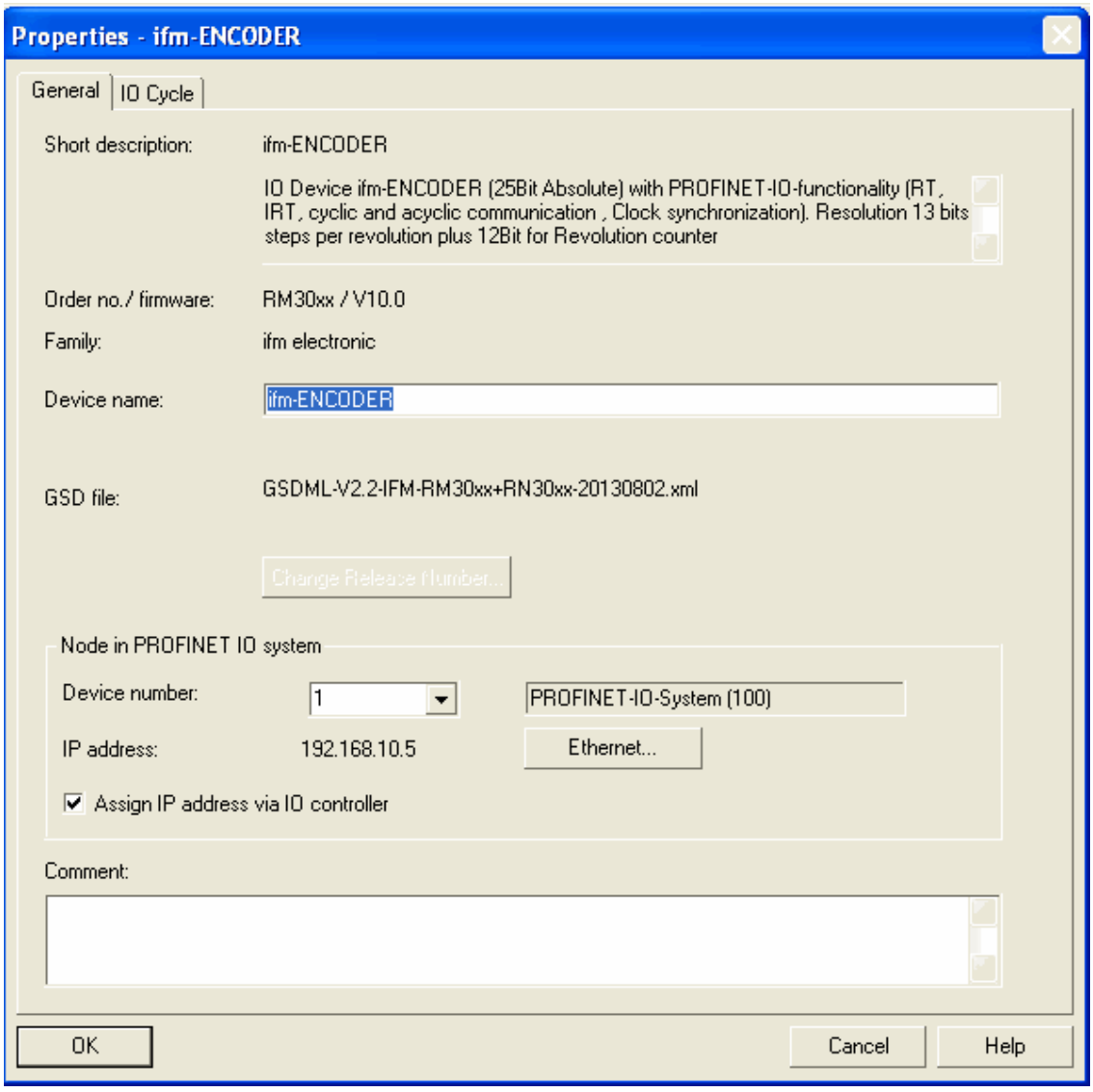


Standard encoder without ohne PDEV

Encoder name and IP address

Double-click the encoder icon to set the PLC communication parameters.

► Set a device name and the IP address of the encoder.



Set device name

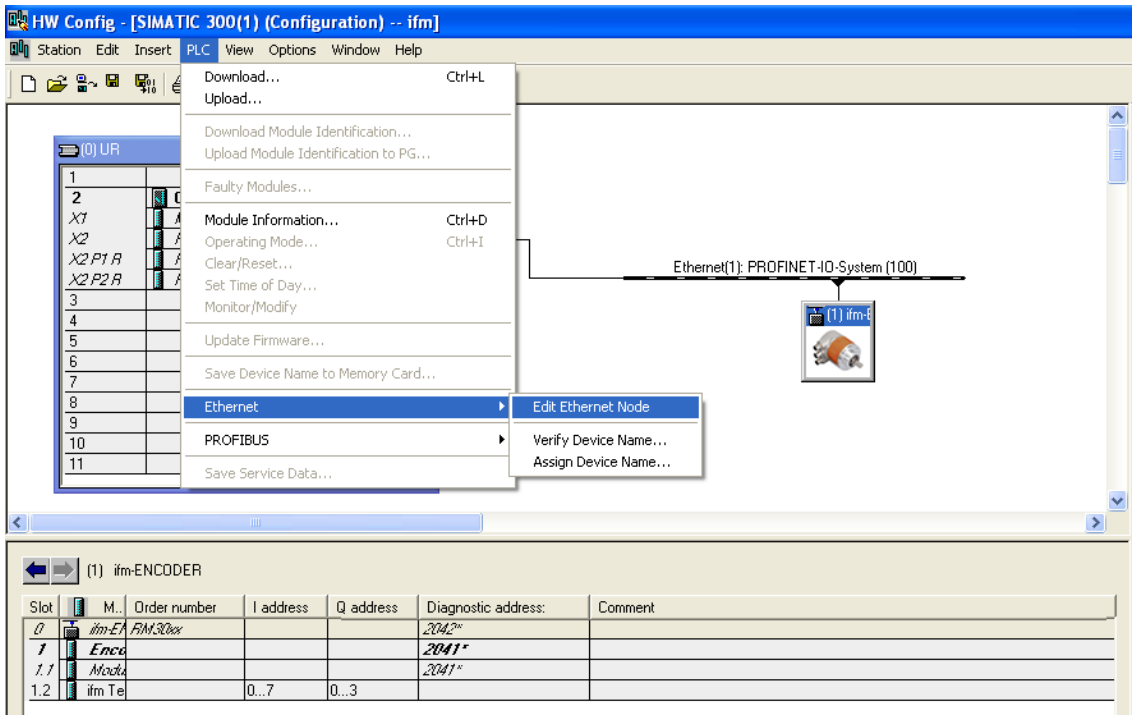
► Click [Ethernet].

► Also, under the [IO cycle] tab, set the desired update time.

► The device name and IP address have to be set directly in the encoder.

► Connect the PLC and the encoder to Ethernet and switch them on.

► Click [Target system] -> [Ethernet] -> [Edit Ethernet node] and then [Browse].



Edit Ethernet node

> A new window with the Ethernet nodes is opened.

> STEP7 will scan for devices on Ethernet and will display them in the window.

> The encoder is displayed under [IFM OCD].

► Select this entry and click [Flash].

> The link LEDs flash with 2 Hz.

► Click [OK] .

> The MAC address is transferred to a new window.

► Click [Use IP parameters].

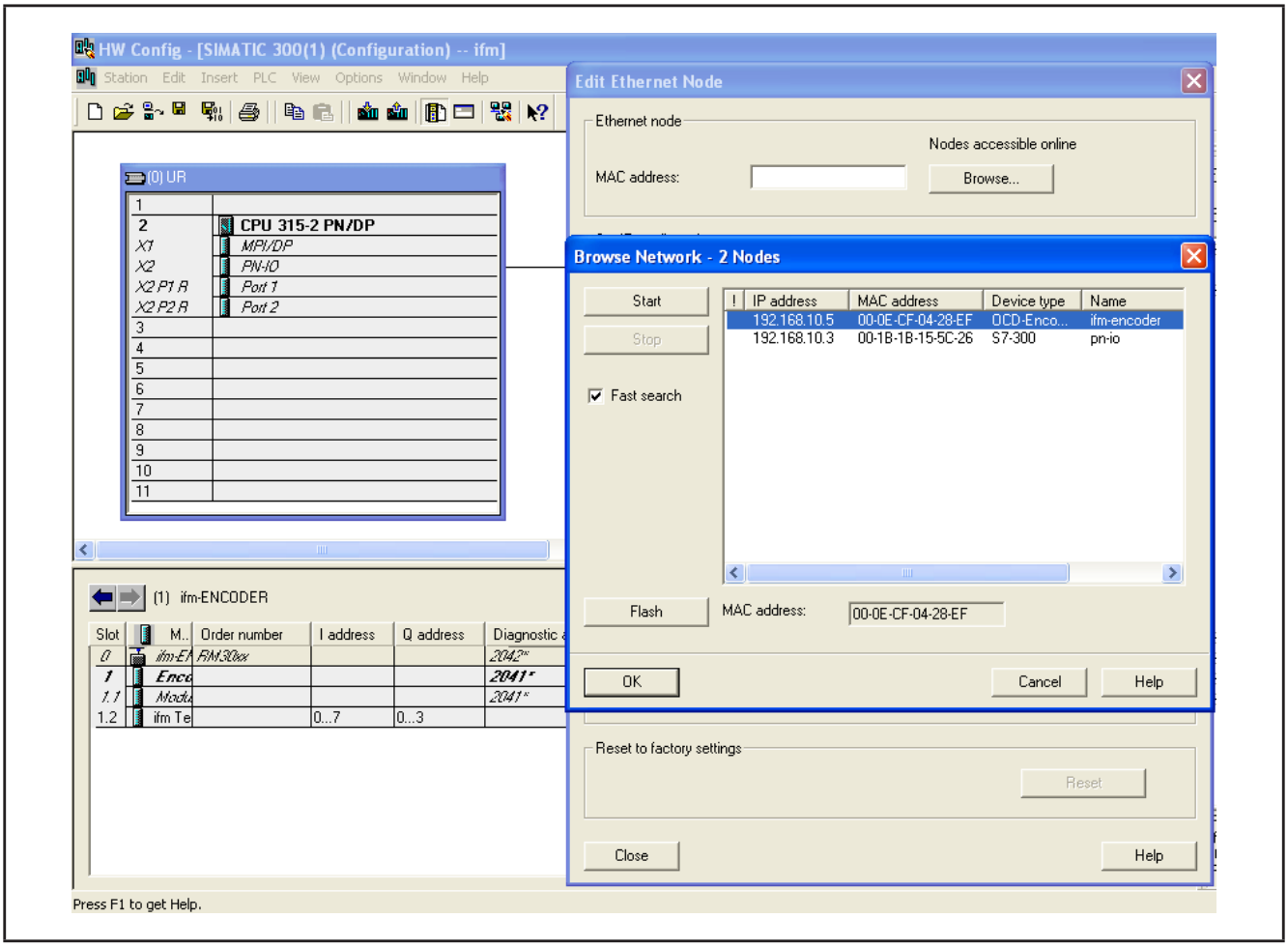
► Enter the IP address and subnet mask of the encoder.

► Click [Assign IP configuration].

► Enter the name of the device in the text field [Device name].

► Click [Assign name].

If more than one encoder is used in the same ProfiNet network, each encoder must be assigned a different name.



Browse network

UK

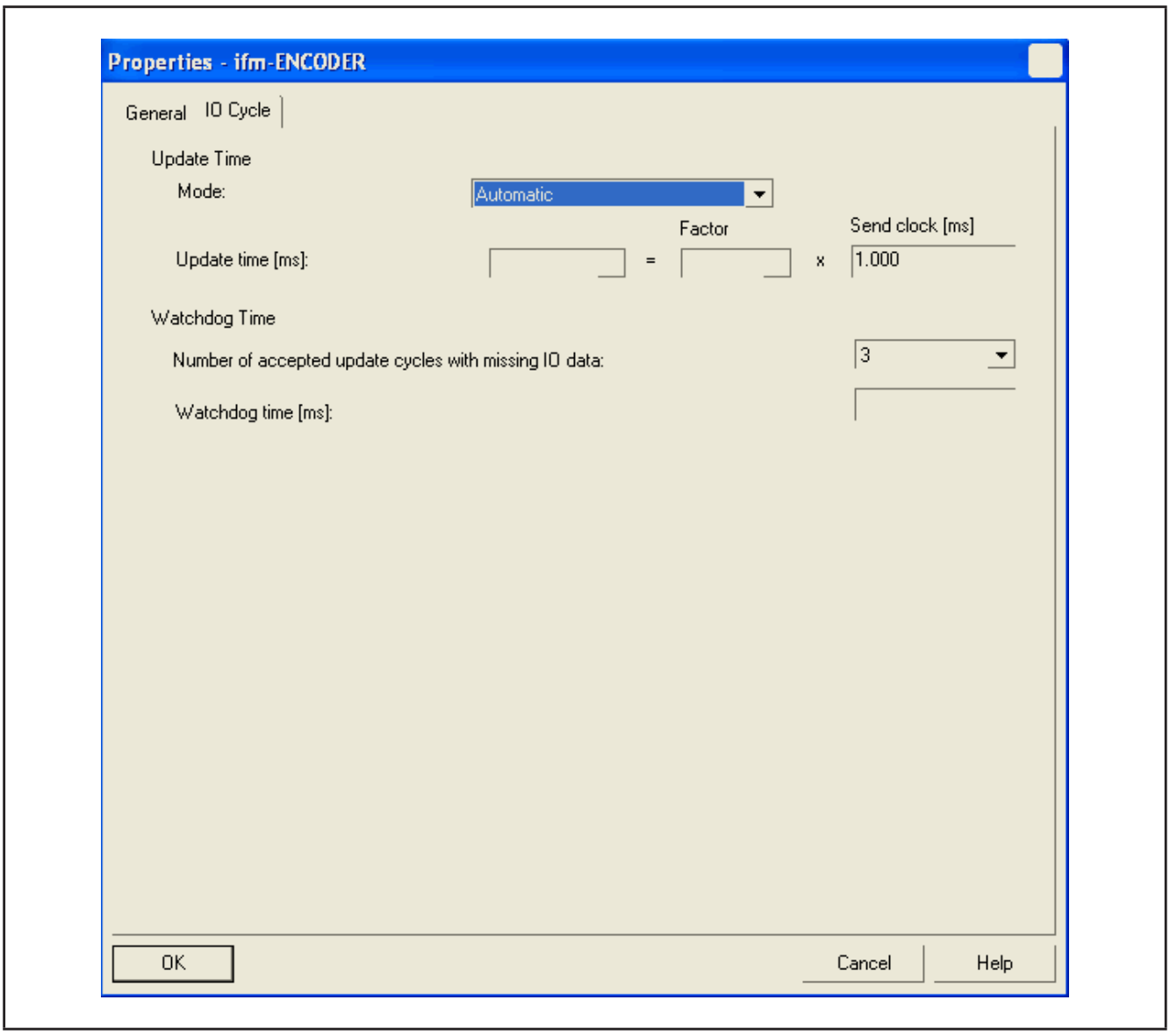
Encoder name and IP address

► Double-click the encoder icon to set the PLC communication parameters.

► Assign device name.

► Click [Ethernet] and set the IP address of the encoder.

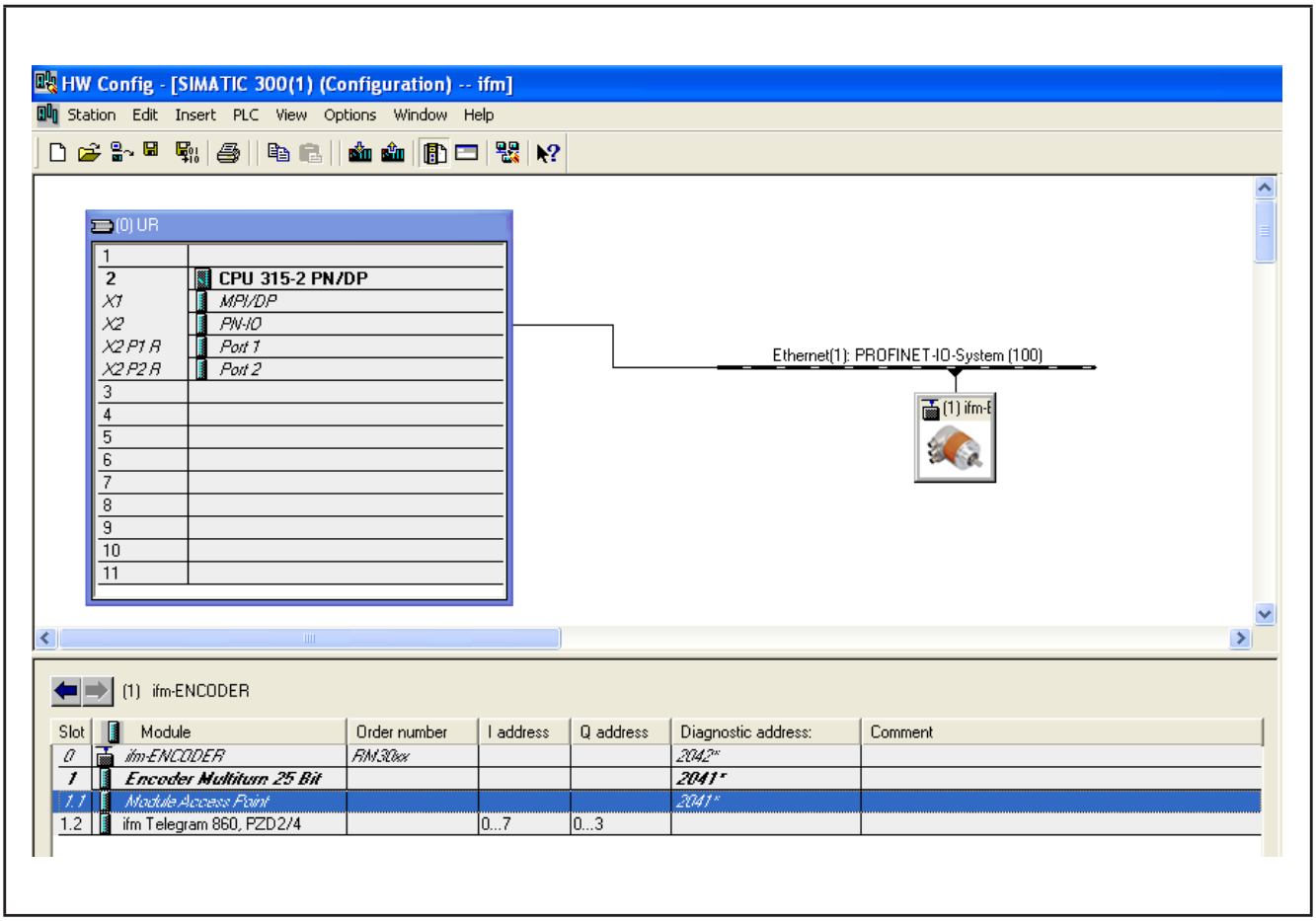
► Set the desired update time under the [IO cycle] tab.



IO cycle

10.3 Module Access Point parameter setup:

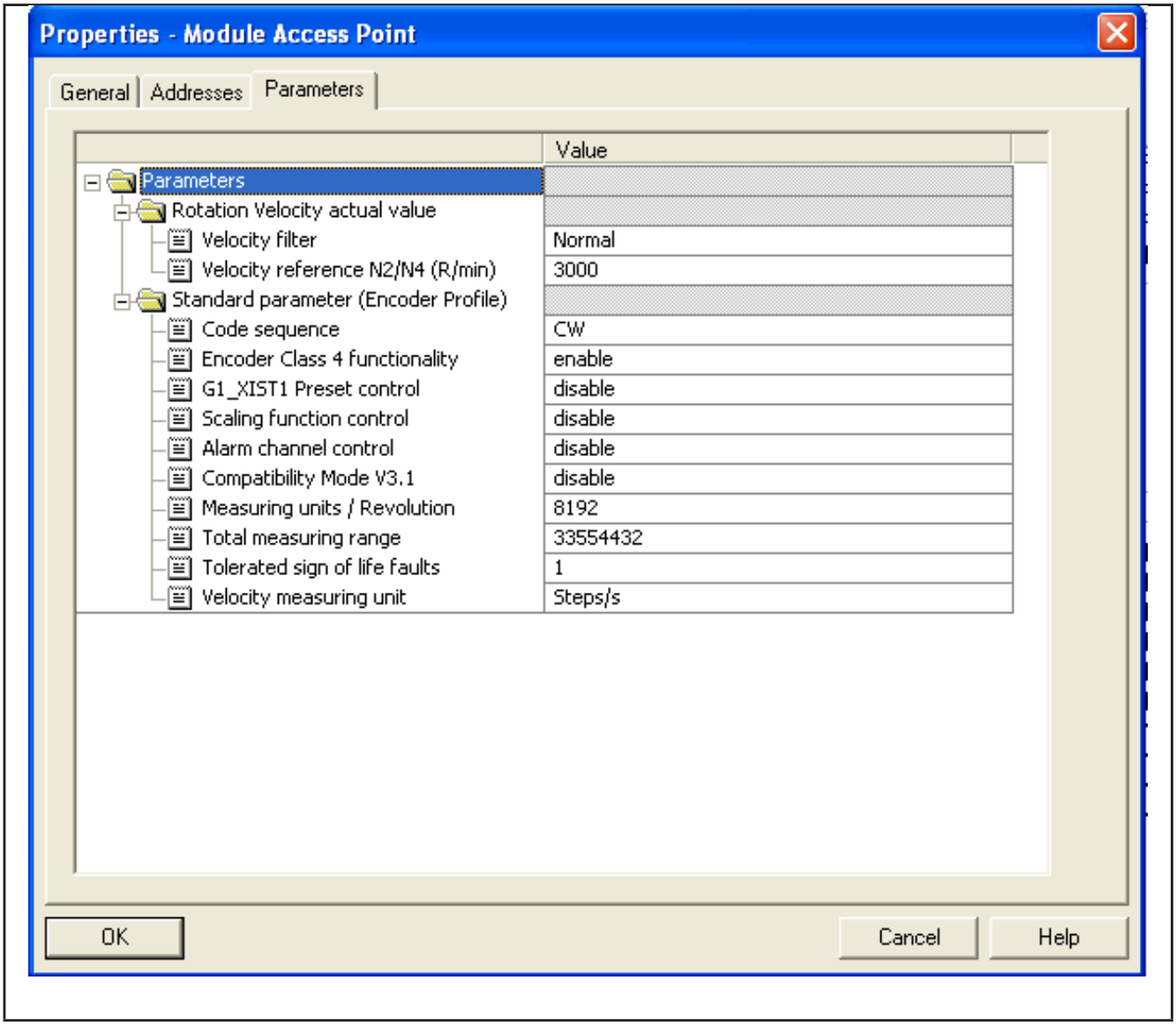
► Double-click on the menu item [Module Access Point].



Module Access Point

> The window with the list of parameters is opened.

These parameters will be transmitted to the encoder on each start of the PLC.



Parameter settings