SUPREME SENSING

TWK

Absolute rotary encoder
Model ABN/ARN
Interface: CANopen Safety

Document no.:
AXN 16340 DE
24.10.2023

- ■ **Absolute singleturn/multiturn rotary encoder**

- ■ **Resolution**

  - □ **ABN**   **4.194.304 steps/360° (22 Bit)**
  - □ **ARN**   **1.048.576 steps/360° (20 Bit)**
    at 4.096 turns

- ■ **Absolute accuracy**

  - □ **ABN**   **≤ ± 10 arcsec**
  - □ **ARN**   **≤ ± 20 arcsec**

- ■ **Protection class IP65 according to EN 60529**

- ■ **Interface**

  - □ **CANopen**
  - □ **CANopen Safety**
    (CiA DS 406 Encoder Profile, 4.0.2)

- ■ **SIL2 / Performance Level PLd in preparation**

KEY INFORMATION OVERVIEW

DESIGN & FUNCTION

- ■ Robust housing made of seawater-resistant aluminium (AlMgSi1 - 3.2315) or stainless steel 1.4305

- ■ Design Ø 58 mm

- ■ Optical sensor system for position detection

- ■ Detection of revolutions through absolute multiturn gearbox (ARN only)

- ■ Electrical connection via plug M12x1

- ■ Interface as CANopen Safety according to IEC 61508 or as CANopen

A positive mechanical connection between the customer shaft and the sensor shaft ensures that the sensor shaft exactly reproduces the rotation of the customer shaft.

With the ABN, one revolution, i.e. max. 4,194,304 steps, is detected.

With the absolute gearbox, the ARN encoder achieves a measuring range of 4096 revolutions.

With the CANopen safety protocol, both the position value and the speed value (SRDO - Safety Relevant Data Object) conform to the requirements of SIL2. The values of the redundant system are compared with each other and checked for plausibility. If the check is positive, the output is normal and bit-inverted.

Extensive checks by means of CRC, timing monitoring, voltage monitoring, etc. enable the output of safe position and speed values. The speed value can be parameterised via the gate time (1 to 1000 ms) depending on the application. In the event of an error, error protocols (emergency protocols) are output and an error listing is created. The target function is that the system switches to a safe state in the event of an error. This is also referred to as the functional safety of the encoder.

The position and speed values (PDO - Process Data Object) are also output via the CANopen standard protocol.

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TECHNICAL DATA

ELECTRICAL DATA

Sensor system. . . . . Optical sensor system
Operating voltage . . . . 9 to 36 VDC reverse polarity protected and short-circuit protection
Power consumption. < 1.5 W
Resolution . . . . ABN: up to 22 bits (4,194,304 steps/360°)
ARN: up to 20 bits (1,048,576 steps/360°) + 12 bits (4,096 revolutions)
Total number of steps . . . . ABN: 4,194,304 steps (at 22 bit resolution)
ARN: 4,294,967,296 steps (1,048,576 x 4,096, at 20 bits resolution)
Accuracy . . . . ABN: ≤ ±10 arcsec
ARN: ≤ ±20 arcsec
Speed value . . . . In addition to the position signal, a velocity signal is generated in digits/gate time,
which can be adapted to the application by the customer via an adjustable gate time.
- Data format velocity value: Word
- Gate time: 1 to 1,000 ms
- Internal sampling rate: 1 ms
- Maximum speed: approx. 1,200 rpm (at 14 bits, gate time 100 ms)
Code path . . . . CW* or CCW**, parameterisable
Reference value . . . . 0 to (total number of steps -1)

CANOPEN / CANOPEN SAFETY SPECIFICATION OVERVIEW

CiA DS301. . . . . CANopen Application Layer and Communication Profile, Version 4.1
CiA DS406. . . . . CANopen - Device Profile for Encoders, Version 4.0.2
CiA DS305. . . . . CANopen - Layer Setting Sevices and Protocol (LSS)
DIN EN 50325-5: 2016-06. . . . . Industrial communication subsystem based on ISO 11898 (CAN)
Part 5: Funcionally safe communication based on EN 50325-4
CAN interface . . . . according to ISO/DIS 11898
Address setting . . . . via LMT/LSS or SDO
Terminating resistance . . . . to be implemented separately
Max. transmission length. . . . . 30 m
Bootloader function . . . . yes
System prerequisites:
- PCAN-USB adapter (www.peak-system.com) including USB cable for PC connection
- Software CANopen tester TWK, hex file for updating
- Connection cable for encoder
Number of PDOs. . . . . 2 Tx
Number of SRDOs . . . . 2 Tx (CANopen Safety)
PDO modes. . . . . sync, async, cyclic, acyclic
SRDO mode . . . . cyclic (CANopen Safety)
Variables PDO-mapping . . . . no
Emergency message. . . . . yes
Heartbeat. . . . . yes
No. of SDOs . . . . 1 Rx/1 Tx
Device Profile: . . . . CiA DSP 406 Version 4.0.2

The details of the profile are described in the user manual 15469. The CRC calculation is carried out with the program CRC-Calculator, which is available at www.twk.de.

* CW = increasing output value when looking at the shaft clockwise
** CCW = increasing output value when looking at the shaft counter-clockwise

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TECHNICAL DATA

SYSTEM DATA

Duty cycle (rise time) of supply voltage . . . . . 500 ms (10 % to 90 %)
Information density . . . . up to 10 000 messages/s
Storage cycle time. 3 s per memory cycle
Setup time . . . . ≤ 2 s
Time between detection
of an error to the output
of the emergency message . . . . 100 ms (power supply)
5 s (RAM test, all individual bits ok)
2 s (ROM test (within setup time))
Safety standard . . . . IEC 61508 2017: Functional safety of safety-related electrical/electronic/programmable electronic systems
EDS file . . . . the EDS file is available on request

MECHANICAL DATA

Operating speed . . . . 10,000 min^{-1} max.
Angular acceleration . . . . 10^5 rad/s² max.
Operating torque . . . . ≤ 8 Ncm (at 500 min^{-1})
Starting torque. . . . . ≤ 3 Ncm
Permissable shaft load . . . . 250 N axial, 250 N radial
Bearing service life . . . . ≥ 10^9 rotations*.
Mass . . . . ABN: ≤ 600 g
ARN: ≤ 1,000 g (depending on the design and material used).

ENVIRONMENTAL DATA

Operating temperature range . . . . - 40 °C to + 85 °C
Storage temperature range . . . . - 20 °C to + 60 °C (depending on packaging)
Resistance against shock . . . . 250 m/s², 6 ms, each 100 x in 3 axes DIN EN 60068-2-27
Resistance against vibration . . . . 100 m/s², 5 Hz ... 2000 Hz, 1 h each in 3 axes DIN EN 60068-2-6
Protection class . . . . IP65 according to EN 60529
(For higher degrees of protection up to IP69K, please get in touch with our technical contacts).

* This value applies at maximum shaft load

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TECHNICAL DATA
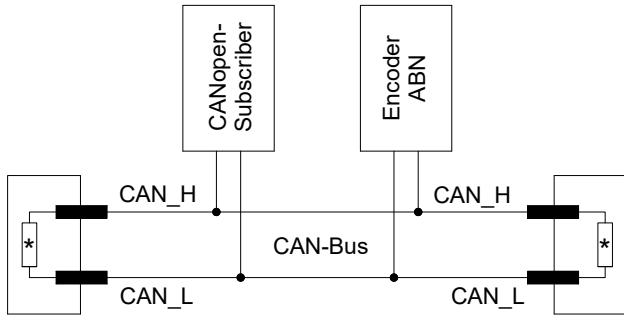
EMC STANDARDS

EN 61000-6-4:2006 + A1:2011	EMC Part 6-4: Generic standards-Emision standard for industrial environments
EN 61000-6-2:2005	EMC Part 6-2: Generic standards-Immunity for industrial environments
EN 61000-4-2:2009	EMC Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test
EN 61000-4-3:2006 A1:2008 + A2:2010	EMC Part 4-3: Testing and measurement techniques - Radiated, radio frequency. electromagnetic field immunity test
EN 61000-4-4:2004	EMC Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test
EN 61000-4-5:2006	EMC Part 4-5: Testing and measurement techniques - Surge immunity test
EN 61000-4-6:2009	EMC Part 4-6: Testing and measurement techniques - Immunity to conducted disturbances, induced by radio-frequency fields
EN 61000-4-8:2010	EMC Part 4-8: Testing and measurement techniques - Power frequency magnetic field immunity test. Power frequency magnetic field immunity test: 30 A/m, test criterion A, 100 A/m, test criterion B
EN 61000-4-29:2000	EMC Part 4-8: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests
IEC 61326-3-2:2018	Electrical equipment for measurement, control and labortory use - EMC requirements Part 3-2: Immunity for safety-related systems and for equipment intended to perform safety related functions (functional safety) - industrial applications with specified electromagnetic environment

SAFETY DATA

Maximum usage duration . . . . 20 years
HFT . . . . 0 (Hardware fault tolerance, ability of a hardware to continue to perform a requested function despite errors or deviations)

SUPREME SENSING

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Absolute rotary encoder
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Interface: CANopen Safety
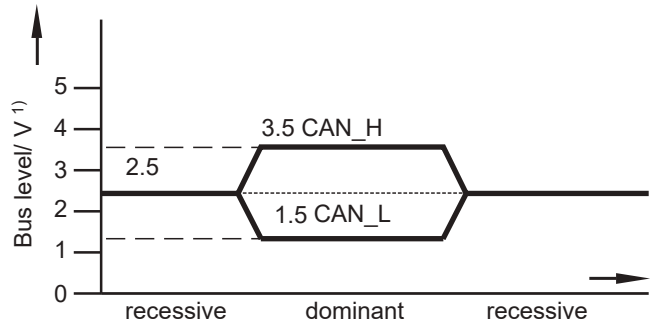
Document no.:
AXN 16340 DE
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TECHNICAL DATA / PRODUCT CHARACTERISTICS

BUS CONNECTION AS PER ISO/DIS 11898
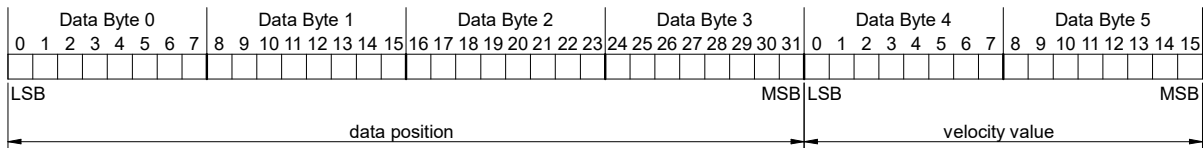

*Termination resistance (120 Ω)

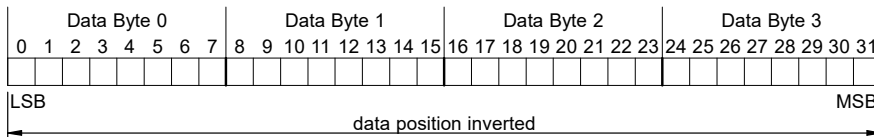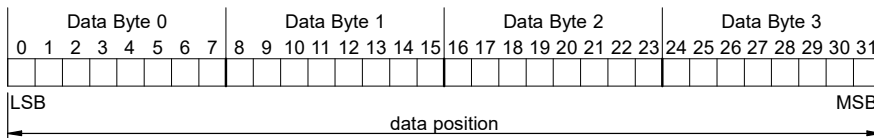### OUTPUT LEVEL AS PER ISO/DIS 11898

1) at Common-Mode-Voltage = 0 V

DATA PROFILE CANOPEN STANDARD AND CANOPEN SAFETY

PDO1/2 (POSITION AND SPEED)
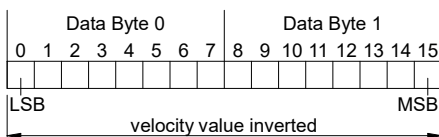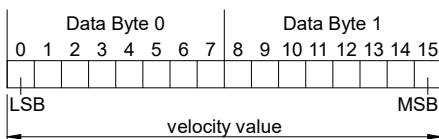

SRDO1 (POSITION) - NORMAL AND BIT-INVERTED

SRDO2 (SPEED) - NORMAL AND BIT-INVERTED

SUPREME SENSORING

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Document no.:
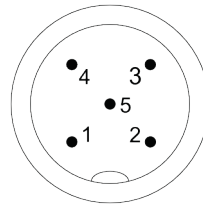AXN 16340 DE
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ELECTRICAL CONNECTION - PINOUT

PIN DIAGRAM VIEW ON CONTACT SIDE

■ AXN Ø 58: 1 x connector, M12x1, pins, 5-pole, A-coded

■ The connection assignment TYxxxxx is part of the scope of supply and is included with each device

M12 CONNECTOR, A-CODED, PINS/MALE

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ORDER CODE FORMAT

ABN	58 - S	A	22	S0	S	N	01	STANDARD VERSION

ABN	Optical singleturn encoder with CANopen interface		
58 - S	Design form, shaft and axis	58 - S 58 - ST	Synchro flange, shaft Ø 6 mm Synchro flange, shaft Ø 6 mm with flattened area
A	Housing material	A S	Aluminium 3.2315 (AlMgSi1) Stainless steel 1.4305 (AISI 303)
22	Resolution	20 21 22	20 bits = 1.048.576 steps / 360° 21 bits = 2.097.152 steps / 360° 22 bits = 4.194.304 steps / 360°
S0	Profile	C3 S0	Standard CANopen, profile version 4.0.2 CANopen Safety SIL2 compliant (not certified), profile version 4.0.2
S	Electrical connection	S	Device connector M12-A, pins, 5-pole, radial
N	Output	N	CANopen-Interface
01	Electrical and mechanical variants*	01	Standard

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

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Absolute **rotary encoder**
Model **ABN/ARN**
Interface: **CANopen Safety**

Document no.:
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ORDER CODE FORMAT

ARN	58 - S	A	20	R	12	S0	S	N	01	STANDARD VERSION

ARN	Optical multiturn encoder with CANopen interface			
58 - S	Design form, shaft and axis	58 - S 58 - ST	Synchro flange, shaft Ø 6 mm Synchro flange, shaft Ø 6 mm with flattened area	
A	Housing material	A S	Aluminium 3.2315 (AlMgSi1) Stainless steel 1.4305 (AISI 303)	
20	Resolution	20	20 bits = 1.048.576 steps / 360°	
R	Code	R S	Binary Binary with slewing ring functionality	
12	Measuring range	12	12 bits = 4096 revolutions	
S0	Profile	C3 S0	Standard CANopen, profile version 4.0.2 CANopen Safety SIL2 compliant (not certified), profile version 4.0.2	
S	Electrical connection	S	Device connector M12-A, pins, 5-pole, radial	
N	Output	N	CANopen-Interface	
01	Electrical and mechanical variants*	01	Standard	

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

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ACCESSORIES (PLEASE NOTE THE DESIGN VERSIONS OF THE ENCODERS)

MATING CONNECTORS (ORDER SEPARATELY)

Order identification	STK5GS56	STK5WS58	STK5GS107
Type	M12x1	M12x1	M12x1
Pole number	5	5	5
Contact design	Socket, A-coded	Socket, A-coded	Socket, A-coded
Connector design	straight	angled	straight
Housing material	Brass, nickel-plated	Brass, nickel-plated	Stainless steel, 1.4404
Cable ø (mm)	6 - 8	6 - 8	5,5 - 8,6
Connection type	Screws	Screws	Screws
Protection class	IP67	IP67	IP67
Max. wire size (mm^2)	0,75	0,75	0,75

PLAY-FREE BELLOWS COUPLING BKM 26 / X - Y

x and y: Bore diameter for shaft mounting
BKM 26 / x - y . . . . Data sheet BKM 11995
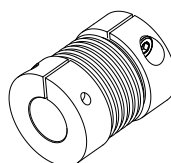
PLAY-FREE BELLOWS COUPLING BKK 32 / X - Y

x and y: Bore diameter for shaft mounting
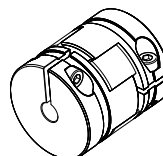**BKK32 / x - y** . . . . Data sheet BKK 11840

PLAY-FREE CLAMP COUPLING KK14S / X - Y (WITHOUT GROOVE)

x and y: Bore diameter for shaft mounting
KK14S / x - y . . . . Data sheet KK 12301

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Document no.:
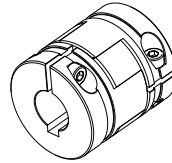AXN 16340 DE
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ACCESSORIES (PLEASE NOTE THE DESIGN VERSIONS OF THE ENCODERS.

PLAY-FREE CLAMP COUPLING KK14N / X - Y (WITH GROOVE)
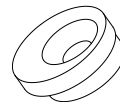
x and y: Bore diameter for shaft mounting
KK14N / x - y . . . . Data sheet KK 12301

MOUNTING BRACKETS

Mounting brackets for encoder mounting
MZ . . . . Data sheet MZ 10111

TORQUE SUPPORT

Torque support/stator coupling. Can be used as encoder bracket
for shaft version 'clamping shaft' (on request) to compensate radial and
axial play of the drive shaft for rotary encoders of the design Ø 58 mm.
ZMS58 . . . . Data sheet ZMS 12939

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INSTALLATION DRAWINGS

MODEL ABN58-SA22S0SN01

Dimensions in mm

Position Typenschild
Position nameplate

14 ±0.5

71 ±0.5

4
3
6

⌀ 58
⌀ 50 f7
⌀ 6 f7

⌀ 50

Lesbarkeit
Readability

Typenschild
Nameplate

ca. 40

ca. 54

120°

M4x8

Wellendichtring
Shaft seal

⌀ 42 ±0.1

Position Kodierstift
Position coding pin

Sensorstecker M12
5-polig, Stifte, A-Kodierung
ausgerichtet
Sensor connector M12
5-pole, pins, A-coded
aligned