POSITAL
FRABA

ABSOLUTE ROTARY ENCODER WITH CANOPEN INTERFACE
USER MANUAL

Posital GmbH
Carlswerkstr. 13c, D-51063 Köln, Telefon +49(0)221-96213-0, Telefax +49(0)221-96213-20
www.posital.eu, info@posital.eu

Table of Contents

General Security Advise

Important Information

Read these instructions carefully, and look at the equipment to become familiar with the device before trying to install, operate, or maintain it. The following special messages may appear throughout this documentation or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

The addition of this symbol to a Danger or Warning safety label indicates that an electrical hazard exists, which will result in personal injury if the instructions are not followed.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

Please Note

Electrical equipment should be serviced only by qualified personnel. No responsibility is assumed by POSITAL for any consequences arising out of the use of this material. This document is not intended as an instruction manual for untrained persons.

About this Manual

Background

This user manual describes how to install and configure an OCD absolute rotary encoder with CANopen interface.

Relate Note

Version date: 06. November 2007
Version number: 3.0
Reference number: MST20071106

Imprint

POSITAL GmbH
Carlswerkstrasse 13c
D-51063 Köln
Telefon +49 (0) 221 96213-0
Telefax +49 (0) 221 96213-20
Internet http://www.posital.eu
e-mail info@posital.eu

Copyright

User Annotation

The POSITAL GmbH welcome all reader to send us feedback and commands about this document. You can reach us by e-mail at info@posital.eu

1. Introduction

This manual explains how to install and configure the OPTOCODE absolute rotary encoder with CANopen interface applicable for both military and industrial applications with CANopen interface. The products are fully compliant with standard DS406.

Measuring System

The measuring system consists of a light source, a code disc pivoted in a precision ball bearing and an opto-electronic scanning device. A LED is used as a light source which shines through the code disc and onto the screen behind. The tracks on the code disk are evaluated by an opto-array behind the reticle. With every position another combination of slashes in the reticle is covered by the dark spots on the code disk and the light beam on the photo transistor is interrupted. That way the code on the disc is transformed into electronic signals. Fluctuations in the intensity of the light source are measured by an additional photo transistor and another electronic circuit compensates for these. After the electronic signals are amplified and converted they are then available for evaluation.

Single-Turn

Single turn encoder are encoders that specify the absolute position for one turn of the shaft i.e. for 360°. After one turn the measuring range is completed and starts again from the beginning.

Multi-Turn

Linear systems normally need more than one turn of a shaft. A single turn encoder is unsuitable for this type of application because of the additional requirement of the number of turns. The principle is relatively simple: Several single turn encoders are connected using a reduction gear. The first stage supplies the resolution per turn, the stages behind supply the number of turns.

The CANopen bus interface on this encoders permits speeds up to 1Mbaud (30m cable for a maximum speed of 1Mbaud, 5000 m cable for a maximum speed of 10 kbaud).

There are several types of encoder versions. Please refer to the datasheets to find out which is the best version for your application.

1.1 General CANopen Information

The CANopen system is used in industrial applications. It is a multiple access system (maximum: 127 participants), which means that all devices can access the bus. In simple terms, each user checks whether the bus is free, and if it is the user can send messages. If two users try to access the bus at the same time, the user with the higher priority level (lowest ID number) has permission to send its message.

Users with the lowest priority level must cancel their data transfer and wait before re-trying to send their message. Data communication is carried out via messages. These messages consist of 1 COB-ID followed by a maximum of 8 bytes of data. The COB-ID, which determines the priority of the message, consists of a function code and a node number. The node number corresponds to the network address of the device. It is unique on a bus. The function

code varies according to the type of message being sent:

- Management messages (LMT, NMT)
- Messaging and service (SDOs)
- Data exchange (PDOs)
- Predefined messages (synchronization, emergency messages)

The absolute rotary encoder supports the following operating modes:

- Polled mode: The position value is only given on request.
- Cyclic mode: The position value is sent cyclically (regular, adjustable interval) on the bus.
- SYNC mode: The position value is sent after a synchronization message (SYNC) is received. The position value is sent every n SYNCs (n ≥ 1).

Other functions (offset values, resolution, etc) can be configured. The absolute rotary encoder corresponds to the class 2 encoder profile (DS 406 in which the characteristics of encoder with CANopen interface are defined). The node number and speed in bauds are determined via rotary switches. The transmission speed can range from 20kBaud up to 1Mbaud. Various software tools for configuration and parameter-setting are available from different suppliers. It is easy to align and program the rotary encoders using the EDS (electronic data sheet) configuration file provided.

1.2 Typical Applications

• Packing Machines
• Mobile Machines
• Wind Mills
• Medical Equipment

Further information is available at:

CAN in Automation (CiA) International Users and Manufacturers Group e.V.
Am Weichselgarten 26
D-91058 Erlangen

(*) Reference: CAN Application Layer for Industrial Applications
CiA Draft Standard 201 ... 207, Version 1.1
CAL-based Communication Profile for Industrial Systems
CiA Draft Standard 301

Note: All datasheets and manuals can be downloaded for free from our website www.posital.eu

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

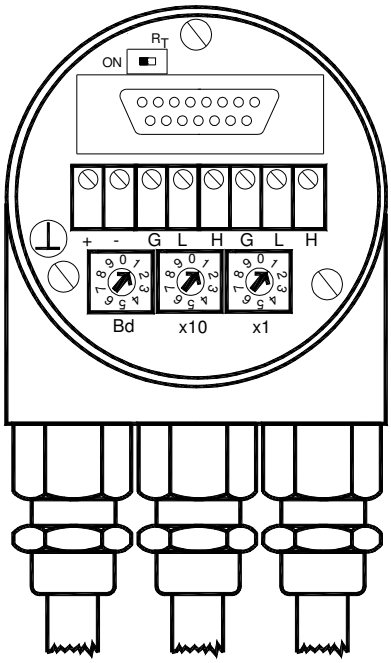
2. Installation

2.1 Electrical Connection

2.1.1 Connection via Connection Cap

Signal Assingment

The rotary encoder is connected with two or three cables depending on whether the power supply is integrated into the bus cable or connected separately. If the power supply is integrated into the bus cable, one of the cable glands can be fitted with a plug. The cable glands are suitable for cable diameters from 6.5 up to 9 mm.



Clamp	Description
⊥	Ground
+	24 V Supply voltage
-	0 V Supply voltage
G	CAN Ground
L	CAN Low
H	CAN High
G	CAN Ground
L	CAN Low
H	CAN High

Tab. 1 Signal Assignment Connection Cap

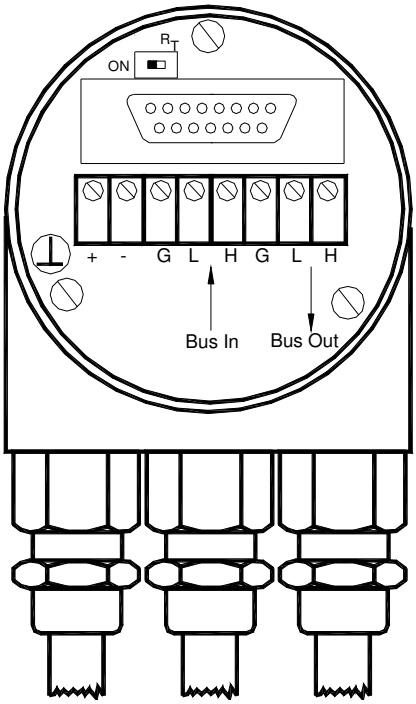


Fig. 2 Connection cap bus in and bus out

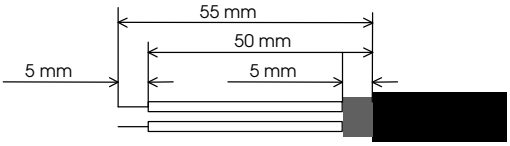


Fig. 3 Cable preparation

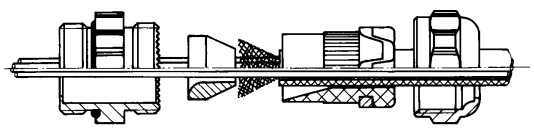


Fig. 1 Cable connection

Bus Connection

The connection cap fulfills the function of a T-coupler. From there the wiring must be done according to the drawing on the left side. Please note the assignment of incoming and outgoing bus signals.

An activated bus termination resistor will lead into a separation of bus in and bus out signals!

Cable Connection

Remove screw, sealing and cone from the cable gland. Remove 55 mm of the sheath and 50 mm of the shielding. About 5 mm of the wires should be de-isolated. Put screw, and sealing on the cable. The cone should be mounted under the shielding according to the figure 3. Put the whole cable into the cable gland and tighten the screw.

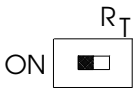
Bus Termination Connection Cap

If the encoder is connected at the end or beginning of the bus the termination resistor must be switched on. The termination resistor is switched on when the switch is in the ON position.

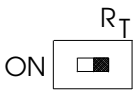
Separation of Bus In and Bus Out signals if termination resistor is activated.

There is a resistor provided in the connection cap, which must be used as a line termination on the last device.

Resistor:



Last Device



Device X

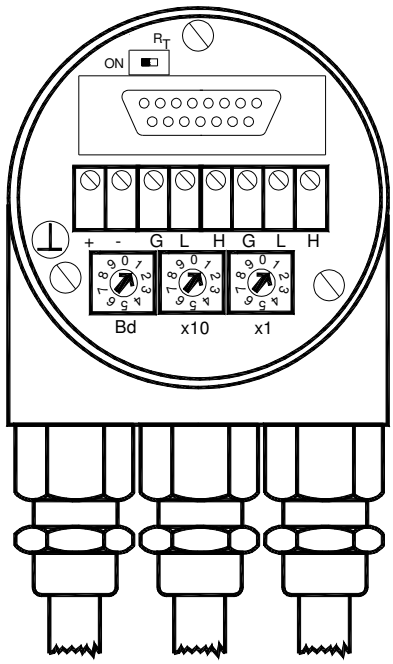
Setting Node Number in Connection Cap

The setting of the node number is done by turning the BCD rotary switches in the connection cap. Possible (valid) addresses lie between 0 and 89 whereby every address can only be used once. Two LEDs on the backside of the connection cap show the operating status of the encoder.

BCD coded rotary switches	
	Device address 0...89
x1	Setting CAN-node number
x10	**Address reserved 90…99**
Bd	Setting of the baud-rate

The CANopen Encoder adds internal 1 to the adjusted device address.

To set the node number the customer can easily remove the connection cap for installation by removing two screws at the backside of the encoder. The meaning and the positioning of the two turn-switches you can see in the picture on the right side.



Protocol Definition via BCD address switches	
x1 x10	**Device address 97** Automatic protocol selection according to kind of connection cap
x1 x10	**Device address 98** Protocol selection according to DS301-V3
x1 x10	**Device address 99** Protocol selection according to DS301-V4

Setting Baudrate in Connection Cap

The adjusting of the baudrate is adjusted by one turn switch in the connection cap. The following baudrates are possible:

Baudrate in kBit/s	BCD coded rotary switches
20	0
50	1
100	2
125	3
250	4
500	5
800	6
1000	7
reserved	8..9

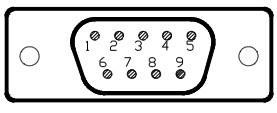
Tab. 2 Baudrate Assignment Connection Cap

2.1.2 Setting Node Number for Connector or Cable Versions

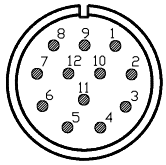
Signal Assignment

Signal	12 pin round connector pin number	5 pin round connector pin number (male / female)	9 pin D-Sub connector pin number	open cable
CAN Ground	3	1	3	green
24 V supply voltage	12	2	9	white
0 V supply voltage	10	3	6	brown
CAN High	7	4	7	yellow
CAN Low	2	5	2	pink

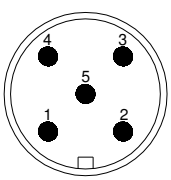
Tab. 3 Signal Assignment Connector / Cable



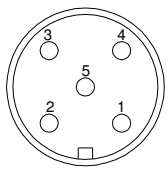
9 pin D-Sub connector



12 pin round connector



5 pin connector male M12



5 pin connector female M12

Setting Node Number via SDO Objects

If the device has a connector or a cable exit instead of a connection cap the node number can only be adjusted via SDO objects. The default node number is in this case 32. Please regard point 4.6 for further information of setting the node number via SDO objects.

Setting Baud Rate via SDO Objects

If the device has a connector or a cable exit instead of a connection cap the node number can only be adjusted via SDO objects. The default baudrate is 20 kBaud. Please regard point 4.7 for further information about setting of the baudrate via SDO objects.

Bus Termination without Connection Cap

If an encoder with connector or cable is used there is no possibility to set an termination resistor inside the encoder. If the encoder is the last device in the bus you can use an external termination resistor on a T-coupler.

3. Technical Data

In the following section you will find general technical datas for OCD absolute rotary encoders with CANopen interface. There are several version with slightly different technical datas. For details please refer to the corresponding datasheet of the used encoder

Electrical Data

Interface	Transceiver according ISO 11898, galvanically isolated by opto-couplers
Transmission rate	max. 1 MBaud
Device addressing	Adjustable by rotary switches in connection cap
Supply voltage	10 – 30* V DC (absolute limits)
Current consumption	max. 230 mA with 10 V DC, max. 100 mA with 24 V DC
Power consumption	max. 2.5 Watts
Step frequency LSB	800 kHz
Accuracy of division	± ½ LSB (12 bit), ± 2 LSB (16 bit)
EMC	Emitted interference: EN 61000-6-4
	Noise immunity: EN 61000-6-2
Electrical lifetime	> 10^5 h

Tab. 4 Electrical Data

*Absolute rotary encoders should be connected only to subsequent electronics whose power supplies comply with EN 50178 (protective low voltage)

Mechanical Data

Housing	Aluminium, optional stainless steel
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 (without shaft sealing)
RPM (continuous operation)	Singleturn: max. 12,000 RPM
	Multiturn: max. 6,000 RPM
Shock (EN 60068-2-27)	≤ 100 g (half sine, 6 ms)
Permanent shock (EN 60028-2-29)	≤ 10 g (half sine, 16 ms)
Vibration (EN 60068-2-6)	≤ 10 g (10 Hz ... 1,000 Hz)
Weight (standard version)	Singleturn: ≈ 500 g
	Multiturn: ≈ 700 g
Weight (stainless steel version)	Singleturn: ≈ 1,100 g
	Multiturn: ≈ 1,200 g

Flange	Synchro (S)		Clamp (C)	Hollow shaft (B)
Shaft diameter	6 mm	10 mm	10 mm	15 mm
Shaft length	10 mm	20mm	20 mm	-
hollow shaft depth min. / max.	-	-	-	15 mm / 30 mm

Tab. 5 Mechanical data

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
C10 (Clamp flange 10 x 20)	247	104	40
S10 (Synchro flange 10 x 20)	262	110	42
S6 (Synchro flange 6 x 10) without shaft sealing	822	347	133

Tab. 6 Mechanical Lifetime

S6 (Synchro flange 6 x 10) with shaft sealing: max. 20 N axial, 80 N radial

Environmental Conditions

Operating temperature	- 40 .. +85°C
Storage temperature	- 40 .. + 85 °C
Humidity	98 % (without liquid state)
Protection class (EN 60529)	Casing side: IP 65
	Shaft side: IP 64 (optional with shaft sealing: IP66)

Tab. 7 Environmental Conditions

4. Configuration

The purpose of this chapter is to describe the configuration parameters of the absolute rotary encoder with CANopen interface.

4.1 Operating Modes

4.1.1 General

The encoder accesses the CAN network after powerup in pre-operational mode:

BootUp Message: 700 hex + Node Number (for details see Communication Profile page 70

It is recommended that the parameters can be changed by the user when the encoder is in preoperational mode. Pre-operational mode entails reduced activity on the network, which simplifies the checking of the accuracy of the sent/received SDOs. It is not possible to send or receive PDOs in pre-operational mode.

4.1.2 Mode: Preoperational

To set a node to pre-operational mode, the master must send the following message:

Identifier	Byte 0	Byte 1	Description
0 h	80 h	00	NMT-PreOp, all nodes
0 h	80 h	NN	NMT-PreOp, NN

NN: node number

It is possible to set all nodes (Index 0) or a single node (Index NN) to pre-operational mode.

4.1.3 Mode: Start - Operational

To put one or all nodes in the operational state, the master have to send the following message:

Identifier	Byte 0	Byte 1	Description
0 h	01 h	00	NMT-Start, all nodes
0 h	01 h	NN	NMT-Start, NN

NN: node number

It is possible to set all nodes (Index 0) or a single node (Index NN) to operational mode.

4.1.4 Mode: Stopped

To put one or all nodes in the stopped state, the master have to send the following message:

Identifier	Byte 0	Byte 1	Description
0 h	02 h	00	NMT-Stop, all nodes
0 h	02 h	NN	NMT-Stop, NN

NN: node number

It is possible to set all nodes (Index 0) or a single node (Index NN) to stop mode.

4.1.2 Reinitialization of the Absolute Rotary Encoder

If a node is not operating correctly, it is advisable to carry out a reinitialization:

NN	Command	Index	Description
0 h	82 h	00	Reset Communication
0 h	81 h	NN	Reset Node

NN: node number

It is possible to set all nodes (Index 0) or a single node (Index NN) in reset mode.

After reinitialization, the encoder accesses the bus in pre-operational mode.

4.2 Normal Operating

Polled Mode	By a remote-transmission-request telegram the connected host calls for the current process value. The encoder reads the current position value, calculates eventually set-parameters and sends back the obtained process value by the same identifier.
Cyclic Mode	The encoder transmits cyclically - without being called by the host - the current process value. The cycle time can be programmed in milliseconds for values between 1 ms and 65536 ms.
Sync Mode	After receiving a sync telegram by the host, the encoder answers with the current process value. If more than one node number (encoder) shall answer after receiving a sync telegram, the answer telegrams of the nodes will be received by the host in order of their node numbers. The programming of an offset-time is not necessary. If a node should not answer after each sync telegram on the CAN network, the parameter sync counter can be programmed to skip a certain number of sync telegrams before answering again.

Tab. 8 CAN Transmission Mode Description

4.3 Storing Parameter

4.3.1 List of storable Parameter

Object Index	Object Description
100Ch	Guard Time
100Dh	Life Time Factor
1016h	Consumer Heartbeat Time
1017h	Producer Heartbeat Time
1800h	Communication parameter PDO 1
1801h	Communication parameter PDO 2 (only C6 Versions)
1802h	Communication parameter PDO 2 (all other versions)
1A00h	Transmit PDO1 Mapping Parameter
1A01h	Transmit PDO2 Mapping Parameter (only C6 Versions)
1A02h	Transmit PDO2 Mapping Parameter (all other versions)
2100h	Operating Parameters
2101h	Resolution per Revolution
2102h	Total Resolution
2103h	Preset Value
2104h	Limit Switch, min.
2105h	Limit Switch, max.
2200h	Cyclic Timer
3000h	Node Number
3001h	Baudrate
6000h	Operating Parameter
6001h	Steps per Revolution
6002h	Total Resolution
6003h	Preset Value
6200h	Cyclic Timer

Tab. 9 List of Storable Parameters

4.3.1 Storing Procedure

The parameter settings can be stored in a non-volatile E^2PROM. The parameter settings are stored in RAM when being programmed. When all the parameters are set and proved, they can be transferred in one burn cycle to the E^2PROM by the parameter memory transfer.

The stored parameters are copied after a RESET (Power on, NMT-Reset) from the E^2PROM to the RAM (volatile memory).

Storing without Reset

By using the object 1010 from the communication profile related object dictionary you can store the parameters into the non-volatile memory without a reset.

Storing with Reset

By using the object 2300 from the manufacturer specific object dictionary you can store the parameters into the non-volatile memory. After storing the parameters a reset of the device is performed.

4.4 Restoring Parameters

The default parameters can be restored by using the object 1011 from communication profile related object dictionary. The already in the non-volatile memory programmed parameters are not overwritten. Only after a new store command the default parameters are stored in the non-volatile memory. To restore the default parameter the following telegram is used. The restored parameters are equal for every type of CANopen encoder and might not fit with the status after delivery. Please check the restored parameters before you store the to the non-volatile memory.

5. Programmable Parameters

Objects are based on the CiA 406 DS V3.2: CANopen profile for encoders (www.can-cia.org)

Command	Function	Telegram	Description
22h	Domain Download	Request	Parameter to Encoderr
23h, 27h, 2Bh, 2Fh (*)	Domain Download	Request	Parameter to Encoder (Bytes indicated)
60h	Domain Download	Confirmation	Parameter received
40h	Domain Upload	Request	Parameter request
43h, 47h, 4Bh, 4Fh (*)	Domain Upload	Reply	Parameter to Master (Bytes indicated)
80 h	Warning	Reply	Transmission error

Tab. 10 General Command Byte Description

(*)The value of the command byte depends on the data length of the called parameter:

Command	Data length	Data type		Command	Data length	Data type
43h	4 Byte	Unsigned 32		23h	4 Byte	Unsigned 32
47h	3 Byte	Unsigned 24		27h	3 Byte	Unsigned 24
4Bh	2 Byte	Unsigned 16		2Bh	2 Byte	Unsigned 16
4Fh	1 Byte	Unsigned 8		2Fh	1 Byte	Unsigned 8

Tab. 11 Detailed Commend Byte Description

Object Dictionary

The data transmission according to CAL is realized exclusively by object oriented data messages. The objects are classified in groups by an index record. Each index entry can be subdivided by sub-indices. The overall layout of the standard object dictionary is shown beside:

Index (hex)	Object
0000	not used
0001-001F	Static Data Types
0020-003F	Complex Data Types
0040-005F	Manufacturer Specific Data Types
0060-0FFF	Reserved for further use
1000-1FFF	Communication Profile Area
2000-5FFF	Manufacturer Specific Profile Area
6000-9FFF	Standardised Device Profile Area
A000-FFFF	Reserved for further use

Tab. 12 Overview Object Dictionary

5.1 Programming exsample: Preset Vealue

If a CANopen device is connected and configured by the turning switches with the right baudrate and also configuratet to a unused node number, it will stard up into the preoperational mode and send a bootup massage to the master. The RUN LED of the device is now blinking.

5.1.1 Set Encoder Preset Value

Master to Encoder with Node Number 1

Setting Preset Value (Value 1000)

Identifier	DLC	Command	Index		Subindex	Service/Process data			
NN 1		Download	6003h			Byte 4	Byte 5	Byte 6	Byte 7
601	8	22	03	60	00	00	10	00	00

Answer of the Encoder

Identifier	DLC	Command	Index		Subindex	Service/Process data			
NN 1		Download	6003h			Byte 4	Byte 5	Byte 6	Byte 7
581	8	43	03	60	00	00	00	00	00

Read Preset Value from the Encoder

Identifier	DLC	Command	Index		Subindex	Service/Process data			
NN 1		Download	6003h			Byte 4	Byte 5	Byte 6	Byte 7
601	8	40	03	60	00	00	00	00	00

Answer of the Encoder

Identifier	DLC	Command	Index		Subindex	Service/Process data			
NN 1		Download	6003h			Byte 4	Byte 5	Byte 6	Byte 7
581	8	43	03	60	00	00	10	00	00

Save Preset Values

Identifier	DLC	Command	Index		Subindex	Service/Process data			
NN 1		Download	1010h			Byte 4	Byte 5	Byte 6	Byte 7
601	8	22	10	10	01	73	61	76	65

5.2 Communication Profile DS301 specific objects from 1000h - 1FFFh

In this manual we refer to the communication profile DS301 V4.02

Object	Description	Page Hand-Book	Page DS301	Page DS406
1000h	Device type	22	86	8
1001h	Error register	22	87	8
1002h	Manufacturer status register	-	87	
1003h	Pre-defined error field	22	88	
1005h	COB-ID SYNC-message	23	89	
1006h	ComCyclePeriode	23	90	
1007h	Synchromous Window Length	23	90	
1008h	Device name	24	91	
1009h	Hardware version	24	91	
100Ah	Software version	24	91	
100Ch	Guard Time	24	92	
100Dh	Life Time Factor	24	92	
1010h	Store parameters	25	92	
1011h	Restore default parameters	25	94	
1012h	COB-ID Time Stamp	26	97	
1013h	High Resolution Time Stamp	26	98	
1014h	COB-ID Emergency	26	98	
1016h	Consumer Heartbeat Time	26	100	
1017h	Producer Heartbeat Time	27	101	
1018h	Identity Object	27	101	
1200h	SDO Server Parameter	-	103	
1800h	Communication parameter PDO 1	28	111	9
1801h	Communication parameter PDO 2 (only C6 Versions)	28	111	11
1802h	Communication parameter PDO 2 (all other versions)	28		
1A00h	Transmit PDO1 Mapping Parameter	30	112	11
1A01h	Transmit PDO2 Mapping Parameter (only C6 Versions)	30	112	12
1A02h	Transmit PDO2 Mapping Parameter (all other versions)	30		

Tab. 13 Object Dictionary 1000-1FFF

5.3 Manufacturer specific objects 2000h – 5FFFh

Object	Description	Page Hand-Book
2000h	Position Value	30
2100h	Operating Parameters	31
2101h	Resolution per Revolution	31
2102h	Total Resolution	32
2103h	Preset Value	33
2104h	Limit Switch, min.	33
2105h	Limit Switch, max.	33
2200h	Cyclic Timer	34
2300h	Save Parameter with reset	34
3000h	Node Number	34
3001h	Baudrate	35

Tab. 14 Object Dictionary 2000-5FFF

5.4 Application specific objects 6000h – 67FEh

In this manual we refer to the communication profile DS406 V3.2

Object	Description	Page Hand-Book	Page DS406
6000h	Operating Parameters	35	17
6001h	Measuring units per revolution	36	18
6002h	Total measuring range in measuring units	36	19
6003h	Preset value	36	19
6004h	Position Value	36	20
6200h	Cyclic Timer	37	28
6500h	Operating status	37	63
6501h	Single-turn resolution	37	64
6502h	Number of distinguishable revolutions	37	65
6503h	Alarms	38	65
6504h	Supported alarms	38	66
6505h	Warnings	39	67
6506h	Supported warnings	39	68
6507h	Profile and software version	39	69
6508h	Operating time	40	70
6509h	Offset value	40	70
650Ah	Module identification	40	71
650Bh	Serial number	41	72

Tab. 15 Object Dictionary 6000-6FFF

5.5 Object Descriptions

In the following chapter you will find detailed information of the object dictionary related to the encoderdevice.

Object 1000: Device Type

Description

The object at index 1000h describes the type of device and its functionality. It is composed of a 16-bit field which describes the device profile that is used and a second 16-bit field which gives additional information about optional functionality of the device. The additional information parameter is device profile specific.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	-	Unsigned 32	N/A	ro	no

OCD absolute rotary encoder single turn: 01196h

OCD absolute rotary encoder multi turn: 02196h

Object 1001: Error Register

Description

This object is used by the device to display internal faults. When a fault is detected, the corresponding bit is therefore activated.

The following errors are supported:

Bit	Description	Comments
0	Generic Error	The generic error is signaled at any error situation.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	-	Unsigned 8	N/A	ro	no

Object 1003: Pre-Defined Error Field

Description

The object holds the errors that have occurred on the device and have been signaled via the Emergency Object.

- The error code is located in the least significant word
- Additional Information is located in the most significant word
- Subindex 0 contains the number of recorded errors

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Number of recorded errors	Unsigned 8	0	rw	no
1	Most recent errors	Unsigned 32	-	ro	no
2	Second to last error	Unsigned 32	-	ro	no
…					
10					

Clearing Error Log

The error log can be cleared by writing 0 to subindex 0 of object 1003.

Object 1005: COB-ID Sync

Description

This object contains the synchronization message identifier.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	-	Unsigned 32	80h	rw	no

Object 1006: Com Cycle Period

Description

This object defines the communication cycle period in µs.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	-	Unsigned 32	0h	rw	no

Note: The device is only a SYNC Consumer. The value has to be always 0.

Object 1007: Synchronous Window Length

Description

Contains the length of the time window for synchronous PDOs in µs.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	-	Unsigned 32	0h	rw	no

Note: The device is only a SYNC Consumer. The value has to be always 0.

Object 1008: Manufacturer Device Name

Description

This object contains the device name.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	-	String	-	ro	no

Object 1009: Manufacturer Hardware Version

Description

This object contains the manufacturer hardware version.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	-	String	-	ro	no

Object 100A: Manufacturer Software Version

Description

This object contains the manufacturer software version.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	-	String	-	ro	no

Object 100C Guard Time

Description

This object contains the guard time in milliseconds.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	-	Unsigned 16	0	rw	yes

Object 100D:Life Time Factor

Description

This object contains the life time factor parameters. The life time factor multiplied with the guard time gives the life time for the node guarding protocol.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	-	Unsigned 8	0	rw	yes

Object 1010: Store Parameters

Description

This object is used to store device and CANopen related parameters to non volatile memory.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Number of sub indices	Unsigned 8	2	ro	no
1	Store all parameters	Unsigned 32	“save”	rw	no

Storing procedure

To save the parameters to non volatile memory the access signature “save” has to be sent to the corresponding subindex of the device.

	Most significant word		Least significant word	
ASCII	e	v	a	s
Hex value	65h	76h	61h	73h

Object 1011: Restore Parameters

Description

This object is used to restore device and CANopen related parameters to factory settings.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Number of sub indices	Unsigned 8	2	ro	no
1	Restore all parameters	Unsigned 32	“load”	rw	no

Storing procedure

To save the parameters to non volatile memory the access signature “load” has to be sent to the corresponding subindex of the device.

	Most significant word		Least significant word	
ASCII	d	a	o	l
Hex value	64h	61h	6Fh	6Ch

Note: The restoration of parameters will only be taken into account after a power up or reset command. Please check all parameters before you store them to the non volatile memory.

Object 1012:COB-ID Time Stamp Object

Description

This object contains the COB-ID of the Time Stamp object.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	-	Unsigned 32	100h	rw	no

Object 1013: High Resolution Time Stamp

Description

This object contains a time stamp with a resolution of 1µs.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	-	Unsigned 32	0	rw	no

Object 1014: COB-ID Emergency Object

Description

This object contains the EMCY emergency message identifier.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	-	Unsigned 32	80h + Node ID	rw	no

Object 1016: Consumer Heartbeat Time

Description

The consumer heartbeat time defines the expected heartbeat cycle time in ms. The device can only monitor one corresponding device. If the time is set to 0 the monitoring is not active. The value of this object must be higher than the corresponding time (object 1017) of the monitored device.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Number of indices	Unsigned 8	1	ro	no
1	Consumer heartbeat time	Unsigned 32	0	rw	yes

The context of subindex 1 is as follows:

Bit	31 to 24	23 to 16	15 to 0
Value	0h (reserved)	Address of monitored device	Monitoring time (ms

Object 1017: Producer Heartbeat Time

Description

The object contains the time intervall in milliseconds in which the device has to produce the a heartbeat message.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	-	Unsigned 16	0	rw	yes

Object 1018: Identity Object

Description

This object contains the device information.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Number of entries	Unsigned 8	1	ro	no
1	Vendor ID	Unsigned 32	0x42	ro	no
2	Product Code	Unsigned 32		ro	no
3	Revision Number	Unsigned 32		ro	no
4	Serial Number	Unsigned 32		ro	no

Object 1800: 1st Transmit PDO Communication Parameter

Description

This object contains the communication parameter of the 1st transmit PDO.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Number of sub indices	Unsigned 8	5	ro	yes
1	COB-ID	Unsigned 32	180h + Node ID	rw	yes
2	Transmission Mode	Unsigned 8	FE	rw	yes
3	Inhibit Time	Unsigned 32	0	rw	yes
4	Not available				
5	Event Timer	Unsigned 32	0x64 or 0	rw	yes

Object 1801: 2nd Transmit PDO Communication Parameter

Description

This object contains the communication parameter of the 2nd transmit PDO. Remark: This value is only available for C6 CANopen encoder versions.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Number of sub indices	Unsigned 8	5	ro	yes
1	COB-ID	Unsigned 32	280h + Node ID	rw	yes
2	Transmission Mode	Unsigned 8	1	rw	yes
3	Inhibit Time	Unsigned 32	0	rw	yes
4	Not available				
5	Event Timer	Unsigned 32	0	rw	yes

Object 1802: 2nd Transmit PDO Communication Parameter

Description

This object contains the communication parameter of the 2nd transmit PDO. Remark: This value is available for all CANopen encoder versions except C6 versions.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Number of sub indices	Unsigned 8	5	ro	yes
1	COB-ID	Unsigned 32	280h + Node ID	rw	yes
2	Transmission Mode	Unsigned 8	1	rw	yes
3	Inhibit Time	Unsigned 32	0	rw	yes
4	Not available				
5	Event Timer	Unsigned 32	0x64	rw	yes

Transmission Mode

The transmission mode can be configured as described below:

Transfer Value (decimal)	Transmission Mode					Notes
	Cyclic	Acyclic	Synchronous	Asynchronous	RTR only	
0		X	X			Send PDO on first Sync message following an event
1-240	X		X			Send PDO every x Sync messages
241-251	reserved					
252			X		X	Receive SYNC message and send PDO on Remote Request
253					X	Update data and send PDO on Remote Request
254				X		Send PDO on event
255				X		Send PDO on event

Inhibit Time

For "Transmit PDOs", the "inhibit time" for PDO transmissions can be entered in this 16 bit field. If data is changed, the PDO sender checks whether an "inhibit time" has expired since the last transmission. A new PDO transmission can only take place if the "inhibit time" has expired. The "inhibit time" is useful for asynchronous transmission (transmission mode 254 and 255), to avoid overloads on the CAN bus.

Event Timer

The "event timer" only works in asynchronous transmission mode (transmission mode 254 and 255). If the data changes before the "event timer" expires, a temporary telegram is sent. If a value > 0 is written in this 16-bit field, the transmit PDO is always sent after the "event timer" expires. The value is written in subindex 5 of a transmit PDO. The data transfer also takes place with no change to data. The range is between 1-65536 ms.

Object 1A00: 1st Transmit PDO Mapping Parameter

Description

This object contains the mapping parameter of the 1st transmit PDO.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Number of sub indices	Unsigned 8	2	ro	yes
1	1st mapped object	Unsigned 32	-	rw	yes

Object 1A01: 2nd Transmit PDO Mapping Parameter

Description

This object contains the mapping parameter of the 2nd transmit PDO. Remark: This value is only available for C6 CANopen encoder versions.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Number of sub indices	Unsigned 8	2	ro	yes
1	2nd mapped object	Unsigned 32	-	rw	yes

Object 1A02: 2nd Transmit PDO Mapping Parameter

Description

This object contains the mapping parameter of the 2nd transmit PDO. Remark: This value is available for all CANopen encoder versions except C6 versions.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Number of sub indices	Unsigned 8	2	ro	yes
1	2nd mapped object	Unsigned 32	-	rw	yes

Object 2000: Position Value

Description

This object contains the position value.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Position Value	Unsigned 32	-	ro	n.a.

Object 2100: Operating Parameters

Description

As operating parameters the code sequence (Complement) can be selected and the limit switches can be turned on or off.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Operating Parameters	Unsigned 8	0h	rw	yes

The parameter code sequence (Complement) determines the counting direction, in which the output process value increases or decreases. The code sequence is determined by Bit 0 in Index 2100h. Additionally, the two limit switches, Min. and Max. can be turned on or off in Index 2100h:

Bit 0	Code sequence	Code
0	CW	increasing
1	CCW	increasing

Bit 1	Limit switch, min.
0	turned off
1	turned on

Bit 2	Limit switch, max.
0	turned off
1	turned on

Calculation Example:

Target: Absolute rotary encoder with direction CCW decreasing and both limit switches disabled

Bitmatrix:

Bit 0 = 1 Direction decreasing (CCW)

Bit 1 = 0 Limit switch min. disabled

Bit 2 = 0 Limit switch max. disabled

Result = 01h

Object 2101: Resolution per Revolution

Description

This object contains the desired steps per revolution of the encoder.

Object Characteristics (Single Turn Resolution up to 13 Bit Bit)

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Resolution per Revolution	Unsigned 16	see type sign	rw	yes

Object Characteristics (Single Turn Resolution >13 Bit)

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Resolution per Revolution	Unsigned 32	see type sign	rw	yes

If the desired value exceeds the hardware resolution of the encoder, the code will not be transmitted stepwise. So it is important, to keep the parameter in the possible value range.

Object 2102: Total Resolution

Description

This object contains the desired total resolution of the encoder.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Total Resolution	Unsigned 32	see type sign	rw	yes

This parameter is used to program the desired number of measuring units over the total measuring range. This value must not exceed the total resolution of the absolute rotary encoder, which is printed on the type plate of the encoder.

Attention:

Following formula letter will be used:

PGA	Physical total resolution of the encoder	(see type sign)
PAU	Physical resolution per revolution	(see type sign)
GA	Total resolution (customer parameter)	
AU	Resolution per revolution (customer parameter)	

Please use the following formula to calculate the total resolution of the encoder:

$$GA = \frac{(PGA * AU)}{PAU}, AU \le PAU \qquad k = \frac{PGA}{GA}, k = \text{ganze Zahl}$$

If the desired resolution per revolution is less than the really physical resolution per revolution of the encoder, then the total resolution must be entered as follows:

Total resolution:

Calculation example:
Customer handicap: AU = 2048
Encoder type sign:
PGA=24 bit, PAU=12bit

$$GA = \frac{(16777216 * 2048)}{4096}$$

$$GA = 8388608$$

If the total resolution of the encoder is less than the physical total resolution, the parameter total resolution must be a multiple of the physical total resolution:

Object 2103: Preset Value

Description

The preset value is the desired 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 the parameter preset. The preset value must not exceed the parameter total resolution to avoid run-time errors.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Preset Value	Unsigned 32	0	rw	yes

Object 2104: Limit Switch, min.

Description

Two position values can be programmed as limit switches. By reaching these values one bit of the 32 bit process value is set to high. Both programmed values must not exceed the parameter total resolution to avoid run-time errors.

Bit 30 = 1: Limit Switch, Min. reached or passed under

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Limit Switch, min.	Unsigned 32	0	rw	yes

The limit switch, Min sets Bit 30=1 with the next message telegram, if the process value reaches or passes under the value of the limit switch:

Function	Status bits		Process value																													
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	0	1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Object 2105: Limit Switch, max.

Description

Two position values can be programmed as limit switches. By reaching these values one bit of the 32 bit process value is set to high. Both programmed values must not exceed the parameter total resolution to avoid run-time errors.

Bit 31 = 1: Limit Switch, Max. reached or passed beyond

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Limit Switch, max.	Unsigned 32	0	rw	yes

The limit switch, max sets Bit 31=1 with the next message telegram, if the process value reaches or passes under the value of the limit switch:

Function	Status bits		Process value																												
Bit	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
	1	0	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Object 2200: Cyclic Timer PDO

Description

This object contains cyclic time of the event timer in ms.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Event Time in ms	Unsigned 16	0	ro	yes

Object 2300: Save Parameter with Reset

Description

With this object all parameters can be stored in the non volatile memory. After storing the parameters a reset is executed.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Access code	Unsigned 32	55AAAA55h	wo	no

Object 3000: Node Number

Description

This object contains the node number of the device.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Node Number	Unsigned 8	-	rw	yes

Object 3001: Baudrate

Description

This object contains the baudrate of the device.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Baudrate	Unsigned 8	-	rw	yes

Eight different baud rates are provided. To adjust the baudrate only one byte is used.

Baudrate in kBit/s	Byte
20	0x00
50	0x01
100	0x02
125	0x03
250	0x04
500	0x05
800	0x06
1000	0x07

Object 6000: Operating parameters

Description

This object shall indicate the functions for code sequence, commissioning diagnostic control and scaling function control.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Operating Parameter	Unsigned 16	1h	rw	yes

Code sequence: The code sequence defines, whether increasing or decreasing position values are output, in case the encoder shaft rotates clockwise or counter clockwise as seen from the point of view of the shaft.

Scaling function control: With the scaling function the encoder numerical value is converted in software to change the physical resolution of the encoder. The measuring units per revolution (object 6001h) and total measuring range in measuring units (object 6002h) are the scaling parameters. The scaling function bit is set in the operating parameters. If the scaling function bit is set to zero, the scaling function is disabled.

Bit structure for the operating parameters

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Use	MS	MS	MS	MS	R	R	R	R	R	R	R	R	MD	SFC	CD	CS

Table Description:

MS: Manufacturer Specific Function (not available)

R: Reserved for future use

MD: Measuring direction (not available)

SFC: Scaling function (0 = disable, 1 = enable)

CD: Commissioning diagnostic control (not availabe)

CS: Code sequence (0 = CW, 1 = CCW)

Object 6001: Measuring units per revolution

Description

This object shall indicate the number of distinguishable steps per revolution.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Measuring units per revolution	Unsigned 32	see type sign	rw	yes

Object 6002: Total measuring range in measuring units

Description

This object shall indicate the number of distinguishable steps over the total measuring range.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Total measuring steps	Unsigned 32	see type sign	rw	yes

Object 6003: Preset value

Description

This object shall indicate the preset value for the output position value

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Preset Value	Unsigned 32	0	rw	yes

Object 6004: Position value

Description

This object contains the process value of the encoder.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Process Value	Unsigned 32	-	romap	yes

Object 6200: Cyclic timer

Description

This object contains the value of the event timer of the corresponding TPDOs. The value can be changed between 1-65538 ms.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Cyclic Time	Unsigned 16	0x64	rw	yes

Object 6500: Operating status

Description

This object shall provide the operating status of the encoder. It gives information on encoder internal programmed parameters.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Operating status	Unsigned 16	-	ro	no

The operating status object corresponds to the value of the object 6000.

Object 6501: Single-turn resolution

Description

The object contains the physical measuring steps per revolution of the absolute rotary encoder.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Single Turn Resolution	Unsigned 32	see type sign	ro	no

Object 6502: Number of distinguishable revolutions

Description

This object contains number of revolutions of the absolute rotary encoder.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Number of Revolutions	Unsigned 16	see type sign	ro	no

Object 6503: Alarms

Description

Additionally to the emergency messages in /CiA301/, this object shall provide further alarm messages. An alarm shall be set if a malfunction in the encoder could lead to incorrect position value. If an alarm occurs, the according bit shall indicate the alarm til the alarm is cleared and the encoder is able to provide an accurate position value.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Alarms	Unsigned 16	-	romap	no

Bit structure of the alarms

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Use	MS	MS	MS	MS	R	R	R	R	R	R	R	R	R	R	CD	PE

Table Description:

MS: Manufacturer Specific Alarm (not supported)
R: Reserved for future use
CD: Commissioning diagnostic control (not supported)
PE: Position Error (not supported)

Object 6504: Supported alarms

Description

The object shall provide the supported alarms of the device. Please refer to the bit structure table to find more details about the supported alarms.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Supported Alarms	Unsigned 16	-	ro	no

Currently there are not supported alarms available for an Optocode absolute rotary encoder.

Object 6505: Warnings

Description

This object shall provide the warnings. Warnings indicate that tolerance for certain internal parameters of the encoder have been exceeded. In contrast to alarm and emergency messages warnings do not imply incorrect position values. All warnings shall be cleared if the tolerances are again within normal parameters.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Warnings	Unsigned 16	-	romap	no

Bit structure of the alarms

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Use	MS	MS	MS	MS	R	R	R	R	R	R	RP	BC	OT	CP	LC	FE

Table Description:

MS: Manufacturer Specific Warnings (not supported)
R: Reserved for future use
RP: Reference Point reached/not reached (not supported)
BC: Battery charge (not supported)
OT: Operating Time limit (not supported)
CP: CPU watchdog status (not supported)
LC: Light control reserve (not supported)
FE: Frequency warning (not supported)

Object 6506: Supported warnings

Description

The object shall provide the supported warnings of the device. Please refer to the bit structure table to find more details about the supported warnings.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Supported Warnings	Unsigned 16	-	ro	no

Currently there are not supported warnings available for an Optocode absolute rotary encoder.

Object 6507: Profile and software version

Description

This object shall provide the implemented encoder device profile version and the manufacturer-specific software version.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Profile and Software Version	Unsigned 32	-	ro	no

MSB LSB

Software Version		Profile Version	
Upper Software Version	Lower Software Version	Upper Profile Version	Lower Profile Version

Object 6508: Operating time

Description

This object indicates the operating time of the device. Currently the operating time is not supported and the value of this object will always be 0.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Operatiung time	Unsigned 32	0	ro	no

Object 6509: Offset value

Description

This object contains the offset value. It is been calculated by the preset function and shifts the physical position value with the desired value.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Offset value	Integer 32	-	ro	no

Object 650A: Module identification

Description

This object shall provide the manufacturer-specific offset value, the manufacturer-specific minimum and maximum position value.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Highest supported subindex	Integer 32	3	ro	no
1	Manufacturer offset value	Integer 32	-	ro	no
2	Man. min. position value	Integer 32	-	ro	no
3	Man. max. position value	Integer 32	-	ro	no

Object 650B: Serial number

Description

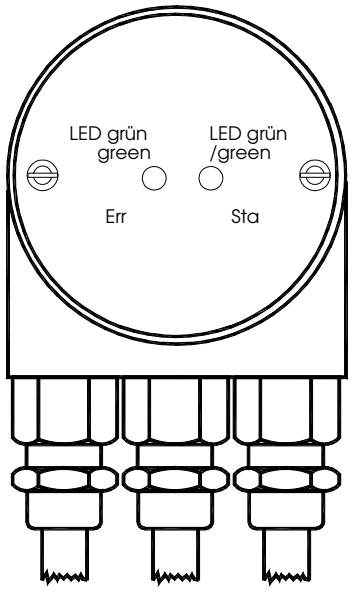
This object contains the serial number of the device. If the serial number is not supported from the device the value is always 0xffffffff.

Object Characteristics

Subindex	Description	Data Type	Default Value	Access	Restore after BootUp
0	Serial Number	Unsigned 32	-	ro	no

6. Diagnosis

6.1 Meaning of the LEDs in the connection cap



Err Green LED	**Sta Green LED**	**Meaning**
off	off	No power supply
off	on	Encoder is ready, Boot Up message not sent (no further device on network, wrong baud rate) or encoder in prepared status
flashing	on	Boot Up message sent, device configuration is possible
on	on	Normal operation mode, Encoder in Operational Status

Tab. 16 Meaning of LED Diagnosis

6.2 Troubleshooting

6.2.1 Power on – Encoder doesn't respond

Problem:
The bus is active but the installed encoder transmitted no boot up message.

Possible solution:
- switch of the PLC
- remove the connection cap of the encoder
- check the 2 turn-switches for the baudrate
- Assemble the connection cap
- power on

6.2.2 Malfunction of the position value during transmission

Problem:
During the transmission of the position value occasional malfunctions occurs. The CAN bus can be temporary in the bus off state also.

Possible solution:
Check, if the last bus node has switched on the terminal resistor. If the last bus node is an encoder the terminal resistor is suited in the connection cap..

6.2.3 Too much ERROR-Frames

Problem:
The bus load is too high in case of too much error frames.

Possible solution:
Check if all bus node has the same baudrate. If one node has another baudrate error frames are produced automatically.

6.2.4 Limit switches without function

Problem:
The encoder didn't transmit the bits for the limit switches.

Possible solution:
The limit switch functionality has to be activated once. Please follow the description you can find at 4.5.

6.2.5 Encoder without connection cap, Version C5 und C6

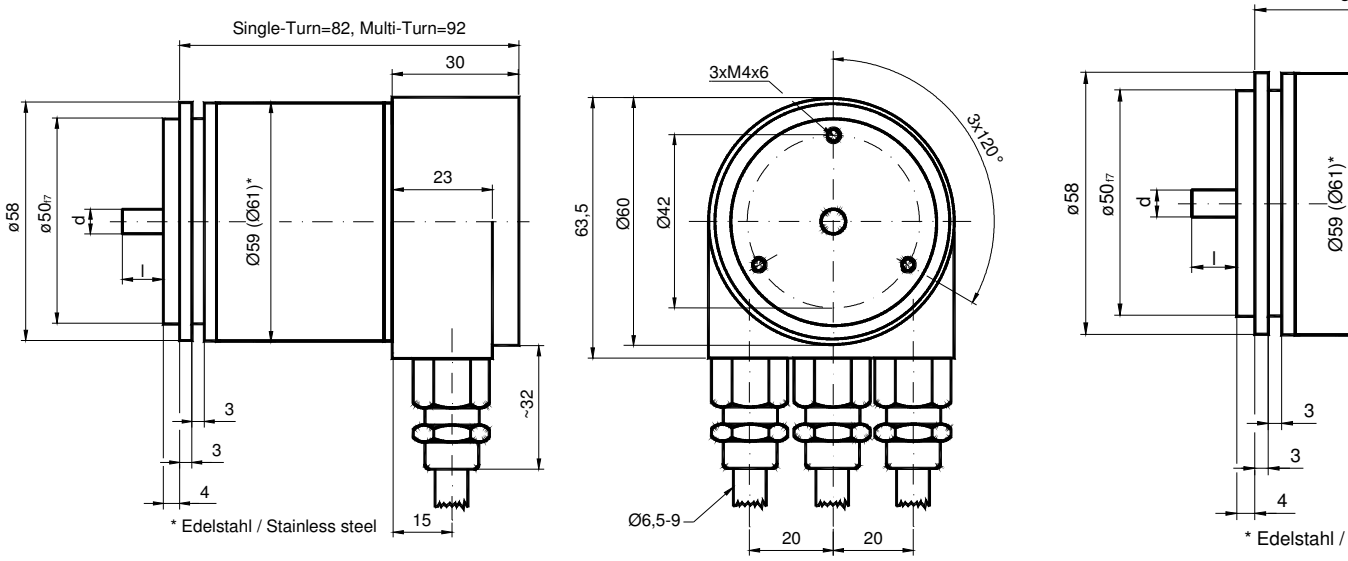
Notice: The changing of baudrate and node number are only valid after a new power up, NMT Reset or the store parameters command.

7. Mechanical Drawings

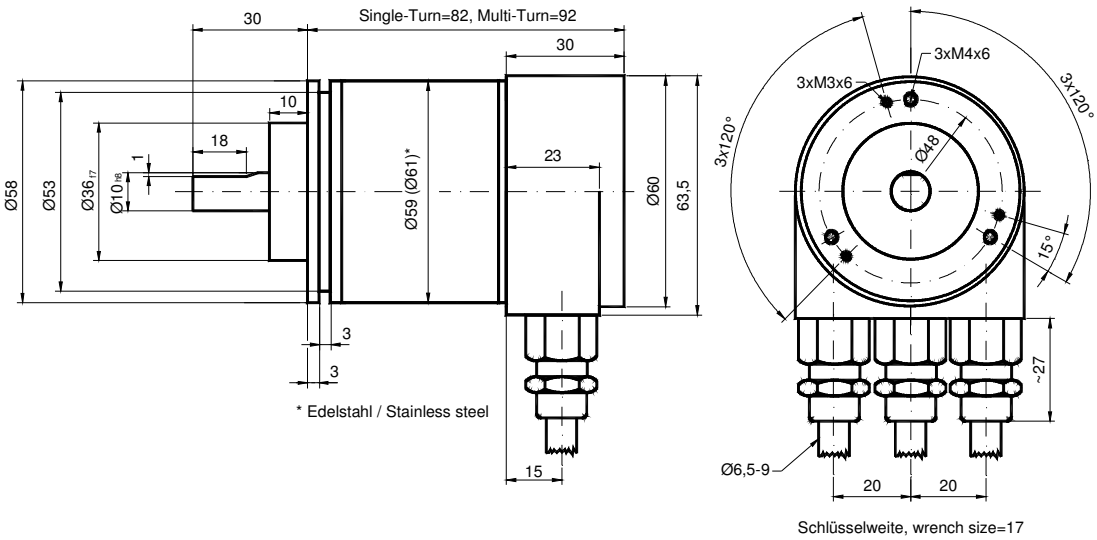
Synchro flange (S)

Two versions available

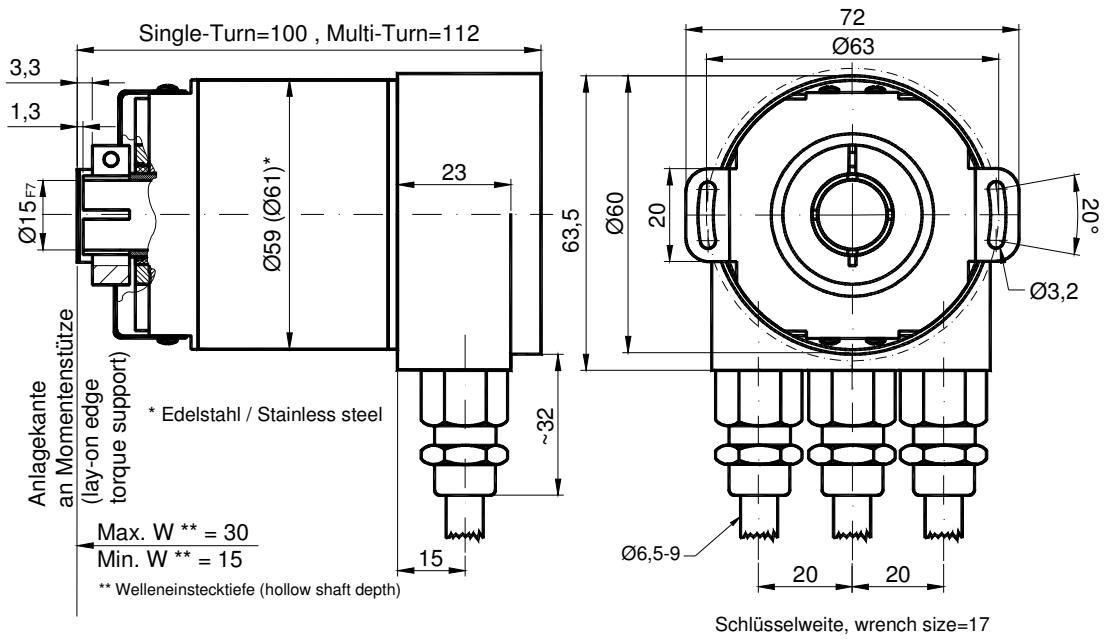
Synchro flange	d / mm	l / mm
Version S06	6_{f6}	10
Version S10	10_{h8}	20



Clamp flange (C)



Hollow shaft (B)



Mounting instructions

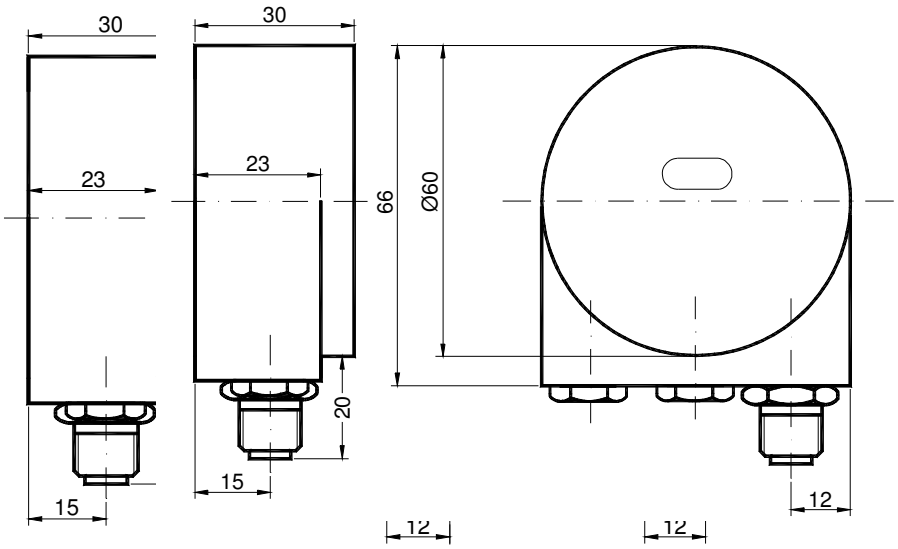
The clamp ring may only be tightened if the shaft of the driving element is in the hollow shaft.

The diameter of the hollow shaft can be reduced to 12mm, 10 mm or 8 mm by using an adapter (this reducing adapter can be pushed into the hollow shaft).

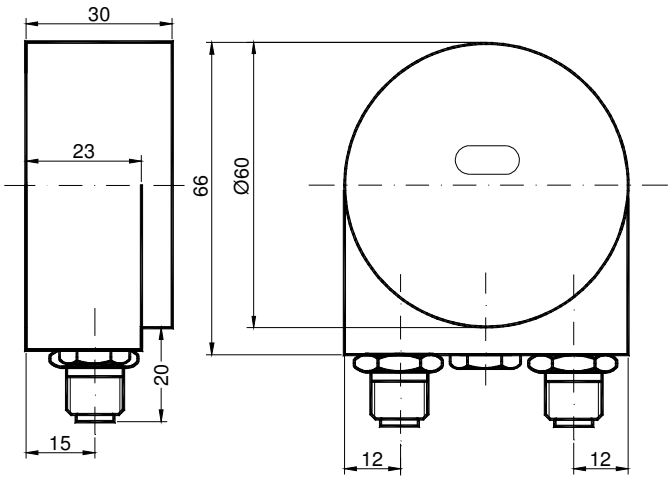
Allowed shaft movements of the drive element are listed in the table.

	axial	radial
static	± 0.3 mm	± 0.5 mm
dynamic	± 0.1 mm	± 0.2 mm

Connection cap AH58-B1CA-1BW, 5pin round connector M12, Micro style



onnector M12, Micro Style

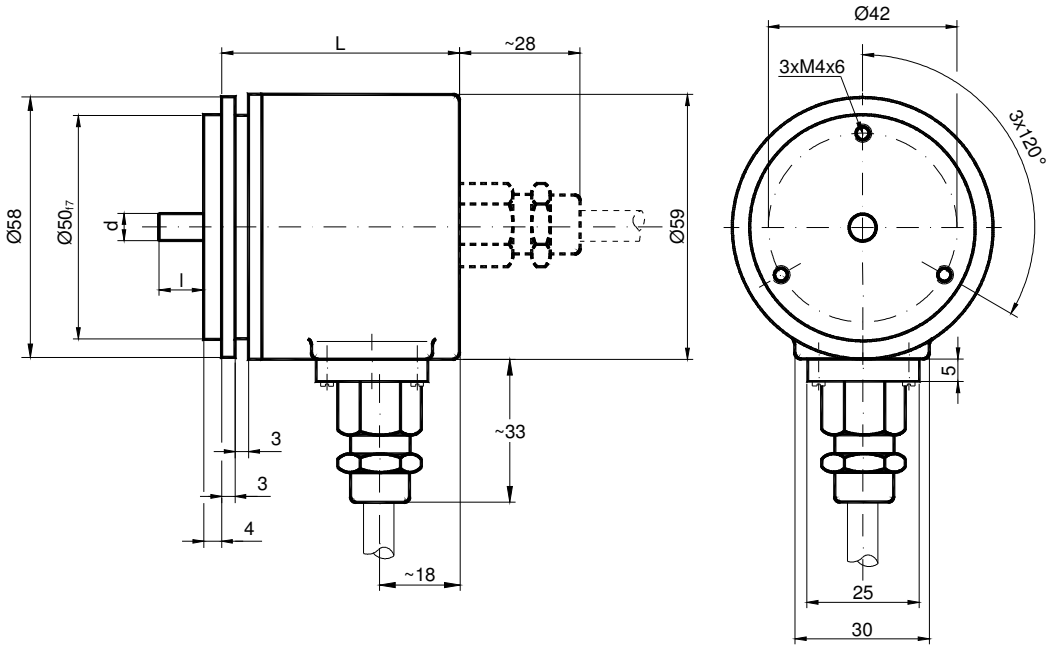


Synchroflange (S)

Two versions available

Cable exit (cable diameter = 8 mm)

Synchroflange	d / mm	l / mm
Version S06	6_{f6}	10
Version S10	10_{h8}	20

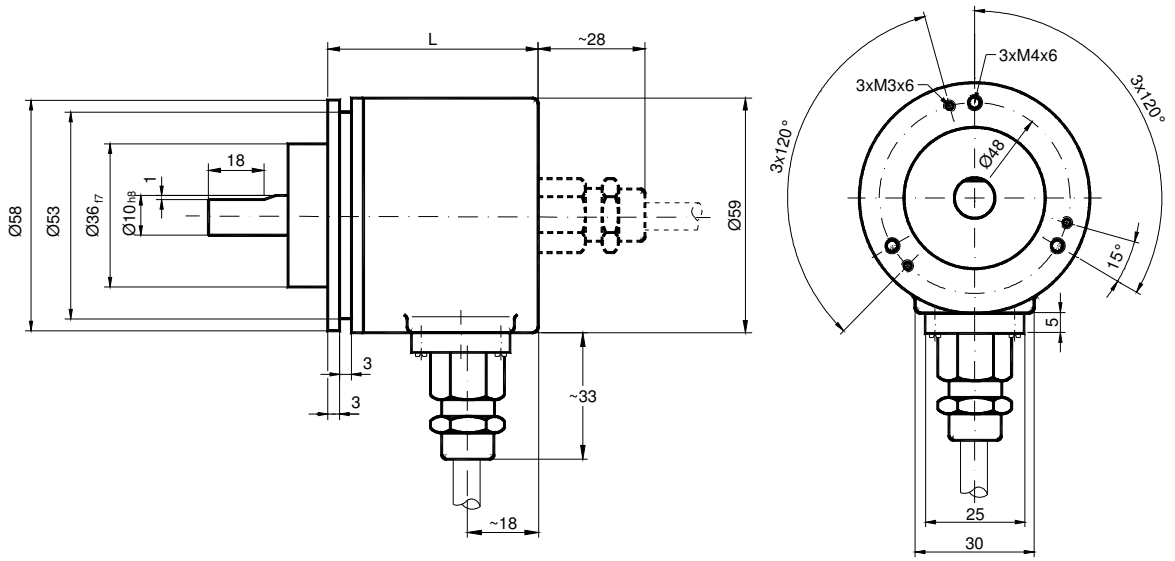


Clampflange (C10)

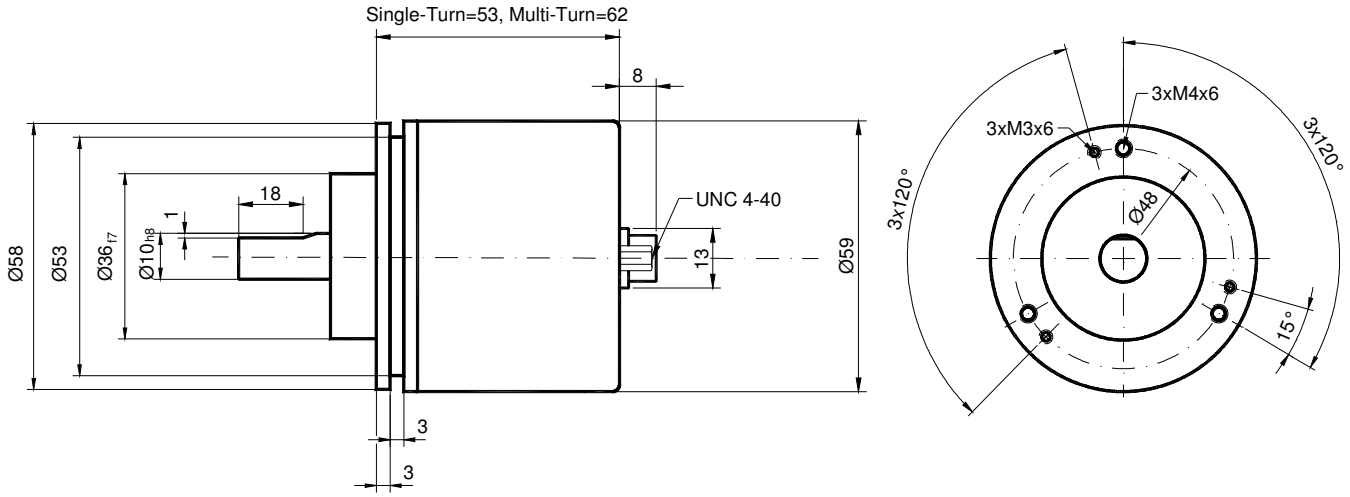
Cable exit (cable diameter = 8 mm)

or 5 pin M12 connector

	L
Single-Turn	53mm
Multi-Turn	62mm



Clampflange (C), 9 pin D-Sub connector



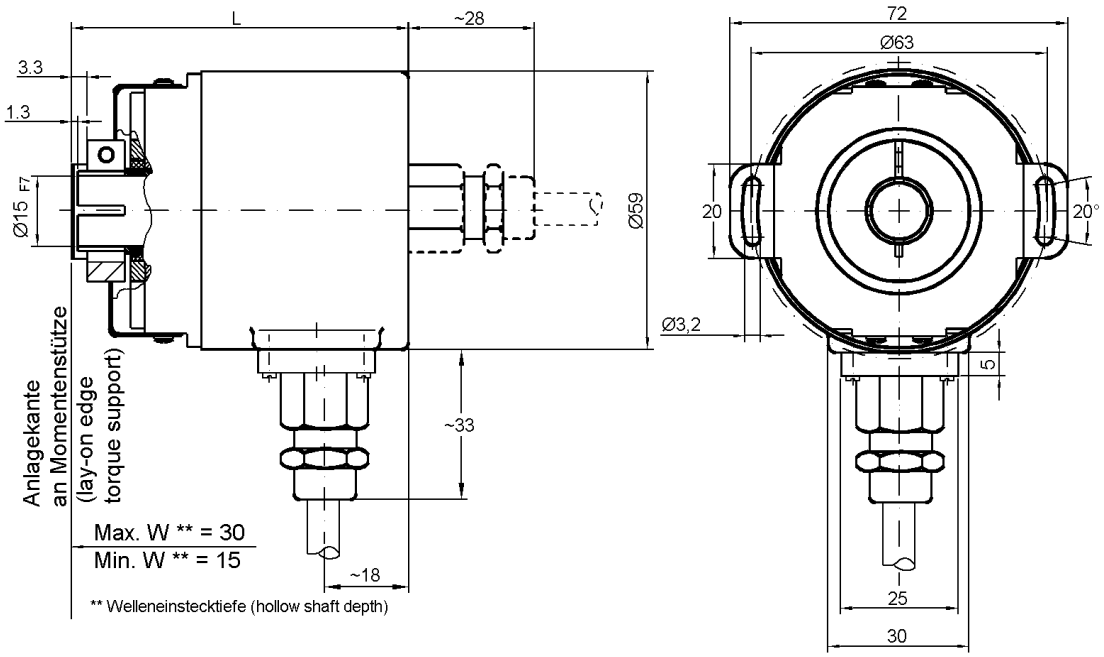
	L
Single-Turn	53mm
Multi-Turn	62mm

Synchroflange (S), 9 pin connector

The dimensions of encoder housing in the versions cable exit, 12 pin circular connector and 5 pin connector from clamp flange are also valid for the synchro flange.

Blind shaft (B)

Cable exit (cable diameter = 8 mm)
or 5 pin M12 connector



	L
Single-Turn	72mm
Multi-Turn	81mm

Mounting instructions

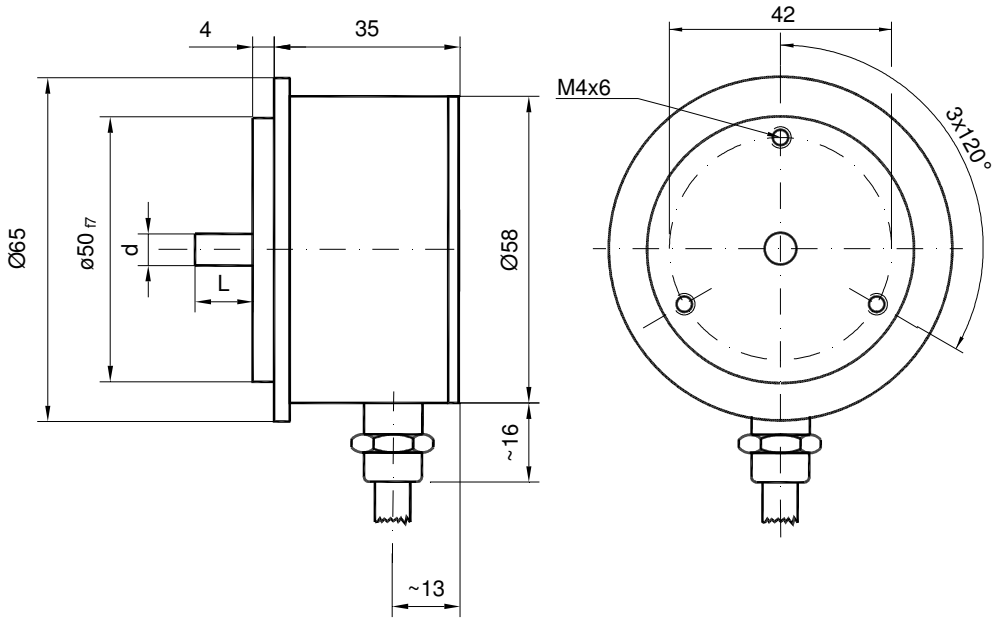
The clamp ring should only be tightened if the shaft of the driving element is inserted into the hub shaft.

The diameter of the hollow shaft can be reduced to 12mm, 10 mm or 8 mm by using an adapter (this reducing adapter can be pushed into the hollow shaft).

Maximum shaft movements of the drive element are listed in the table.

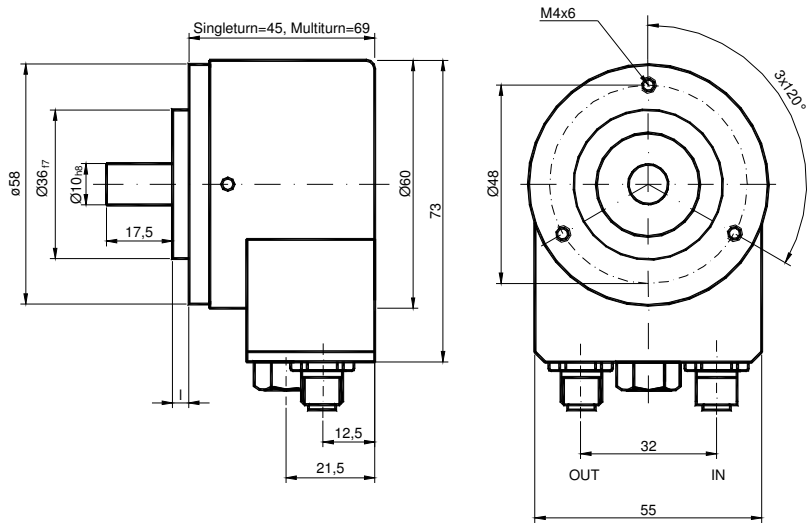
	Axial	Radial
static	± 0,3 mm	± 0,5 mm
dynamic	± 0,1 mm	± 0,2 mm

MidiCAN Synchroflange (SA6C) with radial cable exit and short housing



Heavy Duty version with solid shaft

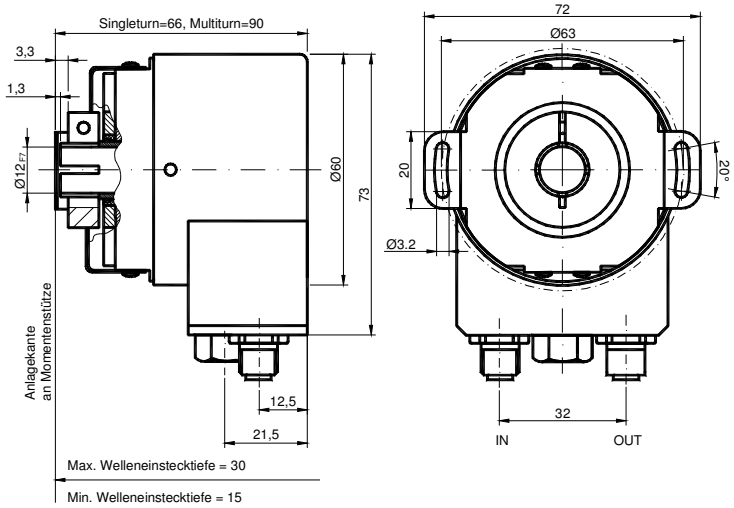
Clampflange as well as Synchroflange with 10mm shaft available



Heavy Duty version with blind shaft

Maximum shaft movements of drive element are listed in the table.

	Axial	Radial
static	± 0,3 mm	± 0,5 mm
dynamic	± 0,1 mm	± 0,2 mm



Appendix A: Order Codes

Remark: This table is only for your information and to find out what is the meaning of the type key on your encoder. For a valid type combination please refer to the corresponding datasheet or contact one of our distributors or Posital directly.

Description	**Typekey**									
Optocode	**OCD-**	_ _	B1	B -	_ _	_ _ -	_	_ _	_-	**0CC**
Interface	CANopen	C2								
	PureCANopen	C5								
	MidiCAN	C6								
Version	C6		00							
	C2, C5,		B1							
Code	Binary			B						
Revolutions (Bits)	Singleturn				00					
	Multiturn				12					
	Multiturn				14					
Steps per revolution	4096					12				
(Bits)	8192					13				
	65536					16				
Flange	Clampflange						C			
	Synchroflange						S			
	Hollow shaft						B			
Shaft diameter	10 mm							10		
	06 mm							06		
	15 mm (hollow shaft)							15		
Mechanical options	without								0	
	shaft sealing (IP66)								S	
	stainless steel version								V	
	customized								C	
	Heavy Duty								H	
Connection	Connection cap									0CC
	Has to be ordered separately – see accessories									
	Connector exit, axial, 9 pin D-Sub connector									PA9
	Connector exit, radial, 5 pin Micro Style M12									PRM
	Connector exit, axial, 5 pin Micro Style M12									PAM
	Cable exit 1m, radial, open cable exit									CRW
	Cable exit 1m, axial, open cable exit									CAW
	Male/ Female connector radial exit, 5 pin, M12									PRN
	Option protective element integrated									

Tab. 17 Order Key

Combinationmatrix

	AH58-B1CA-3PG	AH58-B1CA-3PG-VA	AH58-B1CA-1BW	AH58-B1CA-2BW	AH58-B1CA-2M20	Connector exit 5 pin axial	Connector exit 5 pin radial	Connector exit 9 pin D-Sub axial	Cable exit 1m radial	Cable exit 1m axial
CANopen	●	●	●	●	●					
Pure CANopen						●	●		●	●
Midi CANopen						●	●		●	●
CANopen Lift	●							●	●	●

Tab. 18 Possible Combination of Connection Cap Types

Connection caps

All connections caps are equipped with a switchable terminal resistor, integrated T-coouppler for CAN bus lines, BCD switches to adjust baudrate and node number, as well as LEDs for diagnosis.

Description	Article Name	Article Number
Aluminium housing with three M12 cable glands for cable diameters between 6,5 – 9 mm.	AH 58-B1CA-3PG	0246370325
Stainless steel housing with three M12 cable glands.	AH 58-B1CA-3PG-VA	0246370328
Aluminium housing with one 5 pin male M12 connector.	AH 58-B1CA-1BW	0246370342
Aluminium housing with on 5 pin male M12 connector and one 5 pin female M12 connector	AH 58-B1CA-2BW	0246370370
Aluminium housing with two M20 cable glands for cable diameter between 9 – 13 mm.	AH 58-B1CA-2M20	0246370339

Tab. 19 Availabe Connection Cap Types

Accessories and documentation

Description		Article Name	Article Number
Shaft Coupling	Drilling: 10 mm / 10 mm	GS 10	29100450
	Drilling: 6 mm / 6 mm	GS 06	29100350
Clamp Disc	Set (4 pieces).	SP 15	32400155
Clamp Ring	Set (2 pieces)	SP H	32400152
Reducing Ring*	15 mm to 12 mm	RR 12	32220291
Reducing Ring *	15 mm to 10 mm	RR 10	32220292
Reducing Ring *	15 mm to 8 mm	RR 8	32220295

Tab. 20 List of Accessories

Appendix B: History

History encoder generations
This chapter gives you information about older types of absolute rotary encoder with CANopen interface. Technical changes and compatibilities between the different types are specified.

Encodergeneration Optocode
The encoder generation OPTOCODE replaces the encoder generation AWC. The housing lengths and additional flange drillings are the mechanical changes of the new generation. The entry resolution per revolution in the object dictionary is modified and depends on the physical revolution of the device. The data length is unsigned 16 bit for a resolution per revolution of 15 bit and unsigned 32 bit for a physical revolution of 16 bit. Thus there is no change for the handling of the objects if an older encoder with a resolution per revolution of 13 bit is replaced by the same OPTOCODE encoder.

Encodergeneration AWC
Since the 01.03.2001 we deliver only the new encoder generation with CANopen interface. The changes of the type key, the compatibility of the devices (old/new) are composite in a feature matrix. Please use these changes in case of a new order.

Furthermore you can find details concerning changes of the CANopen protocol regarding to the newest CANopen specification (DS-301 V4.0) supported by the new devices. Please forward this information to your technical division.

Cross reference list:

Type key

Nr.	type key **old**	type key **new**	comment
1	58XX-XXXX-XBA1C203PG	58XX-XXXX-XB**B1**C203PG	encoder CAN
2	AH58-CA-3PG	AH58-**B1**CA-3PG	connection cap CAN

X: wildcard for various designs

Concerning the compatibility between old and new generation the following compatibility matrix gives further information.

Compatibility matrix

connection cap	encoder	function
old	old	OK
old	new	OK
new	**old**	**no function**
new	new	OK

Version history connection cap

In particular the design of the connection cap is improved. Easier installation due to a new type of screw terminals inside of the connection cap. On the back of the connection cap two multi-colour LEDs are implemented for easy diagnosis. The terminal resistor is hooked up via a slide switch. Thus continuative bus connection will be cut off. The localisation of accidentally switched on terminal resistors wil be made easier. The device address and the baudrate will be adjusted via BCD switches. This made the installation easier.

Changes of the CANopen protocol

The following changes have not be relevant to you because only specific function according to the newest CANopen specification (DS-301 V4.0) are not supported anymore or are new implemented. If your application don't use this function, there will be no problem.

Changes of entries in object dictionary

Relevant changes applies to the boot-up message, as well as some entries in the CANopen object index not used by the common user. A complete list of these objects you can find in the following table.

object-nr. (hex)	comment	CANopen profile DS301 V3.0 58XX-XXXX-XBA1C203PG	CANopen profile DS301 V4.0 58XX-XXXX-XBB1C203PG
1004	Number of PDOs supported	supported	according to DS301-V4.0 not supported anymore
100B	Node-ID	supported	according to DS301-V4.0 not supported anymore
100E	COB-ID Guarding protocol	supported	according to DS301-V4.0 not supported anymore
1016	Consumer heartbeat time	reserved	supported
1017	Producer heartbeat time	reserved	supported
1018	Identity Object	reserved	supported

Changing transmit PDO communication parameter

In the new encoder generation the polling isn't supported anymore if the PDO is disabled. According to CANopen specification DS301-V4.0 it is necessary to set the cyclic time (object entry [2200h]) to 0 and left the PDO switched on to poll the encoder. Important! If the PDO is switched off no communication is possible.

Polling in Pre-Operational state

The old generation has accepted polling requests in pre-operational state, but wasn't correct according to CANopen standard. In the manual for the old encoder was a hint, that the polling request is not allowed in pre-operational state, because it is not defined in the CANopen standard. So be aware that the new encoder is in general not accepting poll requests in pre-operational state independent of configuration of the behavior as new or old encoder.

Changes in boot-up sequence

If the old encoder generation is connected to the supply voltage or a NMT message (reset node, reset communication) is sent to the encoder, a boot-up message appears. The telegram structure looks like this: identifier: 80hex + node number, data length 0 bytes

This message was not defined by the specification DS301 V3.0, but vendor specific used by some manufactures to show that the device is 'alive'.

According to DS301 V4.0 the new rotary encoder generation doesn't support this message anymore. In place of the old message a common valid boot-up message is defined. The structure looks like this:

identifier: 700hex + node number, data length 1 byte

This boot-up message also appears if the command 'reset node' and 'reset communication' is sent to the encoder.

Handling of spare parts

Boot-up message new encoder and old connection cap

To use the new encoder generation as spare part for the old encoder generation, the new encoder recognize the old connection cap type and support the specification DS301-V3.0 automatically as well as the appropriate boot-up message.

Changing of the default BootUp message of the B1 version

To get the same boot-up behavior of the old encoder generation if you use the new encoder generation and the new connection cap type there will be following solution:

The needed protocol type will be activated via a defined device address. Please use the following configuration sequence:

1. Setting the needed address (s. table below).
2. Connect the connection cap to the encoder.
3. Switch on supply voltage.
4. Wait until both LEDs are red.
5. Switch off supply voltage.
6. Remove connection cap.
7. Set up the correct device address. (0-89)
8. Connect the connection cap to the encoder.
9. Switch on supply voltage.

normal operation.

protocol according to connection cap type automatically	protocol DS301-V3.0	protocol DS301-V4.0
address 97	address 98	address 99

Beside the set up via hardware there is also the possibility to set up the protocol via SDO objects. For further information please refer the manual.

Appendix C: Glossary

A

Address	Number, assigned to each node, irrespective of whether it is a master or slave. The encoder address (non-volatile) is configured in the base with rotary switches or SDO objects.
APV	Absolute Position Value.

B

Baud rate	Transmission speed formulated in number of bits per second. Bus node Device that can send and/or receive or amplify data by means of the bus.
Byte	8-bit unit of data = 1 byte.

C

CAL	CAN application layer.
CAN	Controller Area Network or CAN multiplexing network.
CANopen	Application layer of an industrial network based on the CAN bus.
CCW	Counter-clockwise
CiA	CAN In Automation, organization of manufacturers and users of devices that operate on the CAN bus.
COB	Elementary communication object on the CAN network. All data is transferred using a COB.
COB-ID	COB-Identifier. Identifies an object in a network. The ID determines the transmission priority of this object. The COB-ID consists of a function code and a node number.
CW	Clockwise

E

EDS file	Standardized file containing the description of the parameters and the communication methods of the associated device.

F

FAQ	Frequently Asked Questions
FC Function code.	Determines the type of message sent via the CAN network.

L

Line terminator	Resistor terminating the main segments of the bus.
LMT	Network management object. This is used to configure the parameters of each layer in the CAN. Master "Active" device within the network, that can send data without having received a request. It controls data exchange and communication management.

N

NMT	Network management object. This is responsible for managing the execution, configuration and errors in a CAN network.
NN	Node number

P

PCV	Process Value
PDO	Communication object, with a high priority for sending process data.
PV	Preset Value: Configuration value

R

RO	Read Only: Parameter that is only accessible in read mode.
ROMAP	Read Only MAPable: Parameter that can be polled by the PDO.
RW	Read/Write: Parameter that can be accessed in read or write mode.

S

SDO	Communication object, with a low priority for messaging (configuration, error handling, diagnostics). Slave Bus node that sends data at the request of the master. The encoders are always slaves.

W

WO	Write Only: Parameter that is only accessible in write mode.

Appendix D: List of tables

Appendix E: List of figures

Appendix F: Document history

Version	Date	Comment
1.0	10.10.03	Initial version
1.1	24.10.03	Correction of the type key. List of figures, List of tables added
2.0	06.11.03	Hint protection low voltage added
2.1	08.01.04	Hint temperature cable exit added
2.2	21.05.04	New inner diameter of the cable glances
2.3	24.09.04	SubIndex of RestoreAllParameter changed
11/07	19.11.07	Complete Review of the manual