Electro-magnetic Absolute Encoders

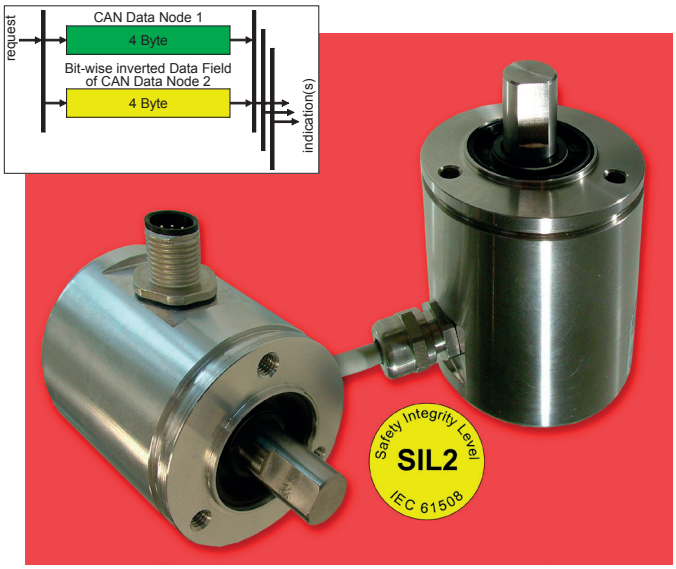
Model series TBN/S3 with SIL2 certificate

SINGLE-TURN □ CANopen Safety interface

TBN 11709 HE

11 / 2016

- **Compact and robust version as a failsafe component for automation in mechanical and plant engineering**
- **SIL2-certified according to IEC 61508 - TÜV certificate, registration no. 44 799 09 555294**
- **With CANopen Safety according to CiA DS304 CANopen Framework for Safety-relevant Communication, Version 1.0.1**
- **Redundant electromagnetic sensor system**
- **Resolution 2 x 4096 steps / 360°**
- **Velocity signal: digits / 10 ms**
- **High vibration and shock resistance**
- **Operating temperature range - 40 °C to + 85 °C**
- **Protection type IP 66 (optionally IP 69K)**
- **Further CANopen safety encoders: See datasheet NOC13292**



Design

Angle position recording by means of Hall sensors and signal processing including generation of the digital output signals.

Robust aluminium or stainless steel housing – stainless steel-shaft – ball bearings with radial shaft seal – housing potted for protection type IP 69K – electrical connections optionally via sensor connector M12x1, 8-pin or via cable with open ends.

Function

The angle position is recorded via two redundant systems of the same design. The position data and the velocity signal are output via SRDO1 and SRDO2. Thereby the SRDO2 (Safety Relevant Data Object) is bit-inverted.

Two independent nodes, which logically behave as one node, i.e. both systems are addressed via one node address, are implemented in the sensor system. The primary node controls the logical functions of CANopen, such as SDO processing, NMT and LSS services, and makes the information available to the redundant node via internal communication. The redundant node checks the safety parameters and internally synchronises its safety status with the primary node. Independently of each other, both nodes supply the position data with the CANopen Safety protocol. The velocity signal is generated in digits / 10 ms from the position data of the primary node and output in the SRDOs, SRDO1 normal and SRDO2 bit inverted. Two sets of safety parameters exist – one for the primary (object 1301_h) and one for the redundant node (object 1302_h). The SRDO COB IDs can be enabled or disabled as desired.
One requirement for safety-relevant operation is a failsafe master. The failsafe master evaluates the redundant data. In the case of improper differences or absence of data the master has to react so that states of risks are avoided.

Interface according to the following specifications

CiA DS301	CANopen Application Layer and Communication Profile, Version 4.1
CiA DS304	CANopen Framework for Safety-relevant Communication, Version 1.0.1
CiA DS305	CANopen - Layer Setting Services and Protocol (LSS)
CiA DS406	CANopen - Device Profile for Encoders, Version 3.0. (For version 4.0.1 see datasheet NOC13292).
IEC 61508	Functional safety of safety-related electrical/programmable electronic systems.

Procurement source for the listed CANopen specifications:
CAN in Automation (CiA),
Kontumazgarten 3, D-90429 Nürnberg
(E-mail: headquarters@can-cia.org, www.can-cia.org)

Electrical data

- Sensor systems: ASICs with Hall elements
- Op. voltage range: + 11 VDC to + 36 VDC
- Power consumption: < 1W
- Resolution: 4096 positions / 360° - (12-bits)
- Absolute accuracy: ± 0.5%
- System synchronisation: < ± 1%
- Output code: Binary
- Preset value: 0 to (total capacity -1)
- Velocity signal: digits / 10 ms
- Code path: CW/ CCW
- CAN interface: Acc. to ISO/DIS 11898
- Address setting: Via SDO / LSS
- Max. transmission length: 200 m *

* No galvanic separation between supply voltage and bus lines (also see CiA DS301).

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Mechanical data

- Operating speed: Max. 1,000 rpm
- Angular acceleration: Max. 10^5 rad/s²
- Moment of inertia (rotor): 20 gcm²
- Operating torque: ≤ 8 Ncm
  (at 500 rpm)
- Starting torque: ≤ 4 Ncm
- Perm. shaft load: 250 N axial / radial
- Bearing life expectancy: ≥ 10^9 revolutions
- Mass in aluminium: Approx. 0.3 kg
- Mass in stainless steel: Approx. 0.6 kg

Environmental data

- Operating temperature: - 40 °C to + 85 °C
- Storage temperature: - 20 °C to + 60 °C
  (due to packaging)
- Resistance:
  - o To shock: 250 m/s²; 11 ms
    DIN EN 60068-2-27
  - o To vibration: 100 m/s² ; 10 ... 2000 Hz
    DIN EN 60068-2-6
- EMC standards: EN 61000-4-2 (ESD)
  EN 61000-4-4 (burst)
  EN 61000-6-4 (emission)
- Magnetic field: At 1 mT error < 0.1%
- Protection type: IP 66 (DIN EN 60529)
  (IP 69K optional)

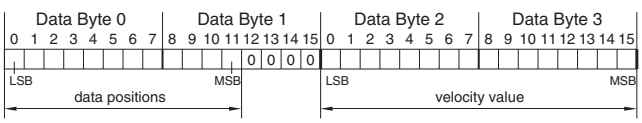
CANopen Features

- NMT master: No
- NMT slave: Yes
- Maximum boot up: No
- Minimum boot up: Yes
- COB ID distribution: Default, SDO
- Node ID distribution: Via index 2000 or LSS
- No. of SRDOs: 2 Tx / node
- PDO modes: Sync, async, cyclic, acyclic
- Variable PDO mapping: No
- Emergency message: Yes
- Heartbeat: Yes
- No. of SDOs: 1 Rx / 1 Tx
- Device profile: CiA DS 406 version 3.0
  CiA DS 304 version 1.0.1

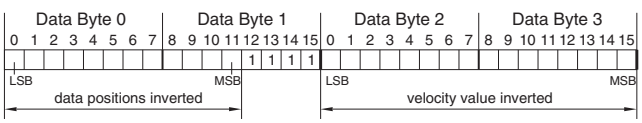
The profile is described in detail in the TBN 11748 user manual. (The user manual and the EDS file are available on CD.)

CANopen Safety, SIL2 data format

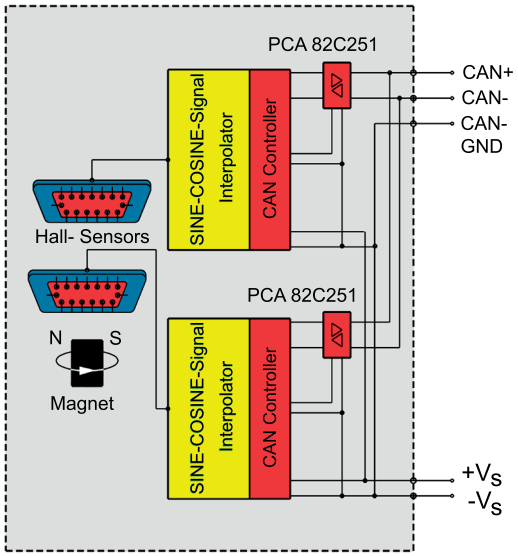
SRDO 1



SRDO 2



Block diagram



Order code format

TBN 50 - S A 4096 R S3 S N 01

- Electrical and mechanical variants*
  - N = CANopen
- Electrical connections
  - K = cable 1m
  - S = device connector M12x1
- Profile:
  - S3 = CANopen Safety acc. to CiA DS 304 version 1.0.1, SIL2 certified
- R = binary
- Resolution
  - 4096 positions / 360°
- Housing material
  - A = aluminium**
  - S = stainless steel**
- S = synchro flange
- Design form ø 50 mm
- Model series:
  - TBN with CANopen Safety interface, SIL2 certified

* The basic versions according to the data sheet bear the number 01. Deviations are identified with a variant number and are documented in the factory.

** Aluminium housing with connector M12x1, stainless steel housing preferably with 1 m cable and D-Sub connector without cover (for test purposes).

- A connection assignment is enclosed with each device.

Counter plug, straight, M12x1 series

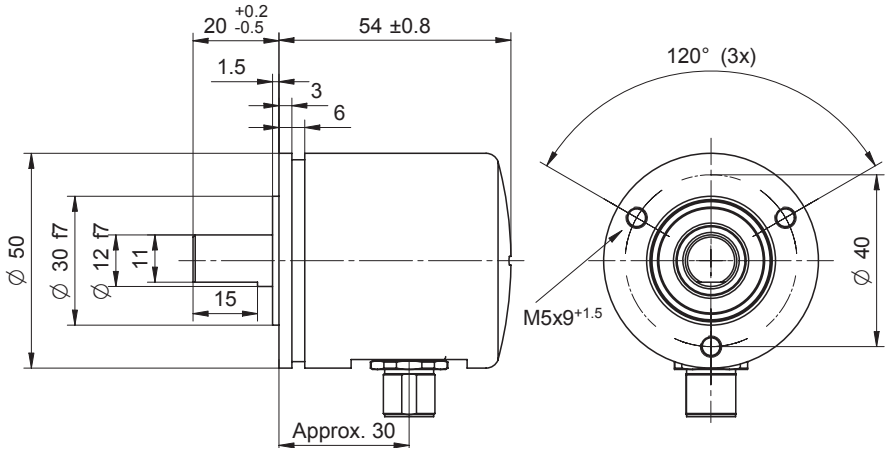
(to be ordered separately)

TBN 50/S3	No. of pins	Housing material		Cable Ø [mm]
		Plastic	Metal	
	8	STK8GS53	STK8GS54	6-8
	5*	STK5GS55	STK5GS56	4-6

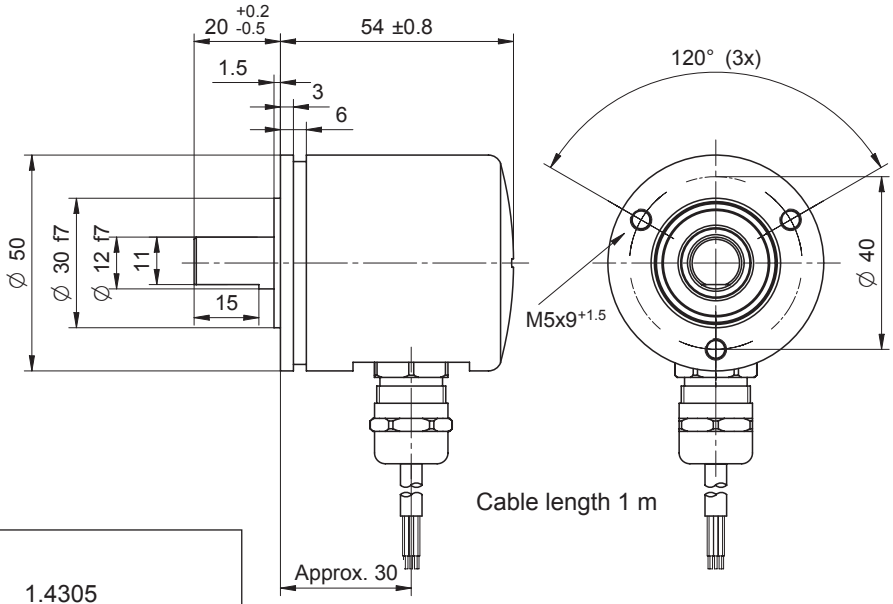
* Optional

Dimensions in mm

Aluminium housing with connector M12 x 1 (version A)



Stainless steel housing with lead exid (version S)

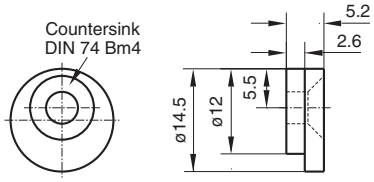


Materials used

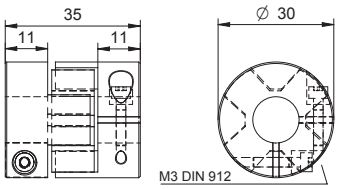
Stainless steel housing:	1.4305
Lead outlet:	Nickel-plated brass
Aluminium housing:	AlMgSi1
Radial shaft seal:	NBR
Stainless steel shaft:	1.4305
Sealing rings:	NBR
Housing cover:	Polyamide or stainless steel

KL 66-2 series mounting clamps

- ☐ Reference circle: 65 +0.5 mm
- ☐ Material: Nickel-plated brass
- ☐ Required bolts: (3 required in each case) M4 countersunk Allen head bolt DIN 7991

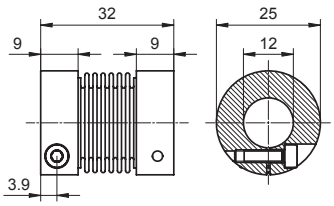


Clamping coupling K14S/12



(Aluminium / plastic)

Bellows coupling BKK 32/12



(See data sheet BKK 11840)

(Stainless steel, 1.4301)

On the drive side, the couplings are also available with bores for other shaft diameters.