Manual
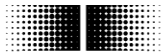
Absolute encoders with PROFINET interface (with bus cover)

Firmware version 2.10 and later

Contents   Page

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At any time we should be pleased receiving your comments and proposals for further improvement of the present manual.

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1. Introduction

1.1. Scope of delivery

Please check the delivery upon completeness prior to commissioning.
Depending on encoder configuration and part number the delivery may include:
- Basic encoder
- PROFINET bus cover
- CD with GSDML file and manual (also available as download in the Internet)

1.2. Product classification

Shaft encoders

Product	Product family	Suitable input in hardware-catalog
BMSV 58	*MAGRES* - Singleturn	GCAMW
BMMV 58	*MAGRES* - Multiturn	GCMMW
GBAMW	Optical - Singleturn	GBAMW
GBLMW	Optical - Multiturn	GBMMW
GBMMW	Optical - Multiturn	GBMMW
GEMMW	Optical - Multiturn (stainless steel	GXMMW
GXAMW	Optical - Singleturn	GXAMW
GXLMW	Optical - Multiturn	GXMMW
GXMMW	Optical - Multiturn	GXMMW

Blind hollow shaft encoders

Product	Product family	Suitable input in hardware-catalog
BMSH 58	*MAGRES* - Singleturn	GCAMW
BMMH 58	*MAGRES* - Multiturn	GCMMW
GBAMS	Optical - Singleturn	GBAMW
GBLMS	Optical - Multiturn	GBMMW
GBMMS	Optical - Multiturn	GBMMW
GXAMS	Optical - Singleturn	GXAMW
GXLMS	Optical - Multiturn	GXMMW
GXMMS	Optical - Multiturn	GXMMW

Through hollow shaft encoder

Product	Product family	Suitable input in hardware-catalog
G0AMH	Optical - Singleturn	GXAMW
G0LMH	Optical - Multiturn	GXMMW
G0MMH	Optical - Multiturn	GXMMW
GBAMH	Optical - Singleturn	GBAMW
GBLMH	Optical - Multiturn	GBMMW
GBMMH	Optical - Multiturn	GBMMW

GSDML-File
The GSDML-File is the same for all products mentioned above.
Please see 5.1 "Importing the GSDML file".

2. Safety and operating instructions

Supplementary information
- The present manual is intended as a supplement to already existing documentation (e.g. catalogues, data sheets or mounting instructions).
- The manual must be studied carefully prior to initial commissioning of the equipment.

Intended purpose of the equipment
- The encoder is a precision sensing device. It is utilized to determine angular positions and revolutions, and to prepare and supply measured values in the form of electrical output signals for the downstream device. Encoders must not be used for any other purpose.

Commissioning
- The encoder must be initialized and mounted only by a qualified expert.
- Observe the operating instructions of the machine manufacturer.

Safety instructions
- Check all electrical connections prior to commissioning of the equipment.
- If mounting, electrical connections or any other work performed at the encoder and the equipment is not correctly executed this can result in malfunction or failure of the encoder.
- Corresponding safety precautions must be provided and observed to exclude any risk of personal injury, damage to material or operating equipment as a result of encoder failure or malfunction.
- Encoders must not be operated outside the specified limited values (see further documentation).

Failure to observe these safety instructions can result in malfunctions, material damage or personal injury.

Transport and storing
- Only ever transport or store the encoder in its original packaging.
- Never drop the encoder nor expose it to major shocks.

Mounting
- Avoid impacts or shocks on housing and shaft/end shaft.
- End shaft/Hollow shaft encoder: Open clamping ring completely before mounting the encoder
- Avoid any twist or torsion on the housing.
- Shaft encoders: never make rigid connections between encoder shaft and drive shaft.
- Do not open the encoder or proceed any mechanical modifications.

Shaft, ball bearings, glass disc or electronic components can be damaged thereby and a safe and reliable operation is no longer ensured.

Electrical commissioning
- Do not proceed any electrical modifications at the encoder.
- Do not proceed any wiring work while encoder is live.
- Never plug or unplug connector while encoder is live (the bus cover however may be removed or docked to the basic encoder when live).
- Ensure that the entire system is installed in line with EMC/EMI requirements. Operating environment and wiring have an impact on the electromagnetic compatibility of the encoder. Install encoder and supply cables separately or far away from sources with high emitted interference (frequency converters, contactors, etc.).
- When working with consumers with high emitted interference provide separate encoder supply voltage.
- Completely shield encoder housing and connecting cables.
- Connect encoder to protective earth (PE) using shielded cables. The braided shield must be connected to the cable gland or connector. Ideally, aim at dual connection to protective earth (PE), i.e. housing by mechanical assembly and cable shield by the downstream devices. In case of earth loop problems, earth at least on one side.

Failure to observe these instructions can result in malfunctions, material damage or personal injury!

3. Product family

The product family architecture is modular. Depending on what is required from the encoder, the basic encoder and bus covers can be combined at will with the selected bus system.
The basic encoders differ in terms of accuracy, ambient conditions and the utilized sensing principle.

Bus cover
The bus cover accommodates the entire electronics for measured value processing and for Ethernet communication.

The bus covers differ by the respectively integrated bus interface.
Available bus interfaces: CANopen®, DeviceNet, EtherCAT, Ethernet/IP, Profibus-DP, Profinet, Powerlink, Power over EtherCAT, SAE J1939, SSI.
All encoders enable parameterization by bus interface.

Functional principle:
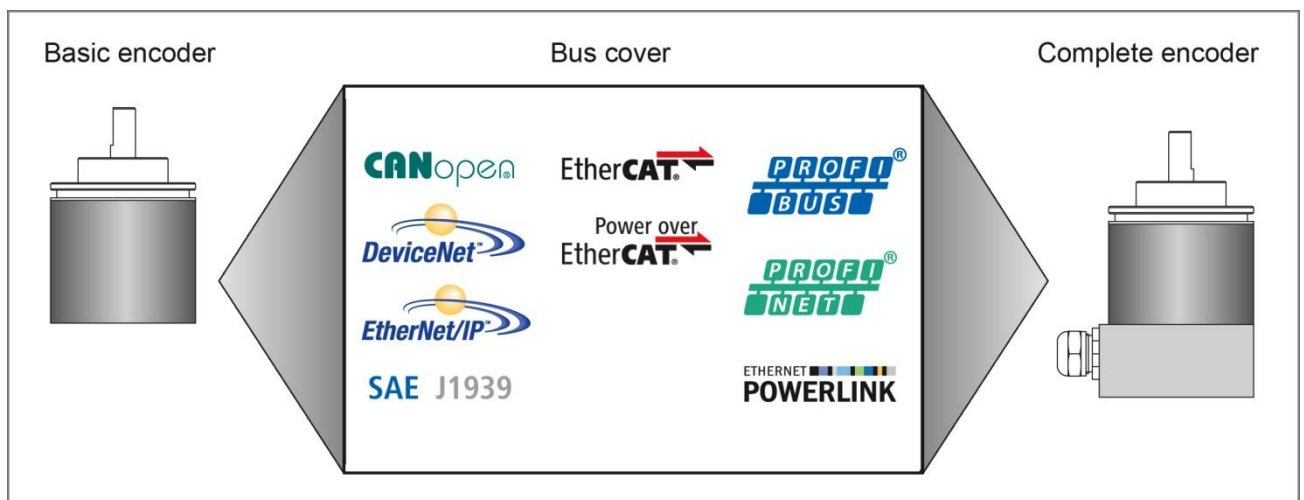
4. Commissioning

4.1. Mechanical mounting

Shaft encoders
- Mount the encoder by help of the mounting holes and three screws (square flange: four screws) provided at the encoder flange. Observe thread diameter and depth.
- There is an alternative mounting option in any angular position by eccentric fixings, see under accessories.
- Connect drive shaft and encoder shaft by using an appropriate coupling. The shaft ends must not touch each other. The coupling must compensate temperature and mechanical tolerances. Observe the maximum permitted axial or radial shaft load. For appropriate couplings please refer to accessories.
- Tighten the mounting screws firmly.

Hollow shaft encoders
- Mounting by clamping ring
  Prior to mounting the encoder open the clamping ring completely. Push encoder onto the drive shaft and tighten the clamping ring firmly.
- Adjusting element with rubber buffer
  Push the encoder onto the drive shaft and insert the cylindrical pin into the adjusting element (customer-mounted) and the rubber buffer.
- Mounting angle
  Push the encoder onto the drive shaft. Insert adjusting angle into the encoder's rubber buffer and fasten the mounting angle at the contact surface.
- Stud screw
  Push the encoder onto the drive shaft and insert the stud screw (customer-mounted) into the encoder's rubber buffer.
- Spring washer
  Fasten the spring washer at the mounting holes of the encoder housing using screws. Push the encoder onto the drive shaft and mount the spring washer to the contact surface.

4.2. Electrical connection

Ever store and transport the bus cover in the ESD bag only.

For electrical connection remove the bus cover as follows:
- Release the fastening screws of the bus cover
- Carefully loosen the bus cover and lift off in an axial direction

4.2.1. Cabling

PROFINET utilizes Fast Ethernet cable (100MBit, Cat 5) composed of four wires AWG22 (white, yellow, blue and orange).
There are three types of PROFINET cables:

- Type A – for fix or rigid cabling
- Type B – for occasional movements or vibrations (flexible)
- Type C – for permanent movements (highly flexible).

4.2.2. Connecting the bus cover

The bus cover provides three M12 connectors.
Two M12 connectors (D-coded, according IEC 61076-2-101) serve for PROFINET connection.

Multi-color LED
Indicating the operating status,
green-yellow-red

Activity – LEDs (green)
to signal bus activity on
Port1, Port2

Port1
Port2
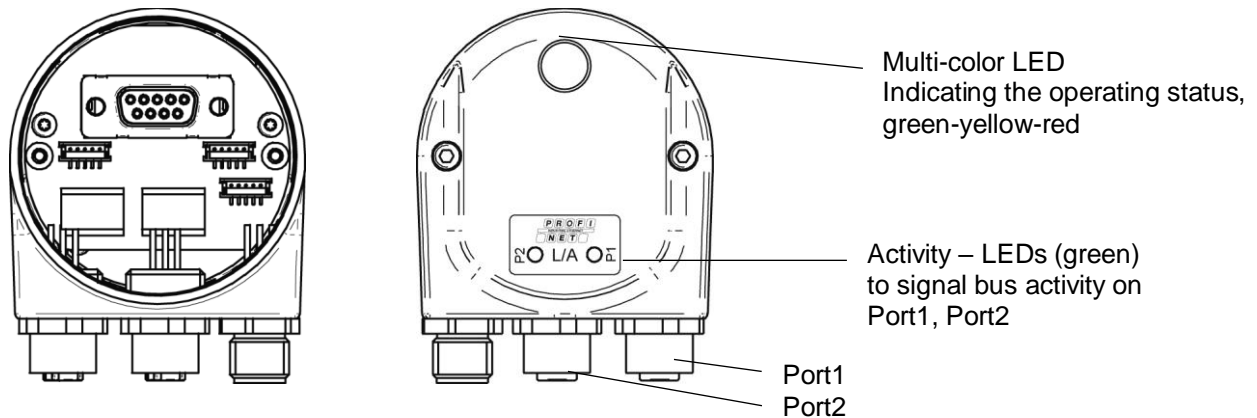
- For voltage supply use A-coded M12 connector only.
- For the bus lines both D-coded M12 connectors may be used at will. However, together with a planned Topology it may be necessary to observe the correct assignment (P1/P2).
- Seal up the unused cable gland using a sealing bolt (included in the delivery).

There is no need to proceed any manual settings inside the bus cover. PROFINET does not require setting a node ID and terminating resistor like Profibus. All address parameters are configured by the engineering tool (e.g. Siemens® Step7®).

Pin assignment

Supply voltage
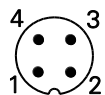
1 x M12- connector (male)
A-coded

Pin	Assignment	Wire color
1	UB (10...30 VDC)	brown
2	N.C.	white
3	GND	blue
4	N.C.	black

PROFINET (data communication line)
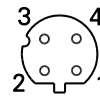
2 x M12-connector (female)
D-coded

Pin	Assignment	Wire color
1	TxD+	yellow
2	RxD+	white
3	TxD-	orange
4	RxD-	blue

Assembly of basic encoder and bus cover:

- Carefully plug the bus cover onto the D-SUB connector of the basic encoder, then press it over the seal taking care not to tilt it.
- Tighten both fastening screws firmly in the same direction.
- The bus cover must fully rest on the housing of the basic encoder and be firmly screwed on.

The encoder housing and braided shield of the connecting cable are only ideally connected if the bus cover is resting fully on the basic encoder (positive locking).

5. Project Setup

All examples in this manual refer to SIEMENS® PLCs and the widely used engineering tool Step7®. When using other tools please proceed correspondingly. All screenhots in this manual were taken from Step7 V5.5 SP3. Of course, the encoder may as well be inserted into a project using the SIEMENS TIA-Portal.

5.1. Importing the GSDML file

First the attached GSDML file must be imported to enable implementation of the encoder in the engineering software. The file format is xml ("Extended Markup Language"). With reference to the Profibus GSD files, GSDML is the common term.

The GSDML file is either supplied on a CD or available for download at www.baumer.com / „Downloads" →
Software. Search for the term „Profinet". Download the zip archive „BMxx Beschreibungsdateien PROFINET".
The following GSDML file versions apply:

- **GSDML-V2.2-Baumer_IVO-GXMMW_PN-20100310.xml**
  for encoders with firmware V2.03 to V2.05.
  GSDML V2.2 is downward compatible and runs in firmware V2.10 and later versions. However, the features of the V2.10 upgrade will not be supported.
  Do not use this GSDML file for new projects.

- **GSDML-V2.2-Baumer_IVO-GXMMW_PN_V41-20150407.xml** (and later)
  for encoders with firmware V2.10 or later.
  End of the file name is the release date.

The import operation is performed by Step7® software in the hardware window (HW Config, „Options – Install GSD File…"). As a prior step it may be necessary to close the actual hardware project („Station - close") to enable successful import. Based on the default settings, any change is configured as described below. The GSDML file itself is not modified.
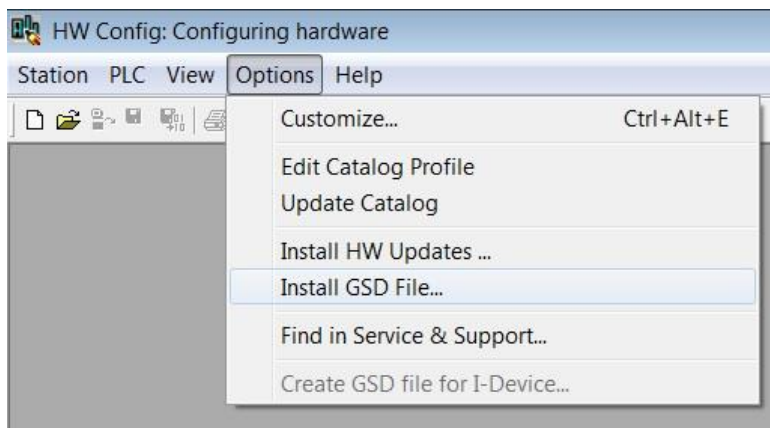
In the following dialogue please select the directory including the GSDML file. Mark the file on screen. „Close"
will finalize the operation. The same directory also includes the corresponding Bitmap file providing a small
encoder image in the engineering tool. This file is automatically installed in parallel.
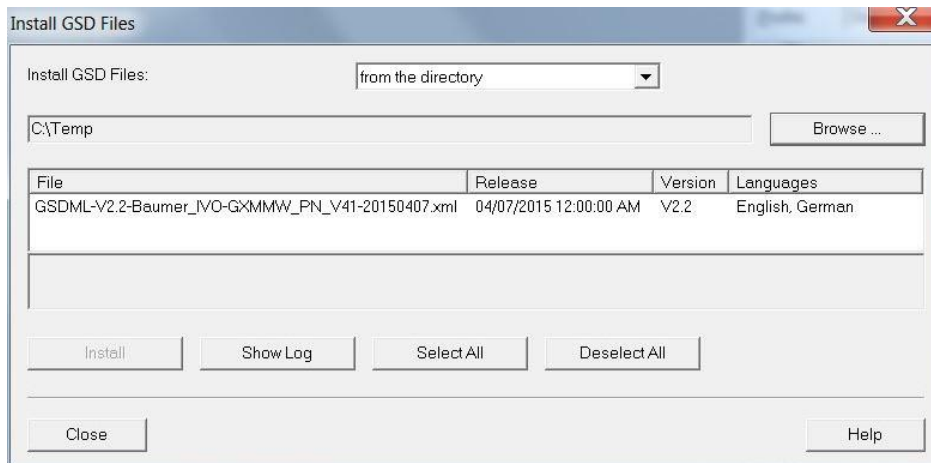
The encoder appears in the hardware catalog at the right under „PROFINET IO" – „Additional Field Devices" – „Encoders" – „Baumer IVO PROFINET Encoder" - "Baumer IVO PROFINET Encoder" – „GxxMW" ("xx" depending on encoder).
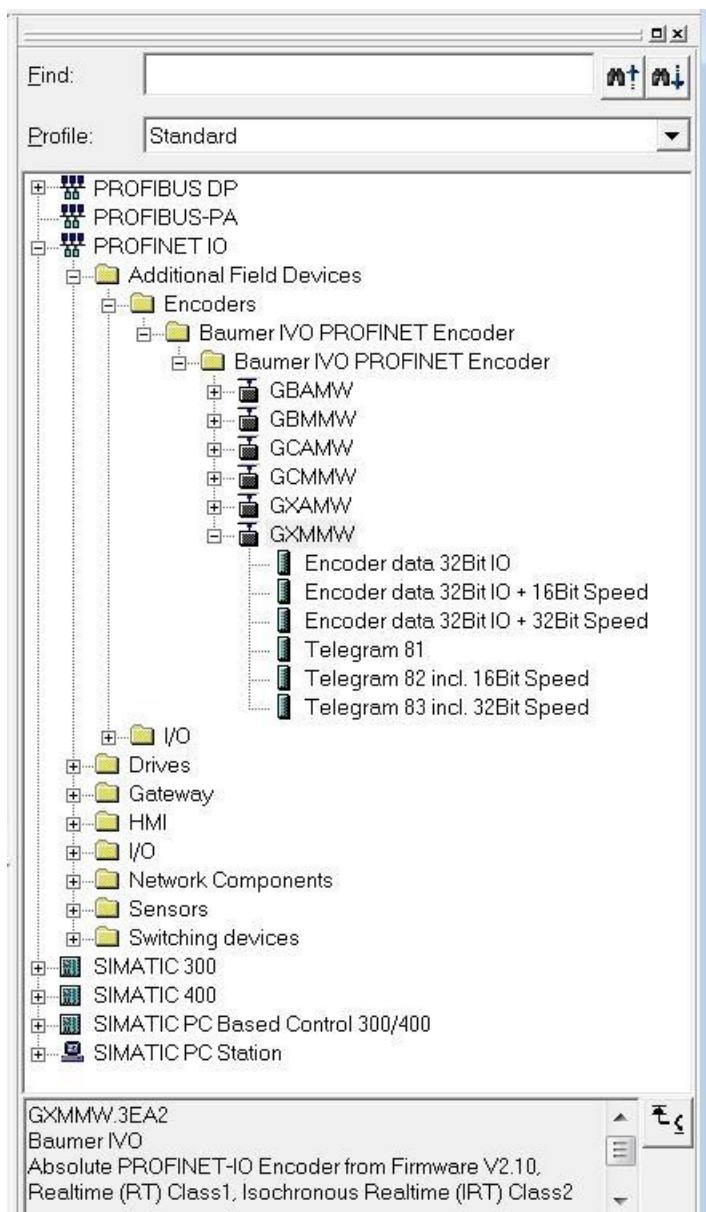
5.2. Inserting of the Encoder into the Project

Use the mouse to drag base module „GxxMW" from the hardware catalog at right to the bus rail.

Use the mouse again to drag encoder I/O module e.g. "Encoder data 32 bit EA + 32 bit" from the right out of the hardware catalog to plug-in position 1 of the module window at left below in the hardware catalog.
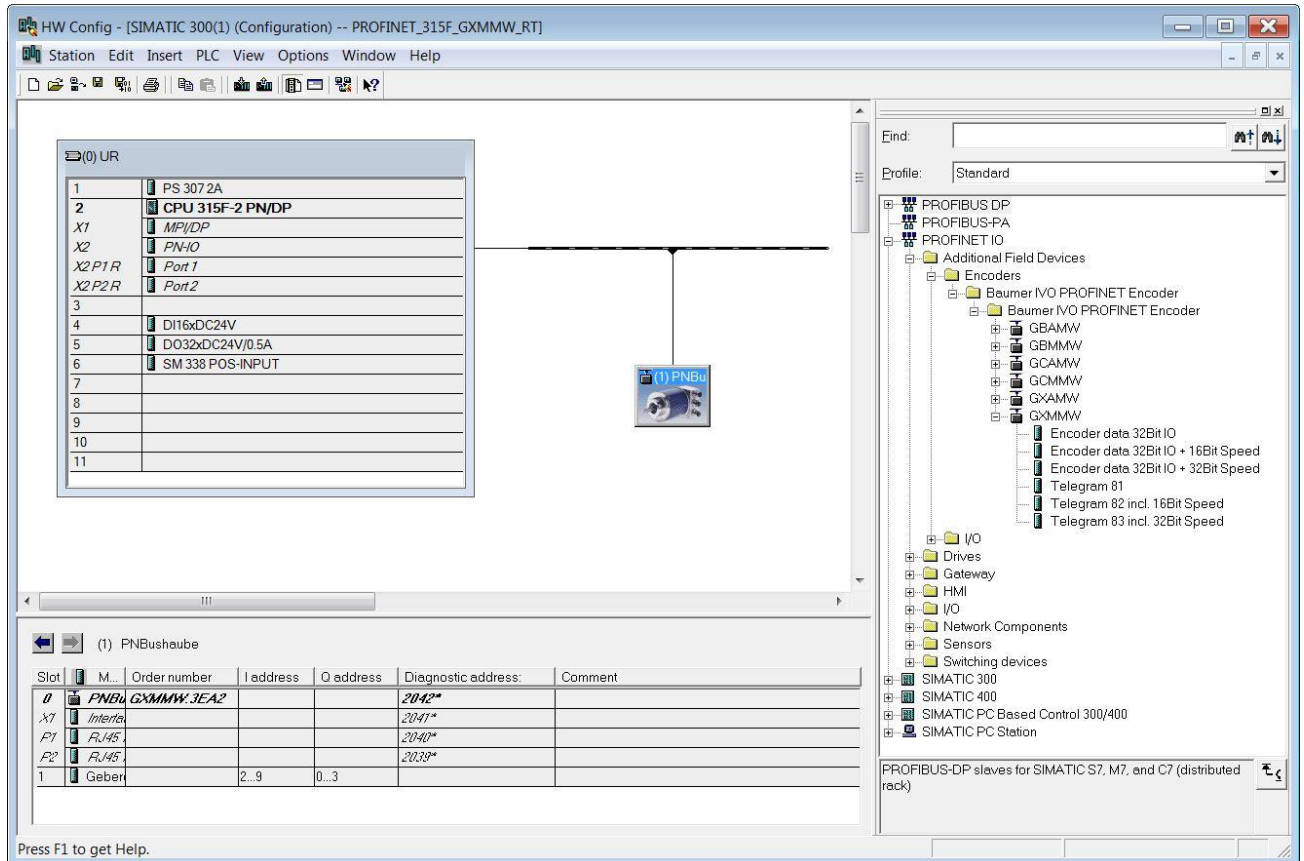
5.3. Assigning the device name

Device identification in the network requires the worldwide unique MAC device address, the (statically or dynamically assigned) IP address, and third a unique device name in the PROFINET network. All three identifiers are used when booting the system. The project work only requires assigning the device name.

5.3.1. Setting the Device Name in the Project

Double-click on the encoder symbol in HW-Config window. The properties window opens with an input field to enter the desired device name.

5.3.2. Automatic Name Assignment

The encoder's device name can also be set automatically.
When shipped (or after a factory setup), the device name is clear ("").

Preconditions for automatic name assignment:
- cleared device name
- active option „Support device replacement without exchangeable medium" in the properties window of the PLC – PN-IO – General (see screenshot below)
- topology planning.

Automatic name assignment runs as soon as the installed encoder is accessed in the network.
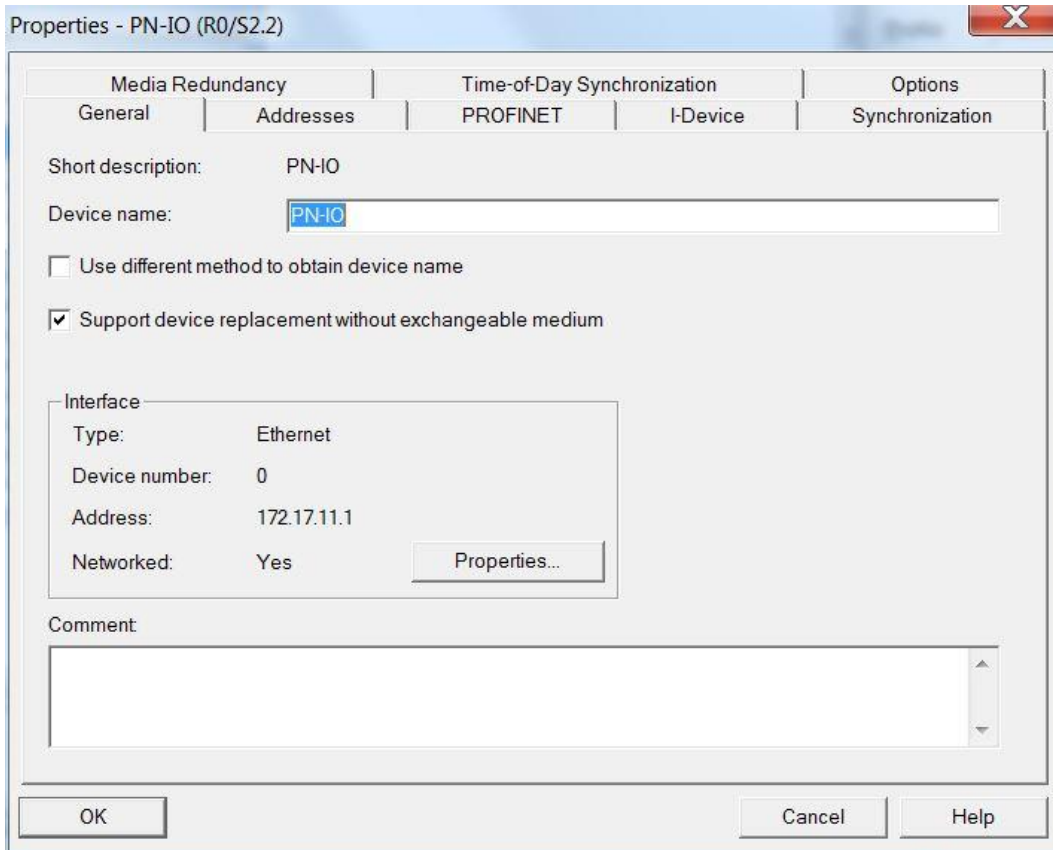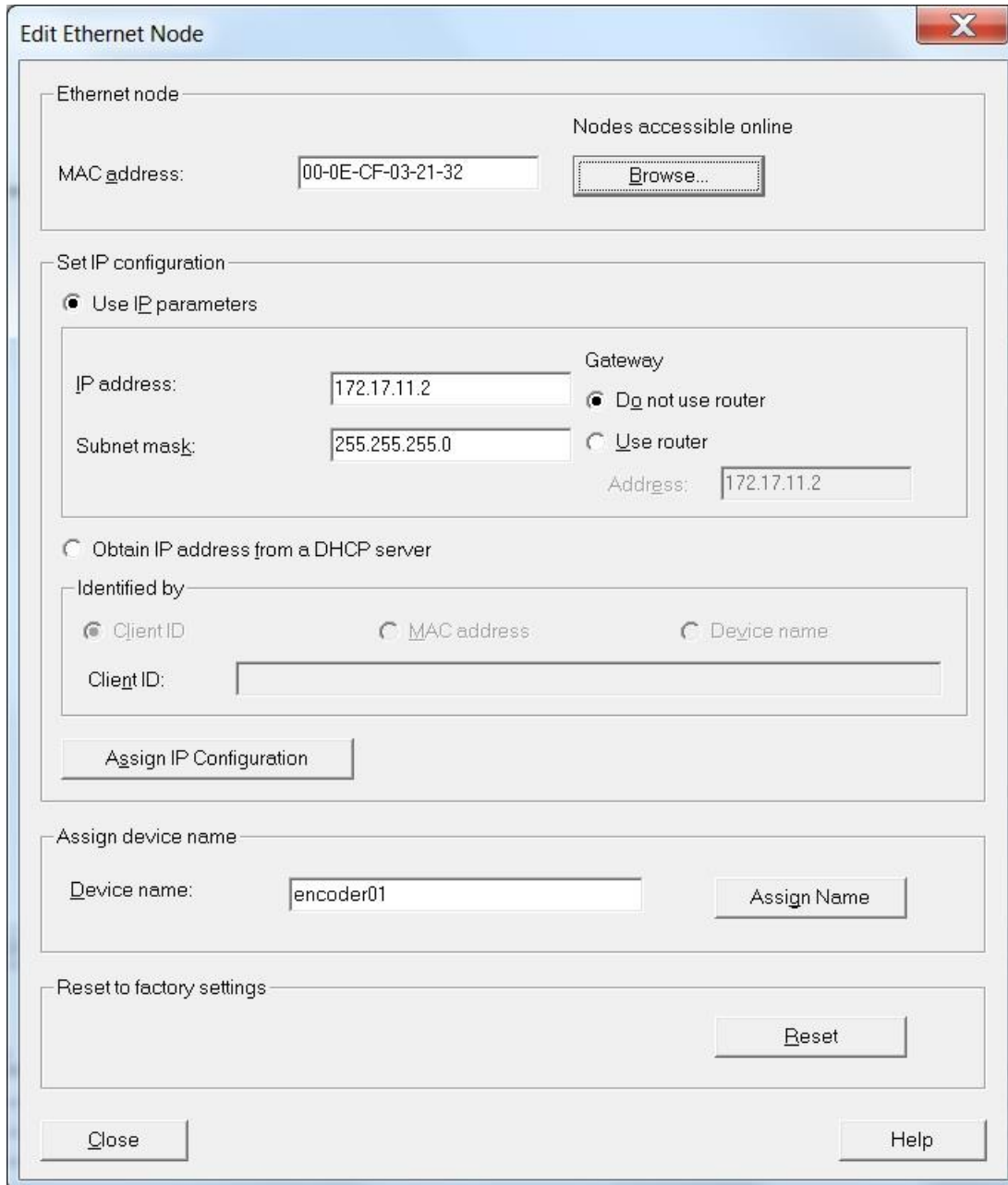
5.3.3. Manual name assignment

To perform an I/O system network scan, go to „PLC" – „Edit Ethernet Node" – „Browse". The scan provides all bus nodes. In the example the PLC and encoder „encoder01" was found.
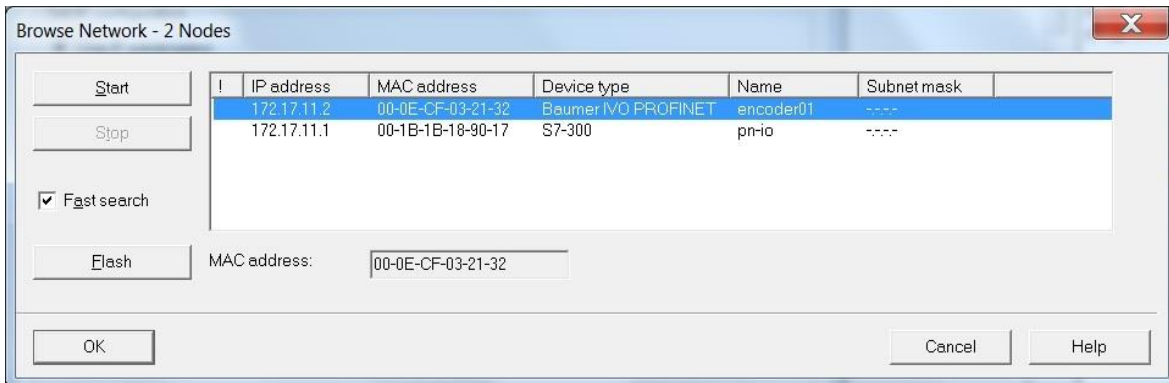
The MAC address serves as a unique identifier. When clicking the button „Flash" the highlighted device will flash its status-LED so it can be found easily amongst other devices.

A double-click on the desired line (here: encoder "encoder01") opens the window "Edit Ethernet Node" Enter the new name required for configuration in line „Device name". Click "Assign name" to execute. After this, the encoder will immediately be recognized with this name in the PROFINET Network.

Edit Ethernet Node

Ethernet node

MAC address: 00-0E-CF-03-21-32

Nodes accessible online
Browse...

Set IP configuration

○ Use IP parameters

IP address: 172.17.11.2

Subnet mask: 255.255.255.0

Gateway
● Do not use router
○ Use router
Address: 172.17.11.2

○ Obtain IP address from a DHCP server

Identified by
● Client ID   ○ MAC address   ○ Device name

Client ID:

Assign IP Configuration

Assign device name

Device name: encoder01   Assign Name

Reset to factory settings

Reset

Close   Help

Note:
It is not possible to set the device name via the MPI interface.

5.4. Realtime Class Selection

The encoder supports the three PROFINET real time classes Realtime (RT), Isochronous Realtime (IRT) Class2 and Class3. Which real time class is used best, depends on the demands of your application and thus on the controller used (i.e. on the PLC).

5.4.1. Domain Management

The Domain-Management determines the PROFINET bus properties.

Enter the Domain-Management by right-clicking the PROFINET bus rail in the Hardware window of Step7 software.

Copy	Ctrl+C
Paste	Ctrl+V
Paste Shared	
Insert Multi-Controller Device	
Insert Object...	
Edit PROFINET IO System IP Addresses...	
PROFINET IO Domain Management...	
PROFINET IO Topology....	
Specify Module...	
Delete	Del
Move	
Size	
Minimize	
Maximize	
Go To	▶
Object Properties...	Alt+Return
Open Object With...	Ctrl+Alt+O
Assign Asset ID...	
Product Support Information	Ctrl+F2
FAQs	Ctrl+F7
Find Manual	Ctrl+F6
Start Device Tool	
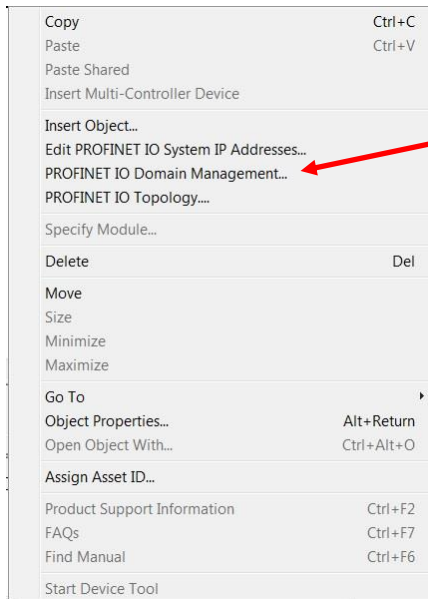
The screen shot below shows the name of the sync domain and the currently selected send clock. The send clock is common to the controller and all devices who are members of this sync domain. It is one of the key factors for overall performance of the PROFINET System.
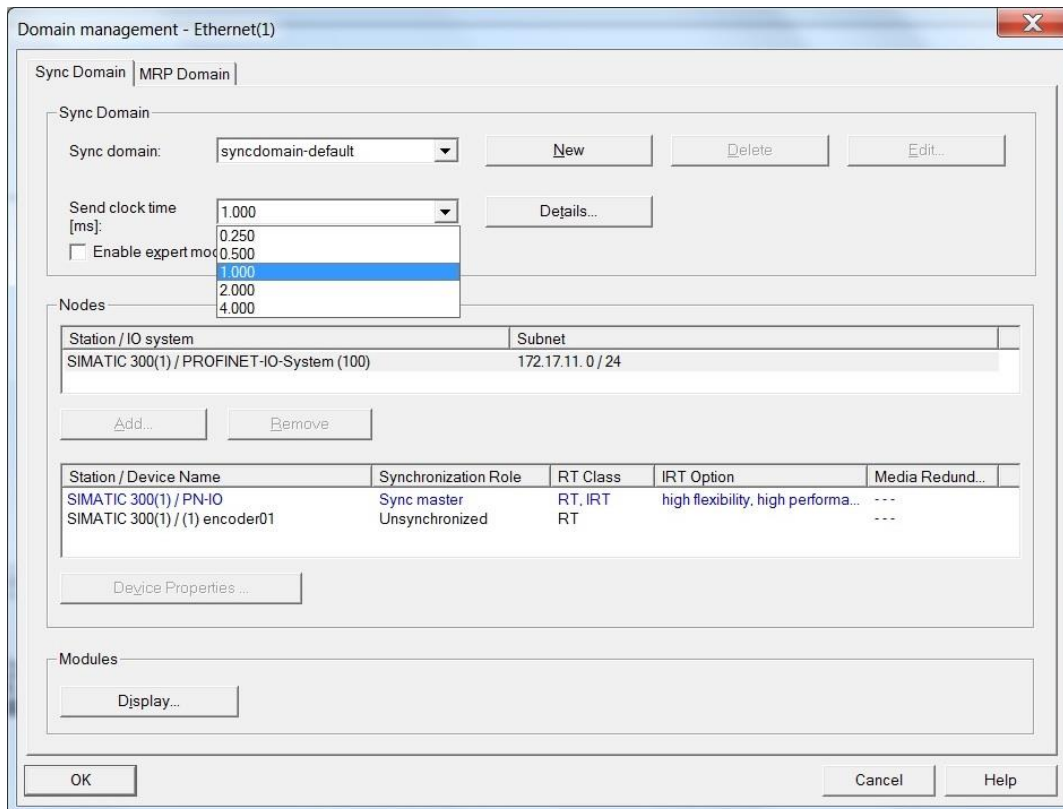
5.4.2. Realtime (RT) Class 1

Typical cycle time in realtime is 100ms or better.
The bus system allows for standard Ethernet components.

Topology planning is not mandatory, but where implemented (e.g. for retrieving feature „Support device replacement without exchangeable medium"), make sure ports P1/P2 are correctly assigned as projected.

5.4.2.1. Address-Assignment within the Process Image

Access to the encoder's input and output data takes place via addresses within the PLC's process image. Assign these addresses according to the needs of the PLC software.

Click on the encoder symbol in HW config of Step7 to select the encoder. Then double-click on module "encoder data 32 bit I/O (slot 1) at left below, opening the properties window with tab "Addresses".

Enter the start address of the respective address range or accept the system's proposal. Identical or overlapping addresses for input and output are possible. Make sure that the address ranges are located inside the cyclically updated process image "OB1 PI" of the main program (non-isochronous).
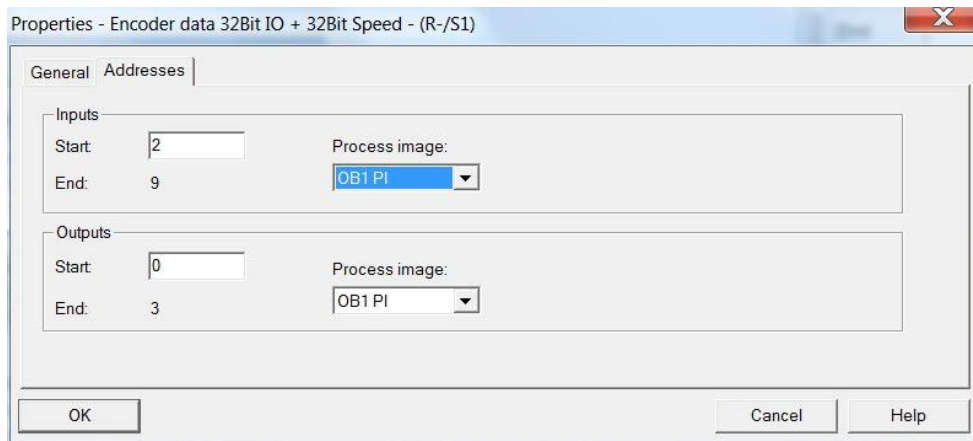
5.4.2.2. Synchronization Setup

Go to the Step7 HW-Config window and click on the encoder symbol on the bus rail to select it. Bottom left in the module window the various encoder modules are shown. Enter the interface properties with a double click on the „Interface" module.

The „Synchronization"-Tab shows the assignment to a certain sync domain. Realtime (RT) Class1 Mode is „not synchronized". Set the synchronization role accordingly.

In „RT class", choose between „RT" or „IRT". When „IRT" is selected, the „IRT option" offers „High Flexibility" (IRT Class2) or „High Performance" (IRT Class3). Settings have to comply with those taken for the controller.
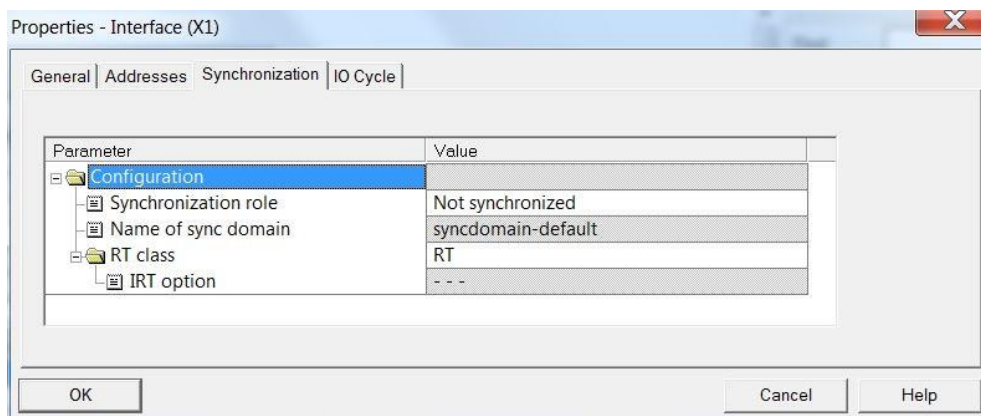
Properties Tab „IO Cycle", area „Update Time" offers settings for the requested Update Time. In relation to the send clock a reduction ratio „Factor" applies. In case of a reduction ratio the encoder will not update and send its position value each send clock cycle, but only every 2nd, 4th or 8th cycle. Not every application needs being updated at the high send clock rate. At a high bus load this reduction may save bandwidth. Applicable factors may vary with the real time class and send clock and are offered in the drop down area.

Properties - Interface (X1)

General | Addresses | Synchronization | IO Cycle

Update Time

Mode: Fixed factor

| | | Factor | | Send clock [ms] |
Update time [ms]: 1.000 = 1 x 1.000

Watchdog Time

Number of accepted update cycles with missing IO data: 3

Watchdog time [ms]: 3.000

Isochronous Mode

Assign IO device in isochronous mode:

Application cycle [µs]:   Data cycle [µs]:

Ti/To mode:

Time Ti (read in process values) [µs]:
TiMin...TiMax [µs]:   Timebase Ti/To [µs]:

Time To (output process values) [µs]:
ToMin...ToMax [µs]:

Isochronous Mode Modules / Submodules...

OK   Cancel   Help
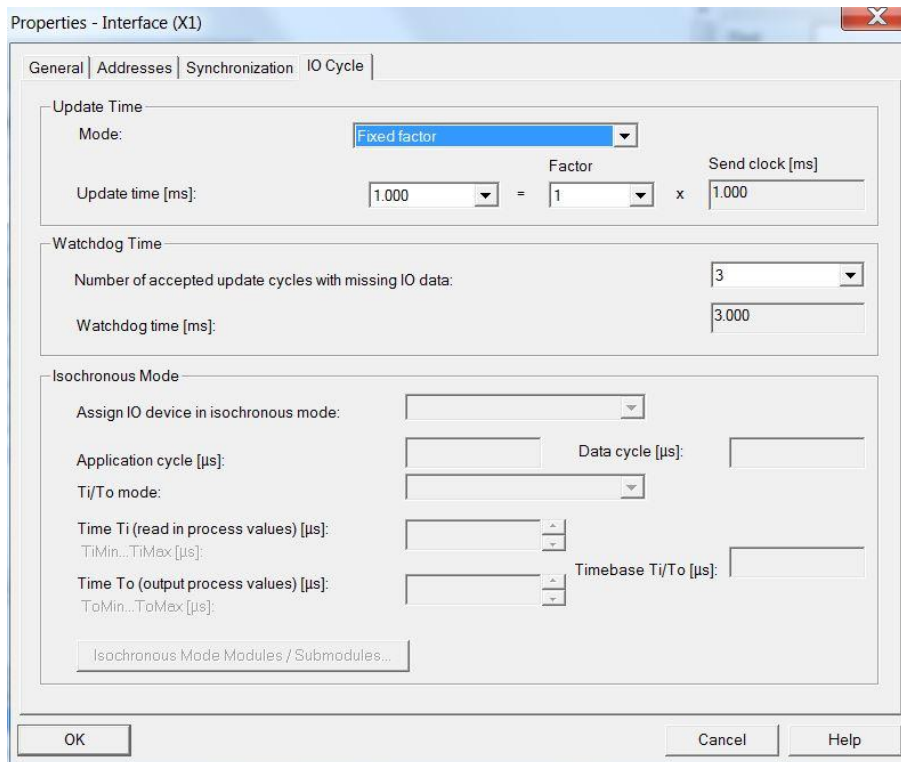
5.4.3.   Isochronous Realtime (IRT) Class 2

Typical cycle time is 10ms or better. Bus components (switches, etc.) must support PROFINET IRT.

Topology planning is not mandatory, but where implemented (e.g. for retrieving feature „Support device replacement without exchangeable medium), make sure ports P1/P2 are correctly assigned as projected.

5.4.3.1.   Address-Assignment within the Process Image

Proceed as in 5.4.4.1 „Address-Assignment within the Process Image".

5.4.3.2.   Synchronization Setup

Proceed as in 5.4.4.2 „Synchronization Setup" for Isochronous Realtime (IRT) Class 3".
However, choose „IRT" and „High Flexibility" rather than „high Performance" for the „RT-Class".

5.4.4.   Isochronous Realtime (IRT) Class 3

Isochronous realtime considering signal delays, typical cycle time 1ms or less. Position is acquired with +/- 1µs precision or higher, according to high-precision bus clock.

Topology planning is mandatory. Make sure ports P1/2 are correctly assigned as projected.

5.4.4.1. Address-Assignment within the Process Image

Access to the encoder's input and output data takes place via addresses within the PLC's process image. Assign these addresses according to the needs of the PLC software.

Click on the encoder symbol in HW config of Step7 to select the encoder. Then double-click on module "encoder data 32 bit I/O (slot 1) at left below, opening the properties window with tab "Addresses".

Enter the start address of the respective address range or accept the system's proposal. Identical or overlapping addresses for input and output are possible. Make sure that the address ranges are located inside the cyclically updated part process image "PIP 1" of the isochronous system task (e.g.OB61)
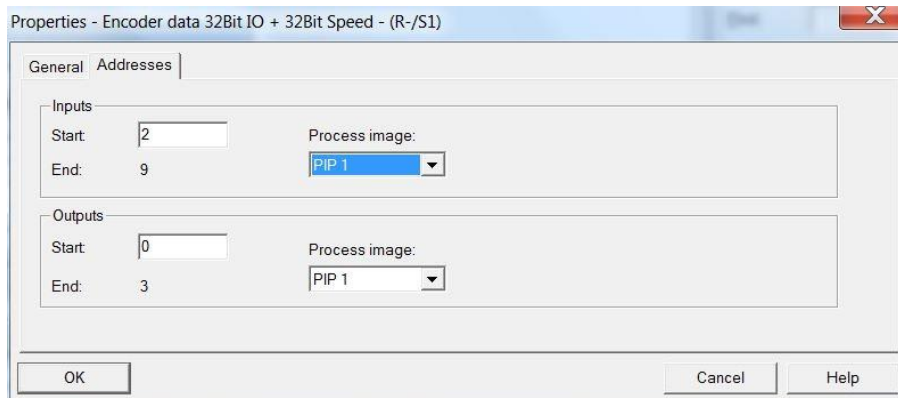
5.4.4.2. Synchronization Setup

Go to the Step7 HW-config window and click on the encoder symbol on the bus rail to select it. Bottom left in the module window the various encoder modules are shown. Enter the interface properties with a double click on the „Interface" module.

The „Synchronization"-Tab shows the assignment to a certain sync domain. Set the synchronization role to "Sync Slave".

Set the „RT-Class" to „IRT" and as „IRT Option" choose „high performance" (IRT Class3).
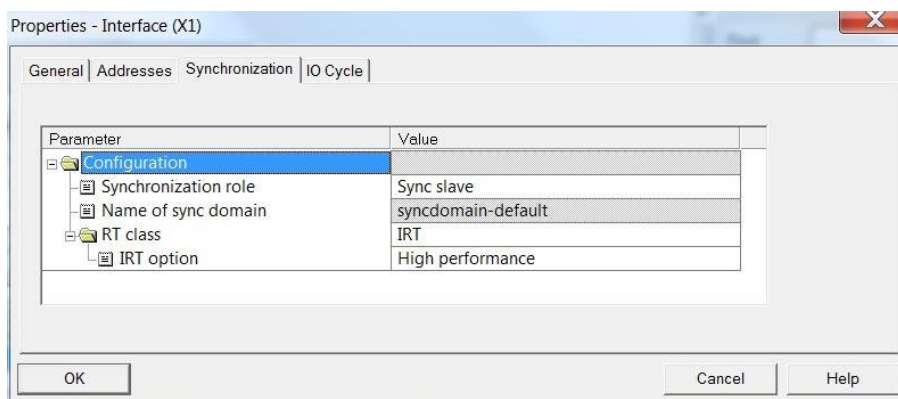
Properties Tab „IO Cycle", area „Update Time" offers settings for the requested Update Time. In relation to the send clock a reduction ratio „Factor" applies. In case of a reduction ratio the encoder will not update and send its position value each send clock cycle, but only every 2nd, 4th or 8th cycle. Not every application needs being updated at the high send clock rate. At a high bus load this reduction may save bandwidth. Applicable factors may vary with the real time class and send clock and are offered in the drop down area.

In area „isochronous Mode", option „Assign IO device in isochronous mode" select the assignment to the isochronous system function OB61.
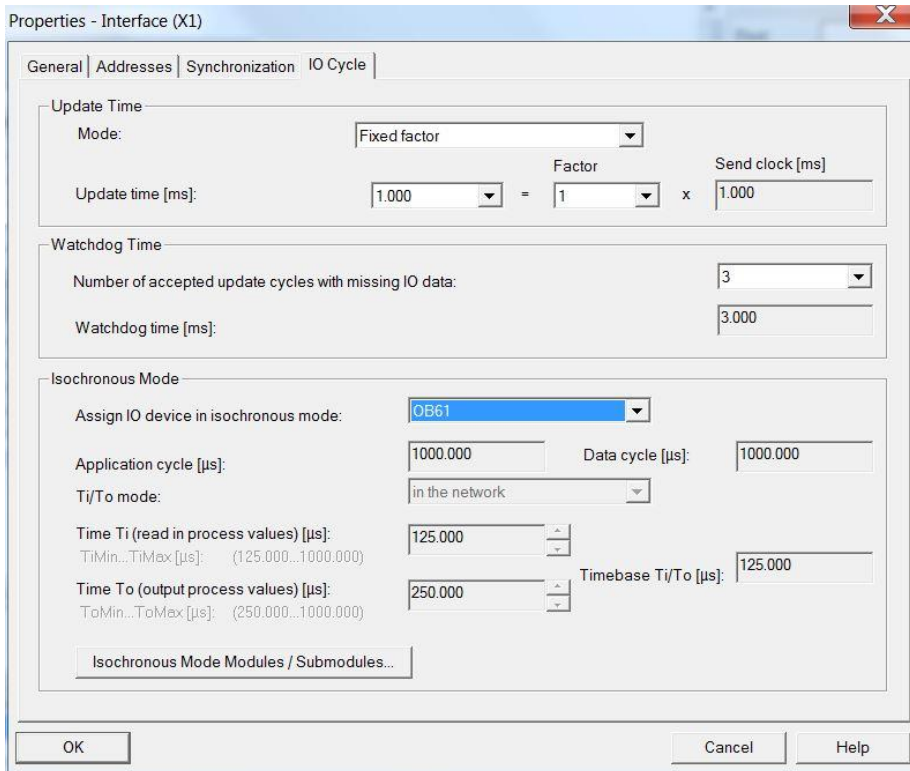
5.4.4.3. IO system Assignment to Synchronous Cycle Interrupts

Open Step7 HW-config window. Double-click on CPU main module. In „Properties" window, tab „Synchronous Cycle Interrupts", PROFINET string „IO System Nr. 100" is assigned to Synchronous Cycle Interrupt OB 61.
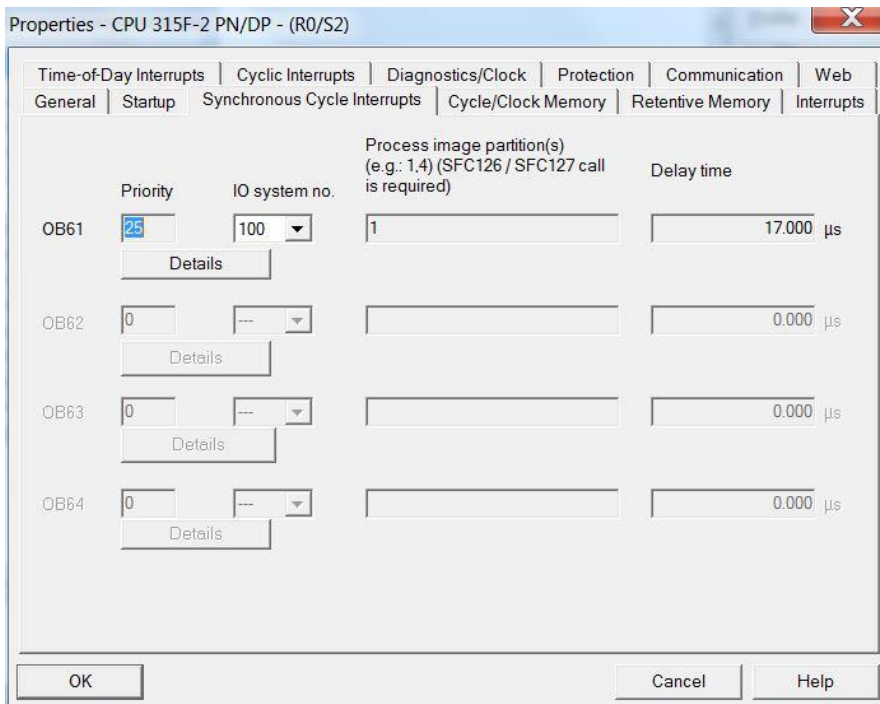
A click on button „Details" provides OB61 properties assigned sub-process image 1.

The application cycle is selected in the view below.
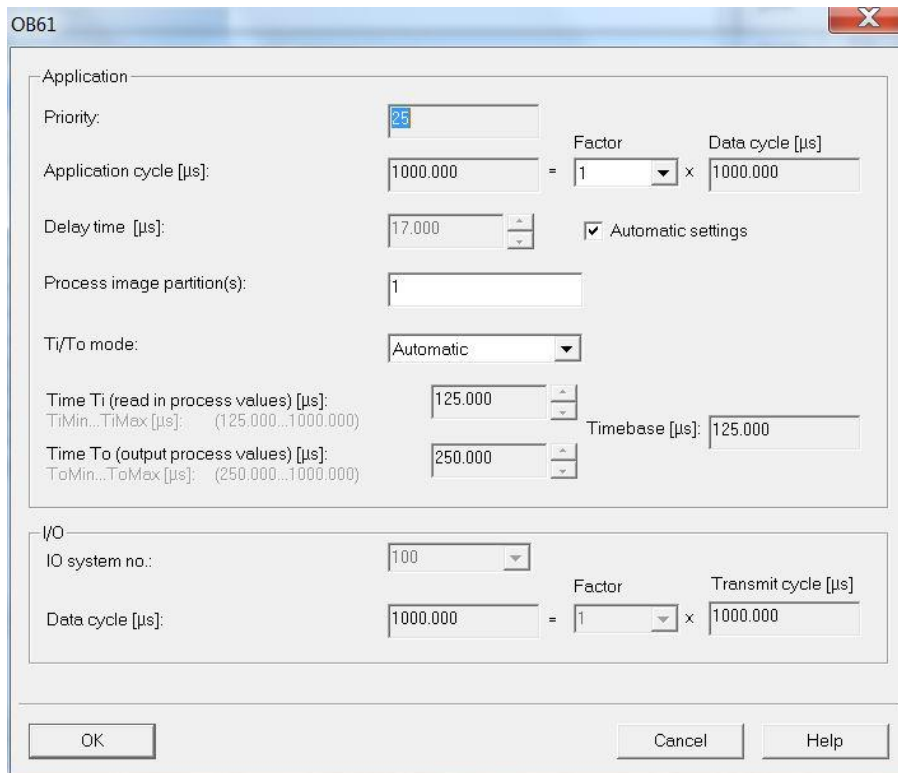
5.5. Topology Planning

It is obligatory to plan the topology in order to perform IRT Class3 and / or to utilize the system feature "Device replacement without exchangeable medium". Port connections and cable lengths between all system components are made known to the project. In this way the project tool is enabled to consider cable-, port- and switch delay times and to optimize overall performance.

Enter Topology Planning e.g. by right-clicking the PROFINET bus rail in the Hardware window of Step7 software, which opens the following pull-down menu.
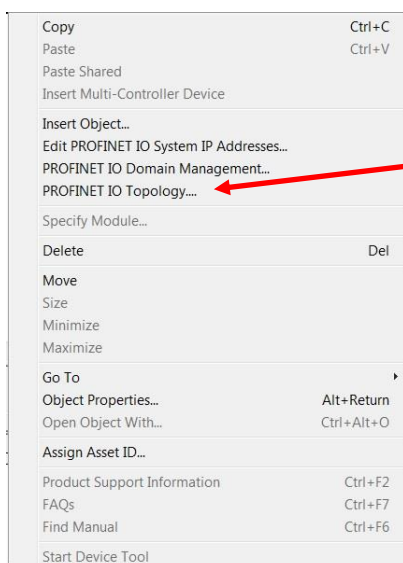
The Graphic View clearly shows port assignment of all bus components. The assignment made here must fit to the real conditions.

In the example below, controller port1 is linked to port 1 of the encoder. The programming tool (PG/PC) is connected to port 2 of the controller.

A double click on the collections allows to input the respective cable length. Offline/Online comparison allows measuring the real values in order to correct data if required.
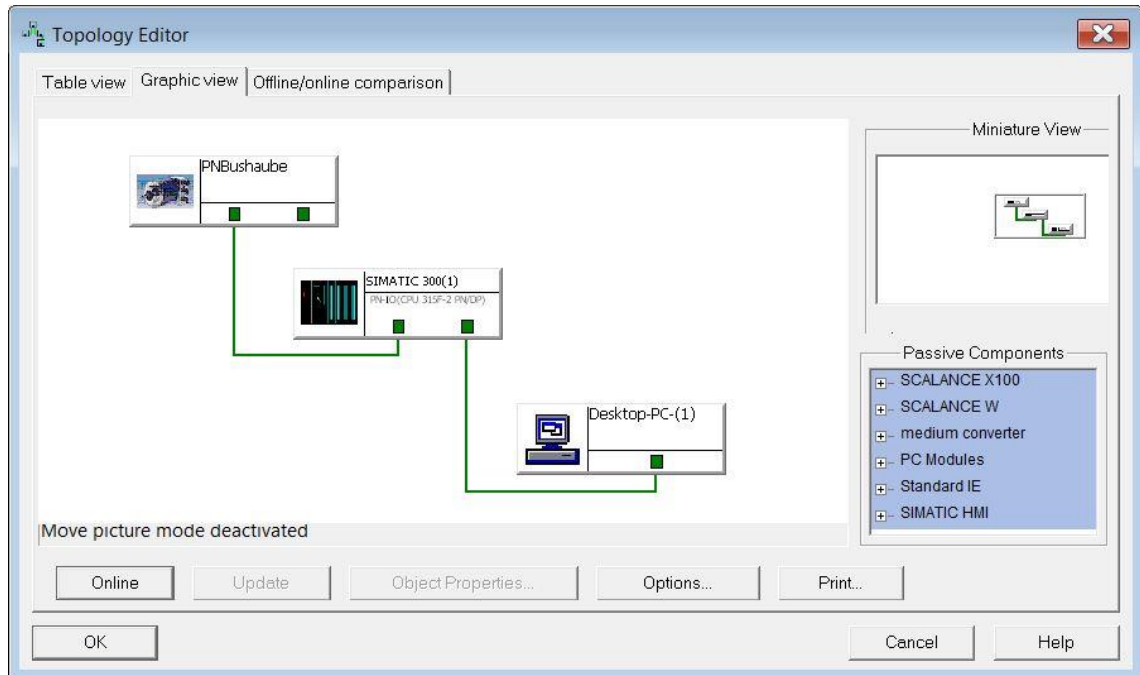
5.6. Parameterization

A double-click on the encoder module in slot 0 will open the window „Properties - PNBushaube" with tabs „General", „Addresses" and „Parameters". Under tab „Addresses" the device diagnostic address can be changed or predefined default can be adopted.

Tab „Parameter" serves for encoder configuration.
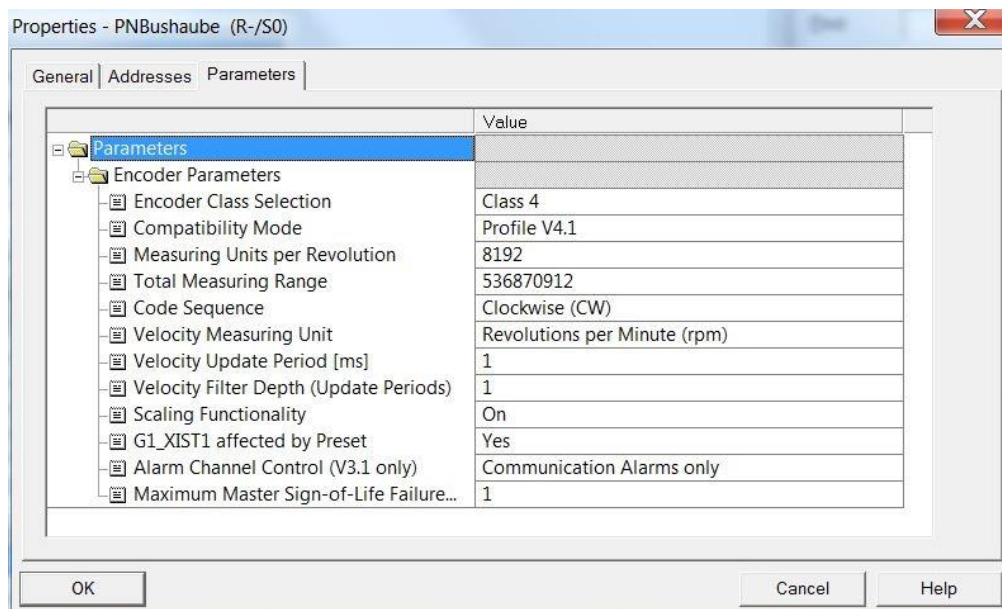
5.6.1. Encoder Class Selection

In encoder class 4, all parameter settings are enabled and affect configuration.

In encoder class 3 some parameters are permanently on default, regardless of the user configuration:
- scaling is not enabled
- the number of steps per revolution is fixed to the maximum of the respective basic encoder
- total measuring range is fixed to the maximum of the respective basic encoder
- rotation sense is fixed to cw
- preset functionality not supported.

5.6.2. Compatibility Mode

Compatibility mode according to encoder profile V3.1,
- considers parameter „max. master life sign error"
- „CR" bit in status word ZSW2 of the PROFIdrive telegrams is always „0".
- control words and setpoints will be adopted, independent of the CP bit in Control Word STW2
- preset will only affect position value G1_XIST2, not G1_XIST1.

5.6.3. Measuring Units per Revolution

Configuration of singleturn resolution within the range from 1 on to the maximum encoder resolution.

Note: A change in resolution parameters clears the preset offset value (if any) so that the current position reference will be lost. See also 6.6 "Preset function".

This setting will be taken into account in Encoder Class 4 only (see Abs. 5.6.1).

5.6.4. Total measuring range

Parameterization of the required total measuring range „TMR".

With singleturn encoders, enter the same value here as for the "Measuring units per revolution"

Admissible values range from 2 to the product of the programmed resolution multiplied by the encoder's maximum number of revolutions. See also 5.6.13 "Important Note for Multiturn Encoder Operation".

Note: A change in "Total measuring Range" clears the preset offset value (if any) so that the current position reference will be lost. See also 6.6 "Preset function".

This setting will be taken into account in Encoder Class 4 only (see Abs. 5.6.1).

5.6.5. Code Sequence

Position data behavior relates to the rotation direction of the encoder shaft when looking at the flange.
CW („clockwise")   = Ascending values with clockwise rotation
CCW („counter-clockwise")   = Ascending values with counter-clockwise rotation

This setting will be taken into account in Encoder Class 4 only (see Abs. 5.6.1).

5.6.6. Speed Measuring Unit

Please refer to 6.5.1 „Speed Measuring Unit "

5.6.7. Speed Update Period

Please refer to 6.5.2 Speed Update Period"

5.6.8. Speed Filter Depth

Please refer to 6.5.3 „Speed Filter "
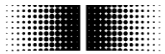
5.6.9. Scaling Functionality

Parameter setting „Scaling Functionality on" will consider the settings in „Measuring Units per Revolution" and „Total Measuring Range".

Parameter setting „ Scaling Functionality off" will always consider the maximum „ Measuring Units per Revolution " and maximum „ Total Measuring Range " of the basic encoder.

This functionality is only supported in encoder class 4. (see chapter 5.6.1).
Encoder class 3 implicates „scaling off".

5.6.10. Preset affects G1_XIST1

If „yes", the preset will have an effect on both position values G1_XIST1 and G1_XIST2. If „no", there will be only an effect on position value G1_XIST2.

In compatibility mode according to V3.1, the preset will always affect position value G1_XIST2 only. Setting is of no importance when using standard telegrams 100 to 102.

5.6.11. Alarm Channel Control

Compatibility mode according to V3.1 enables optional suppression of transmitting channel-specific diagnostic alarms, while in profile V4.1 transmission of channel-specific diagnostic alarms is always enabled.

5.6.12. Maximum Master Sign-of-Life Failures

Compatibility mode according to profile V3.1:
Parameter for maximum tolerated master life sign failures (MLS) monitoring.
Setting „255" means no monitoring („off") .
Acyclic PROFIdrive parameter 925 is without effect.

Mode according to profile V4.1:
Total of tolerated errors is „1" by default (factory settings) but can be changed in acyclic PROFIdrive parameter 925. Setting "255" means no monitoring ("off").

Encoder parameter „ Maximum Master Sign-of-Life Failures " is without effect.

5.6.13. Important Note for Multiturn Encoder Operation

„Endless Operation" is automatically supported where required.

Thus, there are no special requirements for the encoder parameters "total measuring range" and "measuring units per revolution" to stand in a certain ratio.

With endless operation active, the encoder shaft must not rotate when the encoder is unpowered. In those cases where powerless motion cannot be avoided, the encoder has to be referenced (presetted) after every power-up. With Endless Operation inactive, the encoder shaft may rotate unlimitedly when encoder is not powered.

How to determine if „Endless Operation" is in use together with given parameters:
- Multiply the encoder's „max. possible revolutions" (depending on encoder 16 bit = 65536 or 13 bit = 8192) by your parameter setting „measuring units per revolution".
- Divide this value by your parameter setting „total measuring range".
- If there is a division remainder, endless operation is in use.

Example for parameters without endless operation:

Maximum possible revolutions	65536	(16 bit multiturn)
Measuring units per revolution	3600	
Total measuring range	29.491.200	(8192 x 3600)
Calculation:	65536 x 3600 / 29.491.200 = 8 (no remainder)	

Example for parameters with endless operation:

Maximum possible revolutions	65536	(16 bit multiturn)
Measuring units per revolution	3600	
Total measuring range	100.000	
Calculation:	65536 x 3600 / 100.000 = 2359 remainder 29600	

5.7. Implementation of system functions for alarm handling

Make sure that the system components required for alarm handling have been implemented in the project. To Siemens Step7 projects apply in particular OB82 ("I/O Point Fault") and OB86 ("Loss Of Rack Fault"). Missing these components will result in a PLC to STOP in case of alarm.

5.7.1. I/O Point Fault - OB

The encoder supports the follwing channel related diagnostic alarms:

Alarm	Error Number
Battery low (*)	20 (14h)
Position error	22 (16h)
Parameter error (*)	26 (1Ah)
Basic encoder error – communication (analog) (*)	28 (1Ch)
Basic encoder error – communication (digital) (*)	29 (1Dh)
Preset error: value out of range	30 (1Eh)

(*) Channel-specific diagnostics in the event of error is already present during encoder bootup.

5.7.2. Loss Of Rack Fault - OB

Loss Of Rack Fault OB (OB86) is triggered when the encoder is available on the bus after bootup („outgoing event) or when being no longer accessible (switched off or disconnected from the bus, „incoming event").

5.8. Compilation and load of hardware and software configuration

After complete hardware project configuration and once having entered all parameters the project must be compiled ("translated") and exported to the PLC.

5.9. Restore Factory Defaults

The projecting tool may be used to restore encoder settings to the factory default values. Preparations and proceedings are described in chapter 5.3 "Device name assignment". Click button „Reset" in Field "Reset to Factory Settings" as shown in 5.3.3. The restore operation must be followed up by encoder power off and on.

The entire customer-specific configuration including device name and IP will be deleted. Only MAC-ID and serial number are retained.

Note: The device name being deleted may make the PLC immediately try to allocate the projected name again. If this is unwanted, automated name allocation should be disabled in project „Device exchange without removable media" prior to executing the Factory Setup.

6. PROFINET operation

6.1. Controller

After having connected the encoder and started the controller (PLC) there is an automated PROFINET boot up implicating a comprehensive initialising procedure. The device is assigned an IP and the communication and application structure is built up.

6.2. Operating status indicator (multi-color LED)

The bus cover provides an integrated multi-color LED indicating the encoder's operating status. The LED will always signal one of the following operating statuses as long as the encoder is live:

Color	Status
LED yellow continuous	Encoder not active in the bus, no PROFINET link.
LED green continuous	PROFINET link provided by one or both ports (link status active)
LED red continuous for 2,5 s	position error or maximum speed exceeded.
LED red flashing slowly (1 Hz)	Parameterization error
LED red flashing fast (5 Hz)	Preset value out of range

At encoder power-on the LED is lit continuously yellow until the PROFINET controller (PLC) has established the link to the device (encoder). Usually this state is pretty short if the master is already running. However, this state persists in case communication cannot be established, maybe due to a malfunction in the PROFINET cable.

Provided encoder configuration and parameterization was successful (automated process) the cyclic data communication will commence. The LED green continuous signals cyclic data exchange with the controller.

Upon occurrence of a position leap („code consistency error") or excess speed of more than 6200 rpm the LED will change to red continuous for at least 2.5 s. If the signalized error remains or occurs repeatedly within this time, red continuous will be extended correspondingly.

If the encoder receives a preset value outside the limits the LED will change to red flashing fast (5 Hz). This alarm remains until the encoder is receiving an admissible preset value.

In case of incorrect parameterization by the master the LED is flashing red slowly (1 Hz). This may be due to incorrect parameter input in the engineering tool. Most of incorrect inputs are prevented by the GSDML file, but eliminating every error is not possible.

6.3. Activity indicator (green LEDs)

The bus cover provides two additional green Link / Activity LEDs to signal data communication status on ports P1 and P2. During non-permanent data communication (e.g. during bootup) the LEDs flash irregularly. In cyclic data exchange they are lit continuously.

6.4. Input and output data

6.4.1. Standard-Telegram 100: 32 Bit EA

The encoder cyclically transmits consistent, right-aligned 32-bit input and output data.

Output data (preset value)
Output data will set the encoder to a defined position within the configured total value range.

Preset	31																														0
	Preset value (right aligned). Preset operation by bit31																														

Bit 31:   Preset-Bit

Input data (position value)
Encoder transmits a consistent 32-bit, right aligned data word.

Position	31																														0
	Encoder position (right aligned)																														

6.4.2. Standard Telegram 101: 32 bit EA + 16 bit speed

Output data same as in standard telegram 100.

Input data (position value and 16 bit speed)
Encoder transmits a consistent 32-bit, right aligned data word.
Additional Speed value as a signed 16bit 2's complement value

Position	31																														0
	Encoder position (right aligned)																														

Speed	15														0
	Speed as a 16bit 2's complement value														

6.4.3. Standard telegram 102: 32 Bit EA + 32 bit speed

Output data same as in standard telegram 100.

Input data (position value 32bit speed)
Encoder transmits a consistent 32-bit, right aligned data word.
Additional Speed value as a signed 32bit 2's complement value

Position	31																														0
	Encoder position (right aligned)																														

Speed	31																														0
	Speed information as a signed 32bit 2's complement value																														

6.4.4. PROFIdrive Telegram 81

Output data

STW2	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Master Life sign				0	CP	0	0	0	0	0	0	0	0	0	0

G1_STW1	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	SEA	PS	TAR	PR	REL	0	0	0	0	0	0	0	0	0	0	0

- CP: Control by PLC
- SEA: Sensor Error Acknowledge
- PS: Parking Sensor

- TAR: Transfer Absolut Request
- PR: Preset: „Request set/shift of home position"
- REL: Preset Relative / „Home position mode"

Input data

ZSW2	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Slave Life sign				0	0	CR	0	0	0	0	0	0	0	0	0

G1_ZSW1	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	SE	PSA	TAA	PA	EAIP	0	0	0	0	0	0	0	0	0	0	0

G1_XIST1	31															0
	Encoder position (right aligned) with or w/o preset offset															

G1_XIST2	31															0
	Encoder position (right aligned) or error message															

- CR: Control by PLC: „Control Requested"
- SE: Sensor Error
- PSA: Parking Sensor Active
- TAA: Transfer Absolute Acknowledge
- PA: Preset Acknowledge
- EAIP: Error Acknowledgment In Process

6.4.5. PROFIdrive Telegram 82

Output data: same as in telegram 81.
Input data: same as in telegram 81, but in addition 16bit speed information NIST_A.

Input data

ZSW2	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Slave Life sign				0	0	CR	0	0	0	0	0	0	0	0	0

G1_ZSW1	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	SE	PSA	TAA	PA	EAIP	0	0	0	0	0	0	0	0	0	0	0

G1_XIST1	31															0
	Encoder position (right aligned) with or w/o preset offset															

G1_XIST2	31															0
	Encoder position (right aligned) or error message															

NIST_A	15									0
	Speed information as a 16bit 2's complement									

6.4.6. PROFIdrive Telegram 83

Output data: same as in telegram 81.
Input data: same as in telegram 81, but in addition 32bit speed information NIST_B.

Input data

ZSW2	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Slave Life sign				0	0	CR	0	0	0	0	0	0	0	0	0

G1_ZSW1	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	SE	PSA	TAA	PA	EAIP	0	0	0	0	0	0	0	0	0	0	0

G1_XIST1	31															0
	Encoder position (right aligned) with or w/o preset offset															

G1_XIST2	31															0
	Encoder position (right aligned) or error message															

NIST_B	31															0
	Speed information as a signed 32bit 2's complement value															

6.4.7. Control Word STW2

STW2	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Master Life sign				0	CP	0	0	0	0	0	0	0	0	0	0

Bit	Name	Function
CP	Control by PLC	The controller must set the bit upon transmission start of valid control words and set points. Encoder will only accept control words and set points if the CP bit is set. In compatibility mode of profile V3.1, the CP bit is of no significance so that control words and set points will unconditionally be accepted. Status word and actual values are output independently from the state of CP bit.
MLS	Master Life sign	Encoder evaluation of master life sign starts as soon as the MLS is non-zero. As soon as master life sign is non-zero, • encoder starts outputting the slave life sign (see ZSW2), • encoder starts monitoring MLS continuity. Any MLS discontinuity is followed by error message 0x0F02 and setting SE bit. MLS monitoring performs independently from the state of CP bit.

6.4.8. Control Word G1_STW1

G1_STW1	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	SEA	PS	TAR	PR	REL	0	0	0	0	0	0	0	0	0	0	0

Bit	Name	Function
REL	Preset Relative	If set, the encoder will perform a relative preset operation when the PR bit is set.
PR	Preset Request	The PR bit set will make the encoder perform a preset operation.
TAR	Transfer Absolut Request	This bit is not considered.
PS	Parking Sensor	The PLC „parks" the encoder using this bit. With the encoder parked, • bit PSA (Parking Sensor Active) is set in ZSW1 • all position data are being reset to zero (G1_XIST1, G1_XIST2, NIST_A/B • all present errors are cleared. • No output of future errors.
SEA	Sensor Error Acknowledge	I/O controller request for error message reset. Static encoder signal evaluation (no edge detection).

6.4.9. Status Word ZSW2

ZSW2	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	Slave Life sign				0	0	CR	0	0	0	0	0	0	0	0	0

Bit	Name	Function
CR	Control Requested	Control by PLC requested In profile 4.1 the bit remains on set as long as no parameter error is present. In compatibility mode of profile V3.1 the bit remains "0".
SLS	Slave Life Sign	Initial SLS status is zero. As soon as the master life sign is non-zero, the encoder starts outputting the slave life sign (see also STW2) and will not be zero again.

6.4.10. Status Word G1_ZSW1

G1_ZSW1	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	SE	PSA	TAA	PA	EAIP	0	0	0	0	0	0	0	0	0	0	0

Bit	Name	Function
EAIP	Error Acknowledgement In Process	This signal is part of the error handling. • error identified by encoder • encoder sets SE bit in G1_ZSW1 and error code in G1_XIST2 • Error is recognized by the controller, setting the SEA bit in G1_STW1 • encoder acknowledgement by setting of EAIP Bit • SE bit in G1_ZSW1 reset by encoder. Position value in G1_XIST2. • EAIP bit reset by encoder
PA	Preset Acknowledge	Bit is set by encoder after the preset operation has been successfully completed. Bit reset is in parallel with PR bit reset by controller.
TAA	Transfer Absolute Acknowledge	The bit is set as soon as G1_XIST2 supplies valid position data and will be reset upon setting the „SE" or „PSA" bit.
PSA	Parking Sensor Active	Acknowledgement reaction on PS bit by G1_STW1
SE	Sensor Error	The bit is set as soon as the encoder has identified an error. Error code is presented in G1_XIST2. Bit „TAA" is being reset. Error codes: • 0x0001 position error • 0x0F01 invalid command in G1_STW1 • 0x0F02 Master life sign failure

6.5. Speed

Manufacturer-specific telegrams 101 and 102 as well as PROFIdrive telegrams 82 and 83 deliver speed information besides the absolute position value.

6.5.1. Speed Measuring Unit

Speed scaling provides four options:
- rpm   revolutions per minute.
- steps /10ms   number of steps in the configured singleturn resolution every 10ms
- steps /100ms   number of steps in the configured singleturn resolution every 100ms
- steps /1000ms   number of steps in the configured singleturn resolution per second

Scaling is defined by encoder parameterization, see also chapter. **Fehler! Verweisquelle konnte nicht gefunden werden.**„Parameterization".

Each scaling option provides measured value output as a „signed integer". Positive values indicate the direction of rotation with rising position values. Which rotational direction is assigned "positive" depends on the CW/CCW parameter setting.

If speed is outside the +32767 to –32768 range (16 bit speed format), the encoder will output the respective maximum value. Depending on the applied basic encoder and configuration, the maximum value may be achieved even at very low speed. The 32 bit speed format will prevent any overrun.

6.5.2. Speed Update Period

Encoder speed is measured during an update period. Input data are updated at the end of each period.

A short speed update period entails a more dynamic speed output, whereas an extended update period ensures more stable values. The optimum speed update period depends on the application requirements.

The update period can be configured within the range from 1ms to 255 ms.
For configuration refer to chapter **Fehler! Verweisquelle konnte nicht gefunden werden. „Fehler! Verweisquelle konnte nicht gefunden werden.**".

6.5.3. Speed Filter Depth

The speed information acquired within in the update period can be filtered throughout several update cycles. Regardless the configured filter depth, the speed information in the input data is updated at the end of every update cycle.

A shallow filter depth (number of update cycles) entails a more dynamic speed output, whereas a higher filter depth ensures more stable values. The optimum speed filter depth in interaction with the configured update time depends on the application requirements.

The filter depth, which is the total number of average update cycles, is configurable within the range from 1 to 255. For configuration refer to chapter **Fehler! Verweisquelle konnte nicht gefunden werden. „Fehler! Ve rweisquelle konnte nicht gefunden werden.**".

6.6. Preset function

The preset function in the encoder is triggered as soon as the PLC sets the "Preset-Bit" (see below) in the output data. The encoder position is set to the given preset value

For optimum alignment of mechanical position to preset we recommend to set the preset value during encoder standstill, but it may also execute while encoder rotates for less accurate requirements.

It is mandatory to parameterize the required resolution or code sequence (cw/ccw) <u>prior to</u> performing the preset operation.

Upon performing a preset operation an internal offset is calculated and stored non-volatile in the Flash memory to make sure the encoder will be at the same position after cycling power.

Although the Flash provides +100.000 write cycles, frequent software- or event-triggered preset operations may consume even this capacity what has to be considered in the PLC software configuration.

Note:
Any alteration of the total measuring range during encoder re-parameterization will implicate clearing the internal preset-offset value. This however has no effect in practice since in this case the position is lost anyway.

6.6.1. Preset in standard telegrams

Bit 31 in the 32bit output data word is the preset bit. The lower bits (bit 30…0) hold the right-aligned position value, which is adopted by the encoder in the preset operation.

The Preset-Bit must be kept set for at least one full I/O bus cycle to be recognized by the encoder. A timer control of e.g. 10ms or more will do as well. The Preset Bit may stay active for an unlimited period of time since only a change from „0" to „1" will be evaluated. We recommend however to clear the bit after completion in order to provide the original status for a subsequent preset operation.

6.6.2. Preset in PROFIdrive telegrams 81 - 83

A preset operation in control word STW2 requires the PLC having set bit "CP" (Control by PLC). Usually, the PLC should have this bit set from the beginning when it establishes the Application Relationship (AR).

The „REL" bit in control word G1_STW1 defines whether an absolute or relative preset operation will be performed. In a relative preset operation, the current position value will be shifted by the signed preset value.

The „PR" bit in G1_STW1 is the preset bit. Upon changing from "0" to "1", it triggers the preset operation. Once successfully completed, bit "PA" (preset acknowledge) is set in status word G1_ZSW1. The PA bit remains active as long as the preset bit remains set by PLC.

The preset value is retrieved from the value stored in parameter 65000 (see chapter 7.4.18 „Parameter 65000: Preset Value". In a relative preset operation, the 32bit value is interpreted as a complement on 2, i.e. „-1" will be saved as „0xFFFFFFFF".

7. Acyclic parameters

7.1. Acyclic data communication

Besides cyclic process data communication, the encoder provides optional acyclic data block readout. Cyclic and acyclic data communication run in parallel and independently of each other. Acyclic data are I&M data, PROFIdrive-specific parameters, encoder-specific parameters and PN-interface linked parameters.

7.2. I&M functions: identification and maintenance

The encoder supports I&M0 Record according encoder profile 3162 V4.1. chapter 5.4.3.3.
Access (read only) is via Record Index 0xAFF0.

I&M Data block:

Block Header	Block Type	WORD	0x0020	
	Block Length	WORD	0x0038	56d
	Block Version Hi	BYTE	0x01	
	Block Version Lo	BYTE	0x00	
I&M Block	MANUFACTURER_ID	WORD	0x012A	Baumer
	ORDER_ID	BYTE[20]	ASCII	e.g. "GXMMW.3EA2 "
	SERIAL_NUMBER	BYTE[16]	ASCII	e.g. "150407 120000 "
	HARDWARE_REVISION	WORD	0x0002	
	SOFTWARE_REVISION	BYTE[4]	ASCII	e.g. "V210"
	REV_COUNTER	WORD	0x0001	
	PROFILE_ID	WORD	0x0000	
	PROFILE_SPECIFIC_TYPE	WORD	0x0003	
	IM_VERSION (major)	BYTE	0x01	
	IM_VERSION (minor)	BYTE	0x01	
	IM_SUPPORTED	WORD	0x0000	

7.3. Base Mode Parameter

Parameter access is via Base Mode Parameter Access – Local in PROFIdrive profile V4.1 Abs. 6.2.3.

7.3.1. Base Mode Parameter Access

Parameter access is by a request block comprising three segments:
- Request Header
- Parameter Address
- Parameter Value

Parameter Request Block:

Request Header	Request Reference	BYTE	0x00-0xFF	free choice, see response
	Request ID	BYTE	0x01 / 0x02	1=Read 2=Write Request
	DO-ID	BYTE	0x00	(*) (Base Mode)
	No of Parameters	BYTE	0x01	Single-Parameter Access
Parameter Address	Attribute	BYTE	0x00	(*)
	No of Elements	BYTE	0x00	(*)
	Parameter Number	WORD	0x0000	(*) (**)
	Subindex	WORD	0x0000	(*)
Parameter Value	Format / Data Type	BYTE	0x00	(*)
	Number of values	BYTE		Write Request only
	values to write (if any)	BYTE		Write Request only

(*) Not evaluated by the encoder at Read Request.
(**) relates to the applicable relevant acyclic system function, e.g. SFB53.
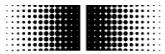
Parameter Response Block:

Request Header	Response Reference	BYTE	mirrored	see Request
	Response ID	BYTE	mirrored	see Request
	DO-ID	BYTE	0x00	(Base Mode)
	No of Parameters	BYTE	0x01	Single-Parameter Access
Parameter Value	Format / Data Type	BYTE	(*)	see parameter description.
	Number of values	BYTE	(*)	see parameter description.
	values read	BYTE	(*)	see parameter description.

(*) encoder information at Read Response.

Encoder supports single parameter access.
Maximum parameter access length: 240 bytes.

7.4. Supported parameters

7.4.1. PROFIdrive Parameters

P922: Telegram Type
P925: Tolerated Life sign Failures
P964: Device ID
P965: Profile ID
P971: Store Data
P974: Base Mode Parameter
P975: Encoder Object ID
P979: Sensor Format
P980: Number List of defined Parameters

7.4.2. Interface Parameters

P61000: Name of Station
P61001: IP of Station
P61002: MAC of Station
P61003: Default Gateway of Station
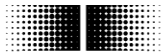P61004: Subnet Mask of Station

7.4.3. Encoder Parameters

P65000: Preset Value
P65001: Operating Status / Parameters

7.4.4. Parameter 922: Telegram Type

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Read: Parameter reads the configured telegram type.
Type 100:   manufacturer-specific telegram, 32bit I/O
Type 101:   manufacturer-specific telegram, 32bit I/O + 16bit speed
Type 102:   manufacturer-specific telegram, 32bit I/O + 32bit speed
Type   81:   PROFIdrive telegram 81
Type   82:   PROFIdrive telegram 82
Type   83:   PROFIdrive telegram 83

Parameter	922
Type	Read only
Data type	unsigned int (0x06)
Value range	100-102 (0x0064 – 0x0066), 81-83 (0x0051 – 0x0053)
Data: 922[0]	Telegram type

7.4.5.   Parameter 925: Tolerated life sign failures

Read: The parameter is to read the number of tolerated Master life sign failures.
Only profile 3.1 will consider this parameter. When running profile no. 4.1,
the number is always 1.

Parameter	925
Type	Read / Write
Data type	unsigned int (0x06)
Value range	1 to 254; 255=Life sign Supervision 0ff
Data: 925[0]	Total number of tolerated life sign failures

Write: The parameter is to read the number of tolerated Master life sign failures.
Only profile 3.1 will consider this parameter. Where running profile no. 4.1.,
the number is always 1.

Parameter	925
Type	Read / Write
Data type	unsigned int (0x06)
Value range	1 to 254; 255=Life sign Supervision 0ff
Data: 925[0]	Total number of tolerated life sign failures

Note:
In "Compatibility Mode", only the user-specific parameter of the project HW configuration will be considered. Parameter 925 is of no significance.

7.4.6.   Parameter 964: Device ID

Read: This parameter is to read a data set for encoder (device) identification.
See also parameter 975.

Parameter	964	
Type	Read only	
Data type	unsigned int (0x06)	
Value range	n/a	
Data: 964[0]	0x012A	MANUFACTURER_ID
964[1]	0x0000	Drive Unit Type (manufacturer-specific)
964[2]	0x0210	Firmware version (example only)
964[3]	0x2015	Firmware year (example only)
964[4]	0x1103	Firmware day and month (example only))
964[5]	0x0001	Number of Drive Objects

7.4.7.   Parameter 965: Profile ID

Read: This parameter is to read the profile ID=0x3D00 of encoder profile 3162 in abbreviation „3D"
as well as the applicable (configured) version V3.1 or V4.1.

Parameter	965	
Type	Read only	
Data type	Octet string (0x0A)	
Value range	n/a	
Data: 965[0]	0x3D	Profile ID: 0x3D
965[1]	0x29 or 0x1F	Profile version: V3.1 (31) or V4.1 (41)
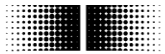
7.4.8. Parameter 971: Store Data

Read: The returned value indicates any transmitted but not yet saved parameter.

Parameter	971
Type	Read / Write
Data type	unsigned int (0x06)
Value range:	0x0000 – 0x0001
Data: 971[0]	0x0000: no unsaved data present; 0x0001: unsaved data

Write: The transmitted preset (Prm 65000) and the number of tolerated Master life sign failures (Prm 925) are saved non-volatile in the encoder memory

|	
Parameter	971
Type	Read / Write
Data type	unsigned int (0x06)
Value range:	n/a
Data: 971[0]	<empty>

7.4.9. Parameter 974: Base Mode Parameter

Read: Parameter „Base Mode Parameter Access service identification" is to read out three parameter channel properties: maximum data length (240), Multi-Parameter-Access capability (no) and maximum processing time to access (1000 x 10ms) for customer-specific timeout.

Parameter	974	
Type	Read only	
Data type	unsigned int (0x06)	
Value range:	n/a	
Data: 974[0]	0x00F0	max. data length 240
974[1]	0x0001	no Multi-Parameter-Access
974[2]	0x03E8	max. processing time to access

7.4.10. Parameter 975: Encoder Object ID

Read: Parameter „Encoder Object Identification" is to read out Drive unit type, Data Object Type, Firmware version and date as well as Drive Object (DO) Type Class, Subclass and ID.
See also parameter 964.

Parameter	975	
Type	Read only	
Data type	unsigned int (0x06)	
Value range:	n/a	
Data: 975 [0]	0x012A	MANUFACTURER_ID
975 [1]	0x0000	Drive Unit Type (manufacturer-specific)
975 [2]	0x0210	Firmware version (example only)
975 [3]	0x2015	Firmware year (example only)
975 [4]	0x1103	Firmware day and month (example only)
975 [5]	0x0005	Profidrive Type Class
975 [6]	0x8000	Profidrive DO Subclass 1
975 [7]	0x0001	Drive Object ID
975 [8]	0x0000	reserved
975 [9]	0x0000	reserved
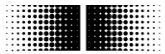
7.4.11. Parameter 979: Sensor Format

Read: Parameter „Sensor Format" is to read out the user configuration. „Determinable Revolutions" (configured number of revolutions) and „Sensor Resolution" (configured singleturn resolution) are generally applied, any other information relates to PROFIdrive telegrams 81 to 83.

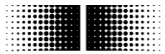| Parameter	979	
Type	Read only	
Data type	UINT32 (0x07)	
Value range:	n/a	
Data: 979[0]	0x00005111	Header Info
979[1]	0x80000000	1st Sensor(G1) Typee (**)
979[2]	0x00002000	Sensor Resolution (*)
979[3]	0x00000000	Shift Factor for G1_XIST1
979[4]	0x00000000	Shift Factor for absolute value in G1_XIST2
979[5]	0x00010000	Determinable Revolutions (*)
979[6]	0x00000000	reserved
to		
979[10]	0x00000000	reserved

(*) example, depends on basic encoder and user configuration
(**) if 979[2] to 979[5] valid; otherwise 0x00000000

7.4.12. Parameter 980: Number List of defined Parameters

Read: Parameter 980 is to read out the supported parameters.

Parameter	980	
Type	Read only	
Data type	unsigned int (0x06)	
Value range:		
Data: 980 [0]	0x039A	922
980 [1]	0x039D	925
980 [2]	0x03C4	964
980 [3]	0x03C5	965
980 [4]	0x03CB	971
980 [5]	0x03CE	974
980 [6]	0x03CF	975
980 [7]	0x03D3	979
980 [8]	0xEE48	61000
980 [9]	0xEE49	61001
980 [10]	0xEE4A	61002
980 [11]	0xEE4B	61003
980 [12]	0xEE4C	61004
980 [13]	0xFDE8	65000
980 [14]	0xFDE9	65001
980 [15]	0	End Mark

7.4.13. Parameter 61000: Name of Station

Read: This parameter is to read out the name of station (encoder name). Name length is from zero (deleted) on to 240 characters. No zero termination.

Parameter	61000
Type	Read only
Data type	octet string (0x0A)
Value range:	ASCII
Data: 61000 [0]	
to	
61000 [n]	mit n+1 = String length name of station

7.4.14. Parameter 61001: IP of Station

Read: This parameter is to read the IP of station (encoder IP address).

Parameter	61001
Type	Read only
Data type	UINT32 (0x07)
Value range:	0.0.0.0 to 255. 255. 255. 255.
Data: 61001[0]	Encoder IP

7.4.15. Parameter 61002: MAC of Station

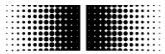**Read:** This parameter is to read the encoder's MAC ID.

Parameter	61002	
Type	Read only	
Data type	octet string (0x0A)	
Value range:	00:0E:CF:xx:xx:xx	
Data: 61002 [0]	0x00	OUI (Organizationally Unique Identifier)
61002 [1]	0x0E	
61002 [2]	0xCF	
61002 [3]	0x03	(*) Individual part of MAC
61002 [4]	0x20	(*)
61002 [5]	0x00	(*)

(*) example only, device-specific

7.4.16. Parameter 61003: Default Gateway of Station

Read: This parameter is to read the Default Gateway IP address.

Parameter	61003
Type	Read only
Data type	UINT32 (0x07)
Value range:	0.0.0.0 to 255. 255. 255. 255.
Data: 61003 [0]	Default-Gateway IP

7.4.17. Parameter 61004: Subnet Mask of Station

Read: This parameter is to read the subnet mask of the encoder-connected network.

Parameter	61004
Type	Read only
Data type	UINT32 (0x07)
Value range:	0.0.0.0 to 255. 255. 255. 255.
Data: 61004 [0]	Subnet mask

7.4.18. Parameter 65000: Preset Value

A preset operation in data format of PROFIdrive profile telegrams 81 to 83 will reset the encoder position to the preset value. Parameter format is „signed 32bit", since relative preset is also permitted.

This parameter is without significance when using manufacturer-specific output formats 100 to 102.

Read: This parameter reads the preset value.

Parameter	65000
Type	Read / Write
Data type	int32 (0x04)
Value range	signed 32bit
Data: 65000 [0]	Preset Value

Write: This parameter is to write the preset value.
After the write operation by parameter 65000, the preset value is stored volatile.
Use parameter 971 for non-volatile saving in the encoder memory.

Parameter	65000
Type	Read / Write
Data type	int32 (0x04)
Value range	signed 32bit
Data: 65000 [0]	Preset Value

7.4.19. Parameter 65001: Operating Status / Parameters

Read: Parameter 65001 reads the current operation status and configuration.

Parameter	65001	
Type	Read only	
Data type	UINT32 (0x07)	
Value range	n/a	
Data: 65001 [0]	0x000C0101	Header Info
65001 [1]	0x0000002A	Operating Status (*)
65001 [2]	0x00000000	Faults (**)
65001 [3]	0x00000001	Supported Faults
65001 [4]	0x00000000	Warnings (**)
65001 [5]	0x00000020	Supported Warnings
65001 [6]	0x00000401	Encoder Profile
65001 [7]	0xFFFFFFFF	Operating Time
65001 [8]	0x00000000	Preset Offset (***)
65001 [9]	0x00002000	Steps per Revolution (*)
65001 [10]	0x20000000	Total Measuring Range (*)
65001 [11]	0x00000003	Speed Scale (*)

(*)   example only, depends on user configuration
(**) example only (error-free status)
(***) example only, depending on preset

8. Troubleshooting – Frequently Asked Questions – FAQ

8.1. FAQ: Project Work

8.1.1. Where do I get an encoder manual?

If ordered, the manual will come as a pdf-file on data carrier (CD). The manual is also available in the Internet under www.baumer.com. Make sure that the manual applies to your encoder referring to the table at the beginning of the manual. You will find the encoder type on the product label (for example GXMMW or GBAMW).

Should your encoder not be on the list please contact Baumer.

8.1.2. Where do I get the applicable GSDML file?

If included in the order, the GSDML file required for the engineering tool is attached to the encoder on data carrier (CD). The GSDML file is also available in the Internet under www.baumer.com .
To find out the GSDML file that is applicable for your encoder please use the table at the beginning of the manual. You will find the encoder type on the product label (for example GXMMW or GBAMW).

Should your encoder not be on the list please contact Baumer.

8.2. FAQ: Operation

8.2.1. What is the significance of the LEDs provided at the bus cover?

The bus cover provides an integrated multi-color LED indicating the encoder operating status. In particular upon commissioning and in case of error it provides first information on the system status. For details on the respective status please refer to chapter 6.2.

Two other, green LEDs are provided near the cable glands for PROFINET connection. These activity LEDs signal the bus activity, i.e. the data communication on each of the two Ethernet ports.

8.2.2. How to adapt the resolution?

The encoder resolution in steps per turn („Measuring units per turn") is programmed within the project by corresponding parameter parameterization in the PROFINET device project.

Usually this is performed by the PLC's engineering software (for example SIEMENS® Step7®) by aid of a PC.

The encoder resolution is programmable in individual steps between the maximum limit (encoder-specific, for example 8192 at GXMMW) and the minimum limit of 1 step/turn.

Important: The encoder's total measuring range ("total measuring range (units "hi/lo") must be aligned w the programmed resolution. If not, this will result in parameterization errors signaled by the LED in the bus cover flashing red. The maximum total measuring range is calculated by multiplying the resolution (steps per turn) by the encoder's maximum number of revolutions. Standard resolution is 16 bit (65536 revolutions). Encoders featuring a 18 bit singleturn resolution (e.g. GBMMW) are capable of a 13 bit resolution (8192 revolutions).

8.3. FAQ: Troubleshooting

8.3.1. No encoder communication (LED yellow continuous)

The encoder connected is not recognized in the bus. Neither configuration nor parameterization has been successful, reason why the LED remains yellow continuous.

This phenomenon may be due to the following reasons

- No PROFINET connection or broken wire in the line.

- The programmed device name does not correspond to the stored device name.

- Incorrect encoder implementation in the PROFINET project, so it does not exist from the PLC's point of view

- Correct encoder implementation in the PROFINET project, but inadvertently the compiled project has not yet been exported to the PLC.

- Should the above troubleshooting prove unsuccessful try to connect the encoder by the other port.

8.3.2. No encoder communication (LED flashing red once per second))

Incorrect encoder parameterization, i.e. one of the programmed parameters is outside the limits.
Most often when altering the encoder resolution (steps per turn, measuring units per revolution") the encoder's total measuring range was not correspondingly aligned.

Singleturn encoders
The total measuring range of a singleturn encoder comprises exactly one complete or partial revolution, reason why the value in parameter "total measuring range" must always be equal to the parameter "measuring units per revolution".

Multiturn encoders
Multiturn encoders are capable of sensing max. 65536 revolutions (GBxxx 8192 revolutions). Maximum admissible limit for the total measuring range is the product of "steps per turn" multiplied by the encoder's maximum number of revolutions (65536 respectively 8192). Excess values in parameterization will result in an error signal (flashing LED) together with a "parameterization alarm" in the diagnostic data.

However, any inferior value may be programmed. All encoders with PROFINET bus covers feature integrated endless operation ensuring admissible values for all resolutions and total measuring ranges even during overrun. Integer ratios of singleturn resolution and total measuring range are not mandatory, as sometimes required by other manufacturers.

Example:
Standard multiturn encoder GXMMW features a singleturn resolution of 13 bit (8192 steps per turn) and is capable of sensing 65536 completed revolutions.

Consequently the total measuring range is 8.192 x 65.536 = 536.870.912 steps.

The singleturn resolution is reduced to 3600 steps / turn.
The total measuring range now is reduced to 3.600 x 65.536 = 235.929.600 steps.

If the total measuring range is not correspondingly aligned to the new maximum limit, the encoder will have to count 149.130 completed revolutions. That is impossible and results in an error signal (flashing LED).

8.3.3. No position data

Encoder DUO-LED lit green continuous, LED of connected port is green continuous, but PLC does not recognize any position data.

- The encoder's device name is clear (""), and PLC cannot automatically assign the proper name because automatic assignment wasn't projected or no Topoplogy Planning was done.

- Make sure the I/O encoder addresses are within the cyclic updated process mapping. Size and position of process mapping or encoder I/O address may require adjustment.

- No I/O module present in encoder HW configuration.

- No topology planning executed. Other port than projected has been connected (operating modes IRT).

8.3.4. PLC error LED is lit

Encoder operational, but error LED at PLC is lit

- Operating mode RT: Topology planning executed. Other port than projected has been connected.

- Diagnostic alarm is present