Absolute single-turn pin joint encoder
Model TBN 37/safety

- **CANopen safety SIL2 / PLd**

- **Also available with CANopen and analogue interfaces**

- **Robust design for rough applications, e.g. in crane technology, construction machines and agricultural machines**

- **Protection type IP69 K**

- **Quick and simple assembly by means of circlip**

Safety Integrity Level
SIL2
IEC 61508

TBN 37
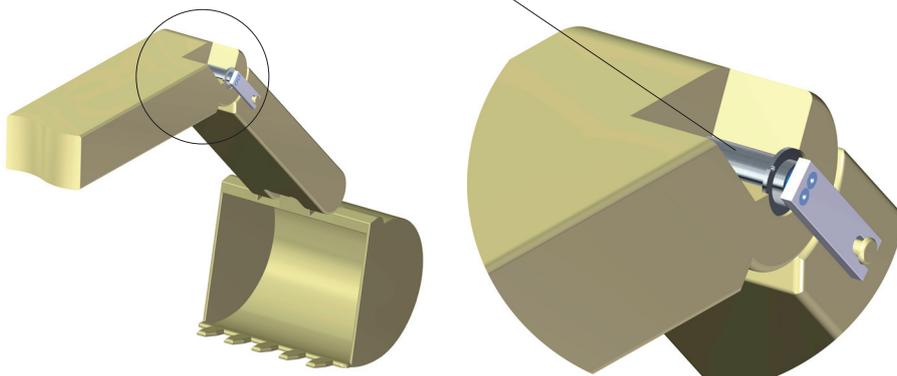
Design

- Robust stainless steel housing.

- The shaft or measurement axis bears the magnet for registering the angular position. The encapsulated main chamber area to the rear of this contains all electronic components for registering, evaluating and outputting the position data. Protection type IP69K is achieved through an embedding compound.

- The rotary encoder is fixed in position in the pin joint using spiral clamping pins (depth setting is carried out using an assembly tool) plus an O-ring and a circlip. These components are optionally available.

- The redundant design of the sensor and additional measures enable the output of a safe position value according to IEC 61508 - SIL2 and EN ISO 13849-PLd.

- Electrical connection via cable with test connector D-sub.

Function

The pin joint encoder can be used as an integrated unit for registering the safe angular position of a boom. It is intended for use in cranes, mobile equipment (e.g. in forestry) or in agricultural technology areas.

Safety design

Two autonomously operating, redundant sensor units register the position of the magnet. In this safety design, the plausibility comparison must be carried out in the master. In this case, the sensor outputs both angular positions separately. The sensor system has two independent CANopen nodes. The rotary encoder meets the conditions of safety level SIL2 according to IEC 61508 and the performance level d (PLd) according to EN ISO 13849. The prerequisite for safety-relevant operation is a fail-safe master with CANopen safety interface.

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Technical data

Electrical data

- Sensor system: ASICs with Hall elements
- Operating voltage: 9 to 36 VDC (protected against polarity reversal)
- Power consumption: < 1.8 W
- Resolution: 4096 steps / 360° = 12-bit, optionally 13-bit
- Code path: CW* or CCW* can be set
- Reference value: 0 to (total number of steps -1)
- Accuracy: ± 0.25%, optionally ± 0.1% (with reference to 360°)
- Reproducibility: ± 0.02% (with reference to 360°)
- Temperature drift: < 0.1% (with reference to 360° over the entire temperature range)
- Internal system position monitoring: 3.13% (with reference to 360°)

Electrical output data

- CAN interface: According to ISO/DIS 11898
- Address setting: Via LSS or object 2000
- Terminating resistor: To be implemented separately
- Output code: Binary

Mechanical data

- Operating speed: 500 rpm
- Angular acceleration: 10^5 rad/s² max.
- Moment of inertia (rotor): 20 gcm²
- Operating torque: ≤ 2 Ncm
- Starting torque: ≤ 3 Ncm
- Perm. shaft load: 100 N axially, 500 N radially
- Bearing service life: ≥ 10^9 revolutions **
- Weight: Approx. 0.3 kg

Environmental data

- Operating temperature range: - 40°C to + 85°C
- Storage temperature range: - 40°C to + 100°C (without packaging)
- Resistance
  - To shock: 500 m/s²; 11 ms
    DIN EN 60068-2-27
  - To vibration: 500 m/s²; 10 Hz ... 2000 Hz
    DIN EN 60068-2-6
- EMC standards: DIN EN 61 000 - 6 - 2 Immission (burst/ESD/etc.)
  DIN EN 61 000 - 6 - 4 Emission
- Protection type (DIN EN 60529): IP69K

*) CW = ascending (CCW = descending) signal viewed looking at the clockwise-rotating shaft.
**) This value applies at maximum shaft load.

Principle circuit diagram
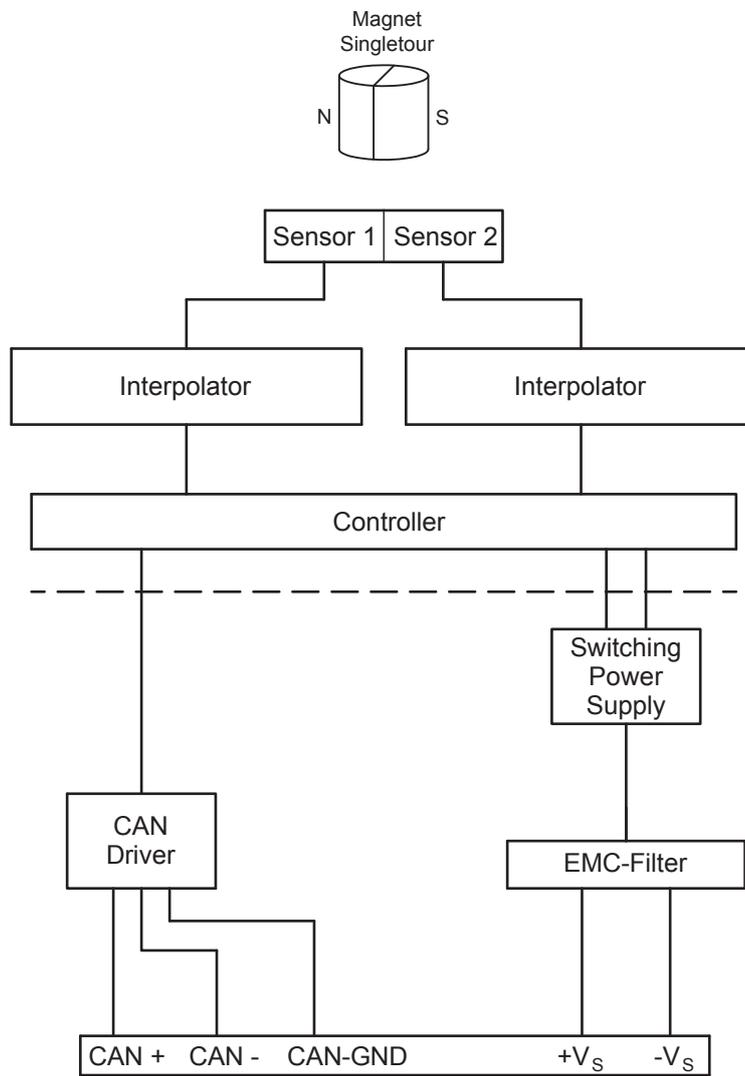
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CANopen features, bus activation, output level, SRDO data format

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
IEC 61508	Functional safety of electrical/electronic/programmable electronic safety-related systems.

Supply source for the listed CANopen specifications:

CAN in Automation (CiA), Kontumazgarten 3, D-90429 Nuremberg, (E-mail: headquarters@can-cia.org, www.can-cia.org)

The profile details are exhaustively described in the TBN/TRN 12889 user manual.

- 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: 1 Tx
- SRDO mode: Cyclic
- Variable SRDO mapping: No
- Emergency message: Yes
- Heartbeat: Yes
- No. of SDOs: 1 Rx / 1 Tx

Bus activation according to ISO / DIS 11898
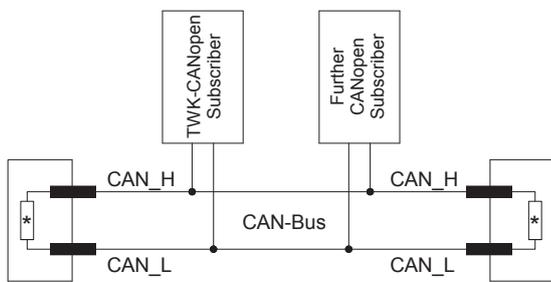
*Termination resistance (120 Ω)

Output level according to ISO/DIS 11898
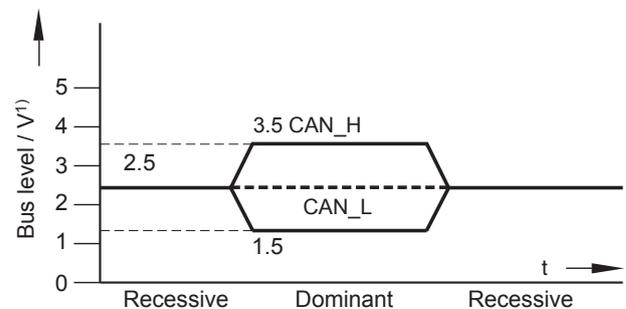
1) With common mode voltage = 0 V

SRDO data format

SRDO - normal

Data byte 1								Data byte 2							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LSB MSB															
Data position															

SRDO - bit-inverted

| Data byte 1								Data byte 2							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LSB MSB															
Data position inverted															

Connection assignment

Connection assignment, cable with test connector (D-sub, 15-pin)

Contact No.	Wire colour	Assigned with
1	gn	CAN +
2	ye	CAN –
3	bla	CAN-GND (bridged with $-V_S = 0$ V)
4-5	-	Not connected
6	rd	$+ V_S = 9 \ldots 36$ V / Pv = 1 W
7	bl	$- V_S = 0$ V
8	-	Not connected
9-13	-	Not to be connected
14-15	-	Not connected

Order number

TBN	37	- M	S	4096	R	S3	K	N	01

									Electrical and mechanical variants*
								01	Standard
							Output:		
							N	CANopen	
						Electrical connection:			
						K	1 m cable		
					Profile:				
					S3	CANopen safety SIL2			
					C2	CANopen			
				Code:					
				R	Binary				
			Resolution:						
			1 ... 4096	Steps / 360°					
		Housing material:							
		S	Stainless steel						
	Flange type:								
	M	Assembly flange							
Design form:									
37	mm Ø assembly flange								
Model:									
TBN	With CANopen safety interface SIL2								

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

Assembly tool (to be ordered separately)

- Assembly tool for pressing in the spiral clamping pins
  MZ-TBX37-01 See description on Page 7

- Assembly tool for pressing in the circlip
 **MZ-TBX37-02** See description on Page 8

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Order number: TBN 37 - MS 4096 R S3 K1 N01

Dimensions in mm

Detail A
3:1

View B
3:1
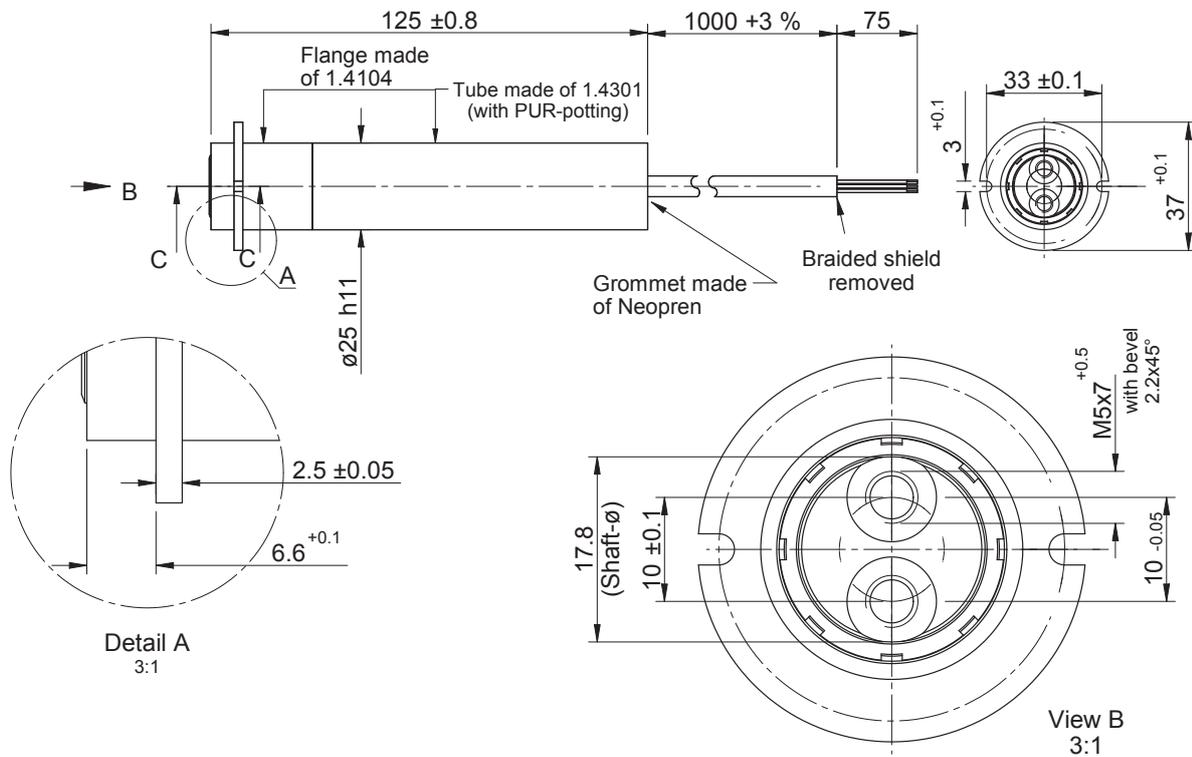
Installation situation of the encoder with example lever in the pin joint
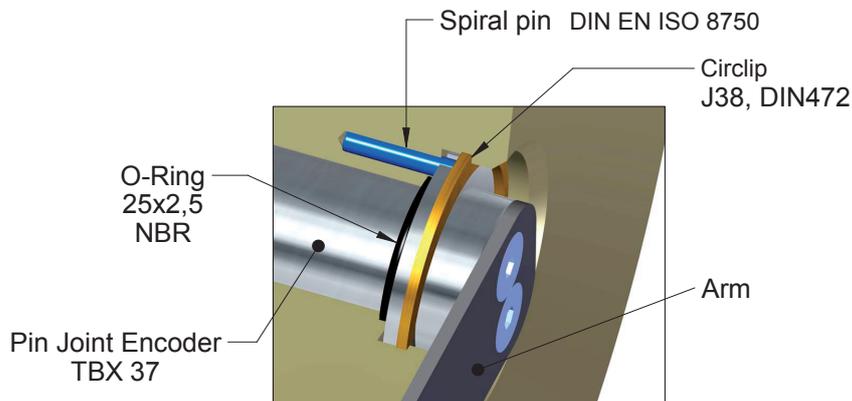
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Installation drawing (dimensions in mm)

**Possible design of the customer's pin joint for installation of the TBX 37**
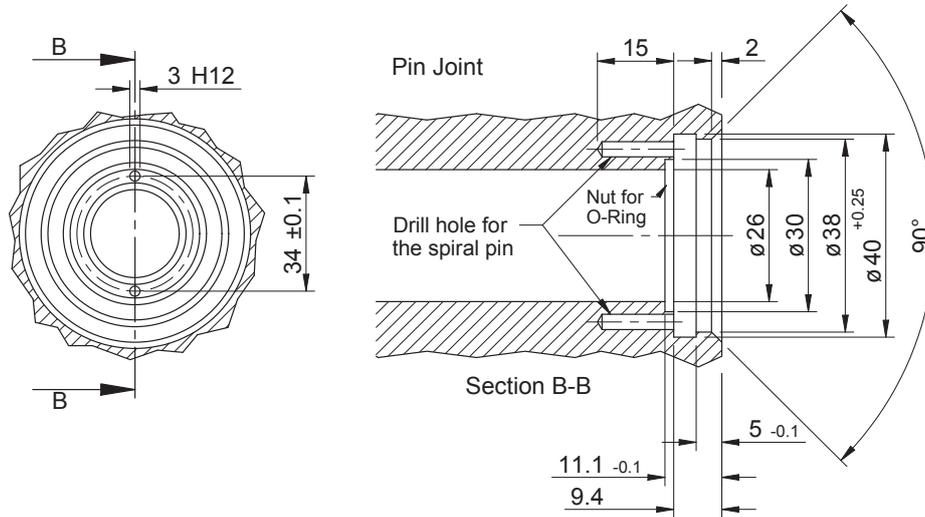
Installation accessories (included in the scope of delivery)

Installation accessories consisting of:

- Spiral clamping pin: 2 x DIN EN ISO 8750, phosphated and oiled (optionally VA)
- Circlip: 1 x J38, DIN 472, phosphated and oiled (optionally VA)
- Bolts: 2 x DIN 7991-M5x8
- O-ring: 1 x O-ring 25x2.5 NBR

Assembly tool for pressing in the spiral clamping pins (to be ordered separately)

Order number: MZ-TBX37-01
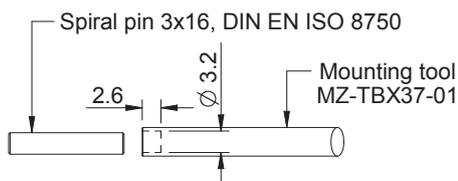
The assembly tool is used to press the spiral clamping pin into the 3 H12 hole of the pin joint until the assembly tool lies on the ø40 (see drawing of customer's pin joint above).

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Installation drawing (dimensions in mm)

Assembly tool for pressing in the circlip (to be ordered separately)

Order number: MZ-TBX37-02
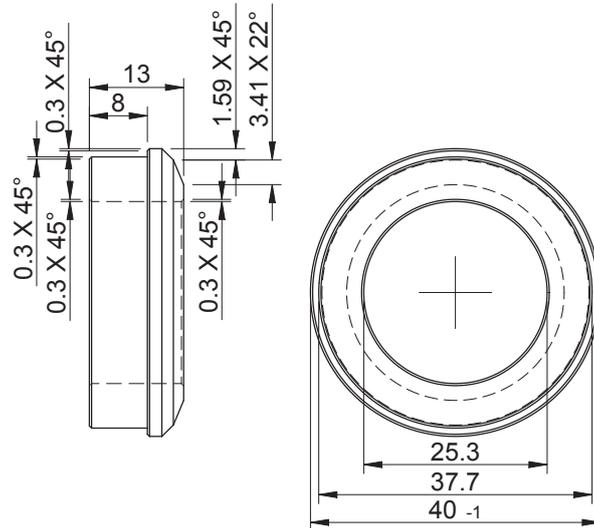
Example of a lever for bolting onto the encoder

Customer-specific levers can be supplied by TWK.