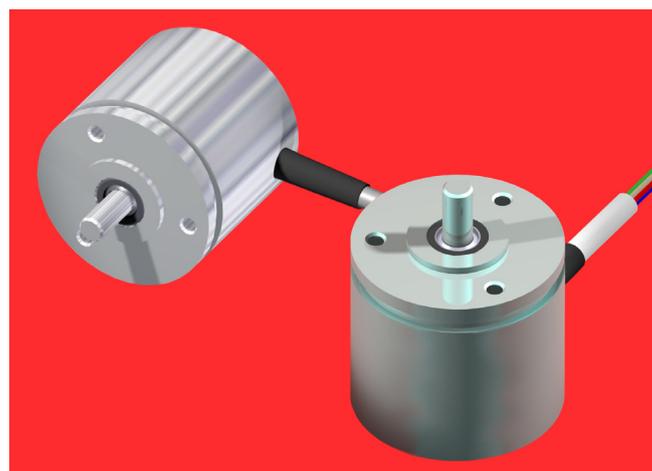


- Compact, robust design for mechanical engineering, instrumentation and outdoor application
- Resolution: 4096 positions / 360° (12 Bits)
- With digital or analogue interfaces
- Case in aluminium or stainless steel
- Optional potting for positive shock and vibration protection
- Two - chamber construction to separate rotating components from electronic circuits
- Protection grades: IP 66 or IP 69K (option)
- Working temperature range: - 40 °C to + 85 °C



Construction

Robust case either in seawater resistant aluminum or in stainless steel - shaft in stainless steel - rotating components with permanent magnet in front chamber - electronic circuit with ASIC and Hall elements and interface components fitted within main chamber, separated from rotating components by a metallic wall - optional potting against water jets (IP 69K) - electrical connections via cable leads with inspection plug.

Electronic interfaces

- **TBE 42:** Synchronous serial SSI (page 2)
- **TBI 42:** Incremental (page 3)
- **TBN 42:** CANopen (page 4)
- **TBA 42:** Analogue (page 5)

Mechanical data of all models

- Measuring range: ≤ 360° ↺
- Operating speed: 1,000 rpm max.
(10,000 rpm / optional)
- Angular acceleration: 10⁵ rad/s² max.
- Inertial mass (rotor): 20 gcm²
- Operating torque: ≤ 8 Ncm at 500 rpm
- Wind-up torque: ≤ 4 Ncm
- Permissible shaft loads: 50 N (axial and radial)
- Bearing life expectancy: ≥ 10⁹ revolutions
- Mass: 0.2 kg approx. (aluminium)
0.3 kg approx. (stainless steel)

Dimensions, materials and accessories: Page 6

Electrical data of all models

- Sensor system: ASIC with Hall elements
- Measuring position deviation: ± 0.5 LSB
- EMC standards: EN 50081-2, EN 50082-2

Environmental data of all models

- Operating temperature: - 40 °C to + 85 °C
- Storage temperature: - 20 °C to + 60 °C
(dependant on packing materials)
- Resistance to shock: 500 m/s² ; 11 ms
(DIN EN 60068-2-27)
- Resistance to vibration: 10 Hz ... 2000 Hz ; 500 m/s²
(DIN EN 60068-2-6)
- Protection grades: IP 66
(DIN EN 60529) IP 69K (with optional potting of main chamber)

The connection data are supplied with each item.



Model TBE 42: Synchronous Serial Interface - 12 Bits / 360°

Function

The absolute angle information derived by the encoder is converted into serial information by an internal parallel-serial converter and then transmitted to a receiving electronic circuit in synchronism with a clock. Important advantages are : Low number of data lines and high reliability.

Maximum data transmission rate

The data rate is defined by the following factors:

- Clock frequency 1 MHz max up to 40 meters connection line
- Delay time of the overall electronics (between 40 and 150 meters)

$$t_{GV} = t_C + 2t_K + t_E$$

t_{GV} : Total delay time

t_C : Delay time of the encoder electronics, e. g. ≤ 300 ns

t_K : Delay time of lead, depending on type and length, e. g. speed 6.5 ns/m

t_E : Delay time of receiving electronics, e. g. 150 ns

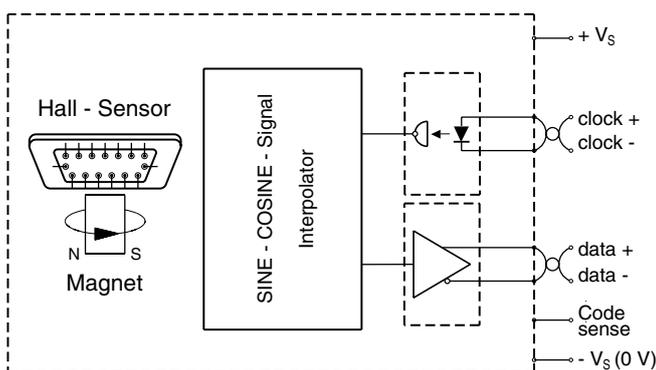
Admitting a security gap of 50 ns between the periods of clock t_T and the delay time of the overall electronics t_{GV} the result is shown as follows:

$$t_T = 500 \text{ ns} + 2t_K$$

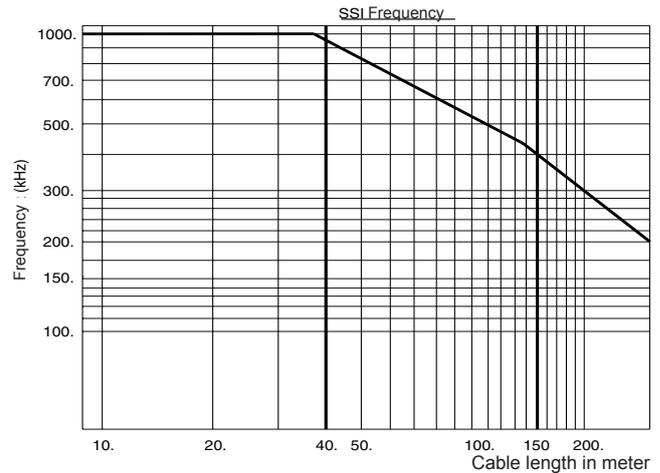
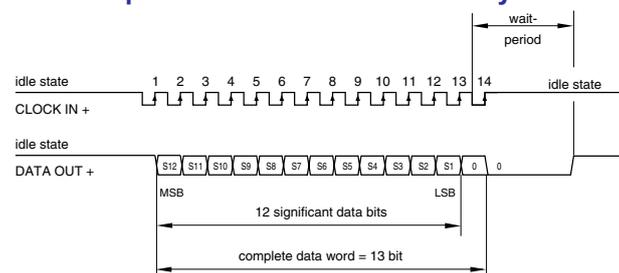
- To RS422 specification starting at 150 m approximately

The opposite diagram is based on the above data.

Block diagram



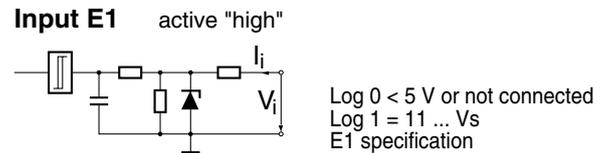
Interface profile SSI - 13 Bits nat. binary



Electrical data

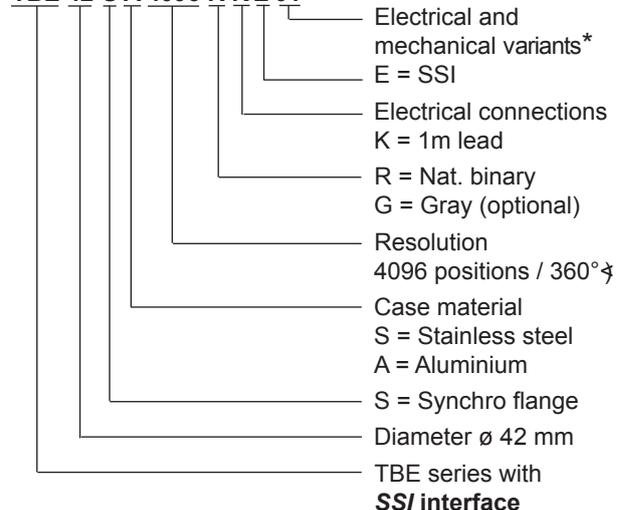
- Supply voltage range: + 11 VDC to + 28 VDC
- Supply current: 70 mA typ. / 90 mA max.
- Resolution (standard): 4096 positions / 360° (12 Bits) (13 Bits optional)
- Output code: Nat. binary (Gray optional)
- Code sense: CW or CCW to be chosen via input E1
- Serial output: Differential data output to RS 422
- Clock input: Differential data input to RS 422
- Monoflop time: 16 ± 10 µs (standard)
- Clock rate: 1 MHz max.

Input circuits 1



Order code format

TBE 42-S A 4096 R KE 01



* The basic versions in accordance with the data sheet bear the code number 01. Variations from the basic version are indicated with a consecutive number and are documented in our works.



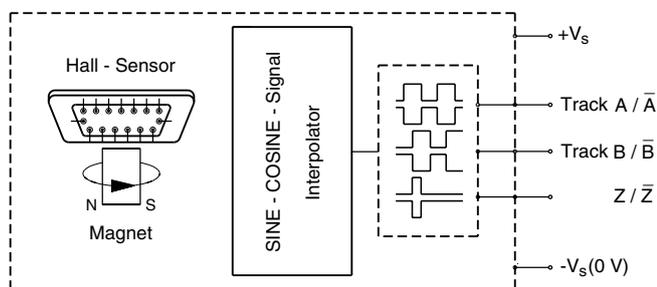
Model TBI 42: Incremental output 1024 counts / per revolution

Electrical data

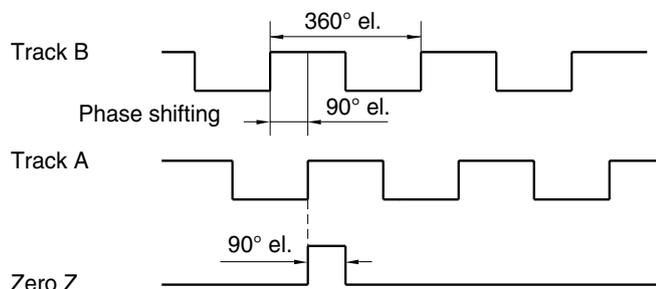
- Number of counts: 1024 (standard)
- Outputs: Tracks A, B and zero plus inversions
- Form of signals: Square
- Other available nos of counts

1	10	32	80	200	500
2	16	40	100	250	512
4	20	50	125	256	1024
8	25	64	128	400	2048

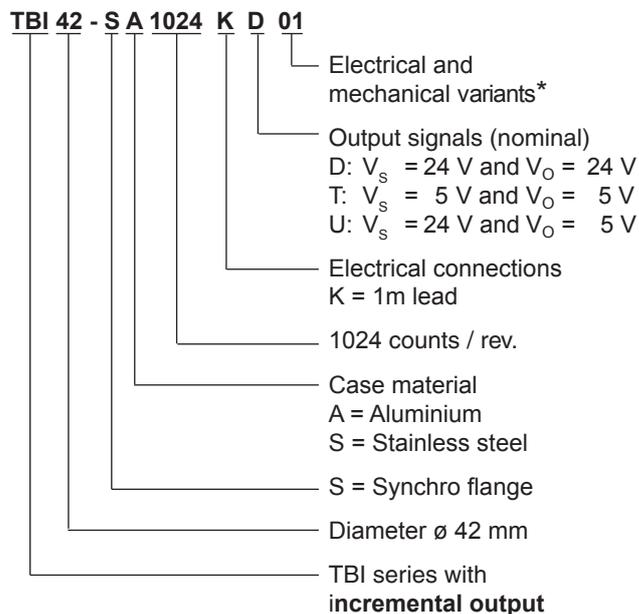
Block diagram



Signal output when CW turning (view on shaft)



Order code format



* The basic versions in accordance with the data sheet bear the code number 01. Variations from the basic version are indicated with a consecutive number and are documented in our works.

Signal data

Signal code	D	T*	U
Supply voltage range V_s	11 to 26 VDC	5 VDC $\pm 5\%$	11 to 26 VDC
Signal current I_o	20 mA	20 mA	5 mA
Signal level (high)	$V_s - 3$ VDC	> 2.8 VDC	> 2.8 VDC
Signal level (low)	< 5 VDC	< 0.5 VDC	< 0.5 VDC
Max. pulse frequency	max. 250 kHz		
Pulse rate	1:1 $\pm 30\%$		
Phase shift	$90^\circ \pm 30\%$		
Length of zero pulse	90° (others upon request)		
Turning sense	CW (standard)		

* compatible to RS 422



Model TBN 42: CANopen interface - 12 Bits / 360°

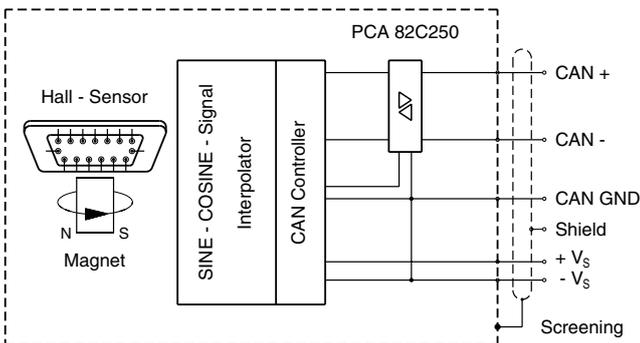
Electrical data

To CANopen Application Layer and Communication Profile, CiA Draft Standard 301, Version 4.1 and to "Device Profile for Encoders CiA Draft Standard Proposal 406 Version 3.0" und CANopen Layer setting Services and Protocol (LSS), CiA DSP 305.

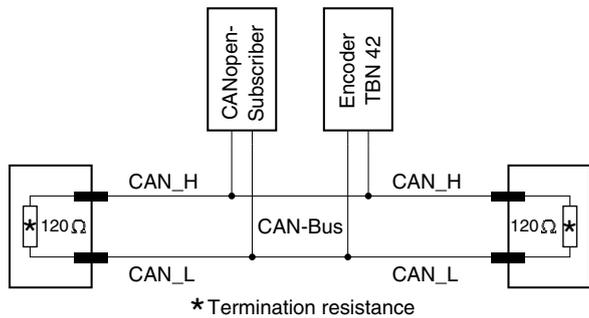
- Supply voltage range: + 11 VDC to + 26 VDC
- Power consumption: < 1 W
- Starting current: < 200 mA
- Resolution: 4096 positions / 360° † - (12 Bits) (13 Bit Option)
- Output code: Nat. binary
- Code sense: CW / CCW
- Reference value: 0 - (total capacity less 1)
- CAN-Interface: to ISO/DIS 11898
- Addressing: via LMT / LSS
- Termination resistance: by separate implementation
- Max. transmission length: 200 m*

* No galvanic isolation between power supply and bus (see CiA DS301)

Block diagram



Bus configuration to ISO / DIS 11898



Data profile CANopen

PDO 1/2

Data Byte 0								Data Byte 1							
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
												0	0	0	0
LSB								MSB							
← 12 significant data bits →															

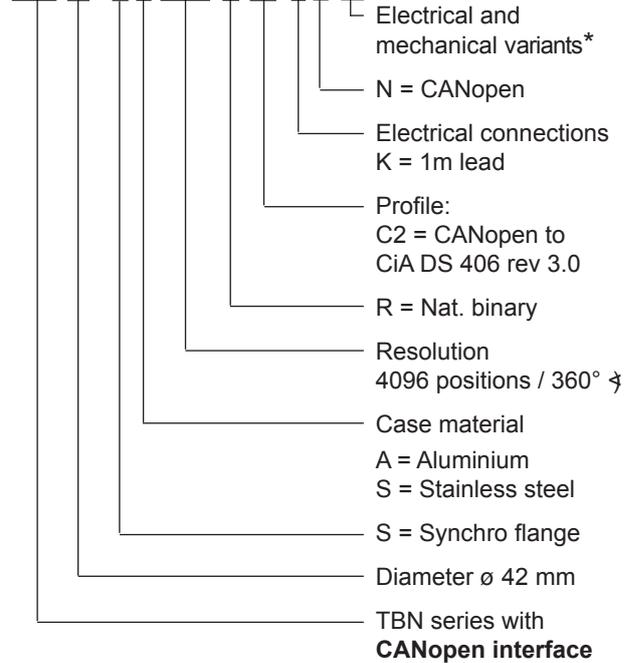
CANopen features

- 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 PDOs: 2 Tx
- PDO-Modes: sync, async, cyclic, acyclic
- Variables PDO-Mapping: no
- Emergency Message: yes
- Heartbeat: yes
- No. of SDOs: 1 Rx / 1 Tx
- Device Profile: CiA DSP 406 Version 3.0

For detailed description of the CANopen profile pl. refer to application manual TXN 11551.

Order code format

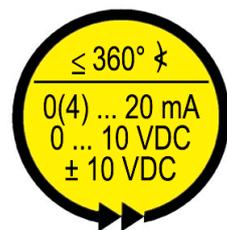
TBN 42 - S A 4096 R C2 K N 01



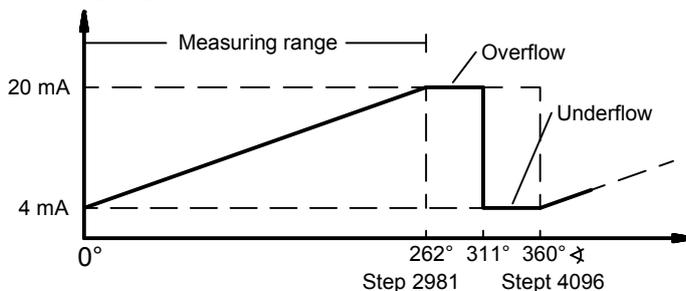
* The basic versions in accordance with the data sheet bear the code number 01. Variations from the basic version are indicated with a consecutive number and are documented in our works.

Model TBA 42: Analogue outputs 0-20 mA, 4-20 mA, 0-10 VDC or ± 10 VDC

In order to record mechanical variables such as angles, rotary movements or positions, the contactless electromagnetic sensor system is extended with a 12-bit (with 360° measuring angle) D/A converter so that the measured variable is available as an analogue signal from 0 (4) to 20 mA, 0 to 10 V or ± 10 VDC. - As standard, the encoders are designed for a measuring angle of 360°. At the request of the customer, other measuring angles can also be set with the specified output signals in the factory. A symmetrical overflow / underflow value is output outside of the measuring range (see characteristic curve).



Characteristic curve: measuring angle 262° as an example



Electrical data

- Resolution at 360°: 12 Bits
- Measuring range: 360° ± (90° or 180° at option) (other ranges upon request)
- Output signals:
 - A: 0 to 20 mA
 - B: 4 to 20 mA
 - C: 0 to 10 VDC
 - D: ± 10 VDC
- Signal sense: CW (CCW at option)
- Zero shift: At option
- Supply voltage range: 20 to 28 VDC (output A,B,C) ± 13 to ± 16 VDC (output D)
- Supply current: 50 mA typ. / 60 mA max.
- Linearity: ≤ 0.5 %
- Repeatability: ≤ 0.2 %
- Temperature drift: < 0.01 % / ° K / typ.

Current output accuracy

- at starting point 0 mA: 0 mA ± 50 µA
- 4 mA: 4 mA ± 50 µA
- at end point 20 mA: 20 mA ± 50 µA
- Load resistance: 0 to 500 Ω at V_S = 20 to 28 VDC

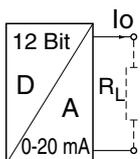
Voltage output accuracy

- at starting point 0 V: 0 V + 0.1 V (output 0 - 10 V)
- 0 V ± 25 mV (output ± 10 V)
- at end point 10 V: 10 V ± 25 mV
- ± 10 V: ± 10 V ± 50 mV
- Output current: 5 mA max. When load resistance > 2 kΩ (short circuit proof)

Output circuits

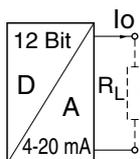
Output A

I_o = 0 - 20 mA
R_L = 0 - 0.5 k



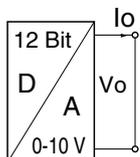
Output B

I_o = 4 - 20 mA
R_L = 0 - 0.5 k



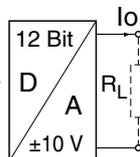
Output C

V_o = 0 ... 10 V
I_{o_max} = 5 mA
R_{min} = 2 k

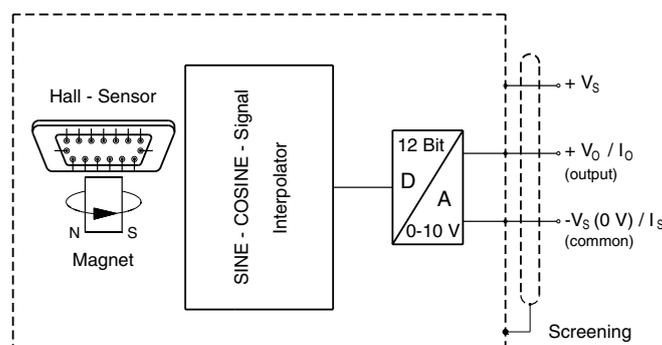


Output D

V_o = -10 ... +10 V
I_{o_max} = 5 mA
R_{min} = 2 k

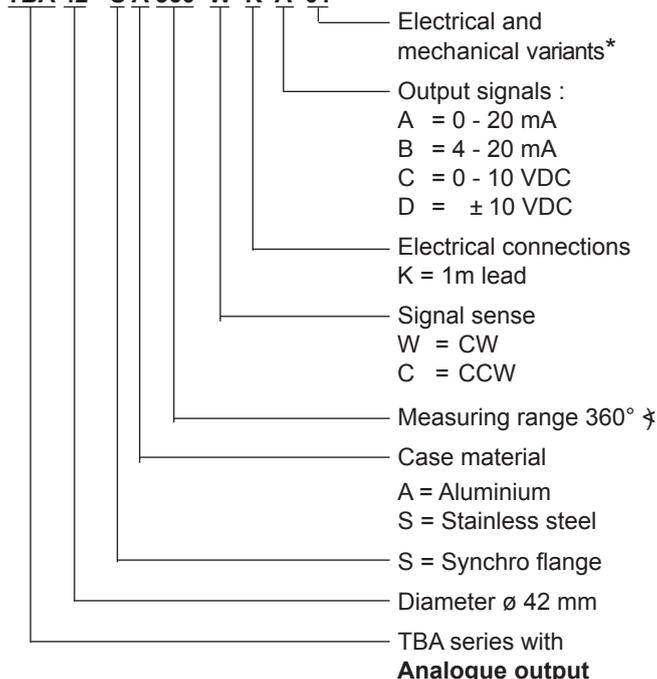


Block diagram



Order code format

TBA 42 - S A 360 W K A 01



* The basic versions in accordance with the data sheet bear the code number 01. Variations from the basic version are indicated with a consecutive number and are documented in our works.

