SIEMENS

SIMOTION/SIMATIC

Absolute encoder with

MC-ENCODER

PROFINET IO

Operating Instructions

Introduction	1
Installing	2
Cyclic Data Exchange	3
Configuration	4
Operating with STEP7	5
Operating with SIMOTION	6
Troubleshooting/FAQs	7
Technical Data	8
Mechanical Drawings	9
Accessories	10
Appendix	A

Preface

Valid for	firmware version
SIMOTION	4.2
Product version MC-ENCODER	1.0

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

DANGER

indicates that death or severe personal injury will result if proper precautions are not taken.

indicates that death or severe personal injury may result if proper precautions are not taken.

with a safety alert symbol, indicates that minor personal injury can result if proper precautions are not taken.

CAUTION

without a safety alert symbol, indicates that property damage can result if proper precautions are not taken.

NOTICE

indicates that an unintended result or situation can occur if the relevant information is not taken into account.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of Siemens products

Note the following:

/!\WARNING

Siemens products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by Siemens. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by [®] are registered trademarks of Siemens AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Siemens AG Industry Sector Postfach 48 48 90026 NÜRNBERG GERMANY Order number: 6SN1197-0AB11-0BP0 @ 05/2011 Copyright © Siemens AG 2010. Technical data subject to change

Preface

An overview of the SIMOTION documentation can be found in a separate list of references.

This documentation is included as electronic documentation in the scope of delivery of SIMOTION SCOUT. It comprises 10 documentation packages.

The following documentation packages are available for SIMOTION V4.2:

- SIMOTION Engineering System
- SIMOTION System and Function Descriptions
- SIMOTION Service and Diagnostics
- SIMOTION IT
- SIMOTION Programming
- SIMOTION Programming References
- SIMOTION C
- SIMOTION P
- SIMOTION D
- SIMOTION Supplementary Documentation

Additional information

Click the following link to find information on the the following topics:

- Ordering documentation/overview of documentation
- Additional links to download documents
- Using documentation online (find and search in manuals/information)

http://www.siemens.com/motioncontrol/docu

Please send any questions about the technical documentation (e.g. suggestions for improvement, corrections) to the following e-mail address: docu.motioncontrol@siemens.com

My Documentation Manager

Click the following link for information on how to compile documentation individually on the basis of Siemens content and how to adapt this for the purpose of your own machine documentation:

http://www.siemens.com/mdm

Training

Click the following link for information on SITRAIN - Siemens training courses for automation products, systems and solutions:

http://www.siemens.com/sitrain

FAQs

You can find Frequently Asked Questions on the Service&Support pages under **Product Support**:

http://support.automation.siemens.com

Technical support

Country-specific telephone numbers for technical support are provided on the Internet under **Contact**:

http://www.siemens.com/automation/service&support

Table of contents

	Prefac	e	3
1	Introdu	uction	9
	1.1	Absolute encoder	9
	1.2	PROFINET technology	9
	1.3	Encoder profile	10
	1.4	Features of the MC-ENCODER	11
	1.5	Encoder functions	12
2	Installi	ng	13
	2.1	Electrical connection	13
	2.2	Ethernet cables	14
	2.3	Diagnostic LEDs	14
	2.4	Status LED indication	15
	2.5	Instructions for mechanical installation and electrical connection of the encoder	16
3	Cyclic	Data Exchange	17
	3.1	Signal list for cyclic data transmission	17
	3.2 3.2.1 3.2.2 3.2.3 3.2.4	Format of actual position values G1_X G1_XIST1 G1_XIST2 G1_XIST3 G1_XIST_PRESET_A	18 19 20
	3.3	Format of actual velocity values NIST	
	3.4	Encoder control word (STW2_ENC)	
	3.5	Encoder status word (ZSW2_ENC)	22
	3.6	Sensor control word (G1_STW)	23
	3.7	Sensor status word (G1_ZSW)	24
	3.8 3.8.1 3.8.2 3.8.3 3.8.4 3.8.5	Telegrams Standard telegram 81 Standard telegram 82 Standard telegram 83 Standard telegram 84 Telegram 860	25 26 26 27
4	Config	uration	29
	4.1	Encoder configuration overview	29
	4.2	Encoder offline configuration	30

	4.3 4.3.1	Encoder parameter description		
	4.3.1	Parameterizing the position actual value		
	4.3.3	Parameterizing the scaling function		
	4.3.4	Parameterizing the velocity signal		
	4.3.5	Parameterizing the communication interface		
5	Operating with STEP7			
	5.1	Installing the GSDML file		
	5.2	Engineering the MC-ENCODER in a STEP7 project	38	
	5.3	LLDP (Link Layer Discovery Protocol)		
	5.4	Selecting the MC-ENCODER telegram	45	
	5.5	Setting encoder parameters		
	5.6	Setting device properties	47	
	5.7	IRT settings	49	
	5.8	Changing and reading encoder parameters during the run-time	49	
	5.9	Accessing cyclic data	50	
6	Operati	Operating with SIMOTION		
	6.1	Applications	51	
	6.2	MC-ENCODER used together with TO External encoder	52	
	6.3	MC-ENCODER used directly from AWP	60	
	6.4	Online parameter access	62	
7	Trouble	shooting/FAQs	65	
	7.1	FAQ	65	
8	Technic	cal Data	67	
	8.1	Electrical data	67	
	8.2	Mechanical data	67	
	8.3	Environmental conditions	68	
9	Mechan	nical Drawings	69	
	9.1	Synchro flange	69	
	9.2	Clamp flange	70	
	9.3	Hollow shaft	71	
10	Access	ories	73	
	10.1	Accessories and Documentation	73	
	10.2	Ordering description	73	
	10.3	Models / ordering description	74	

Α	Appendix	Χ	75
	A.1	Glossary	.75
	A.2	Additional literature	.76

Table of contents

Introduction

This manual describes the implementation and configuration of the absolute rotary encoder (MC-ENCODER) with PROFINET interface.

The device fulfills the requirements of a

- PROFINET IO device with RT (real time) or
- IRT (isochronous real time) classification and
- Encoder profile V4.1 Class 3 and Class 4

Note

Encoders are for installation on industrial machinery only (acc. Standard NFPA 79 in USA).

1.1 Absolute encoder

The basic principle of an absolute encoder is the optical sampling of a transparent code disk which is attached to the drive shaft.

The absolute encoder has a maximum resolution of 8.192 steps per revolution (13 bits).

The multiturn version can sense up to 16.384 revolutions (14 bits).

Therefore the highest resulting resolution is 27 bits = 2^{27} .

The standard singleturn version has a resolution of 13 bits.

The standard multiturn version has a resolution of 27 bits.

1.2 PROFINET technology

PROFINET is an Industrial Ethernet standard merging plant automation with other enterprise IT resources. It provides comparable functionality to PROFIBUS with techniques used by engineering, IT, and management personnel.

Established IT standards are employed as basis of communication: TCP, UDP, IP. XML is used as description language for IO-Device profiles (GSDML files).

PROFINET can be used in two ways:

- PROFINET IO, similar to PROFIBUS DP as a distributed I/O system and
- PROFINET CBA as a modular component-based system for larger systems.

1.3 Encoder profile

Scalable communication

PROFINET offers scalable communication for different applications in industrial automation:

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

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

PROFINET IO is engineered similar to PROFIBUS. The fieldbuses (i. e. Ethernet topologies) are assigned to the control systems during configuration. The IO-device is configured in the actual system based on the contents of its GSDML file.

After engineering has been completed, the installer loads the data for the expansion into the IO controller (PLC) and the IO controller exchanges data with the IO device.

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

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

Further information

For further information about the function principle of operation or setting-up a PROFINET network, please refer to http://www.profibus.com/technology/profinet.

1.3 Encoder profile

Introduction

The PI encoder profile defines a standard application interface for absolute encoders connected to PROFIBUS and PROFINET. In the encoder profiles, a distinction is made between 4 user classes (class 1 to 4) of absolute encoders.

Classes 3 and 4

The encoder classes 3 and 4 contain a complete encoder channel according to PROFIdrive as well as the PROFIdrive parameter channel to access encoder parameters online. Correspondingly, encoders are generally used for clock-synchronous (isochronous) applications and as an equivalent to an encoder used on a PROFIdrive drive.

1.4 Features of the MC-ENCODER

The absolute encoder MC-ENCODER is used on PROFINET IO via telegrams 81, 82, 83 and 84 as Class 3 or 4.

The MC-ENCODER can be operated with clock synchronism (IRT) or without clock synchronism (RT).

Classes 1 und 2

Encoder classes 1 and 2 are intended for applications involving position encoders connected to PLC control systems without clock synchronization.

The MC-ENCODER is used via telegram 860 as class 1 or 2.

Configuration

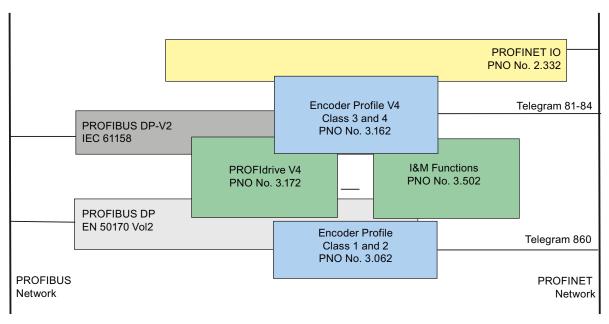


Figure 1-1 Overview of the relevant standards documents and assignment to the particular technologies

1.4 Features of the MC-ENCODER

The MC-ENCODER is a Class 4 absolute encoder and therefore also supports all of the functions of a Class 3 absolute encoder.

In addition, the MC-ENCODER can also be used in applications via telegram 860, where functions according to Class 1 and Class 2 are required.

The basic functions include:

- Communication interface PROFINET IO V2.2
- Neighbor detection
- Engineering identification call

1.5 Encoder functions

- Support of encoder profile V4.1 (Class 3, Class 4)
- Support of encoder profile telegrams 81, 82, 83 and 84
- Support of vendor-specific telegram 860 (for Class 1, Class 2 applications)
- Support of PROFIdrive BMP parameter channel
- Integrated velocity calculation with selectable velocity filters and scaling
- Integrated round axis (endless shaft) functionality
- Integrated bootloader for encoder firmware upgrade

1.5 Encoder functions

The following table provides you with an overview of the functions supported by MC-ENCODER in the particular application classes.

Function	Telegram 860 Class 1, Class 2	Telegram 81 - 84 Class 3, Class 4
Code sequence	√	1
Round axis (endless shaft)	\checkmark	\checkmark
Class 3 functionality	-	\checkmark
Class 4 functionality	-	✓
Scaling function	\checkmark	\checkmark
G1_XIST1 preset control	-	✓
G1_XIST1 offset control	-	\checkmark
Telegram 860 preset control	\checkmark	-
Preset value 64 bit	-	-
Velocity signal 16 bit	-	\checkmark
Velocity signal 32 bit	\checkmark	\checkmark
Velocity filter	✓	✓
Configurable velocity measuring unit	\checkmark	\checkmark
Sign-of-life supervision	-	✓
Configurable controller sign-of-life supervision	-	✓
Operation time	-	-
PROFIdrive fault buffer	_	-
Alarm channel diagnostics	>V1.0	>V1.0

Table 1-1 Overview of the functions

Installing

2.1 Electrical connection

The encoder is connected using a 4 pin M12 connector for the power supply and two 4 pin, D-coded M12 connectors for Ethernet.

The encoder uses a second D-coded connector and provides integrated switch functionality. The mounting description is provided on or in the connector packaging.

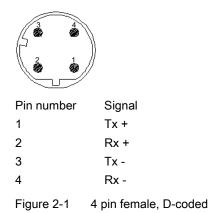
Adapters for field wiring can be ordered.

Refer to chapter: Accessories

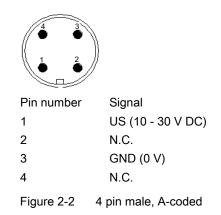
or

Refer to catalog: "SIMOTION & SINAMICS PM 21", Part 7: Measuring systems

Ethernet connector



Connector power supply



2.2 Ethernet cables

2.2 Ethernet cables

Table 2- 1	RJ45 - M12 crossover

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

Table 2-2 M12 - M12 crossover

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

Table 2-3 RJ45 - M12 crossover

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

2.3 Diagnostic LEDs

Table 2- 4 Diagnostic LED

LED	Color	Description for LED = on
Active1	Yellow	Incoming and outgoing data traffic via port 1
Link1*	Green	Link to another Ethernet component via port 1
Active2	Yellow	Incoming and outgoing data traffic via port 2
Link2*	Green	Link to another Ethernet component for port 2
Stat1	Green	Status 2, see chapter Status LED indication (Page 15)
Stat2	Red	Status 2, see chapter Status LED indication (Page 15)
* Flashes with 2 Hz if engineering identification call is activated and link connection is available		

Installing 2.4 Status LED indication

2.4 Status LED indication

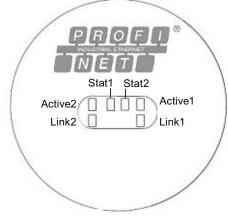


Figure 2-3 LED indication

Table 2- 5	Status LED indication
------------	-----------------------

Status 1 Green	Status 2 Red (bus failure)	Meaning	Cause
Off	Off	No power	
On	On	No connection to a controller Criteria: no data exchange	Bus disconnectedIO-controller not availableIO-controller switched off
On	Blinking *	 Parameterization fault, no data exchange Criteria: data communication correct. However, the IO-device did not switch to the data exchange mode 	 IO-device not configured yet or wrong configuration Wrong station address assigned (but not outside the permitted range) Actual configuration of the IO- device differs from the nominal configuration
On	Off	Mode: Data exchange IO-device and operation ok	
* The blinkir	ng frequency is C	.5 Hz. Minimum indication time is 3	sec.

2.5 Instructions for mechanical installation and electrical connection of the encoder

2.5 Instructions for mechanical installation and electrical connection of the encoder

The following points should be observed during the installation and electrical connection of the encoder.

- Do not drop the angular encoder or subject it to excessive vibration. The encoder is a precision device.
- Do not open the angular encoder housing. If the device is opened and closed again, it can be damaged and dirt may enter the unit.
- The shaft of a full shaft encoder must be connected with the shaft of the suitable measuring object via a shaft coupling. This coupling is used to dampen vibration and imbalance on the encoder shaft and to avoid inadmissibly high forces. Suitable couplings are available from Siemens.
 Additional data is provided in the Catalog: "SIMOTION & SINAMICS PM 21", Part 7: Measuring systems.
- Although Siemens absolute encoders are rugged, when used in harsh ambient conditions, they should be protected against damage using suitable protective measures. The encoder should not be used as handles or steps.
- Only qualified personnel shall commission and operate these devices. These are personnel who are authorized to commission, ground and tag devices, systems and circuits according to the current state of safety technology.
- It is not permissible to make any electrical changes to the encoder.
- Route the connecting cable to the angular encoder at a considerable distance or completely separated from power cables with their associated noise. Completely shielded cables must be used for reliable data transfer and good grounding must be provided. Cabling, establishing and interrupting electrical connections may only be carried-out when the equipment is in a no-voltage condition. Short-circuits, voltage spikes etc. can result in malfunctions and uncontrolled states which can even include severe personnel injury and material damage.
- The encoder must be connected to PE through a large surface area. If the flange does not have a good electrical connection to the machine – i.e. if a plastic mounting device was used – then use e.g. a 30cm long and 2cm wide copper strap to establish the PE connection

Before powering-up the system, check all of the electrical connections. Connections, which are not correct, can cause the system to malfunction. Faulty connections can result in severe personnel injury and material damage.

Cyclic Data Exchange

Setpoints and actual values to the absolute encoder are cyclically exchanged using standard telegrams, refer to the Telegrams (Page 25). The standard telegrams comprise a fixed compilation of signals, refer to the Signal list for cyclic data transmission (Page 17).

The structure of the telegrams as well as the content of the signals contained in them are provided in this documentation:

Literature

Encoder profil Additional literature (Page 76) [1] PROFIdrive standard Additional literature (Page 76) [2]

3.1 Signal list for cyclic data transmission

Signal	Significance	PROFIdrive signal No.	Data type
STW2_ENC	Encoder control word	80	U16
ZSW2_ENC	Encoder status word	81	U16
NIST_A	Velocity value A	6	l16
NIST_B	Velocity value B	8	132
G1_STW	Sensor control word	9	U16
G1_ZSW	Sensor status word	10	U16
G1_XIST1	Sensor position actual value 1	11	U32
G1_XIST2	Sensor position actual value 2	12	U32
G1_XIST3	Sensor position actual value 3	39	U64
G1_XIST_PRESET_A	Sensor position preset control word 32 bit	238	U32

Table 3-1 Signal list

3.2 Format of actual position values G1_X

3.2 Format of actual position values G1_X

The signals G1_XIST1 and G1_XIST2 represent the actual position values. For the MC-ENCODER the format for both signals is right aligned and fixed. See table G1_XIST1 (Page 18), G1_XIST2 (Page 19) below.

As the MC-ENCODER is a gray-coded absolute encoder, in G1_XIST it permanently supplies the absolute value – and G1_XIST2 supplies no additional value regarding the absolute value. If you directly access the position actual value in telegrams 81 - 84 from the user program, then you read out the position actual value from G1_XIST1 and you only use G2_XIST2 to read out the error code in the case of an error.

Note

The MC-ENCODER is using fixed shift factors for XIST1 and XIST2. There is no possibility to configure the shift factor. The shift factors are always zero and can be read out of parameter 979 by the controller or a supervisor:

- P979, Subindex 3 (Shift factor for G1_XIST1) = 0
- P979, Subindex 4 (Shift factor for G1_XIST2) = 0

3.2.1 G1_XIST1

The position value representing the current position value is right aligned (shift factor 0) according to table "Absolute value in G1_XIST1". After starting the encoder ("station come" and ZSW2_ENC bit 9 = 1 and G1_ZSW bit 14 = 0) the G1_XIST1 shows the absolute position value of the encoder. For a singleturn encoder, the bits "S" show the absolute value within one revolution, for the multiturn encoder also the current multiturn information (bits 13 to 26) are shown. If the absolute encoder is operational and is rotated beyond the absolute range (singleturn: up to bit 12, multiturn: up to bit 26), then the encoder continues to count electronically beyond these bits up until overflow is reached at bit 31. After the reset/new start of the absolute encoder, from the position actual value, only the value limited to the maximum possible absolute resolution of the absolute encoder is displayed in XIST1, (bits 0 - 12 or 0 - 26).

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	87	6	5	4	3	2 1	0
М	М	М	М	М	М	М	М	М	М	М	М	М	М	М	М	М	М	М	S	S	S	S	s s	s s	S	S	S	sε	S

Table 3-2 Absolute value in G1_XIST1

M = distinguishable revolutions (multiturn value)

S = pulses (singleturn steps per revolution)

3.2.2 G1_XIST2

The signal G1_XIST2 is a multiplex from the absolute position actual value and error code. If the encoder channel is not in an error state (G1_ZSW bit 15 = 0), then in G1_XIST2 the actual absolute value of the absolute encoder is transferred.

If the absolute encoder is operational and rotated beyond the absolute range, then the position value in G1_XIST2 is not counted electronically any further. This means that the range of the position actual value is limited according to Table "Absolute value in G1_XIST2 for singleturn encoder" or Table "Absolute value in G1_XIST2 for multiturn encoder" corresponding to the absolute encoder type being used.

Table 3-3 Absolute value in G1_XIST2 for singleturn encoder

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6 5	54	3	2 ′	1 0
																			S	S	S	S	S	S	s s	SS	S	s :	s s

S = pulses (singleturn steps per revolution)

Table 3-4	Absolute value in G1_XIST2 for multiturn encoder
-----------	--

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	76	5		3 2	2 1	10
					М	М	М	М	М	М	М	М	М	М	М	М	М	М	S	S	S	S	s :	s s	s s	SS	s s	s s	SS

S = pulses (singleturn steps per revolution)

M = distinguishable revolutions (multiturn value)

If the encoder channel is in the error state (G1_ZSW bit 15 = 0), then in G1_XIST2 the error code is transferred corresponding to the Table "Error Code G1_XIST2" in G1_XIST2. The encoder channel remains in the error state until the cause of the error has been resolved, and the error state was acknowledged using the encoder control word (G1_STW bit 15 = 0 \rightarrow 1 edge).

Table 3-5 Error code G1_XIST2

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	87	6	5	4	3 2	2 1	0
																				Е	Е	Ε	EE	E	E	Е	E	E	E

E = error code

Table 3- 6	List of error codes in G1_XIST2
------------	---------------------------------

Error code	Error	Error description
0x001	Sensor group error	Error in the processing of the sensor signal which causes an invalid Gx_XIST (e.g. electronic malfunction or invalid sensor signal).
0xF01	Command not supported	Optional command (in G1_STW) not supported.
0xF02	Controller sign-of-life failure	The number of permissible failures of the masters sign-of-life was exceeded.
0xF04	Synchronization fault	The number of permissible failures for the bus cycle sign signal was exceeded.

3.2 Format of actual position values G1_X

3.2.3 G1_XIST3

The function and bit assignment of signal G1_XIST3 is identical to signal G1_XIST1 (Page 18) only with a 64 bit signal word.

Bit 32 up to bit 63 contain the multiturn information "M".

Signal G1_XIST3 can be beneficial, for example, if you wish to count the position actual value in the encoder directly electronically with 64 bit in order to eliminate having to perform a modulus calculation in the user program when the 32 bit position actual value overflows in G1_XIST1.

3.2.4 G1_XIST_PRESET_A

Using the G1_XIST_PRESET_A signal, the controller can enter a preset value for the MC-ENCODER via the cyclic data telegram, and activate this using the trigger bit. As the trigger bit is transferred in the same signal, in this case, only a preset value of maximum 31 bits can be entered.

The structure of the G1_XIST_PRESET_A signal is shown in the subsequent table "Absolute value in G1_XIST_PRESET".

With the $1 \rightarrow 0$ edge of the trigger bit, the actual preset value (bits 0 - 30) is accepted as actual value in G1_XIST1. When this preset value is accepted, then this is also retentively saved automatically. The reason for this is that absolute value set using a preset is also kept after a reset/new start of the absolute encoder.

If a preset has not been set, then set trigger bit 31 to the standard value of 0.

Note

The speed of the encoder shaft at the time that the preset value is set should be as low as possible or zero. As a consequence, the influence of the communication dead times on the preset value that has been set are kept as low as possible.

Table 3-7 Absolute value in G1_XIST_PRESET_A

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8 7	6	5 4	13	2	1 0
Т	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	Ρ	ΡF	P	ΡF	P	Ρ	ΡP

P = preset value (31 bit) for G1_XIST1 in the format/resolution of G1_XIST1

T = trigger bit to control the transfer of the preset value

3.3 Format of actual velocity values NIST

The velocity value, which is transferred in NIST_A or in NIST_B is a speed actual value calculated by the absolute encoder from the equidistant position sensing. By calculating the speed actual value at the absolute encoder in real-time, the controller can also be provided a high accuracy velocity signal without isochronous communication (without PROFINET IRT). In addition, you can utilize parameterizable filtering for the velocity signal in NIST_x.

The normalization of the value in NIST_x can be parameterized.

The following parameterization options exist:

- Increments / s
- Increments / 100 ms
- Increments / 10 ms
- Revolutions/ minute
- N2 / N4 normalization:

Velocity normalization (scaling) as used in PROFIdrive telegrams. The velocity actual value in NIST is a percentage of the reference value.

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

- for N2, 4000 hex corresponds to a value of 100 % of the reference value
- for N4, 4000 0000 hex corresponds to a value of 100 % of the reference value
- the value range extends from -200 % up to +200 %.
 - MSB = 1 is a negative sign
 - MSB = 0 is a positive sign

Note

If the expected velocity value does not appear in signal NIST_x, then check the selected normalization or scaling for NIST.

Standard setting:

- NIST_A = N2
- NIST_B = N4

3.4 Encoder control word (STW2_ENC)

Signal STW2_ENC is used in telegrams 81 - 84.

The signal transfers the sign-of-life from the controller to MC-ENCODER. Further, in STW2_ENC, the controller must set bit 10 (control by PLC) to 1, in order to signal to the devices that the cyclic data are valid.

3.5 Encoder status word (ZSW2_ENC)

The Table "Bit assignment of STW2_ENC" shows the bit assignment of the STW2_ENC signal.

Note

If, in STW2_ENC, the controller does not set bit 10 to 1, then MC_ENCODER does not respond to the commands in G1_STW.

For clock cycle synchronous (isochronous) applications, the sign-of-life (sign-of-life counter) is used to monitor the correct synchronization of the controller processes to the sampling process in the absolute encoder.

The sign-of-life counter is a 4-bit counter. The controller application starts the sign-of-life with any value between 1 and 15. The controller increases the counter in every cycle of the controller application.

Valid values for the controller sign-of-life are 1 to 15, "0" indicates an error and is left out in normal operation.

Bit	Value	Significance	Comments
10	1	Control by PLC	Control via interface, data is valid.
	0	No control by PLC	Data is not valid, except sign-of-life bits.
12 15		Controller sign-of-life	Sending continuous counting value from 1 to 15.

Table 3-8 Bit assignment of STW2_ENC

3.5 Encoder status word (ZSW2_ENC)

Signal ZSW2_ENC is used in telegrams 81 – 84 to transfer the sign-of-life from the MC-ENCODER to the controller. Further, in ZSW2_ENC, the controller must evaluate bit 9 (control requested) in order to evaluate whether the cyclic data sent from the MC-ENCODER are valid, and the MC-ENCODER is ready to accept control commands.

The table "Bit assignment of ZSW2_ENC" indicates the bit assignment of the ZSW2_ENC signal.

Note

If, in ZSW2_ENC, bit 9 is not 1 then the information in G1_ZSW and G1_XIST_x is invalid and the MC-ENCODER does not respond to commands in the G1_STW.

For clock cycle synchronous applications, the sign-of-life (sign-of-life counter) is used to check the correct synchronization of the controller processes to the sampling process in the MC-ENCODER.

The sign-of-life counter is a 4-bit counter. The IO-device application starts the sign-of-life with any value between 1 and 15 after successful synchronization to the controller. The counter is increased by the IO-device in every data cycle.

3.6 Sensor control word (G1_STW)

Valid values for the IO-device sign-of-life are 1 to 15, "0" indicates an error and is left out in normal operation.

Note

If the MC-ENCODER identifies an error in the controller sign-of-life, then it stops sending the sign-of-life to the controller. This means that a missing sign-of-life (=0) from the MC-ENCODER to the controller can also be the consequence of an error in the controller sign-of-life to MC-ENCODER.

Table 3-9 Bit assignment of ZSW2_ENC

Bit	Value	Significance	Comments
9	1	Control requested	The automation system is requested to assume control, data is valid.
	0	No control by PLC	Data is not valid, except sign-of-life.
12 15		Encoder sign-of-life	Sending continuous counting value from 1 to 15.

3.6 Sensor control word (G1_STW)

Signal G1_STW is used to control the state machine of the PROFIdrive encoder channel. As the MC-ENCODER is a gray-coded absolute encoder, the following functions are often significant:

- Preset of the absolute position
- Encoder parking
- Error acknowledgment

Table 3-10 Bit assignment of 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 configured absolute value or shifted by this value.
			0: set home position / preset (absolute)
			1: shift home position / preset (relative = offset)
12	1	Set preset / request shift	Preset (resp. shift) is set when changing this Bit to "1" (rising edge). Default preset value (shift): 0
			Note: It can also be parameterized that with a rising edge, the value XIST1 also makes a step.

Cyclic Data Exchange

3.7 Sensor status word (G1_ZSW)

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	Activate parking sensor	If the "activate parking sensor" bit is set, the encoder is switched inactive and error will be reset. While the encoder is in the parking state, no errors will be generated.
15	1	Acknowledging a sensor error	Request to acknowledge / reset a sensor error.

By appropriately parameterizing the absolute encoder, when accepting the preset value, you can set whether this is also directly accepted in G1_XIST1 or G1_XIST3. When the preset value is accepted, this value is also retentively saved automatically. This is to ensure that an absolute value set using preset is also kept after a reset/power up of the absolute encoder.

3.7 Sensor status word (G1_ZSW)

Signal G1_ZSW is used to control the state machine of the PROFIdrive encoder channel and is the counterpart to control word G1_STW.

Bit	Value	Meaning	Comment
0 10			Reserved, currently not used.
11		Acknowledgement sensor error in process	Is set while requested error acknowledge is processed. Handshake signal related to G1_STW bit 15.
12	1	Set preset / shift reference point executed	Acknowledgement for "set preset / request shift".
13	1	Transmit absolute value cyclically	Acknowledgement for "request absolute value cyclically".
14	1	Parking sensor activated	Acknowledgement for "activate parking sensor". The encoder transmits no valid position value, sensor errors are reset.
15	1	Sensor error	Indicates a sensor error. A device specific error code is transmitted in G1_XIST2.

Table 3- 11 Bit assignment of G1_ZSW

3.8 Telegrams

Configuration of the cyclic data interface of the MC-ENCODER is done by selecting one of the following standard telegrams. The selection of the required standard telegram is done by inserting the related telegram submodule when setting up the PROFINET configuration of the encoder in STEP7 "HW Config", see also Auto-Hotspot

Standard telegrams 81 to 84 are typically used if the encoder is used together with a motion control system with PROFIdrive interface such as e.g. SIMOTION or SINUMERIK. Telegrams 81 to 84 offer a standard PROFIdrive sensor interface, which is equal to the sensor interface offered by a standard drive. Nevertheless, telegrams 81 to 84 may also be used with a PLC controller if sign-of-life supervision or error codes via cyclic interface is required.

For more simple applications, convenient transmission of position and velocity actual values to PLC based controllers is possible using telegram 860.

See also

Configuration (Page 29)

3.8.1 Standard telegram 81

Telegram 81 provides the following:

• Standard PROFIdrive encoder channel

Table 3- 12Telegramm 81, structure

Output data (PZD/Word)	1	2
Setpoint value	STW2_ENC	G1_STW

Input data (PZD/Word)	1	2	3	4	5	6
Actual value	ZSW2_ENC	G1_ZSW	G1_XIST1		G1_XIST2	

See also

G1_XIST1 (Page 18) Encoder control word (STW2_ENC) (Page 21) Sensor control word (G1_STW) (Page 23) Sensor status word (G1_ZSW) (Page 24)

Absolute encoder with PROFINET IO Operating Instructions, 11/2010, 6SN1197-0AB11-0BP0 3.8 Telegrams

3.8.2 Standard telegram 82

Telegram 82 provides the following:

- Standard PROFIdrive encoder channel
- 16 bit velocity actual value

Table 3-13 Telegram 82, structure

Output data (PZD/Word)	1	2
Setpoint value	STW2_ENC	G1_STW

Input data (PZD/Word)	1	2	3	4	5	6	7
Actual value	ZSW2_ENC	G1_ZSW	G1_	XIST1	G1_XI	ST2	NIST_A

3.8.3 Standard telegram 83

Telegram 83 provides the following:

- Standard PROFIdrive encoder channel
- 32 bit velocity actual value

Table 3-14 Telegram 83, structure

Output data (PZD/Word)	1	2
Setpoint value	STW2_ENC	G1_STW

	nput data PZD/Word)	1	2	3	4	5	6	7	8
A	Actual value	ZSW2_ENC	G1_ZSW	G1_>	(IST1	G1_X	(IST2	NIS	Г_В

3.8 Telegrams

3.8.4 Standard telegram 84

Telegram 84 provides the following:

- PROFIdrive encoder channel with a 64 bit XIST
- 32 bit velocity actual value

Table 3- 15	Telegram 84, structure

Output data (PZD/Word)	1	2
Setpoint value	STW2_ENC	G1_STW

Input data (PZD/Word)	1	2	3	4	5	6	7	8	9	10
Actual value	ZSW2_ENC	G1_ZSW		G1_>	(IST3		G1_X	(IST2	NIST	Г_В

3.8.5 Telegram 860

Telegram 860 provides the following:

- 32 bit position actual value XIST1
- 32 bit velocity actual value
- Using cyclic data, in the G1_XIST_PRESET_A signal a preset value can be entered for the position and activated.

Note

The telegram does not have a sign-of-life monitoring.

Encoded diagnostics is only possible using the standard PROFINET diagnostics.

Table 3-16 Telegram 860, structure

Output data (PZD/Word)	1	2
Setpoint value	G1_XIST_PRESET_A	

Input data (PZD/Word)	1	2	3	4
Actual value	G1_XIST1		NIST_B	

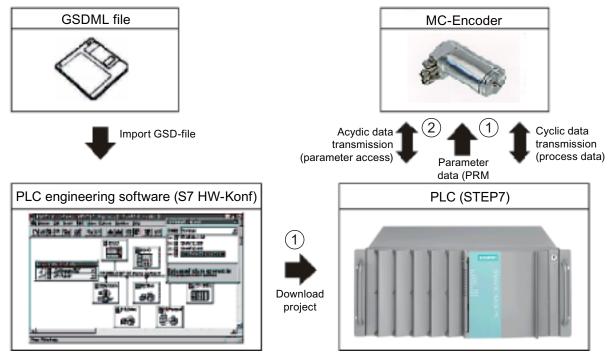
Cyclic Data Exchange

3.8 Telegrams

Configuration

The MC-ENCODER with PROFINET IO interface has to be configured by parameterization corresponding to the purpose of the application. The GSDML file pertaining to the encoder has to be installed in the PLC engineering software tool that is being used to enable this configuration.

4.1 Encoder configuration overview



① Offline configuration path via the hardware configuration

② Online access to encoder parameters via the non-cyclic parameter channel

Figure 4-1 Rotary encoder functions

The MC-ENCODER is essentially configured and parameterized offline using STEP7 HW-Config (Figure: ①).

In online operation of the MC-ENCODER, a non-cyclic parameter channel according to the encoder profile/x/ or PROFIdrive profile/y/is also available (Figure: ②). Using this PROFIdrive parameter channel, parameters can be read and write accessed in online operation.

Configuration

4.2 Encoder offline configuration

Literature

You can find additional information on this topic in this documentation: Additional literature (Page 76) [3b] Encoder-Profil Additional literature (Page 76) [1] PROFIdrive-Norm Additional literature (Page 76) [2]

4.2 Encoder offline configuration

The MC-ENCODER is configured and parameterized offline using STEP7 HW Config. HW Config is made aware of the MC-ENCODER by importing the GSDML of the encoder device.

Procedure

After importing the GSDML, the MC-ENCODER is inserted into the project and configured and/or parameterized.

After compiling the project, when the project is downloaded to the controller (SIMATIC or SIMOTION CPU), then the encoder parameterization is also transferred. When the CPU goes online and when the PROFINET connection is established to the MC-ENCODER, then also the parameterization is automatically transferred to the encoder (PRM data record) and becomes active.

When configuring the MC-ENCODERS in the HW Config, then principally, a distinction is made between the following three configuration areas:

Interface configuration, PROFINET

Configuration of the general communication properties of the encoder PROFINET interface e.g.:

- RT/IRT communication
- Cycle time
- Times Ti and To (for IRT operation)

You configure the properties at the interface submodule X1 at slot 0.

Configuration, telegrams

By selecting the telegram, you select the type of cyclic interface of the MC-ENCODER. The configuration is realized by selecting and inserting the appropriate telegram submodule (81, 82, 83, 84, 860).

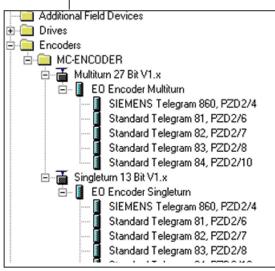
4.2 Encoder offline configuration

Function configuration, MC-ENCODER

Using the encoder parameters in the MAP submodule, then for example, the following individual MC-ENCODER functions are configured:

- · Parameterization of the direction of rotation
- Optional scaling function
- Velocity signal
- Sign-of-life monitoring

ral Addresses Synchronization 100	lycle		Ge	neral Addresses Parameters	
	ionin.		F		Volue
	1.000			Refameters Rotation Velocity actual value	
xameter	Value			-W Velocky filter	Normal
Configuration				Velocity reference N2/N4 (R/Inin	
- E Synchronization role	Sync slave syncdomain-default			🗄 🔄 Standard parameter (Encoder Profi	
- Name of sync domain	syncdomain-default			- Code sequence	CW.
RT dass				Encoder Class 4 functionality Preset affects XIST1	enable disable
IRT option	High performance			- Scaling function control	disable
				- Alarm channel control	disable
Inter	face configuratio	n, PROFII	NET	- iii Compatibility Mode V3.1	disable
	-			Scaling: Measuring units per Rev	
				Scaling: Total measuring range W Tolerated sign of life faults	134217728
					1
			101	Function co	nfiguration, MC-ENCC
(2) MC ENCODER			18		
2) MC (ENCODER	Order number	I address	Q address		
Module	Order number 6FX2001-5xN25	I address	Q address	Function co	nfiguration, MC-ENCC
		I address	Q address	Function co	nfiguration, MC-ENCC
Modile		1 address	Q address	Function co	nfiguration, MC-ENCC
Modile MCxE FN-10		I address	Q address	Function co	nfiguration, MC-ENCC
Modile <i>MCxE</i> / <i>CODER</i> <i>PW-0</i> <i>Port</i> 1		I address	Q address	Function co Diagnostic address: 16365* 16364* 16063*	nfiguration, MC-ENCC
Modile MCaE FW-D Fort 1 Fort 2		I address	Q address	Function co. Diagnostic address: 16365* 16364* 16063* 16062*	nfiguration, MC-ENCC



Configuration, telegrams

Figure 4-2 Encoder access points for configuration and parameterization

4.3 Encoder parameter description

4.3 Encoder parameter description

4.3.1 Encoder parameter

Parameter setting options

The MC-ENCODER parameters can be set offline using HW Config.

For specific parameters there is also the option of being able to access these online via the non-cyclic parameter channel – as well as retentively saving these in the encoder.

Also refer to:

Encoder configuration overview (Page 29)

4.3.2 Parameterizing the position actual value

The following table provides you with an overview of the configuration parameters of the position actual value in XIST1 and XIST2 (telegrams 81, 82, 83, 84 and 860).

These parameters are only available via HW Config.

Overview

Parameter	Significance	Valu	Ie
direction of the MC-ENCODERS (when viewing from the shaft side). Note: "Encoder Class 4 functionality" must be activated.		0	Clockwise direction of rotation, positive (default).
	1	Counter-clockwise direction of rotation, positive.	
Preset influences XIST1	This parameter is used to control whether, XIST1 should also make a step when	0	XIST1 is influenced by a preset command.
	presetting. Note: "Encoder Class 4 functionality" must be activated.	1	XIST1 is not influenced by a preset command (default).
Encoder class 4	This function is used to enable or inhibit the	0	No Class 4 functionality.
functionality	following supplementary functions:ScalingPresetDirection of rotation	1	Class 4 functionality enabled (default).

Table 4-1 Position actual value in XIST1 and XIST2

4.3 Encoder parameter description

Enabled/disabled functions

The following table provides you with an overview of the enabled/disabled MC-ENCODER functions depending on the setting of "Encoder Class 4 functionality".

Function	Class 4 functionality disabled	Class 4 functionality enabled
Code sequence	-	\checkmark
G1_XIST1 preset control	-	\checkmark
Scaling function control	-	\checkmark
Alarm channel control	\checkmark	\checkmark
Preset value	-	\checkmark
Preset value 64 bit	-	-
Measuring units per revolution / measuring step	-	\checkmark
Total measuring range	-	\checkmark
Measuring units per revolution 64 bit	-	\checkmark
Total measuring range 64 bit	-	\checkmark
Maximum controller sign-of-life failures	-	\checkmark
Velocity measuring unit	\checkmark	\checkmark
Operating time	-	-
Offset line	-	\checkmark
Offset value	-	\checkmark
Offset value 64 bit	-	\checkmark
Rotary axis (endless shaft)	Always active	Always active
Velocity filter	\checkmark	\checkmark

Table 4-2 Overview of the functions

4.3.3 Parameterizing the scaling function

The following table provides you with an overview of the configuration parameters of the scaling function for the position actual value XIST1 and XIST2 (telegrams 81, 82, 83, 84 and 860).

These parameters are only available via HW Config.

Overview

Table 4- 3	Scaling function in XIST1 and X	IST2
		1012

Parameter	Significance	Val	ue
Scaling function	Using this parameter, the scaling function in the	0	Scaling off (default)
	MC-ENCODER is enabled or disabled.	1	Scaling enabled
	"Encoder Class 4 functionality" must be activated, otherwise the scaling function is always off.		

Configuration

4.3 Encoder parameter description

Parameter	Significance	Val	ue
Scaling: resolution per revolution	Singleturn resolution in increments per revolution when the scaling function is active.	11	Unsigned 32
Scaling: Total resolution	Absolute measuring range in increments per revolution when the scaling function is active.	11	Unsigned 32

4.3.4 Parameterizing the velocity signal

An overview of the configuration parameters of the velocity signal in NIST_A or NIST_B (telegrams 82, 83, 84 and 860) is provided in the following table.

Parameters "Speed filtering" and "Speed scaling" are only available via HW Config.

Parameter "Reference speed N2/N4" can be set via HW Config, and can be read via the parameter channel of parameter p2000.

Overview

Table 4-4	Velocity signal in NIST_A and NIST_B
-----------	--------------------------------------

Parameter	Significance	Val	ue
Speed filtering	Active velocity filter for the speed actual	1	Fine (no filtering)
	value in NIST_x.	2	Medium (default)
		3	Coarse
Speed scaling	Unit or scaling of the velocity actual value in NIST_x.	0	Increments / s
		1	Increments / 100 ms
		2	Increments / 10 ms
		3	rpm
		4	N2/N4 scaling
Reference speed N2/N4 (rpm)	Speed reference value for 100 % for selected N2/N4 scaling in rpm.	UIN	IT 32

4.3.5 Parameterizing the communication interface

The following table provides you with an overview of the configuration parameters to configure help functions in the cyclic communication channel (telegrams 81, 82, 83, 84 and 860).

Parameters "Compatibility module V3.1" and "Diagnostics via alarm channel" are only available via HW Config.

Parameter "Tolerable sign-of-life error" can be set via HW Config and can also be additionally read and written to via the parameter channel as parameter 925.

4.3 Encoder parameter description

Overview

Parameter	Significance	Value	
Tolerated sign-of-life error	This parameter is used to set the maximum number of tolerated sign-of- life errors.	0	No error tolerated (e.g. for communication test)
	Note: The "Compatibility mode V3.1" must be activated.	1 254	Number of tolerated sign-of-life errors (1 = default)
	The setting has no effect for telegram 860.	255	Monitoring off (e.g. for commissioning)
Compatibility mode	Using this parameter, an encoder interface behavior compatible with encoder profile V3.1 is set (only for compatibility in previous projects).	0	V3.1 compatibility
V3.1		1	V4.x interface (default)
	Note: The setting has no effect for telegram 860.		
Diagnostics via alarm channel	Using this parameter, diagnostic alarms are either enabled or disabled via the	0	Alarm channel disabled (default)
	PROFINET alarm channel. Note: "Compatibility mode V3.1" must be activated, as otherwise, the diagnostic alarms are always enabled.	1	Alarm channel enabled

Table 4-5 Help functions in the cyclic communication channel

Overview

In the online operation of the MC-ENCODER, a non-cyclic parameter channel according to the encoder profile/x/or PROFIdrive profile/y/is available. Parameters can be read and write accessed in online operation using this PROFIdrive parameter channel.

For MC-ENCODER, the access point to this parameter channel is at the MAP submodule (module 1, submodule 1.1) via the data record with index 0xB02E.

Access to the parameter channel is realized via the non-cyclic communication channel and is therefore possible by the controller as well as also a supervisor.

Literature

You can find a detailed description of the access protocol in the following documentation: Additional literature:

Additional literature (Page 76) [3b]

4.3 Encoder parameter description

Parameters supported via parameter channel

Below is a list of the online parameters available via the parameter channel on the MC-ENCODER with their properties.

Number	Parameter	Significance	Data type	Access	
922 Telegram selection		Information about the currently set telegram (PROFIdrive parameters).	Unsigned16	Read only	
925	Number of controller sign- of-life failures which may be tolerated	Maximum number of tolerated sign-of-life errors (PROFIdrive parameters).	Unsigned16	Read/write	
964	Drive unit identification	Information about the manufacturer, type, version of the encoder (PROFIdrive parameters).	Array[6] Unsigned16	Read only	
965	Profile identification number	Information about the supported encoder profile version (PROFIdrive parameters).	Octet string[2]	Read only	
971	Transfer into non volatile memory	The parameter set is saved in the NV- RAM (PROFIdrive parameters).	Unsigned16	Read/write	
975	EO identification	Profile-specific information on the encoder object/module 1 (PROFIdrive parameters).	Array[n] Unsigned32	Read only	
979	Sensor format	Information on the position sensor (PROFIdrive parameters).	Array[n] Unsigned32	Read only	
980	Number list of defined parameter	List of all of the parameters available online via the parameter channel (PROFIdrive parameters). [2]	Array[n] Unsigned16	Read only	
2000	Velocity reference value	Speed reference value for 100% in the speed actual value signal NIST_A or NIST_B.	Float32	Read only	
65000	Preset value	Position preset value, which for telegrams 81, 82, 83 and 84, which become active when using the set/shift home position function via G1_STW, bit 12 (encoder profile parameter).	Integer32	Read/write	
65001	Operating status	Information about the actual configuration and error status of the encoder (encoder profile parameter).[1]	Array[n] Integer 32	Read only	

Table 4- 0 INC-ENCODER FROFIUITVE parameters	Table 4- 6	MC-ENCODER PROFIdrive parameters
--	------------	----------------------------------

Literature

Additional literature (Page 76) [1]

Additional literature (Page 76) [2]

Operating with STEP7

In the following chapter the configuration of the encoder with the configuration tool STEP7 "HW Config" is shown as example.

5.1 Installing the GSDML file

If the MC-ENCODER is used for the first time it is necessary to install the GSDML file to import the encoder description into the hardware catalog of the HW Config-tool:

Choose "Install GSD File..." in the HW Config-window of the project (menu item "Options") and select the GSDML-file.

The GSDML file is supplied by SIEMENS. In order to represent the encoder with a bitmap in STEP7; the bitmap file will be installed automatically with the GSDML file – therefore both files must be in the same directory.

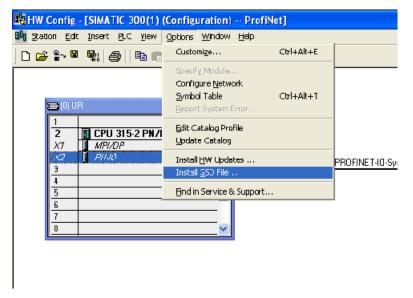


Figure 5-1 Installing GSD file in STEP7 HW Config

After the GSDML file has been successfully installed, the encoder can be found in the hardware catalog under "PROFINET-IO" – "Encoders".

5.2 Engineering the MC-ENCODER in a STEP7 project

5.2 Engineering the MC-ENCODER in a STEP7 project

To engineer the encoder in a project, drag the device MC-ENCODER on to an existing PROFINET Ethernet network.

or

Choose the network and double-click the "MCxENCODER" icon.

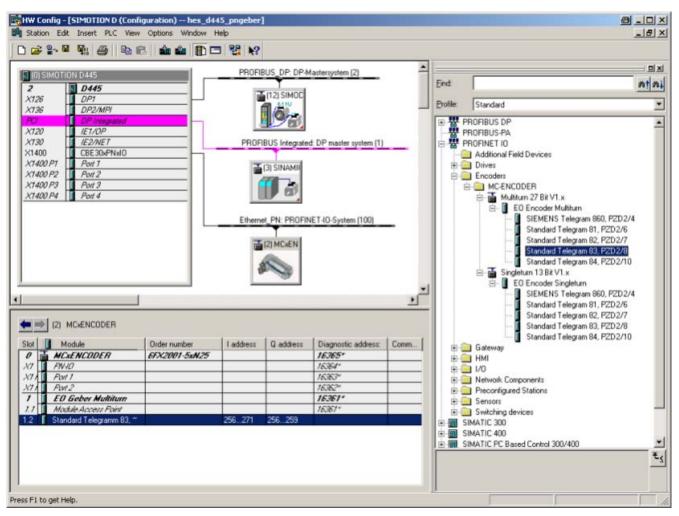


Figure 5-2 Engineering an encoder in a STEP7 project

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

Operating with STEP7

5.2 Engineering the MC-ENCODER in a STEP7 project

Properties - MC-ENCO	DER	
General		
Short description:	MC-ENCODER PROFINET IO MC-Encoder 27 Bit (Encoder value 14 bits revolutions, 13 bits steps per revolution) with PROFINET IO functionality (RT, IRT, cyclic and acyclic communication)	
Order No. / Firmware: Family:	6FX2001-5xN25 / 6.1 MC-ENCODER	
<u>D</u> evice name	MCENCODER	
GSD file:	GSDML-V2.2-SIEMENS-MC-Encoder-20100504.xml	
Node / PN IO system-		
De <u>v</u> ice number:	1 PROFINET-IO-System (100)	
IP address:	192.168.0.17 <u>E</u> thernet	
Assign IP address	via ID controller	
<u>C</u> omment:		
		×
ОК	Cancel	Help

Figure 5-3 Setting device properties

The device name and IP address now have to be set physically in the encoder.

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

Click "PLC" \rightarrow "Ethernet" \rightarrow "Edit Ethernet Node" and click "Browse" for accessible Ethernet nodes in the new window.

STEP7 will scan for devices on the Ethernet and will displays them in a window.

5.2 Engineering the MC-ENCODER in a STEP7 project

Browse Network -	2 Nodes			
<u>Stop</u> Stop I Fast search	IP address 192.168.0.5 192.168.0.2	MAC address 00-0E-CF-03-13-DE 00-1F-F8-00-34-AE	Device type MC-ENCO SIMOTION D	Device name encoder1 prixio
Elash	MAC address:			>
ОК			Cancel	Help

Figure 5-4 Network browser

The encoder should be displayed under the device type MC-ENCODER.

Select this entry and click "Flash" to have the identification LED flash with 2 Hz.

Click "OK" to take the MAC address of the chosen device to the previous window and select "Use IP parameters".

The MAC address of the MC-ENCODER is available on the type plate (see the diagram below).

	SIEME	NS (E
		Winkelcodierer	þ
		MC-ENCODER	Polar
Code:	Binary Bit	Betr. Spg. 10-30V	in Po
MAC:	00:0E:CF:03:13:	ED PROFINET	de i
Fab.Nr.:	06/10 - 387651	A1	Mai

Enter the IP address (and subnet mask) for the encoder that you previously assigned and click "Assign IP configuration".

Also, enter the device name previously chosen in the text field "Device name" and click "Assign Name".

Operating with STEP7

5.2 Engineering the MC-ENCODER in a STEP7 project

Edit Ethernet Node	X
Ethernet node	
	Nodes accessible online
MAC address: 00-0E-CF-03-13-DE	Browse
Set IP configuration Use IP parameters	
<u>IP address:</u> 192.168.0.5	Gateway Op not use router
Subnet mask: 255.255.255.0	
- ,	Addr <u>e</u> ss: 192.168.0.5
Obtain IP address from a DHCP server	
☐ Identified by	
© Client ID C MAC address	C De <u>v</u> ice name
Client ID:	
Action ID Conformation	
Assign IP Configuration	
Assign device name	
Device name: MCxENCODER	Assign Name
Reset to factory settings	
	Reset
<u>C</u> lose	Help

Figure 5-5 Editing an Ethernet node

Note

If more than one encoder is used in the same PROFINET domain, each encoder must have a different name and each encoder must be assigned its name before another is connected to the network. 5.3 LLDP (Link Layer Discovery Protocol)

5.3 LLDP (Link Layer Discovery Protocol)

The Link Layer Discovery Protocol allows a device in the PROFINET network to be replaced. The partner port in front of and behind the replaced device saves relevant information so that no additional configuration is necessary.

But the flag for activate "Device replacement without replacement medium" must be activated under the General tab.

and the state of the	עפי Options				
Port Interconnection					
Local port:	SIMOTION D	SIMOTION DAPNAIO (D410)APort 2 (X201 P2)			
vledium:	Local port	Copper	Partner port:	Copper	
Cable name:	Copper				<u></u>
Partners					
⊇artner port:	SIMOTION D'OCDXENCODER\RJ4510/100 MBit/s (X1 P1)				
Ajternating partner ports:		VJCDXENCICERV VDCDXENCODERV	RJ45 10,100 MBt/s ()- RJ45 10/100 MBit/s ()-	1 P1) 1 P2)	
	<u>s</u>				X
	<u>Å</u> dd		lete D <u>e</u> t	ails	
Cable Data					
	<1	OD m 💻) (Signal delay tim	ne: 0.60 µs	
🖲 <u>C</u> able length:		0	-		

Figure 5-6 Properties PNxIO

Using the Topology Editor in the STEP7 Hardware manager, it is possible to get an overview about the connections, the cable length and signal delay.

Operating with STEP7

5.3 LLDP (Link Layer Discovery Protocol)

	- Interconne		-			
Show statio	nname	<u>Filte</u>	r: Show all p	porte		
Port		Partner part	Cable len	Signal del 🤇	Comment	
1000		SIMOTION D \PNXID(D410) \ Po.	100m	0.60µs		
	-					
De	faull port					
e-PNxIO(Port 1 (X200 P1) Port 2 (X201 P2)	OCDXENCODER \ RJ45 10/100 .	100m	0.60µs		
<					Ì	
Online	<u>U</u> pdate	Object Properties.	Export	Unit o length	f Meters	

Figure 5-7 Topology Editor, table view

a's topology Editor	
Table view Graphic view Offine/online comparison	
PC/PC(1) PC/PC(1) PC/COLC410) PC/COLC410	Miniaturo View
	Pass ve Components
Nove picture mode deactivated	P
Drline Update Object Properties Options Print	
	Cancel Help

Figure 5-8 Topology Editor, graphic view

Operating with STEP7

5.3 LLDP (Link Layer Discovery Protocol)

It is possible to compare the configuration with the physical network.

🛂 Lopology E ditor					
Table view Graphic view	w Offinatontre comparison				
Co	rfigured topology (olfline)		D	eteolec topology (online)	
	Hiller: Show all cevices	•	<u>Start</u> 2 devic	es lound	
Okject name	Partner port	Cable data	Object hame	Partner port	Cskle dats
■ - MOXHNEEDER					
⊞- PG/FC(1)					
E - PNxIO(D41.0)			⊟-рако		
Port 1 (X200 P1)			Port 1		
Port 2 (X201 P2)			Port 2		
			 Incxencoder 		
			Ph#1		
			Port 2		
			-MAC-C0:0d:00 C2:01:	95	
			Port 1	Mutiple partner portal exist	
			C		2
< <u> </u>			<u>Ássi</u> un Au	νίν Εκσαι Dµtions	
۸				Cancel	Help

Figure 5-9 Topology Editor, offline/online comparison

5.4 Selecting the MC-ENCODER telegram

5.4 Selecting the MC-ENCODER telegram

The functionality and interface is dependent on the selected telegram. The telegram is selected by inserting the appropriate telegram submodule (81, 82, 83, 84, 860).

Insert the corresponding telegram submodule by dragging it from the hardware catalog and dropping it into subslot 1.2 of the MC-ENCODERS.

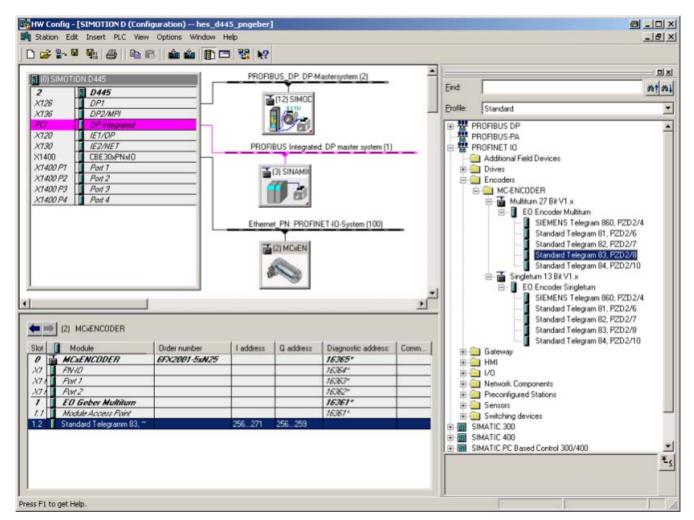


Figure 5-10 Selecting of telegram

5.5 Setting encoder parameters

5.5 Setting encoder parameters

Select the encoder in the hardware configuration and double click the MAP submodule 1.1. The properties dialog will appear. The input addresses can be changed under the tab "Addresses" (if desired). To set the encoder parameters, the "Parameters" tab has to be selected.

Properties - Module Access Point			8	×
General Addresses Parameters				
	Value		_	
	Value		-	
Parameters Patalian Valueity actual value				
Rotation Velocity actual value	Normal			
Velocity filter	3000			
Le Velocity reference N2/N4 (R/min)	3000			
☆ Standard parameter (Encoder Profile) │ │ 딸 Code sequence	CW			
_ ≡ Code sequence _ ≡ Encoder Class 4 functionality				
Encoder Class 4 Functionality	disable			
—	disable			
	disable			
 ☐ Alarm channel control ☐ ☐ Compatibility Mode V3.1 	disable			
☐ Compatibility Mode V3.1 —	8192			
	134217728			
—				
	1			
Velocity measuring unit	N2/N4			
OK		Cancel	Help	

Figure 5-11 Setting encoder parameters

5.6 Setting device properties

5.6 Setting device properties

PROFINET IO Domain Management (i.e. right click on slot 0) allows the synchronization role and the RT class to be selected.

If the synchronization role is selected as "unsynchronized", then the encoder operates in the RT class. If sync controller is selected, then it is possible to switch between "high flexibility" (FLEX) and "high performance" (TOP).

Domain Management provides an overview of all of the available devices. All devices should use the same Synchronization Role and RT class.

만	HW Confi	ig - [SIM	OTION	D (Con	figuı	ration)	hes_	d445_png	eber]		
20	Station	Edit Ins	ert PL	.C Viev	N O	ptions	Window	Help			
] [) 📂 🖁	Copy Paste			Ctrl+ Ctrl+			= 🎇	N?		
	🚺 (0) SIM		Redund	lant			- I - r	P	ROFIBU	S_DP: DP-Ma	astersystem (2
	2 X126 X136	Delete Select			Del CtrlH	ΗA	╞		۲) <mark>کے</mark> (1	2) SIMOD	
	PCI X120	Go To Symbo	ls						<u> </u>	7.3	
	<i>X130</i> X1400		r Syster NET IO	n			▶ 📕 ▶ PR	OFINET IO		IS Integrated:	DP master s
	X1400 F X1400 F X1400 F X1400 F	Object		ties With				main Manag pology	jement		
	<u></u>	Chang	e Acces	s			▶ Iso	chronous M	1ode		
		Assign	Asset I	(D				E	thernet_	PN: PROFINE	T-IO-System
		Start [Device T	iool					(2)		
4											
	()	Ethernet_F	'N: PRO	FINET-	10-Sy	vstem (1)	00)				
	Device Nu	umber		IP addre	es	Device	Name	Order nu	mber	Firmware	Diagnostic
	2		19	2.168.	0.2	MCxEN	ICODER	6FX200	1-5xN25	¥1.0	16365*

Figure 5-12 Domain management

Operating with STEP7

5.6 Setting device properties

Sync domain: Send clock time [ms]:	syncdomain-de	fault 💌 New			
Send clock time [ms];			Delete	Edit	
	1.000	▼ Detail	k		Devic
lodes					ER
Station / 10 system					27 B
SIMOTION D / PROFIN	NET-IO-System (100)			BIEM
					5tand 5tand
					5 Btand
					Stand
					m 13
		-r			Enco
Add	Remove				5IEM Stand
		i.	1	1	Btand
Station / Device Name		Synchronization Role	RT Class	IRT Option	Stand
SIMOTION D / CBE30 SIMOTION D / MCXEN		Sync master Sync slave	RT, IRT IRT	high performance high performance	Stand
		Device prope	rties - MCxENCODER		8
		Synchroniza	tion		
		Paramete		Value	
			ofiguration		
					17.5
Device Properties	I	-=	Name of the sync domain	syncdomain-	
Device Properties	ŧ	-8	Name of the sync domain Device name	MCXENCODE	R
Device Properties	k	-# -#	Name of the sync domain Device name Station	MC×ENCODE SIMOTION D	BR D
	t		Name of the sync domain Device name Station IO system	MCXENCODE SIMOTION D PROFINET-IO	BR D
Device Propetties todules Display			Name of the sync domain Device name Station	MC×ENCODE SIMOTION D	BR D

Figure 5-13 Synchronization

5.7 IRT settings

The upper limit for IRT transmission can be set.

ails - Sync Domain			
Maximum bandwidth for cyclic	dəta	500.000	μs
Bandwidth used, reserved for	cyclic data:	157.040	μs
Fiee bandwidth for TCP/IP:		842.960	με
<u>30%</u> 150.000 μs	1	i00.000 µs	
Cyclic Data in Reserved Bandwidth Upper limit for IRT:	150.000	μs = 30	• %
Calculated allocation for IRT	26.394	μs	
Unused bandwidth: (TCP/IP not possible)	0.000	μs	
Cyclic Data in Free Bandwidth			
Calculated allocation for RT:	7.040	μs	
Exceeding bandwidth permitte	d		
DK		Cancel	Help

Figure 5-14 IRT transmission

5.8 Changing and reading encoder parameters during the run-time

Encoder parameters will be set when configuring the encoder. You can find information on the parameters under: Encoder parameter description (Page 32)

To change or read encoder parameters in a STEP7 automation program, refer to system function blocks SFB53 and SFB52 (write/read record) or with the variable table for testing.

Literature

For additional information see

Additional literature (Page 76) [3b]

5.9 Accessing cyclic data

5.9 Accessing cyclic data

Settings

To access the cyclic data in the telegram, create a variable for each signal used in the telegram input and output data.

As a logical address, use the basis address of submodule 1.2 from HW Config and the relevant byte offset of the signal in the telegram.

Operating with SIMOTION

In the following chapter the configuration and operation of the encoder with the SIMOTION controllers is shown. In this example SIMOTION SCOUT Version 4.2 is used.

6.1 Applications

Applications

In general, there are two use case for operation of the encoder with SIMOTION:

- MC-ENCODER together with TO "External encoder": The MC-ENCODER is used as sensor device for the TO "External encoder". In this case, the encoder is typically operated isosynchronously (IRT device). The encoder is completely controlled by the TO. Sign-of-life monitoring is automatically used. Telegrams 81 or 83 are used.
- MC-ENCODER operated directly from AWP: The encoder telegram is directly accessed from the user program. The MC-ENCODER is completely controlled and managed by the user program. Telegram 860 is typically used.

In addition, SIMOTION provides system functions for accessing parameters online via the non-cyclic standard parameter channel for the MC-ENCODER. You can use these system functions for both of the applications described above.

6.2 MC-ENCODER used together with TO External encoder

The following steps are necessary in order to configure the MC-ENCODER at SIMOTION as sensor at the TO " External encoder.

For the general procedure to create and configure MC-ENCODER in the HW Config, refer to the chapter Configuration (Page 29) and chapter Operating with STEP7 (Page 37)

You can find the online parameter access via the parameter channel in the chapter Online parameter access (Page 62)

Configuring MC-ENCODER in HW Config

For this particular application, select the following settings:

- IRT communication (IRT with high performance)
- Cycle time and Ti identical to the drive axes
- Select the telegram
 - Telegram 81
 - or
 - Telegram 83 (for 32 bit speed actual value NIST_B)
- Set the encoder parameters: Accept the default setting. If you use the speed actual value NIST from MC-ENCODER in the TO, then set the speed reference value in parameter "Reference speed N2/N4 (rpm)" to a value that is suitable for your application.

Example

The following example shows the configuration settings for the MC-ENCODER in HW Config for telegram 83 and a reference speed (100%) of 3000 rpm.

Image: Processes Processe	- 1-	Volue Normal 3000 CW enable So
Premieter Value Synchronization role Synchronization Synchronization role Synchronization Interface configuration, PROFINET Interface configuration Interface configurat	Relation Welcky actual value Welcky (Rer Welcky (Rer Welcky (Rer Welcky (Rer Welcky (Rerearch R2/M4 (R)))) Dedee segmence Discoder Class 4 functionality Press dfrest 31511 Sosing function corbrol Alem charmel control Compatibility Model V3.1 Sosing Total measuring range Tolerated sign of the faults Welcky (Measuring (Reference)) Welcky (Measuring (Reference)) Tolerated sign of the faults Welcky (Measuring (Reference)) Sosing Total measuring (Reference)) Welcky (Measuring (Reference)) Sosing Total measuring (Reference) Welcky (Measuring (Reference)) Welcky (Measuring (Reference))	Normal 3000 CW enable Goldie Goldie Goldie Soldie Soldie 194217728 1 1427H guration, MC-ENCODEF
Parameter Value Configuration role Sync slave Name of sync domain Sync domain-default Interface configuration, PROFINET Interface configuration Interface configuration Interface configuration Interface configuration Interface configuration	Relation Welcky actual value Welcky (Rer Welcky (Rer Welcky (Rer Welcky (Rer Welcky (Rerearch R2/M4 (R)))) Dedee segmence Discoder Class 4 functionality Press dfrest 31511 Sosing function corbrol Alem charmel control Compatibility Model V3.1 Sosing Total measuring range Tolerated sign of the faults Welcky (Measuring (Reference)) Welcky (Measuring (Reference)) Tolerated sign of the faults Welcky (Measuring (Reference)) Sosing Total measuring (Reference)) Welcky (Measuring (Reference)) Sosing Total measuring (Reference) Welcky (Measuring (Reference)) Welcky (Measuring (Reference))	2000 CM enable disable
Image: Synchronization role Sync. slave Synchronization role Sync. slave Image: Synchronization role Sync. slave Image: Synchronization Interface configuration, PROFINET Interface configu	Velocky filer Velocky filer Velocky reference R2/M4 (R/Jein) Velocky reference R2/M4 (R/Jein) Order sequence Dreceder Class 4 functionelity Prese affects 1311 Soling Almost Anothol Alam chared control Compatibility Mole V3.1 Soling: Measuring units per Ren Soling: Measuring units Velocky measuring units Function confil Diagnostic address: Colored Colored	2000 CM enable disable
Since of synchronization role Name of synchronian-default RT dats Interface configuration, PROFINET Interface configur	Sundard persenter (Encoder Profile) Code requerce Disoder Class 4 functionality Preset affects 1351 Scaling function control Alem channel control Compatibility Mole V3.1 Scaling Measuring units per Rev Scaling Teatment of the faults Televisted sign of the faults Function confil Diagnostic address: IS365* IS365*	CW enable disable disable disable disable enable disable enable disable enable disable enable disable enable disable d
Image: State of sync domain Bit image: Sync domain default Image: State of sync domain Image: Sync domain default Image: State of sync domain Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of sync domain default Image: Sync domain default Image: State of syn	Code sequence Droder Class 4 functionality Preset affects XISTI Soaling function control Compatibility Mode V3.1 Soaling Total measuring range Tole and sign of the Faults Preset affects and the Control Compatibility Mode V3.1 Soaling: Total measuring range Tole and sign of the Faults Preset affects Total measuring unit Function confil	enable deable deable deable deable deable fish fish fish fish fish fish fish fish
Image: proton High performances Interface configuration, PROFINET Interface configuration, PROFINET Interface configuration, PROFINET Image: proton Im	Preset effects x1371 Soling Unction control Alars channel control Compatibility Model V3.1 Soling: Total measuring range Toire totals give if if is fulls Yelocky measuring unit Function confi Diagnostic address: 163655 163654	Godie Godie Godie BitQ 13417728 1 H27M guration, MC-ENCODEF
Interface configuration, PROFINET Interface configuration, Profile Intend configuration, Profile	Alex charel control Compatibly Mode V3.1 Soling: Measuring units per Rec., Soling: Total measuring unit: Function confi Diagnostic address: 16365*	Section Section 1942 1942 1942 1942 1942 1942 1942 1942
Image: Standard Telegram 83, T Image: Standard Telegram 81, T	Compatibility Mode V3.1 Soling: Total measuring range Toterated sign of life faults Veloby measuring main Veloby measuring mit Function confi Diagnostic address: C 16365*	5420 8192 134217728 1 NR2MM guration, MC-ENCODEF
Int Modile Order number Laddress Q address Q MCat CODER EFX2001-5xN25 Address Q address V1 Powr 1 Address Address Address Address V1 Powr 1 Address Address Address V1 Powr 2 Address Address Address V1 For 2 Address Address Address V1 For 3 Standard Telegram 860, PZD2/4 Standard Telegram 81, PZD2/6	Society: Totel measuring range Totel measuring range Totel measuring unit Function confit Diagnostic address: 0 16365* 16364*	ISHEIT728 I HR23H guration, MC-ENCODEF
Intermediate Order number Laddress Q address V MCat2 ICODER 67×2001-5x4/25 Image: Comparison of the second secon	Tolerated sign of life faults Velocity measuring unit Function confi Diagnostic address: 0 16365* 16364*	guration, MC-ENCODE
Intermediate Order number Laddress Q address V MCat2 ICODER 67×2001-5x4/25 Image: Comparison of the second secon	Function confi	guration, MC-ENCODEF
Iot Model Order number Laddress Q address 0 MCxE CODER GFX2001-5xN25 Address Q X1 Fort 2 Image: Standard Telegramm 83, Image: Standard Telegramm 83, Image: Standard Telegramm 83, Image: Standard Telegramm 83, Image: Standard Telegram 81, PZD2/6 Image: Standard Telegram 81, PZD2/6	Diagnostic address: 0 16365* 16364*	-
Int Modile Order number Laddress Q address Q MCat CODER EFX2001-5xN25 Address Q address V1 Powr 1 Address Address Address Address V1 Powr 1 Address Address Address V1 Powr 2 Address Address Address V1 For 2 Address Address Address V1 For 3 Standard Telegram 860, PZD2/4 Standard Telegram 81, PZD2/6	16365* 16364*	omment
0 MCxt VCODER 6FX2001-5xN25 V1 Port 1 Image: Constraint of the second seco	16365* 16364*	omment
Art FW40 Image: Construction of the second sec	16365* 16364*	
Abit 1 Abit 1 April 2 Poil 2 Image: Provide Access Paint Image: Provide Access Paint Image: Provide Access Paint Image: Provide Access Paint <t< td=""><td></td><td></td></t<>		
Port 2 Fort 2 Image: Construction of the second	16363*	
Image: Construction of the second		
7.7 Machile Alaceus Plaint .2 Standard Telegramm 83, T 256271 256259	16362*	
2 Standard Telegramm 83, Additional Field Devices Additional Field Devi	16361"	
Additional Field Devices	16367*	
Standard Telegram 82, PZD2/7 Standard Telegram 83, PZD2/8 Standard Telegram 84, PZD2/10 Singleturn 13 Bit V1.x EVENCE Encoder Singleturn SIEMENS Telegram 860, PZD2/4 Standard Telegram 81, PZD2/6 Standard Telegram 82, PZD2/7		
Configuration, telegr		

Figure 6-1 Example: Setting required in HW Config

Creating and configuring TO "External encoder"

Insert a TO "External encoder" in the project and run the wizards for the external encoder configuration.

Select the following settings:

- Encoder type: rotary
- Encoder type: absolute encoder or absolute encoder, cyclic, absolute
- Encoder mode: SSI
- Encoder pulse number: 8.192
- Fine resolution: 0
- Fine resolution, absolute value in Gn_XIST2: 0
- Data width, absolute value without fine resolution:
 - 27 (for multiturn encoder) or
 - 13 (for singleturn encoder)
- Encoder monitoring: activate

sert External e	ncoder						æ
21	Name:	External_enco	der_1				
General Object	t address						
				thor: rsion:		_	
			¥6.	raion.	1		
Existing Exter	nal encoder						
- Existing Exter	nal encoder						
	nal encoder						
Comment:	nal encoder						
	nal encoder						

Figure 6-2 Inserting an encoder

Procedure

Operating with SIMOTION

6.2 MC-ENCODER used together with TO External encoder

External encoder config	uration - External_enc	oder_1 - Encoder type	8
Encoder type Encoder assignment Encoder configurati Summary	Aready set data c the configuration d	an be lost if this entry is changed, as lata changes.	the structure of
	Encoder type:	C Linear	
	Encodertype.	Rotary	
		Configure units	1
ŀ			
	< Back	Next > Cancel	Help

Figure 6-3 Configuring the encoder type

Encoder type		⊖ Assignment partner [III/00T]*	Assignment	
Encoder assign	72		Al	
Encoder configurati	1	> Define assignment later		_
Summary	2	G SiemensxMCxEncoder		
	3			
	4	L Encoder_1	assign	
	5	SMODRIVEx611UxDP2xDP3 SMODRIVEx611UxDP2xDP3		
		G SINAMICS_Integrated		
	Propertie	s: ive message frame		8
	PROFide	ive message frame		8
	Input			PI 25
	Output	er use in SIMOTION:		PQ 25
	Louis Louis	er use in SIMOTION: Enc. type: Absolute encod Encoder mode: SSI Measuring system: Rotary encoder	fer, cyclic absolute	PQ 25

Figure 6-4 Assigning an encoder, configuring the type and mode

Operating with SIMOTION

6.2 MC-ENCODER used together with TO External encoder

Encoder type	Reference variables	
Encoder assignment	Encoder pulses per rev.:	6192
Encoder config Summary	Fine resolution:	0
Juniay	Fine resolution of absolute value in Gr_/05T2:	1
	Data width of absolute value without fine resolution:	27
	Additional settings	lakze when it is not involved in the
t of	Activate encoder mon	itoing
30		

Figure 6-5 Configuring an encoder

Encoder type Encoder assignment	All the necessary data for configuration has been entered
✓ Encoder configurati Summary	Name: - External_encoder_1 Technology - External encoder Encoder type: - Rotary encoder - Elechic Encoder - Drive_1 Encoder_1 (SienensMCxEncoder) Encoder type: - Cyclic absolute
	< Back Finish Cancel Help

Figure 6-6 TO configuration, summary

Example

After the MC-ENCODER has been successfully configured at the TO, the following configuration settings are shown at the TO "External encoder".

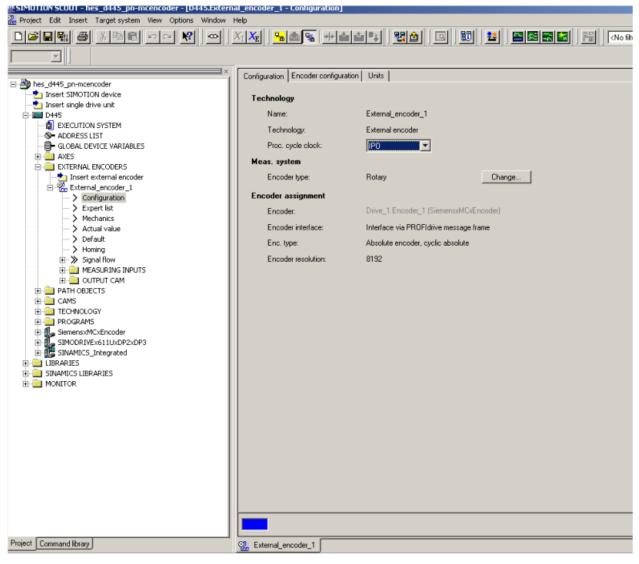
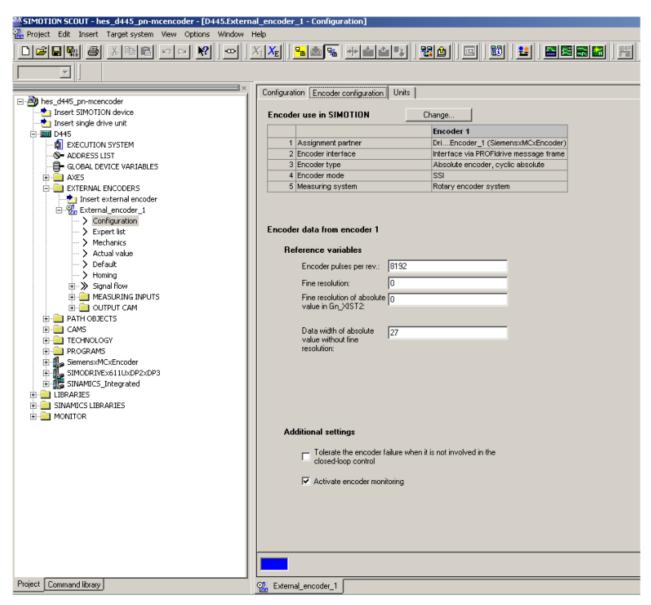
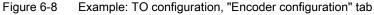


Figure 6-7 Example: TO configuration, "Configuration" tab

Operating with SIMOTION

6.2 MC-ENCODER used together with TO External encoder





Operating with SIMOTION

6.2 MC-ENCODER used together with TO External encoder

hes_d445_pri-incencoder trisert SIMOTION device	Configuration Encoder configuration Unit: If you change the unit system, the configuration and system validation possible), but specifications in programs are not failern into account.	are recalculated (rounding ensu
Insert single drive unit. Imp DH45 Execution SYSTEM	Physical quantity	ltur
ADORESS LIST	Poston	78
GLOBAL DEVICE VARIABLES	Incrementation	1000k#t
18 ANES	Velocity	770
E EXTERNAL ENCODERS	Acceleration	10/2*
- traert external encoder	Jark	***
E- Coternal_encoder_1	Fields	5
> Configuration	Tes	
-> Expert lot	Arch	
-> Mechanics	Argular velocity	20
— > Actual value	Arquiar acceleration	*02*
-> Default	Arodar ani	*10*
-> Honing	Frequency	Hz
E ≫ Signal flow	Leadscrew pitch	entid
	Votage	V
E TECHNOLOGY BOGRAMS BosenschOcEncoder		
SIMODERICLIST ULLOPEDER SIMANDES Integrated LIBRARIES SINANDES LIBRARIES SINANDES LIBRARIES MONITOR		

Figure 6-9 Example: TO configuration, "Units" tab

Using the velocity actual value NIST from MC-ENCODER

The TO "External encoder" can calculate its internal velocity actual values as follows:

- · From the internal position actual values
- From the external velocity value NIST_B of the MC-ENCODER

Using the expert list of the TO, you parameterize which velocity actual value is used in TO.

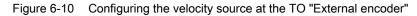
Example

The following screenshot shows the setting options using the TO parameter "encoderValueType". In this particular example, the following values are relevant:

[0]:	ROTARY_SYSTEM	The velocity is calculated in the TO from the position.
[4]:	POSITION_AND_PROFIDRIVE_ENCODER_NISTB	The velocity is taken from the encoder signal NIST_B.

6.3 MC-ENCODER used directly from AWP

21	⊕ SensorControlConfig	Toleration of encoder errors				
22	E SensorNist	Actual speed value extrapolation	balance and the second s			
23	- dataAdaption	Switch encoder parameter adaptati	[91] NO	+	Restart	Enum/YesNo' = enum/DINT
24	encoderidentification	Encoder identification	[2] DPMASTER	4	Download	EnumAxisEncoderidentification/ = enum/DINT
25	- encoderMode	Encoder mode	[2] SSI_MODE	+0	Download	'EnumAxisEncoderMode' = enum/DINT
26	- encoderSystem	Encoder system	[0] ROTATORY_SYSTEM		Download	'EnumAxisEncoderSystem/ = enum/DINT
27	- encoderType	Encoder type	[3] SENSOR_CYCLIC_ABSOLUTE	+	Download	EnumAxisEncoderType' = enum/DR/T
26	L encoderValueType	Actual value type	[4] POSITION_AND_PROFIDRIVE_BNCODER_NIST_B	-	Download	EnumAxisEncoderValueType' = enum/DINT
29	⊕Extrapolation	Actual value smoothing				
30	n⊞ Gear	Load gear	Va	lue: 4 = Calculate	actual position value	s and velocity from DP protocol (standard message fr
31	⊕ SmoothingFilter	Actual value smoothing			10	1 in in in 1996.
32	r⊞ StandStillSignal	Standstill signal				
33	LtypeOtAxis	Axis type	[0] REAL_AXIS	40	Download	"EnumEncoderidentification" = enum/DINT



6.3 MC-ENCODER used directly from AWP

The following steps are necessary in order to use the MC-ENCODER directly from a SIMOTION user program as sensor:

The general procedure for creating and configuring MC-ENCODER in HW Config is provided in the chapter Configuration (Page 29) and chapter Operating with STEP7 (Page 37)

Configuring MC-ENCODER in HW Config

Access via telegram 860

You can freely select the settings corresponding to the requirements of your particular application.

The simplest option of accessing the position supplied from the MC-ENCODER from the user program is by using telegram 860. If you use telegram 860, the user program does not have to use any control or status word when transferring the pure position. Further, the user program does not have to generate or monitor a sign-of-life, as telegram 860 has no sign-of-life monitoring. To simplify the position calculation in the user program, parameterizable help functions for scaling as well as to set a preset position value are available in the MC-ENCODER.

Access using telegrams 81, 82, 83, 84

If you control the MC-ENCODER using telegrams 81, 82, 83 or 84, then in the user program, you must program the control and status words, where relevant, also sign-of-life counting and monitoring according to the standard MC-ENCODER profile or PROFIdrive profile.

Accessing cyclic data

In order to access the cyclic data in the telegram, create one IO variable each in the address list on the SIMOTION device for each signal used in the input and output data of the telegram.

As logical address, use the basis address of submodule 1.2 from HW Config and the relevant byte offset of the signal in the telegram.

6.3 MC-ENCODER used directly from AWP

Example

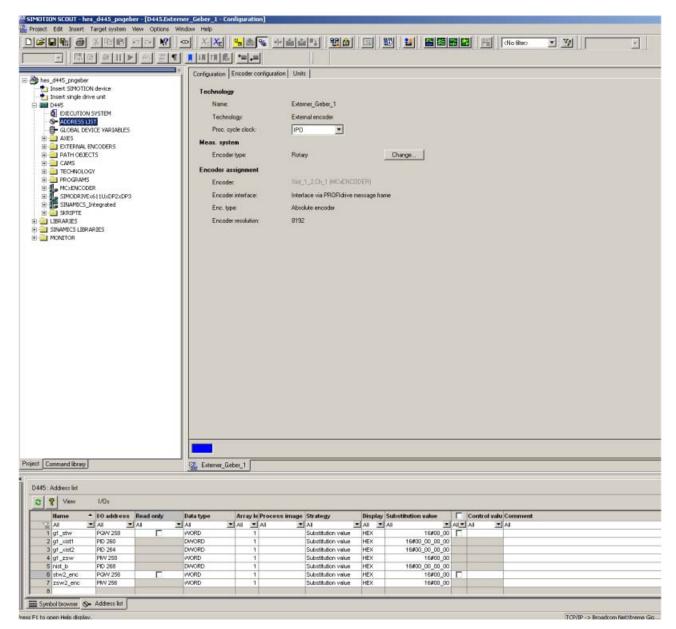


Figure 6-11 Variable list for MC-ENCODER cyclic data in SIMOTION Scout

6.4 Online parameter access

6.4 Online parameter access

Online parameter access via the parameter channel

To access the parameters of the MC-ENCODER online, the encoder has the standard parameter channel. For the encoder, the access point to this parameter channel is at the MAP submodule (module 1, submodule 1.1) via the data record with index 0xB02E.

Access to the parameter channel is realized via the non-cyclic communication channel, and is therefore possible from the controller as well as from a supervisor. The access protocol for the parameter channel is standardized in the PROFIdrive profile.

Literature

Refer to the following documentation for details:

Additional literature (Page 76) [2]

You can find a detailed description of the access protocol in the following documentation:

Additional literature (Page 76) [3b]

Online parameter access using SIMOTION system functions

To simplify online parameter access, SIMOTION provides the appropriate system functions. These system functions can be generally used for the encoder, independent of whether the MC-ENCODER is interconnected with a TO – or is directly controlled by the user program.

The following SIMOTION system functions are available for simple online access to the parameters of the MC-ENCODER:

- _readDriveParameter: reading the value of an individual parameter
- _readDriveMultiParameter: reading the values of several parameters at the same time
- _writeDriveParameter: writing the value of an individual parameter

Literature

You can find a detailed description of the system functions in the following documentation: Additional literature (Page 76) [3c / 3d]

As logical address for the parameter channel, enter the address of the MAP submodule of the encoder (submodule 1.1).

The parameters available on the MC-ENCODER for the online access can be taken from the chapter Parameterizing the communication interface (Page 34)

6.4 Online parameter access

Example

ST Program to read the reference parameters for the speed actual value in signal NIST_A or NIST_B:

```
INTERFACE
     PROGRAM readParaRefSpeed; // Motion Task.
END_INTERFACE
IMPLEMENTATION
     VAR_GLOBAL
           refSpeed : REAL := 0.0;
           readP2000 : structretreaddriveparameter;
     END_VAR
     PROGRAM readParaRefSpeed
         readP2000:=_readdriveparameter(
             logaddress := 256,
             parameternumber := 2000,
             nextcommand := WHEN_COMMAND_DONE,
             Commandid := getCommandId()
         );
         IF ((readP2000.functionResult = 0) AND (readP2000.parameterResult = 0)) THEN // Conversion to real.
         refSpeed := BIGBYTEARRAY_TO_ANYTYPE (byteArray := readP2000.data);
         END_if;
     END PROGRAM
END IMPLEMENTATION
```

Operating with SIMOTION

6.4 Online parameter access

Troubleshooting/FAQs

7.1 FAQ

Why don't I obtain position values?

According to the encoder profile it is necessary to set bit 10 to "1" in stw2 and bit 13 in $g1_stw1$.

1 stw2_e	nc 96QAV0	WORD	4	2100	-		
2 d1 stw				0400	HEX	☑ 0400	1
	%QW2	WORD	1	2000	HEX	2000	
3 ZSW2_6	nc %MV0	WORD	1	a200	HEX		
4 g1_zsw	1 %W 2	WORD	1	2000	HEX	11 I I	
5 g1_xist1	%ID 4	DWORD	1	851968	DEC		
6 g1_xist2	%ID 8	DWORD	1	6656	DEC		4
7 nist_b	%ID 12	DINT	1	139	DEC		
8			1				
<							>

Figure 7-1 Restore the encoder profile

Why doesn't the neighboring detection work?

The encoder supports the LLDP protocol, but it is necessary to use the latest version of STEP7 or SIMOTION Scout. The flag "Device replacement without replacement medium" must be active in the Properties window under General.

What has to be done if an encoder has to be replaced by a new one?

See answer: Why doesn't the neighboring detection work?

What is the easiest way to set the preset value?

Set the preset value in the Hardware Manager from STEP7 or SIMOTION Scout. That preset value will then be transmitted to the encoder during the starting phase. To activate it, it is necessary to set bit 12 to "1". In the screenshot above it should send 3000 instead of 2000.

Why can I not set the preset value or the other parameters?

It is only possible to set the parameters in class 3 with activated class 4 functionality. If necessary, it is important to use class 4 or to activate the class 4 functionality in the Hardware Manager.

7.1 FAQ

When using the D410, the error "Synchronization error between PROFIBUS and PROFINET" popped up. What must I to do?

Both systems have to use the same cycle time. If the PROFINET cycle time is 1 ms then the PROFIBUS must use the same time. See the next screenshot with the settings for 1 ms.

DP slave properties							×
General Configuration Is	ochronous Op	eration	1				
Synchronize drive to ea	quidistant DP o	iyde					
-Network settings in ms-							-1
Equidistant bus cycle act	ivated						
Equidistant DP cycle:	1.000		Data_Ex	change_	Time	e comp. T dx: 0.000	
	7	_	Factor			Grid / base time (ms)	
Master application cycle Tmapc [ms]:	1.000	=		÷	×	1.000	
	1	_	Factor			Frame / base time [ms]	
DP cycle Tdp (ms)	1.000	=	8	÷	×	0.125	
Time Ti[ms]	la son	-	Factor			Grid / base time [ms]	
(actual value acquisition):	0.125	=	1	÷	x	0.125	
Time To [ms]	0.000	_	Factor			Grid / base time [ms]	
(setpoint acceptance):	0.250	-	2	÷	×	0.125	
OK.						CancelHelp	

Figure 7-2 Synchronization between PROFIBUS and PROFINET

Technical Data

8.1 Electrical data

Supply voltage	10 - 30 V DC (absolute limits)
Power consumption	Max. 4 Watt
EMC	Emitted interference: EN 61000-6-4
	Noise immunity: EN 61326-1
Bus connection	Ethernet
Transmission rate	10/100 MBit
Accuracy of division	± 1 LSB (± 0,0439 °)
Speed	Max. 5000 rpm (valid code)
Cycle time	1 100 ms
Electrical lifetime	> 10⁵ h
Cycle of parameter saving	50 million
Conformance class	C (IRT communication,), B, A (RT communication)
Device addressing	Programmable IP address and network parameters

8.2 Mechanical data

Housing	Aluminum
Lifetime	Dependent on shaft version and shaft loading – refer to table
Max. shaft loading	Axial 40 N, radial 110 N
Inertia of rotor	≤ 30 gcm ²
Friction torque	≤ 3 Ncm
RPM (continuous operation)	Max. 12000 rpm
Shock (EN 60068-2-27)	≤ 30 g (half sine, 11 ms)
Vibration (EN 60068-2-6)	≤ 10 g (10 Hz 1000 Hz)
Weight (standard version)	Singleturn:≈ 500 g
	Multiturn:≈ 700 g

Flange	Synchro (F)	Clamp (Q)	Hollow shaft (W)
Shaft diameter	6 mm	10 mm	8, 10, 12, 15 mm
Shaft length	10 mm	20 mm	-
Hollow shaft depth min. / max.	-	-	15 mm / 30 mm

8.3 Environmental conditions

Minimum (mechanical) lifetime

Flange	Lifetime in 10 ⁸ re	Lifetime in 10 ⁸ revolutions with F _a / F _r		
	40 N / 60 N	40 N / 80 N	40 N / 110 N	
Clamp flange 10 x 20	247	104	40	
Synchro flange 6 x 10	822	347	133	

8.3 Environmental conditions

Operating temperature	- 40 + 70°C
Storage temperature	- 40 + 70°C
Humidity	Up to 98 % (without moisture condensation)
Degree of protection DIN 40050	Housing side: IP 67
	Shaft side: IP 64

Mechanical Drawings

9.1 Synchro flange

Overview

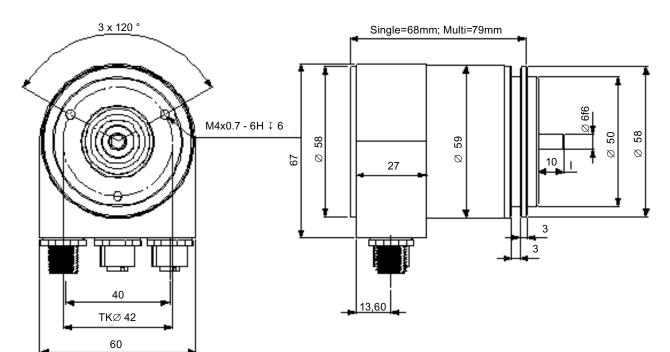


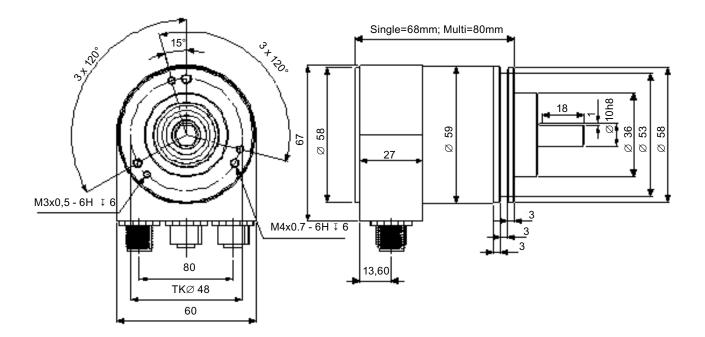
Figure 9-1 Syncro flange

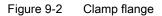
Mechanical Drawings

9.2 Clamp flange

9.2 Clamp flange

Overview





9.3 Hollow shaft

9.3 Hollow shaft

Overview

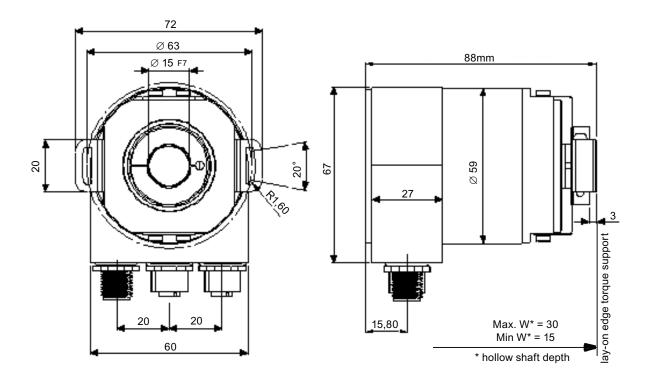


Figure 9-3 Hallow shaft

Note

Mounting instructions

The clamp ring should only be tightened after the shaft of the drive element has been inserted into the hollow shaft.

The diameter of the hollow shaft can be reduced to 12 mm, 10 mm or 8 mm using a reducing adapter (these are included in the scope of supply). These reducing adapters are simply inserted into the hollow shaft.

Maximum radial and axial misalignment of the drive shaft:

	Axial	Radial
static	± 0.3 mm	± 0.5 mm
dynamic	± 0.1 mm	± 0.2 mm

Mechanical Drawings

9.3 Hollow shaft

10

Accessories

10.1 Accessories and Documentation

Description		Туре
Spring disk coupling	6 mm/ 6 mm	6FX2001-7KF10
	6 mm/ 5 mm	6FX2001-7KF06
Connecting cable, Ethernet	PAM4/RJ45 Straight 5 m	6XV1871-5TH50
Connecting cable, power	PAM5 2 m Shielded	6XV1801-5DH50
Coupling **	Drilling: Ø 10 mm	6FX2001-7KS10
Clamp disk **	Set = 1 pcs	6FX2001-7KP01
Operating Instructions *	Installation / configuration manual, English	6SN1197-0AB11-0BP0
GSDML file *		

Additional information about the accessories is provided in the Catalog:

"SIMOTION & SINAMICS PM 21", Part 7: Measuring systems

* This can be downloaded free of charge from MDM, see: Preface (Page 3)

** Can only be used for full shaft

We do not assume responsibility for technical inaccuracies or omissions. Specifications are subject to change without notice.

10.2 Ordering description

The order designation consists of a combination of alphanumeric characters, the machinereadable product designation MLFB. When placing an order, it is sufficient just to specify the unique MLFB.

The MLFB consists of three blocks that are separated by hyphens. The first block has seven characters and designates the product family and size of the primary or secondary section. In the second block, further design features are encoded, such as length and speed. The third block is provided for additional data.

Note that not every theoretical combination is possible in practice.

10.3 Models / ordering description

10.3 Models / ordering description

Overview

		6FX2001	- 5 x N <u>x</u>
Encoder			
absolute			
$\label{eq:F} \begin{array}{l} A & A \\ A $	flange		
N ≙ PROFINET P ≙ PROFIBUS			
Resolution 13 ≙ Singleturn 13 25 ≙ Multiturn 27 bi]

Absolute encoder with PROFINET IO Operating Instructions, 11/2010, 6SN1197-0AB11-0BP0

Appendix

A.1 Glossary

Term	Explanations
10Base-T	Transmission line with 10 Mbit data transmission rate.
100Base-T	Transmission line with 100 Mbit data transmission rate.
Auto crossing	Allow to use straight or crossover wiring.
Auto negotiation	Is an Ethernet procedure by which two connected devices choose common transmission parameters, such as speed and duplex mode.
AWP	User program running on the PLC or SIMOTION.
Baud rate	Transmission rate; it display the transmission bits per second.
Binary	Numeric system with value 0 or 1.
BMP	PROFIdrive "Bau Mode Parameter Access" channel defined in PROFIdrive Profile, standard for online Parameter access (Access Point Data Record 0xB02E).
CAT5	Terminations for transmission rates up to 100 Mbit.
DCP.Hello	On Fast Start up the encoder will register to the IO-Controller with the "DCP.Hello"-Service.
EMC	Electromagnetic compatibility, there are rules to verifying devices.
Ethernet	Ethernet is a computer network technology based on frames.
Endless shaft	(Rotary axis) solves the problem with non binary values for revolutions.
Fast Ethernet	Transmission technology with 100 Mbit transmission rate.
Fast starting	Optimized start time for PROFINET (< 1s).
Flash	Internal memory, saved data will be available after power down.
GSDML	Generic Station Description Markup Language: XML based description language. Contains all available parameters, classes, Generic Station Description Markup Language: XML based description language. Contains all available parameters, classes.
Implicit Messaging	IO Connection: communication between IO-controller and IO-device.
IP address	Allows a computer to be logically addressed in a network.
IRT	Isochronous Real Time (Ethernet).
LLDP	Link Layer Discovery Protocol.
MAC address	Worldwide explicit address of a device. The encoder uses three MAC Addresses: one for internal interface and two for the ports. The basic MAC Address is stamped on the type plate.
Mbit	Transmission rate or baud rate, million bits per second.
MAP	Module Access Point. This MAP submodule contains at least the mandatory Parameter Access Point (PAP) which is mapped to a dedicated Record Data Object.
OSI-Model	The Open System Interconnection reference model is a open layer model for the organization of a communication.
PDEV	Physical device. Not all PLCs support several sub slots. Then select in the product tree Customized - otherwise ProfileV4.x.
PZD	Process Data: Process data part of a PPO.
Rotary axis	See -> Endless shaft.

Appendix

A.2 Additional literature

Term	Explanations
Switch	A switch is an electronic device to connect computers e.g. network segments in a local network. Unlike a hub, a switch uses stacks to avoid network collisions.
ТСР	The Transmission Control Protocol is a connection orientated transmission protocol, in a network.
UDP	User Datagram Protocol is used to send data that does not need to be transferred in a reliable way.

A.2 Additional literature

- Encoder Profile Profile Encoder Version 4.1, December 2008 PROFIBUS User Organization e.V. Haid- und Neu-Straße 7, D-76131 Karlsruhe http://www.profibus.com Order Number 3.162
- PROFIdrive Profile
 PROFIBUS Profile PROFIdrive Profile Drive Technology
 Version V4.1, May 2006,
 PROFIBUS User Organization e.V.
 Haid-und-Neu-Straße 7, D-76131 Karlsruhe
 http://www.profibus.com
 Order Number 3.172
- [3] System Manual SIMOTION SCOUT Communication
 - [3a] Chapter: PROFIdrive; PROFIdrive overview
 - [3b] Chapter: PROFIdrive; acyclic communication (Base Mode Parameter Access)
 - [3c] Chapter: PROFIdrive; acyclic communication (Base Mode Parameter Access); system commands in SIMOTION
 - [3d] Chapter: PROFIdrive; acyclic communication (Base Mode Parameter Access); rules for using _readRecord and _writeRecord