

SIMOTION/ SIMATIC

MC-ENCODER Absolute encoder with PROFINET IO




Product Information

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

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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.

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Introduction

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.

Readme/Product information/Technical update

2.1 Technical Data

2.1.1 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 ($\pm 0,0439^\circ$)
Speed	Max. 5000 rpm (valid code)
Cycle time	1... 100 ms
Electrical lifetime	$> 10^5$ h
Cycle of parameter saving	50 million
Conformance class	C (IRT communication, ...), B, A (RT communication)
Device addressing	Programmable IP address and network parameters

2.1 Technical Data

2.1.2 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

Minimum (mechanical) lifetime

Flange	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

2.1.3 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

2.2 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 descriptive language for device profiles (GSDML files).

Further Information

For further information about how a PROFINET network functions and how it is set-up, please refer to <http://www.profibus.com/pn>.

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 of use for motion control applications.

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

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

After 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 possibly also by external IT components) through its IP address.

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

2.3 Pinning

2.3.1 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.

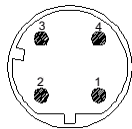
Adapters for field wiring can be ordered.

Refer to chapter: Accessories

or

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

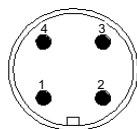
Ethernet connector



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

Figure 2-1 4 pin female, D-coded

Connector power supply



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

Figure 2-2 4 pin male, A-coded

2.3 Pinning

See also

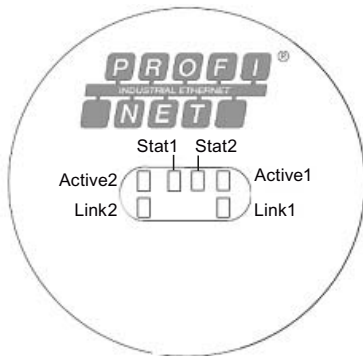
Accessories and Documentation (Page 18)

2.3.2 Diagnostic LEDs

Diagnostic

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

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



2.4 Programmable Parameters

The PROFINET IO interface supports Class 3 and Class 4 functionality according to the encoder profile V4 (PNO No. 3.162). Class 4 supports the IRT functionality for isochronous communication for high performance applications. In addition to these functions, the GSDML-file supports other features. Furthermore, the following encoder parameters can be programmed directly via the PROFINET IO network without requiring any additional device.

Parameter	Description
Counting direction	This "counting direction" parameter defines whether the output code increases or decreases when the shaft rotates clockwise.
Resolution per revolution	The "resolution per revolution" parameter is used to program the desired number of steps per revolution. Each value between 1 and the physical resolution per revolution can be programmed.
Total resolution	This parameter is used to program the required number of measuring units over the total measuring range. This value may not exceed the total physical resolution of the absolute rotary encoder.
Preset value	The preset value is the required position value, which should be reached at a certain physical position of the axis. The position value is set to the desired process value by presetting the parameter.
Velocity	The implemented software can additionally supply the actual velocity. This value is transmitted in binary code together with the process value. It is possible to select between four different units: steps per 10 ms, per 100 ms, per 1000 ms and revolutions per minute.

See also

Details are available in the operating instructions:

MC-ENCODER Absolute encoder with PROFINET IO

2.5 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
- 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

2.6 Mechanical Drawings

2.6.1 Synchro flange

Overview

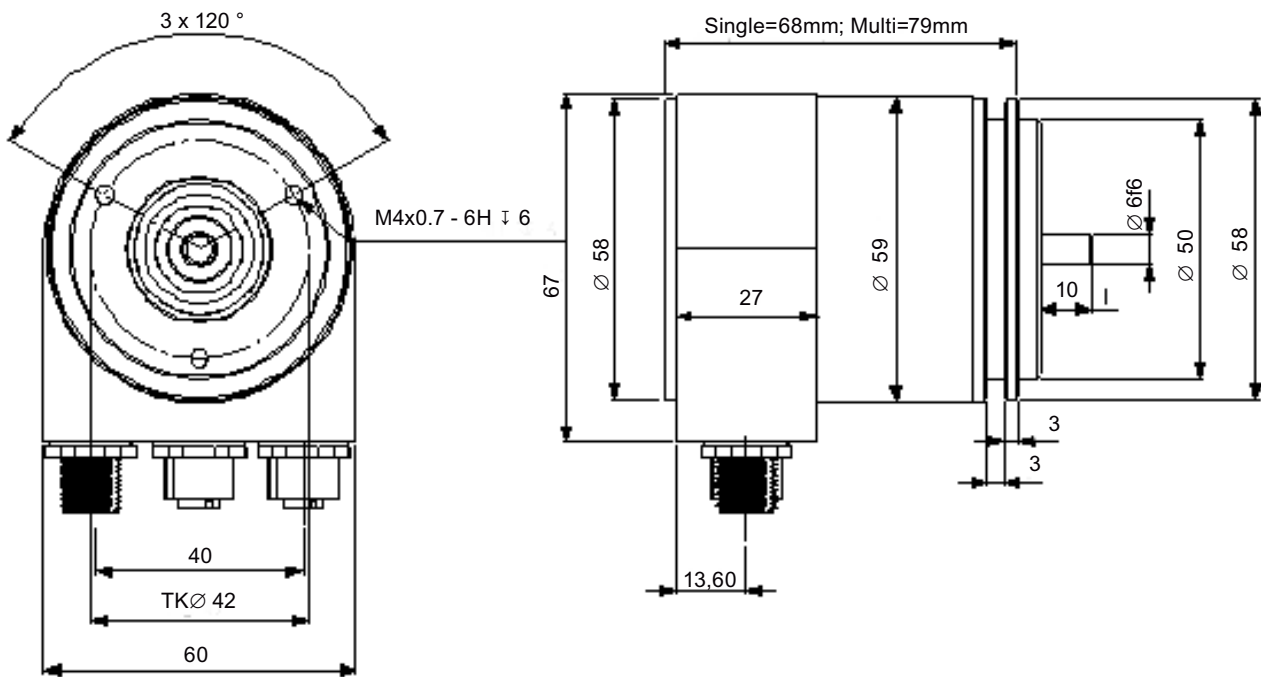


Figure 2-3 Synchro flange

2.6.2 Clamp flange

Overview

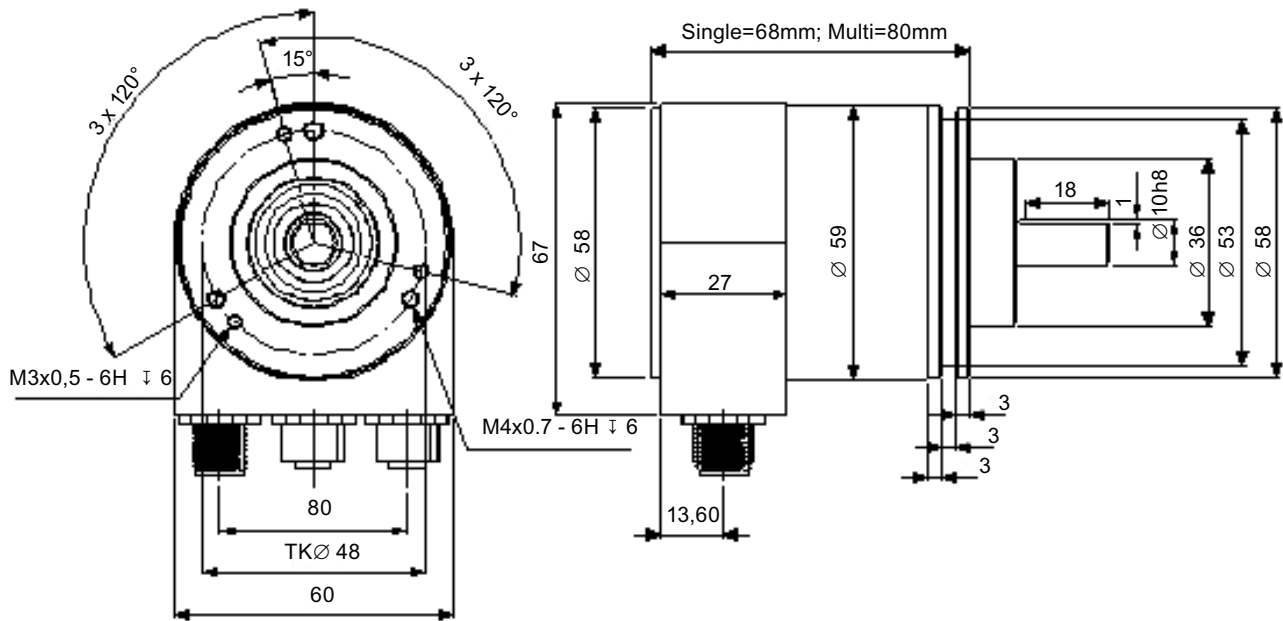


Figure 2-4 Clamp flange

2.6.3 Hollow shaft

Overview

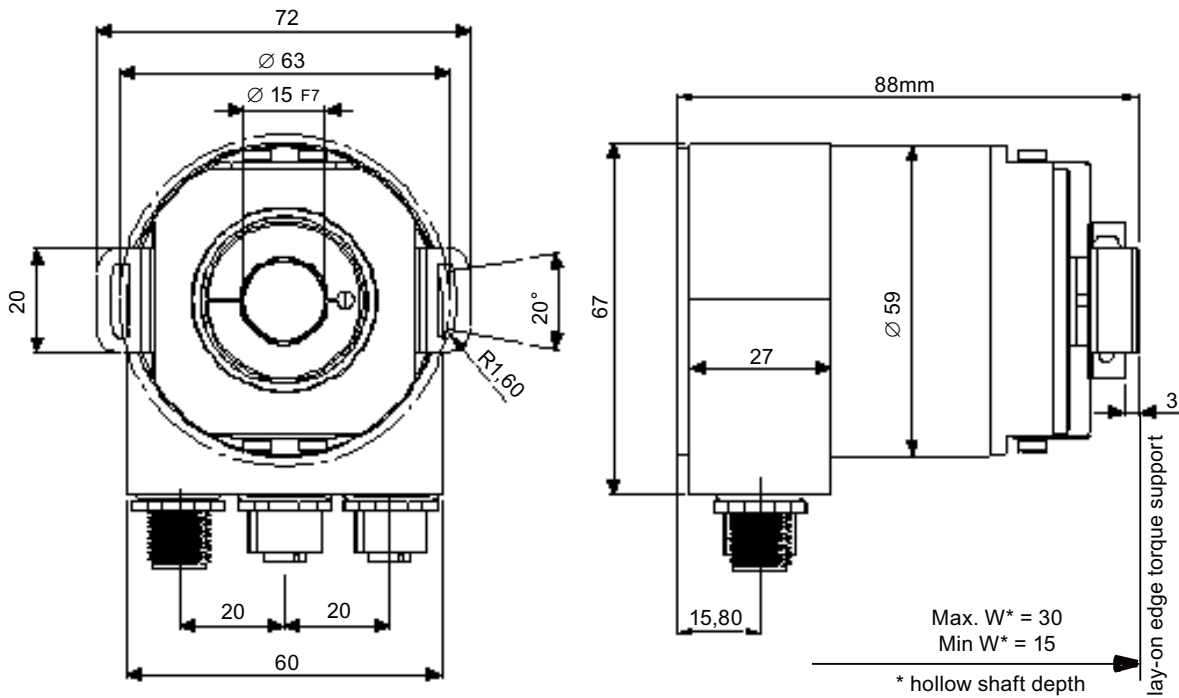


Figure 2-5 Hollow shaft

Note

Mounting instructions

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

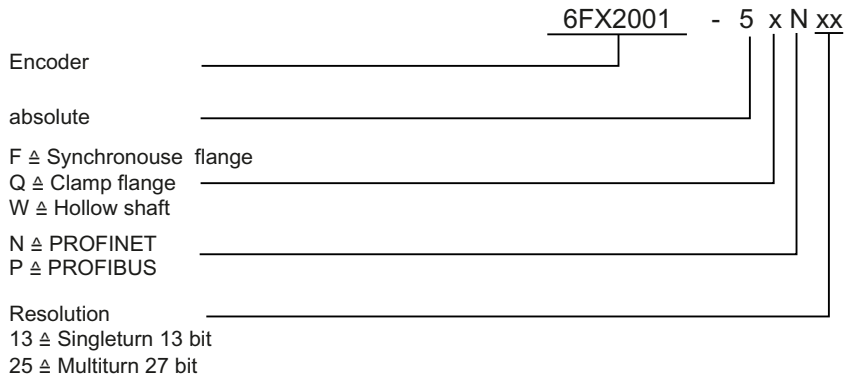
The diameter of the hollow shaft can be reduced to 12 mm, 10 mm or 8 mm using a reducing adapter (these are included in the scope of supply). These reducing adapters are simply inserted into the hollow shaft.

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

2.7 Models / ordering description

Overview



2.8 Accessories and Documentation

Power connecting cable	
Pre-assembled cable for power supply of PROFINET IO absolute encoders with M12 connector and M12 socket, A-coded, 4-pin	
• Length: 2 m (6.56 ft)	• 6XV1801-5DH20
• Length: 3 m (9.84 ft)	• 6XV1801-5DH30
• Length: 5 m (16.4 ft)	• 6XV1801-5DH50
• Length: 10 m (32.8 ft)	• 6XV1801-5DN10
• Length: 15 m (49.2 ft)	• 6XV1801-5DN15

IE connecting cable	
Pre-assembled signal cable for PROFINET IO absolute encoders with M12 and RJ45 connectors, D-coded, 4-pin	
• Length: 2 m (6.56 ft)	• 6XV1871-5TH20
• Length: 3 m (9.84 ft)	• 6XV1871-5TH30
• Length: 5 m (16.4 ft)	• 6XV1871-5TH50
• Length: 10 m (32.8 ft)	• 6XV1871-5TN10
• Length: 15 m (49.2 ft)	• 6XV1871-5TN15

IE FC RJ45 Plug 145 (1 unit)	
	6GK1901-1BB30-0AA0
2 × 2 RJ45 plug connector with rugged metal enclosure and FC connecting method, cable outlet 145°	

IE FC M12 Plug PRO (1 unit)	
	6GK1901-0DB20-6AA0
M12 plug connector with metal enclosure and FC connecting method, axial cable outlet, D-coded	

IE FC TP Trailing Cable 2 × 2 (Type C)	
	6XV1840-3AH10
4-wire, shielded, PROFINET compliant, TP installation cable for use in cable carriers Sold by the meter	
Max. consignment: 2000 m (6562 ft)	
Min. ordering quantity: 20 m (65.62 ft)	

