Optoelectronic absolute encoder
Models KBN 58-S and KBN 58-K
SINGLE-TURN with CANopen interface

- Compact design for mechanical engineering and device technology
- According to CANopen Application Layer and Communication Profile, CiA Draft Standard 301, Version 4.1 and according to "Device Profile for Encoders CiA Draft Standard Proposal 406 Version 3.0"
- CANopen Layer Setting Services and Protocol (LSS), CiA DSP 305
- Resolution: 8192 steps/360° - 13-bit (Optional: up to 16-bit)
- Output code: Binary
- With speed signal
- Design form "S" with synchroniser flange (IP 64)
- Design form "K" with clamped flange (IP 66)

Design
Aluminium flange and housing - stainless steel shaft - ball bearing with seal - code disk manufactured from glass or dimensionally stable plastic - GaAlAs diode - photo array with comparator and trigger circuit for long-term sensor system stabilisation- SMD technology.

The bit-parallel information on the rotational angle is processed in a µController with integrated CAN interface and made available via a CAN driver.

Function
The CANopen application layer, the communication profile, CiA Draft Standard 301, version 4.1 and the CANopen interface specifications for encoders according to CiA DSP 406 version 3.0 are implemented in the absolute encoder. The requirements for a class 2 subscriber are met.

In addition to administrative and pre-defined messages according to CANopen (e.g.: synchronisation, NMT, LSS, ...), service data objects (SDOs) and process data objects (PDOs) are also supported. The latter are used for data exchange between the master and slave. During direct write and read access to individual object directory entries, the SDOs are exchanged between the master and slave. These SDOs are used mainly for device configuration (e.g. changing the transmission type of the Tx-PDO - object 1800H).

The node ID and baud rate (max. 1 MBaud) are set via DIP switches in the connecting cap or via the LSS service. The object entries for the general features, PDO parameters, encoder parameters, diagnostic parameters and LMT/LSS are described in detail in the KBN 11278 user manual.
Model KBN

Technical Data

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 DIP switches or LSS
- No. of PDOs: 2 Tx
- 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 DSP 406 version 3.0

General parameters
- Data rate:
  - DIP switch: 20, 125, 500 kBaud, 1 MBaud
  - LSS: 20, 50, 125, 250, 500, 800 kBaud, 1 MBaud, default: 20 kBaud
- Node address: 1-127 (can also be set via LSS), default: 1 and FFhex
- Scaling function: On/off and setting the preset value (see operating mode)
- Cycle timer: Cycle time (0 to 65,536 ms)
- Alarms: EEPROM error CRC error
- Terminating resistor: Engageable via DIP switches in the connecting cap

Operating modes (programmable with SDO)

Polling mode (asynchronous*):
The encoder transmits the current actual position value, once the current position value has been queried via a "remote frame" message by the master.

Cyclic mode (asynchronous-cyclic*):
The encoder transmits the current actual position value cyclically - without being requested by the master. The cycle time can be parameterised for values between 1 ms and 65,536 ms.

Sync mode (synchronous-cyclic*):
After receiving a SYNC message transmitted by the master, the encoder transmits the current actual position value. The SYNC counter in the encoder can be parameterised so that the position value is only transmitted after a defined number of SYNC messages.

Acyclic mode (synchronous-acyclic*):
The encoder only transmits the current actual position value after receiving a SYNC message if the position value has changed since the last transmission.

* PDO transmission type
Model KBN

Technical Data

Output level according to ISO / DIS 11898

![Output level diagram]

Bus activation according to ISO / DIS 11898

![Bus activation diagram]

Speed signal

The speed signal is activated by bit 14 = 1 in object 6000hex. With 10 ms (=0) or with 100 ms (=1), bit 15 defines the gate time for recording the speed signal. To calculate the speed signal, the system works internally with the max. resolution of 16 bits (65,536 steps/revolution) and with the corresponding gate time. The measured speed value is entered in the objects 1A00 hex and 1A01 hex. The data format of the PDO position value (2 bytes) and speed signal (2 bytes) has a length of 4 bytes (see data format).

Principle circuit diagram

![Principle circuit diagram]
Technical Data

Data format (without speed signal)

PDO 1

<table>
<thead>
<tr>
<th>Data Byte 0</th>
<th>Data Byte 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7</td>
<td>8 9 10 11 12 13 14 15</td>
</tr>
</tbody>
</table>

16 significant data bits

Data format (with speed signal)

PDO 1 / PDO 2

<table>
<thead>
<tr>
<th>Data Byte 0</th>
<th>Data Byte 1</th>
<th>Data Byte 2</th>
<th>Data Byte 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 1 2 3 4 5 6 7</td>
<td>8 9 10 11 12 13 14 15</td>
<td>0 1 2 3 4 5 6 7</td>
<td>8 9 10 11 12 13 14 15</td>
</tr>
</tbody>
</table>

16 significant data bits

Absolute encoder parameters

- Code sense*: CW / CCW
- Resolution: 2 to 8192 steps / 360°
  Optional: 14-, 15-, 16-bit
- Reference value: 0 to total number of steps -1
- Serial number: Long integer value
* Looking at the flange side

Electrical data

- Sensor system: GaAlAs diode - photo array
- Resolution (standard): 8192 steps / 360° - 13-bit
  Optional: 14-, 15-, 16-bit
- Division code: Grey
- Output code: Binary
- Measurement step dev.: ≤ ± 1' 59" with 13-bit (± 1 digit)
- CAN interface: ISO / DIS 11898 (physical)
- Operating voltage: + 11 to + 30 VDC
- Operating current: 70 mA typ. / 90 mA max.
- EMC standards: EN 50081-2, EN 50082-2
Model KBN

Technical Data

Mechanical data
- Operating speed: 10,000 rpm max.
- Angular acceleration: $10^5$ rad/s² max.
- Moment of inertia (rotor): 15 gcm²
- Operating torque:
  - ≤ 3 Ncm (KBN 58-S)
  - ≤ 8 Ncm (KBN 58-K)
- Starting torque:
  - ≤ 1 Ncm (KBN 58-S)
  - ≤ 4 Ncm (KBN 58-K)
- Perm. shaft load:
  - 100 N axial
  - 100 N radial
- Bearing service life: $10^9$ revolutions
- Weight: Approx. 0.6 kg

Environmental data
- Operating temperature range: -20 °C to +60 °C
- Storage temperature range: -20 °C to +60 °C (due to packaging)
- Perm. relative humidity: 85% without condensation
- Resistance:
  - To shock: 200 m/s², 11 ms, DIN EN 60068-2-27
  - To vibration: 10 Hz ... 1000 Hz; 100 m/s², DIN EN 60068-2-6
- Protection types (DIN EN 60529)
  - KBN 58-S: IP 64
  - KBN 58-K: IP 66 (Simmerring)

Connecting cap ZKC
T-coupler functionality with integrated addressing, planned for the following functions and connection cables:
- Node ID (1-6), baud rate (7-8) and bus terminating resistor (9-10) setting via DIP switches.
- Diagnostic LEDs
- 1 cable for the supply voltage (+ $V_S = 24$ VDC, - $V_S = 0$ VDC), cable gland PG 7
- 1 cable for bus in, cable gland PG 9
- 1 cable for bus out, cable gland PG 9

Documentation and supply sources
- Device Profile for Encoders, CiA Draft Standard 406, Version 3.0
- CANopen Application Layer and Communication Profile, CiA Draft Standard 301, Version 4.1
- CANopen Cabling and Connector Pin Assignment, CiA Draft Recommendation Proposal 303-1, Version 1.1.1
- CiA - CAN in Automation
  Kontumazgarten 3
  D-90429 Nürenberg
  www.can-cia.org
- TWK user manual KBN 11278 and
  EDS file from info@twk.de
Model KBN

Order number

Absolute encoder

<table>
<thead>
<tr>
<th>KBN 58</th>
<th>S</th>
<th>8192</th>
<th>R</th>
<th>C1</th>
<th>Z</th>
<th>01</th>
</tr>
</thead>
</table>

| Electrical and / or mechanical variants * |
| 01 Standard |

| Electrical connection: |
| Z Connecting cap |

| Profil: |
| C1 C1-CANopen, DS 406 version 3.0 |

| Output code: |
| R Binary |

| Resolution: |
| 8192 Steps / 360° |
| 16,384 Steps / 360° |
| 32,768 Steps / 360° |
| 65,536 Steps / 360° |

| Design form |
| S Synchroniser flange |
| K Clamped flange |

KBN 58 Model series KBN 58

Connecting cap ZKC

<table>
<thead>
<tr>
<th>ZKC</th>
<th>N</th>
<th>01</th>
</tr>
</thead>
</table>

| Electrical and / or mechanical variants * |
| 01 Standard |

| N CANopen |

ZKC Connecting cap for model series KBN

The cap is listed and supplied as a separate order item. It can be separated from the absolute encoder for setting purposes by releasing two screws.

* 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.
Model KBN

Installation drawing

Dimensions in mm

**Model KBN 58-S**  
(Synchroniser flange)

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**Model KBN 58-K**  
(Clamped flange)

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**Accessories**

**Series KL 66-2-S securing clamps**  
(3 units required in each case)

- Pitch diameter: 71.5 + 0.5 mm
- Material: Stainless steel (1.4305)
- Required screws: M4 countersunk head with hexagon socket DIN 7991
### Model KBN

#### Connecting cap

**Connecting cap ZKC**

- **Screw plug** (Push button for reference value)
- **Fastening screws** (permanently inserted)
- **LED status displays**
- **Connection terminal 1**

<table>
<thead>
<tr>
<th>Status LEDs</th>
<th>V_S</th>
<th>DATA</th>
<th>COM</th>
<th>Err</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating voltage</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process data communication and communication OK</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Communication warning</td>
<td></td>
<td>Flash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus off</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error which triggers the emergency message or the SDO abort transfer protocol</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DIP switch</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>ON = 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OFF = 0</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Address 1 - 64 can be set** (1: default address)
- **Terminating resistor: on**
- **Terminating resistor: off**