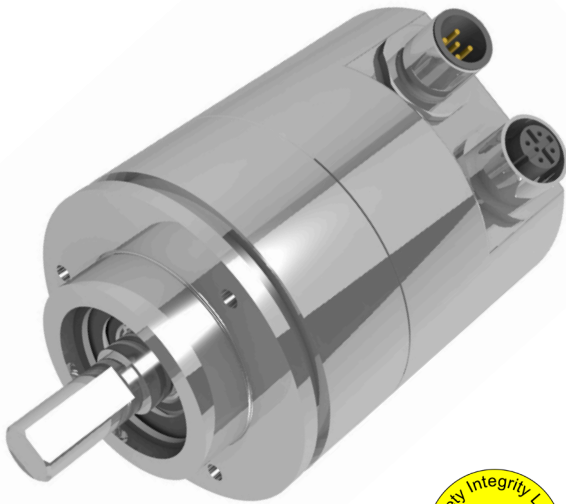


High resolution Absolute single-turn rotary encoder Model HBN

Document no.: HBN 13218 FE

Date: 30.04.2015



- Robust design for rough applications with high resolution requirement such as crane technology, construction machines and special engineering
- High vibration and shock resistance thanks to the compact mechanical design
- Resolution < 22 bit / 360°
- Speed signal in digits/ms with variable gate time
- Protection type IP 66

Design

- Robust housing (wall thickness 5 mm) manufactured from seawater-proof aluminium (AlMgSi1) or stainless steel (material: 1.4305 optionally 1.4404).
- Position recording and evaluation are of a redundant design to implement a reliable position value and speed signal.
- A network in/out module with transient filtering, voltage supply and output driver unit forms the electrical interface.
- Electrical connection via two M12 connectors, 5-pin, pin and socket for bus IN / bus OUT.

Function

A correct mechanical connection between the customer and sensor shaft ensures that the sensor precisely detects the customer shaft's rotations. A safe position is provided by the plausibility check of two sensor systems. Detected errors are evaluated.

The CAN interface outputs the validated position value and speed signal via the CANopen Safety protocol within an SRDO (Safety Relevant Data Object) using 2x2 messages (normal and inverted).

The rotary encoder meets the conditions of safety level SIL2 according to IEC 61508 and performance level "d" according to EN13849. The prerequisite of safety-relevant operation is a failsafe master.

Absolute single-turn rotary encoder with high resolution

Model HBN

Technical data

Electrical data

- Operating voltage: 9 to 36 VDC (protected against polarity reversal)
- Power consumption: < 1.8 W
- Resolution: 16 bit (for higher resolution, please contact our technical staff)
- Code direction: CW* or CCW** can be set
- Reference value: 0 to (total number of steps -1)
- Accuracy: $\leq \pm 0.05 \%$ (with reference to 360°)
- Reproducibility: $\leq \pm 0.01 \%$ (with reference to 360°)
- Temperature drift: < 0.1 % (with reference to 360° over the entire temperature range)
- CAN IC voltage rating: Maximum common mode voltage -7 to +12 V
Maximum allowed voltage at pins ± 36 V

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
- Speed: Digits/gate time (gate time can be set in the 1...1000 ms range, default: 100 ms)***
Speed resolution is fix at 16 bit/revolution

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: 250 N axially, 250 N radially
- Bearing service life: $\geq 10^9$ revolutions ****
- Weight: Aluminium housing approx. 0.4 kg,
stainless steel housing approx. 0.6 kg

Environmental data

- Operating temperature range: - 40 °C to + 85 °C
- Storage temperature range: - 40 °C to + 100 °C (without packaging)
- Resistance
 - To shock: 250 m/s²; 6 ms
DIN EN 60068-2-27
 - To vibration: 200 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 class (DIN EN 60529): IP 66
(for higher protection class, please contact our technical staff)

*) CW = increasing signal clockwise viewed looking towards the shaft

**) CCW = increasing signal counter-clockwise viewed looking towards the shaft

***) If greater gate times are required, please contact our technical staff.

****) This value applies at maximum shaft load.

Absolute single-turn rotary encoder with high resolution Model HBN

Technical data

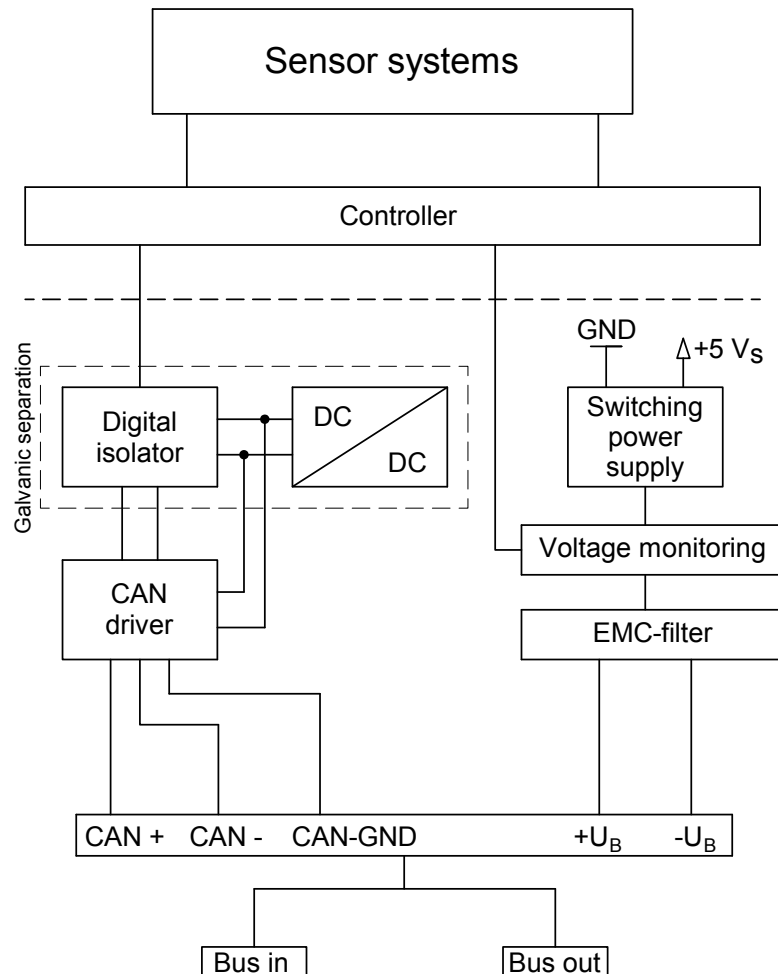
System in general and Safety

- Slew rate power supply: 500 ms (10 % bis 90 %)
- Rate of messages: up to 1000 messages / s
- Time of storage cycles: 3 s per storage cycle
- Setup Time: 2 s

- Time between error recognition and alarm (emergency message): 100 ms (power supply)
5 s (RAM test, single bit error)
2 s (ROM test during setup time)

- Safety data: MTTF > 100 a
- Safety-norms: EN 61508, 1 to 7: 2010
EN 62061: 2005
EN ISO 13849-1: 2008
EN 60947-5-1: 2004 + A1: 2009

Principle circuit diagram



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CANopen features

Interface according to the following specifications

CiA DS301 CANopen Application Layer and Communication Profile, Version 4.1

EN 50325-5

(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 4.0.1

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

Supply 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)

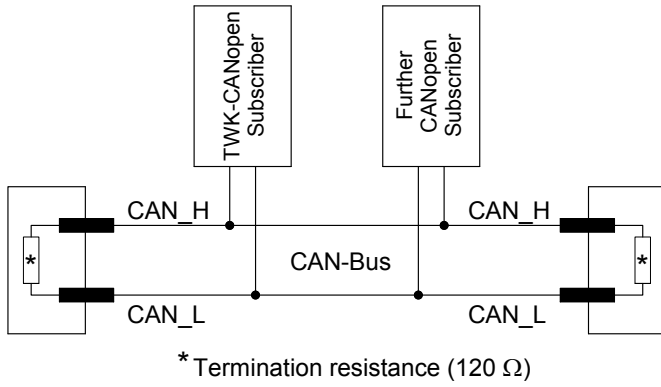
The profile is described in detail in the [NOC13100](#) user manual.

- | | |
|---------------------------|-----------------------|
| ■ 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 SRDO Position: | 1 Tx |
| ■ No of SRDO Velocity: | 1 Tx |
| ■ SRDO mode: | Cyclic |
| ■ Variables SRDO mapping: | No |
| ■ Emergency message: | Yes |
| ■ Heartbeat: | Yes |
| ■ No. of SDOs: | 1 Rx/1 Tx |

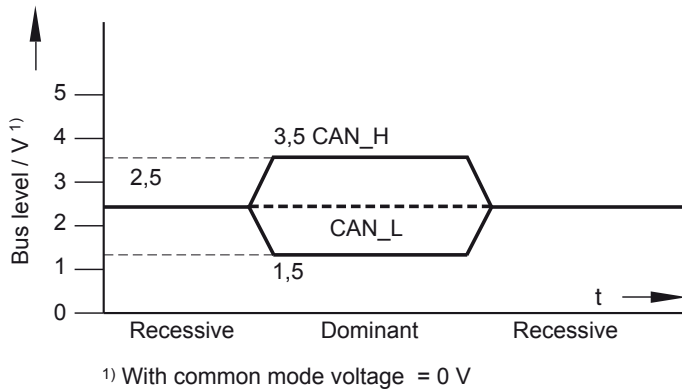
**Absolute single-turn rotary encoder with high resolution
Model HBN**

Bus termination, output level

Bus termination according to ISO / DIS 11898



Output level according to ISO/DIS 11898

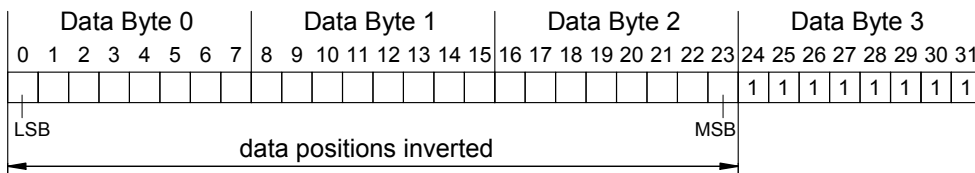
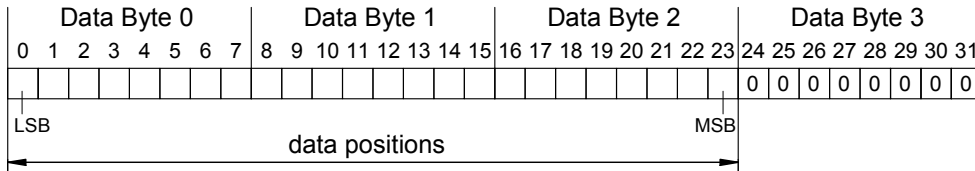


**Absolute single-turn rotary encoder with high resolution
Model HBN**

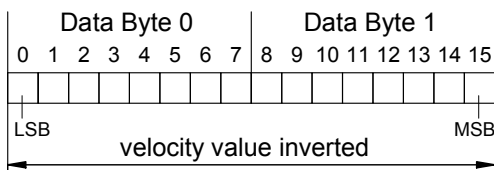
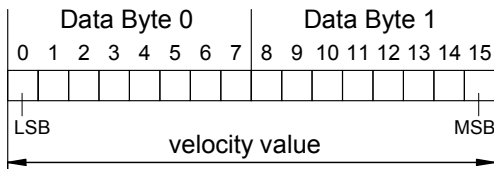
SRDO data format , PDO data format

SRDO data format for HBN/S3 (safety version)

SRDO 1

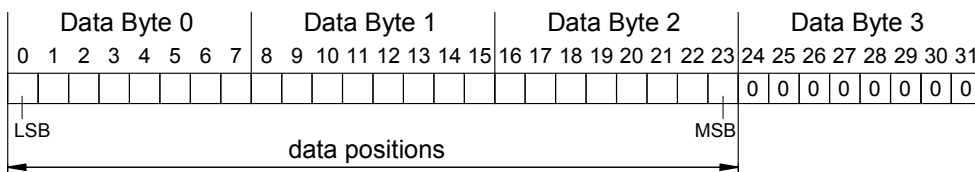


SRDO 2

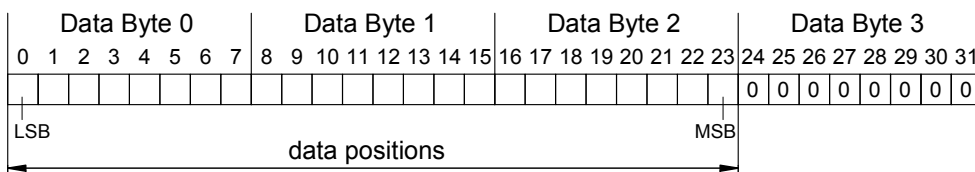


PDO data format for HBN/C3

PDO 1



PDO 2



**Absolute single-turn rotary encoder with high resolution
Model HBN**

Electrical connections, mating connector

Electrical connection

- Two round connectors M12x1, pin and socket for bus IN/OUT, 5-pin, A-coded
- Refer to the tables below for the connection assignments; these are also enclosed with the devices.

Mating connectors (to be ordered separately)

All of the mating connectors listed in the following table are M12X1, 5-pin, A-coded, with screw clamp connection, with protection type IP 67, with screening on the housing and the maximum connection cross-section is 0.75 mm².

Order number	Contact design	Connector design	Housing material	Cable Ø (mm)
STK5GS56	Socket	Straight	Nickel-plated brass	4 - 6
STK5GP90	Pin	Straight	Nickel-plated brass	4 - 6
STK5WS58	Socket	Angled	Nickel-plated brass	4 - 6
STK5WP102	Pin	Angled	Nickel-plated brass	4 - 6
STK5GS107	Socket	Straight	Stainless steel	5.5 – 8.6
STK5GP106	Pin	Straight	Stainless steel	5.5 – 8.6

Please note: if angled mating connectors are used, please notify us so that the device connectors can be aligned accordingly.

Absolute single-turn rotary encoder with high resolution Model HBN

Connector S1 and S2 contact assignment for standard version

Note: This is the contact assignment for the standard version. Other versions may have a different contact assignment. In this case, please observe connection assignment TY enclosed with each device.

Different M12 connector combinations or assignments are possible at the request of the customer.

For the following description and pictorials is valid: Viewed looking at the PIN side of the connector installed in the HBN.

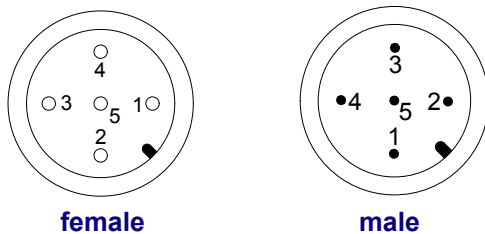
There is one connector for Bus-In and Bus-Out each for the HBN. If there is only Bus-In, the female connector Bus-Out is omitted.

Important: The recommended version is V1 with full galvanic separation. This offers maximum EMC resistance, maximum CANopen data transfer security and thus maximum operating safety.

Versions V2 and V3 are special versions which must be compatible with the structure (topology) of the CANopen bus system in the customer application (→ control system and other CANopen subscribers). Operating safety or data transfer security may otherwise be affected.

Version 1: CAN_GND and U_B galvanically separated. Screening/housing galvanically separated

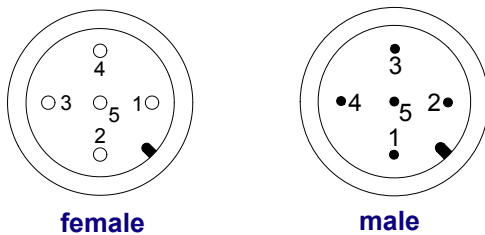
This version provides complete galvanic separation. Power supply and CAN_GND is galvanically separated. The housing and the screening of the cable is galvanically separated as well. The screening of the cable comes to the housing of the HBN via the housing of the mating plug.



PIN	Function
1	CAN GND
2	Operating voltage + U_B
3	Operating voltage - U_B
4	CAN_H
5	CAN_L

Version 2: CAN_GND and U_B not galvanically separated. Screening/housing galvanically separated

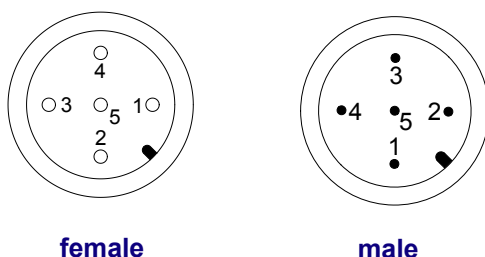
This version provides partly galvanic separation. Power supply and CAN_GND are not galvanically separated. The housing and the screening of the cable are galvanically separated from power supply and CAN_GND. The screening of the cable comes to the housing of the HBN via the housing of the mating plug and/or Pin 1 of the connector. Please note the maximum voltage rating of the CAN interface IC on page 2.



PIN	Function
1	Screen (Cable / housing)
2	Operating voltage + U_B
3	Operating voltage - U_B and CAN_GND
4	CAN_H
5	CAN_L

Version 3: CAN_GND and U_B not galvanically separated. Screening/housing not galvanically separated

This version provides no galvanic separation. Power supply and CAN_GND are not galvanically separated. The housing and the screening of the cable are not galvanically separated from power supply and CAN_GND. The screening of the cable comes to the housing of the HBN via the housing of the mating plug and/or Pin 1 of the connector. Please note the maximum voltage rating of the CAN interface IC on page 2.



PIN	Function
1	Screen (Cable / housing) - shorted to pin 3 -
2	Operating voltage + U_B
3	Operating voltage - U_B and CAN_GND - shorted to pin 1 -
4	CAN_H
5	CAN_L

**Absolute single-turn rotary encoder with high resolution
Model HBN**

Order number, Accessories

HBN	58	-	K	A	65,536	R	S3	S	V1	N	01
											Electrical and mechanical variants *
											01 Standard
											Output:
											N CANopen
											Galvanic separation (≠). See page 8:
											V1 $-V_s \neq \text{CAN_GND} \neq$ screening/housing (recommended version)
											V2 $-V_s = \text{CAN_GND} \neq$ screening/housing
											V3 $-V_s = \text{CAN_GND} =$ screening/housing
											Electrical connection:
											S M12 connector (bus in/bus out)
											Kx Cable, x=length in m
											Profile:
											C3 CANopen according to CIA, DS 406 revision 4.0.1 **
											S2 CANopen Safety SIL2 in preparation
											S3 CANopen Safety SIL2 ***
											Code:
											R Binary
											Resolution:
											1 to 4,063,232 steps / 360°
											Housing material:
											A Aluminium
											S Stainless steel
											Flange type:
58	K	Clamped flange, shaft 10 mm with flattened area									
	KF	Clamped flange, shaft 10 mm with woodruff key									
	KP	Clamped flange, shaft 10 mm with feather key									
	KZ	Clamped flange, shaft for play compensating toothed gear ZRS (toothed gear, see accessories)									
	ST	Synchro flange, shaft 6 mm with flattened area									
	SR	Synchro flange, clamped shaft for 12 mm (torque support, see accessories)									
	SN	Synchro flange, clamped shaft for 12 mm with groove for feather key (torque support, see accessories)									
Design form											
Model:											
HBN High resolution singleturn encoder											

*) 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.

**) Not covered by the SIL2 certificate.

***) Not available yet

Accessories (to be ordered separately)

- Fastening clamps for sensor assembly
KL 66-2-S See data sheet [MZ 10111](#)
- Play-free clamping coupling for shaft connection
KK14N With groove for feather key according to DIN 6885 sheet 1 – JS9, see data sheet [KK 12301](#)
- Toothed gear
ZRS Play compensating toothed gear [ZRS 11877](#)
- Torque support/stator coupling for shaft offset compensation between the rotary encoder and drive
ZMS58 Manufactured from permanently elastic plastic, see data sheet [ZMS 12939](#)
- Please refer to the table on page 6 for the mating connector order numbers.

Reference:

- EDS-file, data sheet, manual and drawings are available on www.twk.de

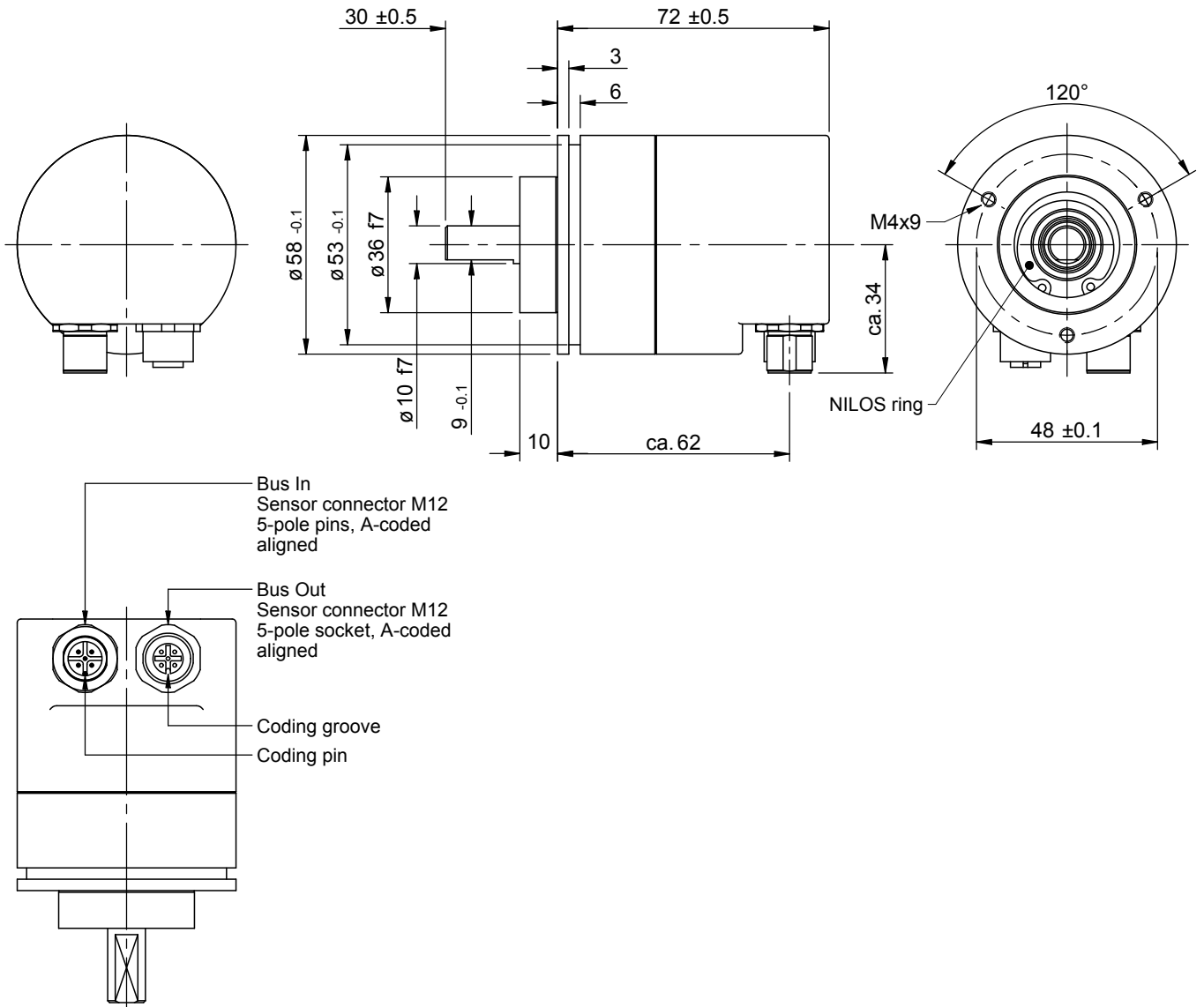
**Absolute single-turn rotary encoder with high resolution
Model HBN**

Installation drawing

Standard design form: clamped flange, shaft 10 mm with flattened area

Order number: **HBN58 - KA 65,536 R S3 S N01**

Dimensions in mm



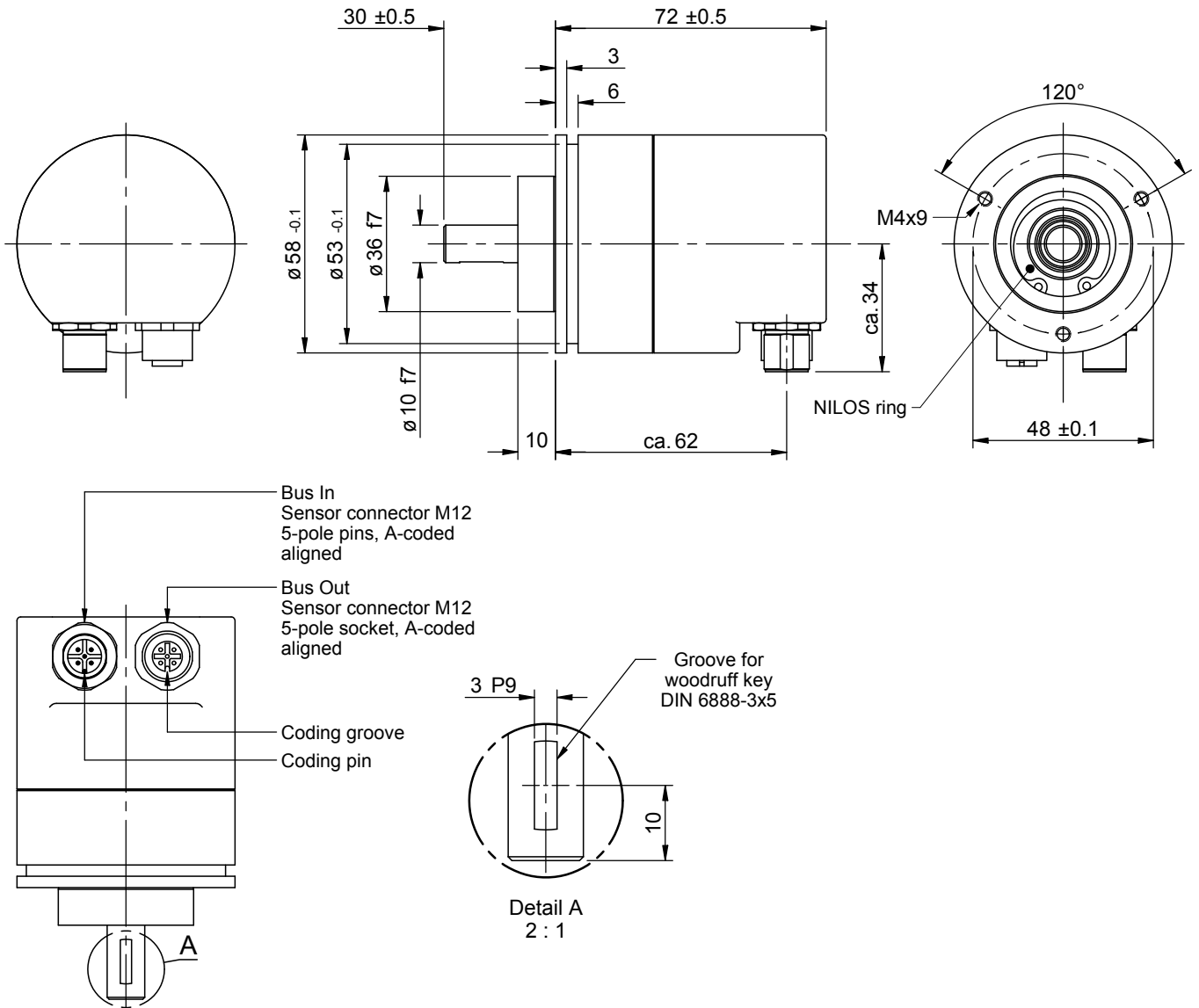
**Absolute single-turn rotary encoder with high resolution
Model HBN**

Installation drawing

Further possible design form: clamped flange, shaft 10 mm with woodruff key

Order number: **HBN58 - KFA 65,536 R S3 S N01**

Dimensions in mm



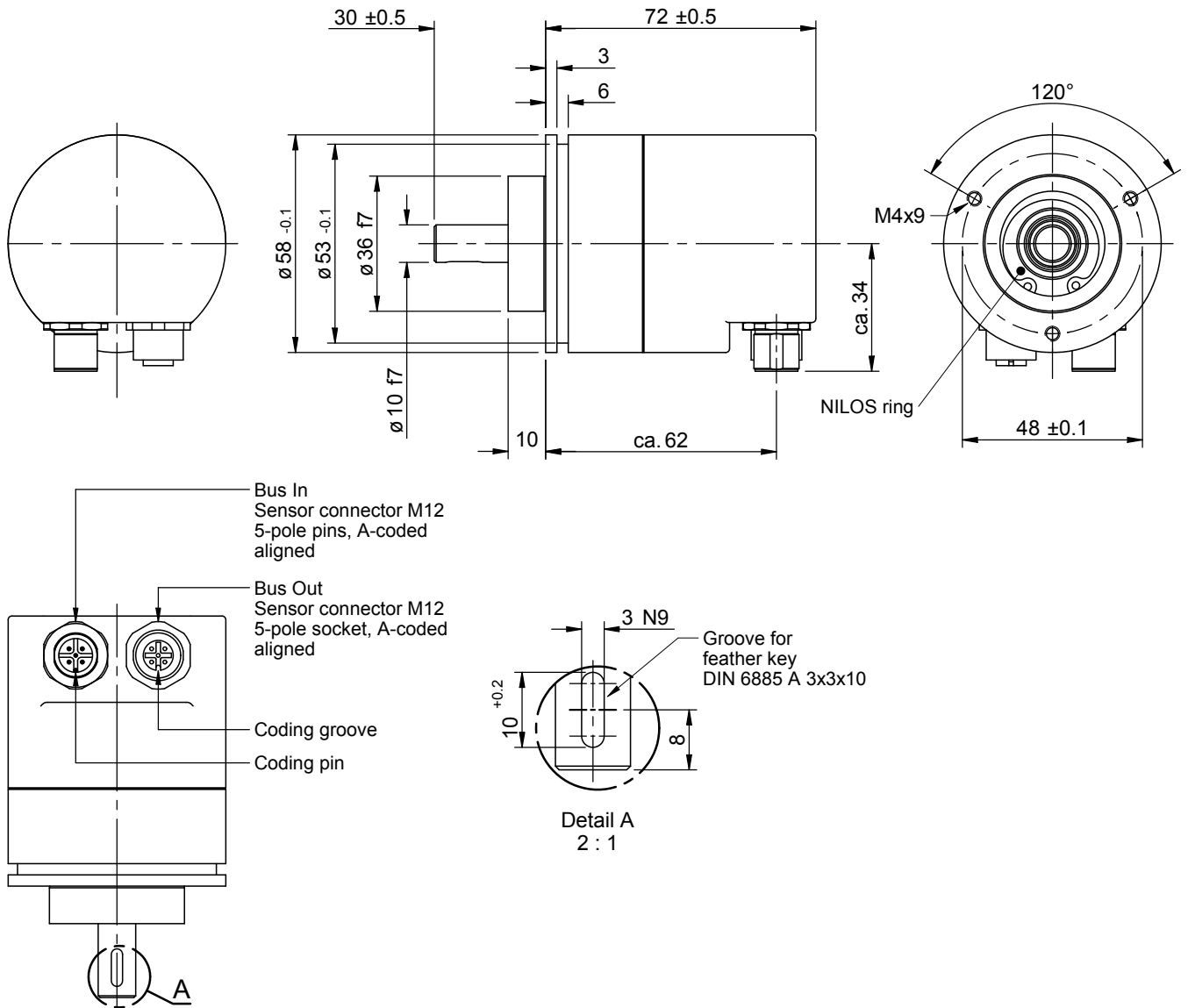
**Absolute single-turn rotary encoder with high resolution
Model HBN**

Installation drawing

Further possible design form: clamped flange, shaft 10 mm with feather key

Order number: **HBN58 - KPA 65,536 R S3 S N01**

Dimensions in mm



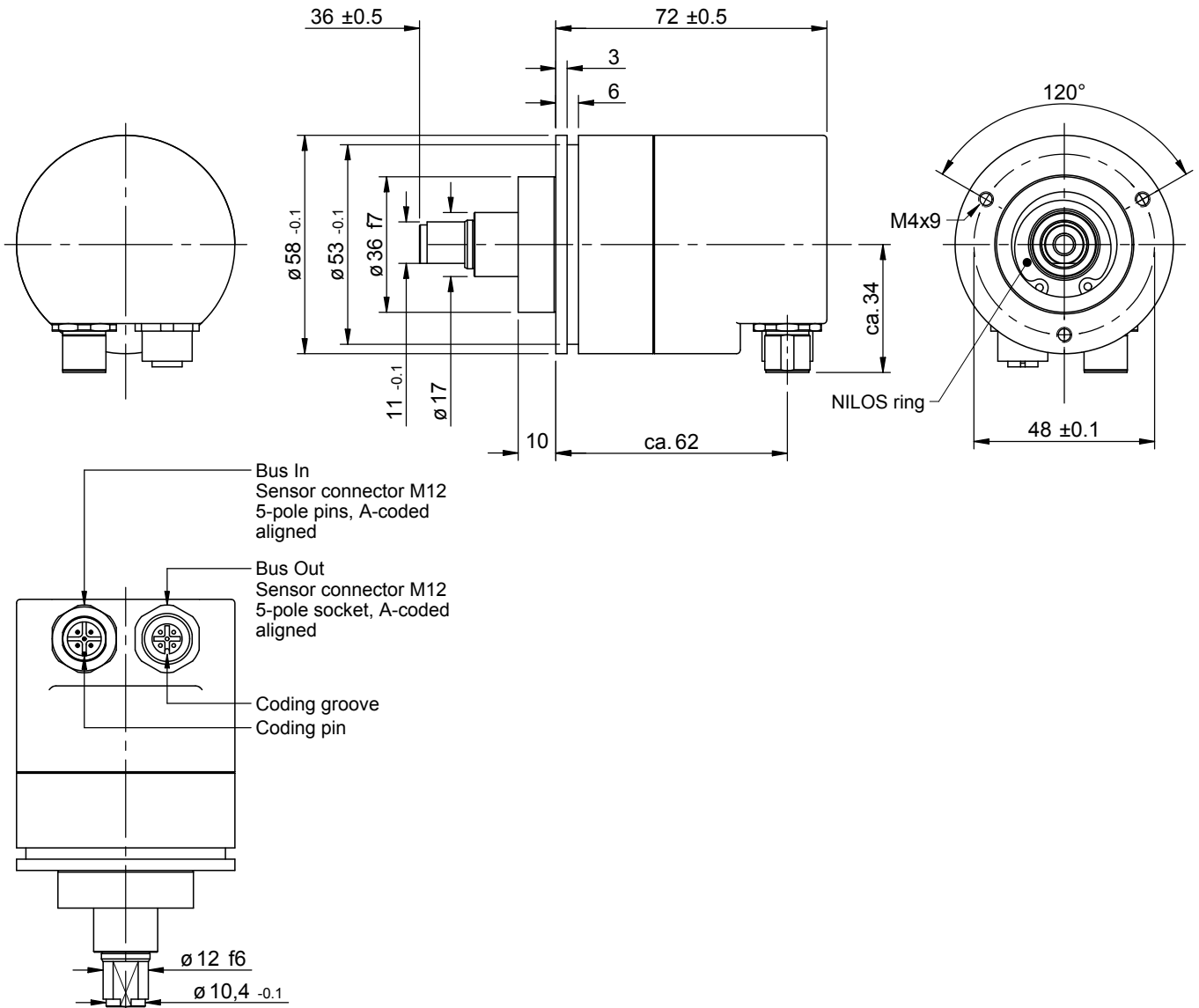
**Absolute single-turn rotary encoder with high resolution
Model HBN**

Installation drawing

Further possible design form: clamped flange, shaft for play compensating toothed gear ZRS
(toothed gear, see accessories)

Order number: **HBN58 - KZA 65,536 R S3 S N01**

Dimensions in mm



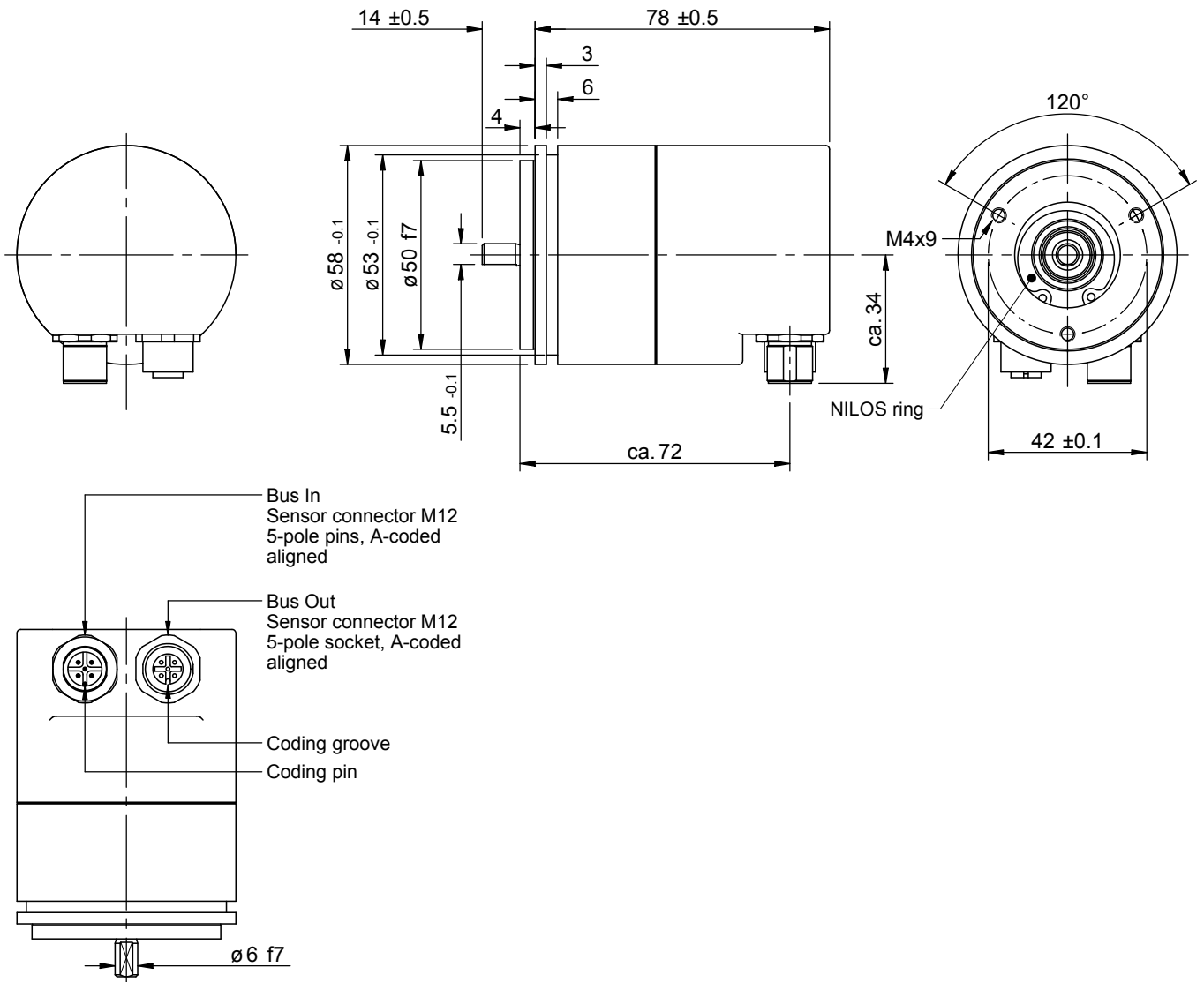
**Absolute single-turn rotary encoder with high resolution
Model HBN**

Installation drawing

Further possible design form: synchro flange, shaft 6 mm with flattened area

Order number: **HBN58 - STA 65,536 R S3 S N01**

Dimensions in mm



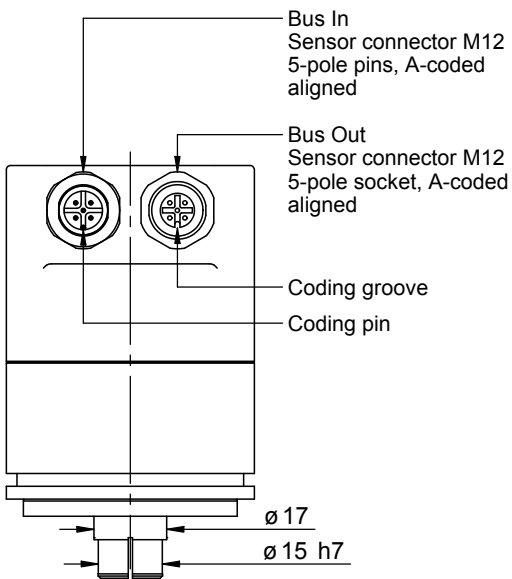
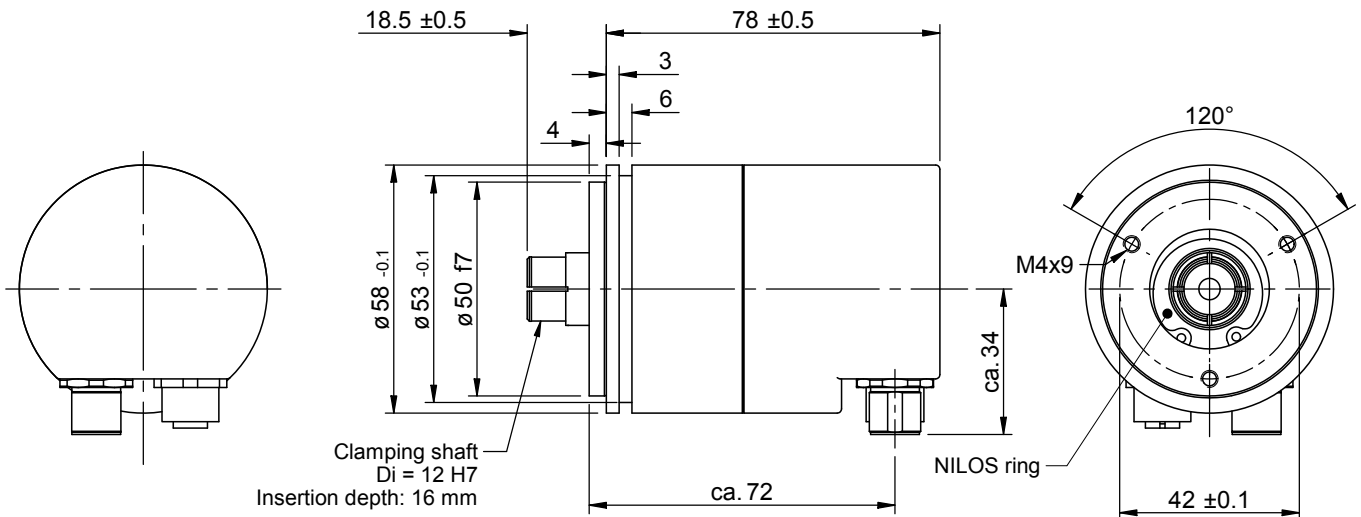
**Absolute single-turn rotary encoder with high resolution
Model HBN**

Installation drawing

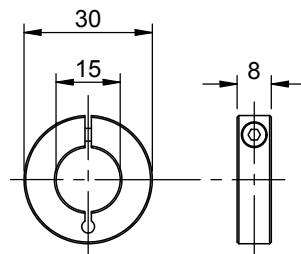
Further possible design form: synchro flange, clamped shaft for 12 mm (torque support, see accessories)

Order number: **HBN58 - SRA 65,536 R S3 S N01**

Dimensions in mm



Clamping ring (Aluminium)



**Absolute single-turn rotary encoder with high resolution
Model HBN**

Installation drawing

Further possible design form: synchro flange, clamped shaft for 12 mm with groove for feather key (torque support, see accessories)

Order number: **HBN58 - SNA 65,536 R S3 S N01**

Dimensions in mm

