Made in Germany

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Technical Information

GEL SEK11

Inductive Rotor Position Sensor

VarioCODER Compact

D-51T-SEK11 | Status 2026-11-02

LENORD +BAUER

Finding solutions. Founding trust.

Motion sensors and integrated drive technology

General Information

- Compact, configurable incremental hollow-shaft encoder for installation in electric drives
- For measuring position, angle, and rotational speed
- High design flexibility: compact, extremely flat, freely selectable shape
- Maximum efficiency and control quality through high-precision position control
- Reduction of development and product costs



Features

- Rotational speed: ≤ 100,000 min^{-1}
- Accuracy: typically < 0.5° electrical
- Latency: < 5 µs
- Operating temperature range: -40 °C ... +125 °C, up to +150 °C for short periods
- Integrated signal conditioning
- Line driver for cable lengths up to 30 m
- Prepared for ASIL C and ASIL D (internal self-diagnosis)
- Rotor material: Conductive material ≥ 35 µm (PCB, aluminum, steel)

Advantages

- Can be integrated into all motor designs with minimal space requirements and high mounting tolerances
- Immediate angle output upon power-up without a reference run
- High accuracy without calibration
- High reliability under mechanical stress
- First samples or prototypes available on short notice
- Better price-performance ratio than a mass-produced resolver
- Magnet-free and insensitive to magnetic fields
- Compact dimensions, low moment of inertia
- Wide axial and radial mounting tolerances
- Maintenance-free and wear-free due to bearingless design

Configurable parameters:	
Number of pole pairs	1 … 64
Stator outer diameter	49 … 200 mm
Rotor shaft diameter	2 … 140 mm
Stator mounting	2 … 32 holes or slotted holes
Rotor mounting	2 … 32 screws / adhesive / clamps possible
Connector Output	Tangential / Axial / Transverse
Output signal (Sin/Cos)	Single-ended / Differential

Applications

Industry & Automation

Servo Drives & Motor Feedback:
- Rotor angle determination for FOC control (BLDC, PMSM, synchronous motors)
- Polling for initial commutation

Robotics & Handling:
- Joint angle feedback in robots and cobots
- Position feedback in AMRs and AGVs

Automotive & Commercial Vehicles

Electric Drives:
- Rotor Angle Determination in Electric Motors
- Sine/Cosine Feedback for Inverter Circuits

Vehicle Dynamics & Vehicle Control:
- Angle and Position Detection in Auxiliary Systems
- Motor-side sensors for hybrid modules

E-bikes, e-scooters, light electric vehicles:
- Rotor position sensors in wheel hub motors

Commercial Vehicles & Agricultural Machinery:
- Position feedback in hydraulic pumps and auxiliary drives
- Monitoring of conveyor units, screws, and drums

Rail technology & transportation

Rail Vehicles:
- Rotor position sensors in highly dynamic traction motors

Conveyor and Cable Car Technology:
- Drive control on deflection pulleys
- Synchronization Control for Multi-Motor Cable Car Systems

Maritime Applications

Marine propulsion systems:
- Rotor position feedback for electric and hybrid marine propulsion systems

Auxiliary units:
- Input/output speed for pumps, compressors
- Slip monitoring in mechanical couplings

Aerospace

Aircraft Actuators & UAV Propulsion Systems:
- Rotor position sensors in BLDC/PMSM drives for flaps and landing gear

Satellites & Space Robotics:
- Angle measurement in reaction wheels and solar array drives

Logistics & Conveyor Technology

Conveyor Belts:
- Speed and control feedback in distribution centers
- Synchronization of Conveyor Lines

Automated Storage Systems:
- Angle and position feedback for storage and retrieval machines

Crane and lifting systems:
- Position Sensing for Lifting and Travel Mechanisms
- Control of Travel and Rotational Movements

Technical Data

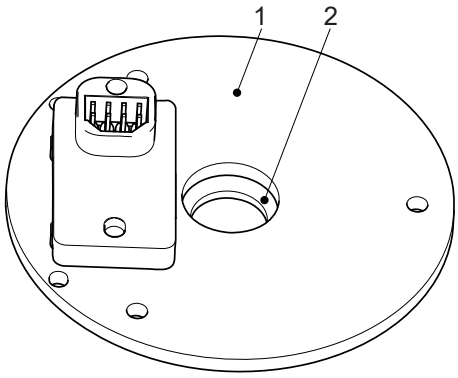
Electrical Data	
Supply Voltage U_B (short-circuit-proof)	5 V DC
Current consumption I_B (no load)	< 30 mA
Output signals sin/cos (short-circuit-proof)	Single-ended: Two sine waves shifted by 90° Differential: Two sine waves shifted by 90° and their inverse signals
Output signal level (single-ended) (1)	2 V_{PP}
Accuracy per period	typ. < 0.5° electrical
Latency	< 5 µs
Number of periods per mechanical revolution	1 ... 64
Frequency range	0 ... 10 kHz
Recommended output current	< 5 mA
Mechanical Data for Built-in Encoders	
Weight	< 100 g (2)
Air gap (nominal)	2.0 mm
Mechanical Data for Stator	
Material	Plastic; electronics in plastic housing
Outer diameter D_{OS}	49 … 200 mm
Mounting Methods	Screw mounting, adhesive mounting, clamping
Axial height	at least 12.1 mm
Mechanical Data for rotor	
Material	Conductive material ≥ 35 µm (PCB, aluminum, steel)
Rotational speed (3)	≤ 100,000 min#¹
Shaft diameter D_{IR}	2 … 140 mm
Environmental testing	
Operating temperature range	-40 °C … +125 °C in accordance with ISO 16750-4:2010, up to +150 °C for short periods (4)
Storage temperature range	-40 °C ... +125 °C
Degree of protection	IP 30 (higher on request)
Dielectric strength	ISO 16750-1 ... ISO 16750-5
Electromagnetic Compatibility	DIN EN 61000-4-4; DIN EN 61000-4-2; ISO 10605 ECE-R10
UN ECE R10 Rev. 6:2019-10	ISO 11452-2:2004-11 (ALSE); ISO 11452-4:2011-12 (BCI) DIN EN 55025:2003-11
Vibration Resistance	DIN EN 60068-2-64; DIN EN 60068-2-6; ISO 16750-3
Shock resistance	DIN EN 60068-2-27; ISO 16750-3
Chemical Resistance	ISO 16750-5
MTTF value	≥ 3,000,000 h at 55 °C

(1) Depends on output current and temperature
(2) Depends on the configuration (particularly the rotor's diameter and material)
(3) Depends on the number of pole pairs, mounting type, diameter, and material
(4) Depending on the availability of the safety function, the operating temperature range, and the service life (MTTF value)

The Built-in Encoder is explained using generally applicable characteristics as examples. Due to a wide variety of configurations, individual technical specifications may vary. These are listed in full in the technical drawing for the configured Built-in Encoder.

Product construction of the Built-in Encoder

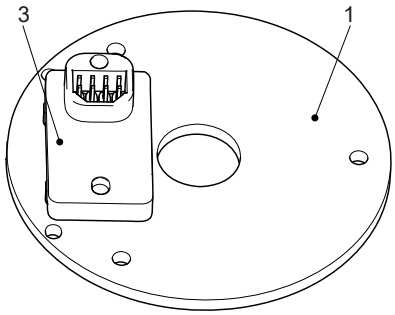
The inductive rotor position encoder consists of a stator and a rotor. This compact system is particularly well-suited for integration into electric drives with high electromagnetic compatibility requirements. Thanks to its configurable diameter, number of periods, and slim construction type, the Built-in Encoder can be integrated into virtually any environment. The contactless and wear-free system requires no bearings or couplings. Full 360° mechanical scanning allows for high installation tolerances without significantly affecting function or accuracy. The internal signal evaluation and processing provides signals that can be directly processed by standard inputs without additional effort. The sin/cos signals are virtually offset-free and amplitude-stable even with high mounting tolerances. Stable signals are output even at high rotational speeds and extreme temperatures, enabling precise and reliable determination of phase angle and Rotational speed across the entire operating range.



1 Stator
2 Rotor

Stator

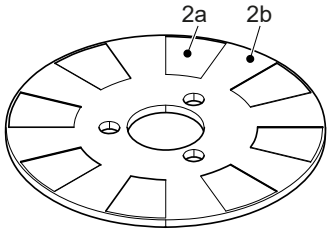
The stator consists of a printed circuit board with a housing mounted on top to protect the electronic components. The large bore allows shafts with large diameters to pass through. The stator is mounted, for example, to the drive housing using a number of screws adapted to the size of the printed circuit board. The stator is electrically connected via a connector (axial, tangential, or transverse connector output). A safety clearance from the electronics and the encoder system must be maintained only within a defined circle and a defined area of the connection technology.



1 Stator
3 Housing

Rotor

The rotor can be a thin plate on which conductive and non-conductive surface segments alternate. The number of segment pairs must match the number of pole pairs on the stator. In the simplest case, a printed circuit board can be used, with copper areas enabling the rotor position to be determined. The rotor can also consist entirely of conductive material such as aluminum or steel.
In principle, the surface structures of existing rotor components can also be scanned. This eliminates mechanical interfaces and keeps tolerance chains short. Costs are reduced, and the reliability of the overall system is further increased.



Example: Rotor with 8 pole pairs

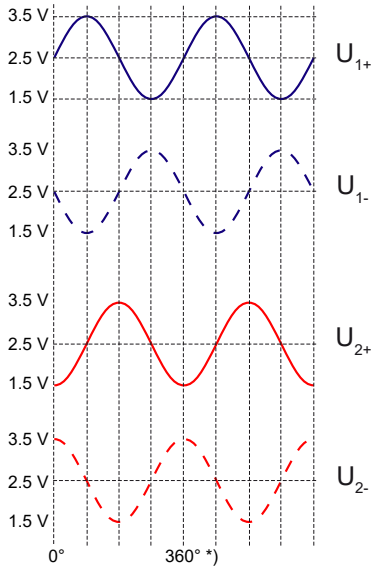
2 Conductive surface segments (for example, a copper surface on a printed circuit board)
2b Non-conductive surface segments (for example, printed circuit board material)

Output Signals

The number of pole pairs on the Built-in Encoder corresponds to the number of sine/cosine periods.

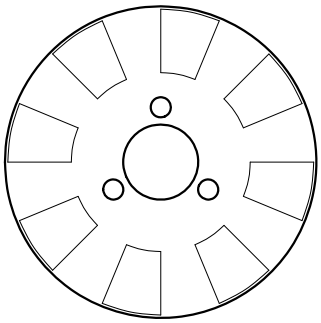
Output signals for use with one pole pair

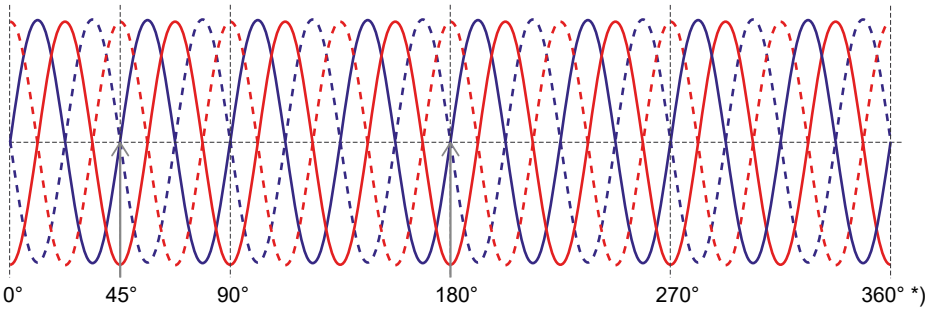
Differential output signals



If single-ended output signals (i.e., not differential but only U_{1+} and U_{2+}) are used, make sure that the terminals for the U_{1-} and U_{2-} signals are not connected.

Application example: Rotor with eight pole pairs

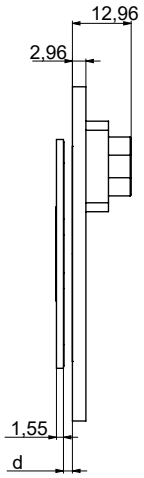




*) 360° = 1 mechanical revolution

Assembly and Installation

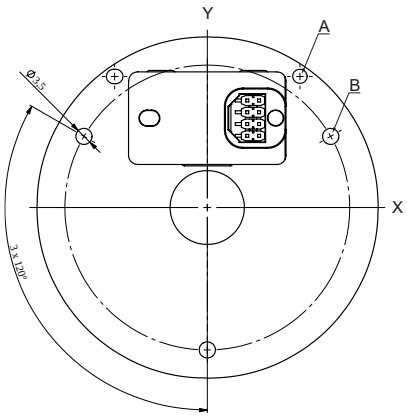
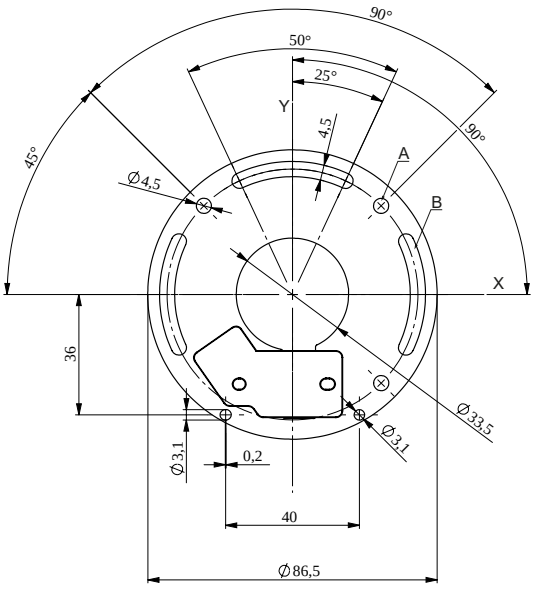
Installation

Rotor behind the stator	
	1 Stator 2 Rotor d Air gap

The Built-in Encoder is shipped with a nominal air gap of 2 mm. Deviations from this dimension alter the amplitudes of the output signals. Changes in the air gap of 0.5 mm have only a minor effect on the interpolation capability.

Stator Assembly

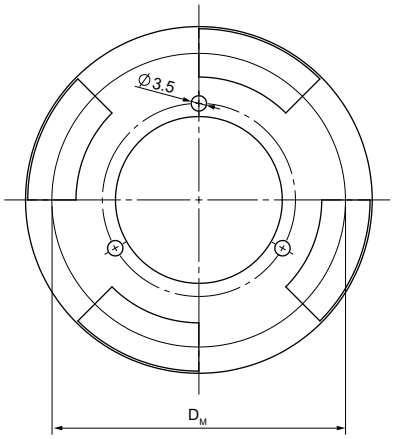
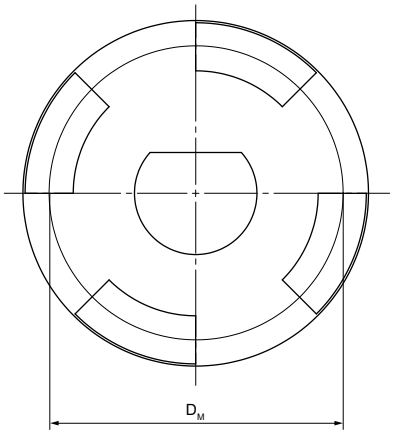
The stator is mounted using a freely selectable number of screw fasteners. The mounting holes are designed for M3 or M4 screws, for example. A distinction is made between whether the zero position of the stator is electrically synchronized with the pole position of the drive system's rotor via the controller/inverter (Variant 1) or mechanically via the sensor (Variant 2).

Installation example with 3 mounting holes (spaced 120° apart)	
Variant 1	Variant 2
	
A Internal centering holes (2x)	**B** Mounting holes

Deviations of 0.5 mm in the X or Y direction (coaxiality) have no significant effect on the system's accuracy.

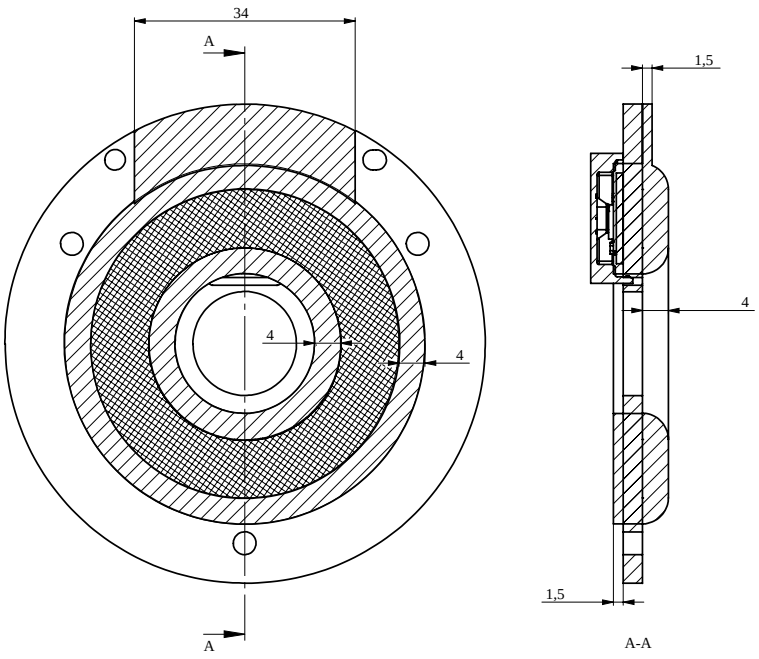
Rotor Assembly

In Variant 1, the rotor is mounted using a configurable number of screw fasteners. The mounting holes are designed for M3 screws. Variant 2 shows the option of clamping and gluing the rotor. Direct integration of the rotor into the application is possible.

Example: Option 1	Example: Option 2
	
D_M: Rotor center diameter	

Stator Clearances

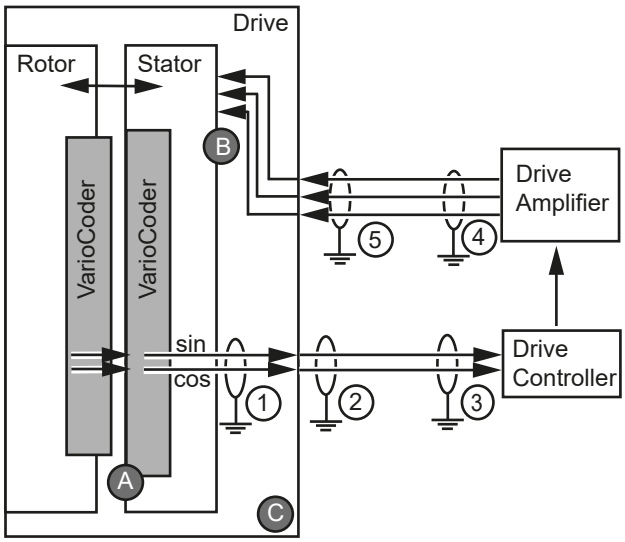
No conductive features are permitted within a 4-mm radius of the stator coil system. The clearance between the stator housing and electrically conductive materials must be > 1.5 mm.



Installation Instructions
- Recommended cable routing: 80 mm from the connector
- Tightening torque for M3 screws: 1.3 Nm

Shielding Concept

The Built-in Encoder does not generate any electromagnetic interference itself and is sufficiently immune to interference at its mounting location. Depending on the application, the connection cable for the Built-in Encoder may need to be fully integrated into the drive system's shielding concept. The electromagnetic environment of the drive system remains unaffected by the Built-in Encoder.



Special Installation Conditions	
A	Physical Environment of the VarioCODER
B	Drive supply cable
C	Drive housing

Interfaces Considered Separately	
1	Electrical connection to the VarioCODER
2	Connection between the motor and the Built-in Encoder
3	Input to the motor controller
4	Output power cable on the drive amplifier
5	Power cable input on the motor

Schematic example illustration

Despite the high immunity to interference, depending on the application, it may be necessary to integrate the Built-in Encoder into a shielding concept.

Depending on the installation conditions (A, B, and C) of the Built-in Encoder, different requirements for the shielding concept must be observed.

In particular, the shield connections at positions 1, 2, 3, 4, and 5 must be considered holistically, depending on the possibilities and conditions of the application, to avoid unfavorable configurations.

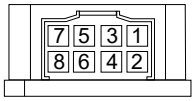
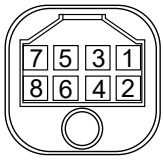
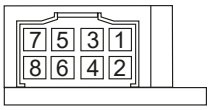
During the configuration of the Built-in Encoder and beyond, Lenord+Bauer provides support with its extensive knowledge and experience in integrating the Built-in Encoder into the application's shielding concept.

Pin Assignment and Accessories

Connectors on the Stator

Pin Assignment

8-pin, male (plug-in view)

Tangential connector outlet	
Axial connector outlet	
Transverse connector output	

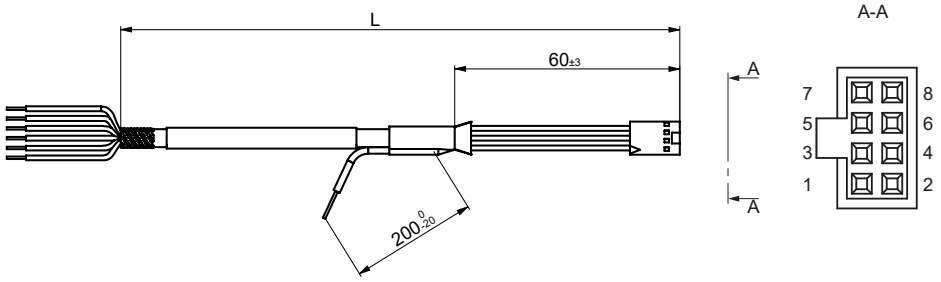
Pin Assignment	Signal designation
1	Not Assigned
2	Not Assigned
3	U_{1+}
4	U_{1-}
5	U_{2+}
6	U_{2-}
7	GND
8	U_B

If single-ended output signals (i.e., not differential but only U_{1+} and $_{U2+}$) are used, then ensure that the terminals for the U_{1-} and U_{2-} signals are not connected.

Accessories

Starter Kit GGPOSE001

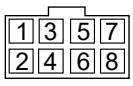
Item	Length L	Cross-Section	Signal	Note
ZKSEK10Y00000	3000 mm	0.25 mm²	Differential	6-wire
ZKSEK10Y00002	3,000 mm	0.25 mm²	Single-ended	4-wire
ZKSEK10Y00003	3,000 mm	0.50 mm²	Differential	6-wire
ZKSEK10Y00004	3,000 mm	0.50 mm²	Single-ended	4-wire



The Built-in Encoder does not itself cause any electromagnetic interference and is sufficiently immune to interference at its mounting location. Depending on the application, the connection cable for the Built-in Encoder may need to be fully integrated into the drive system's shielding concept.

To test the application, Lenord+Bauer therefore offer a connection cable with a shield connection strand. In most cases, this is not required.

8-pin, female connector (plug-in view)
Type: AMPMODU MODU IV/V, Order Number: 104483-1, Manufacturer: TE Connectivity



Pin Assignment	Signal designation	Wire color
1	Not assigned	-
2	Not assigned	-
3	U_{1+}	white
4	U_{1-}	brown
5	U_{2+}	yellow
6	U_{2-}	black
7	GND	blue
8	U_B	red

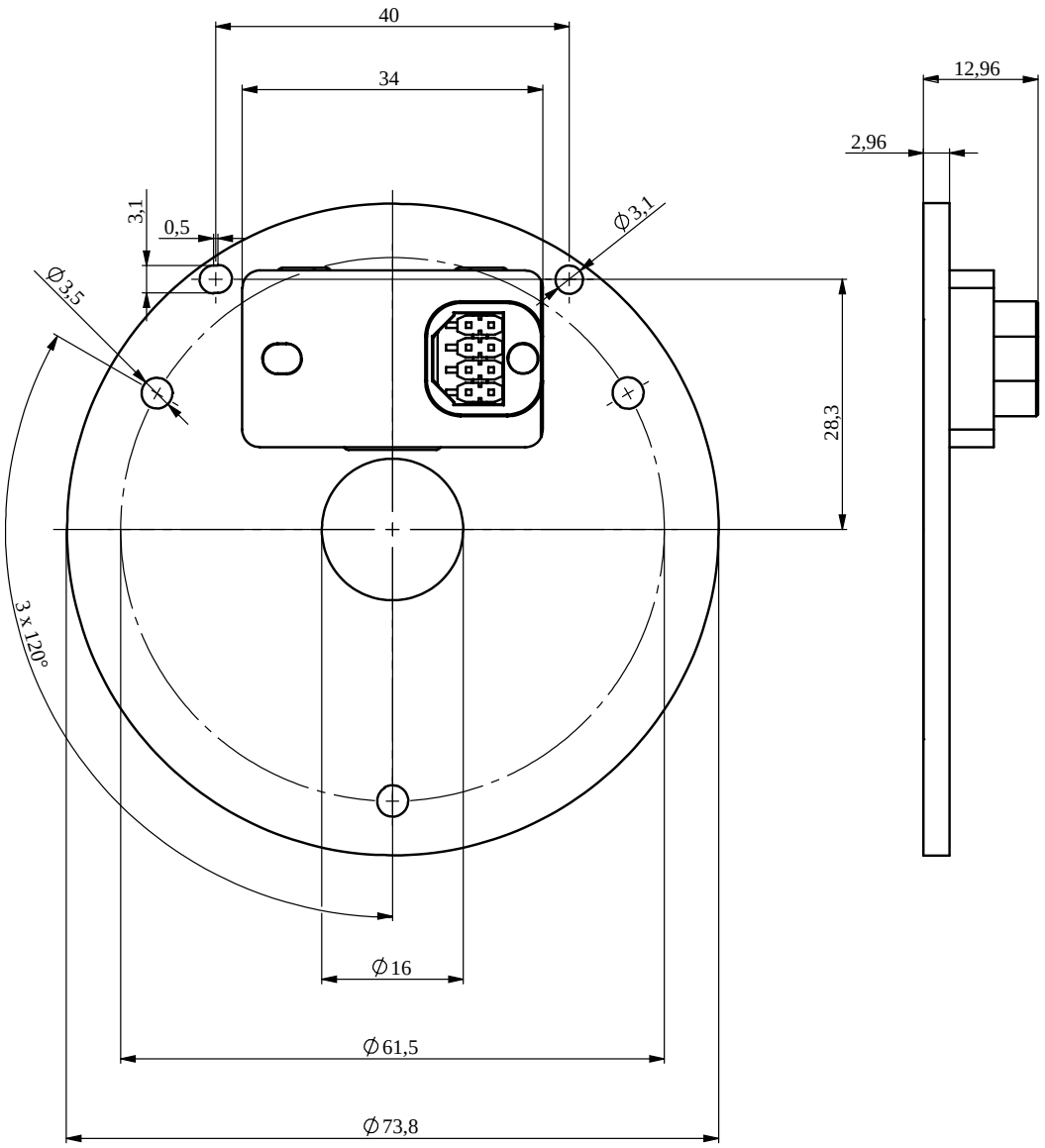
Unlocking tool	
ZBSEK10Y00002	When disconnecting the connection cable from the connector, it is recommended that you use the release tool to prevent damage.

Dimension Drawings

All dimensions are in millimeters; general tolerance: DIN ISO 2768 mK

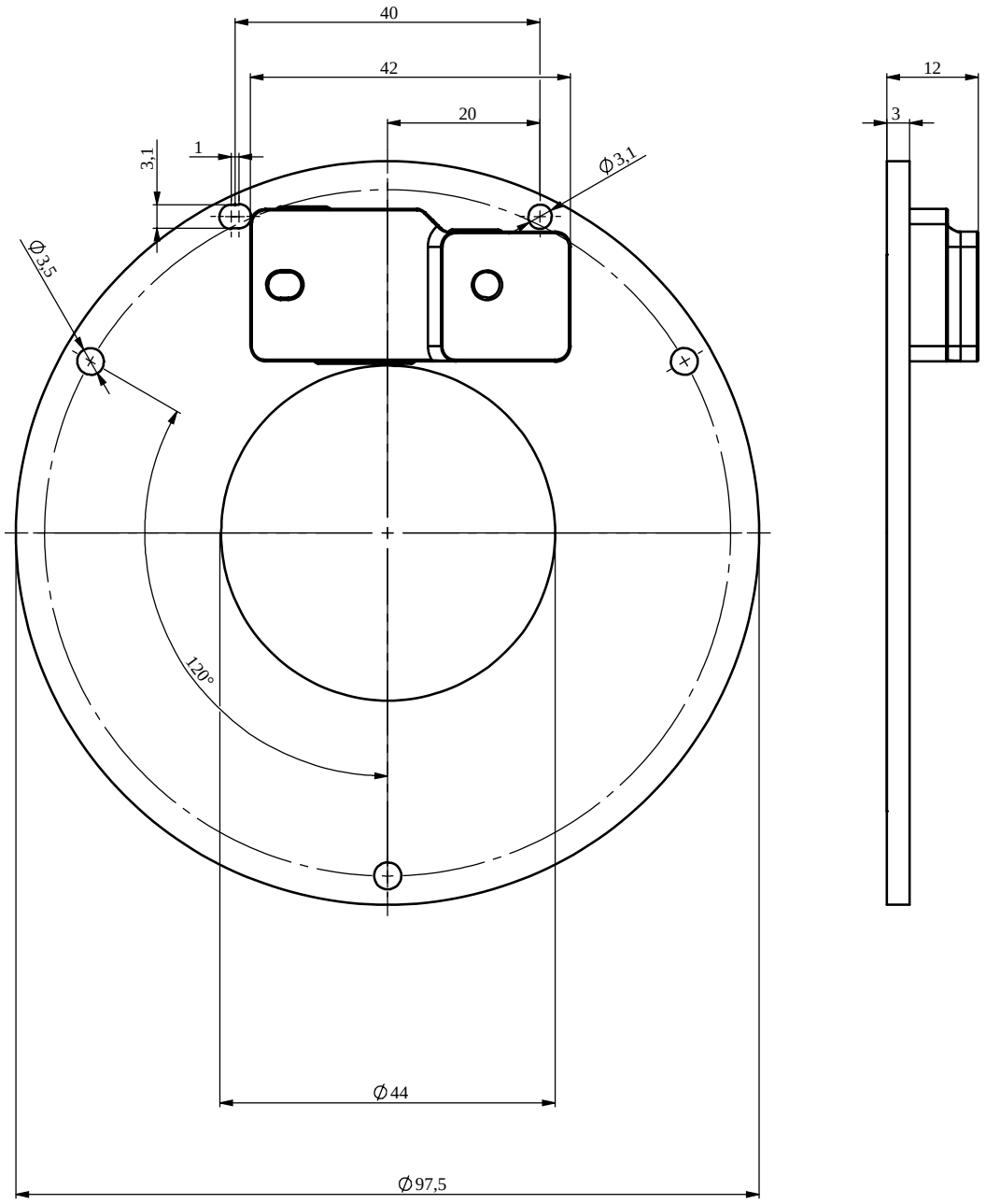
Axial connector outlet

Example with 3 mounting holes (spaced 120° apart)



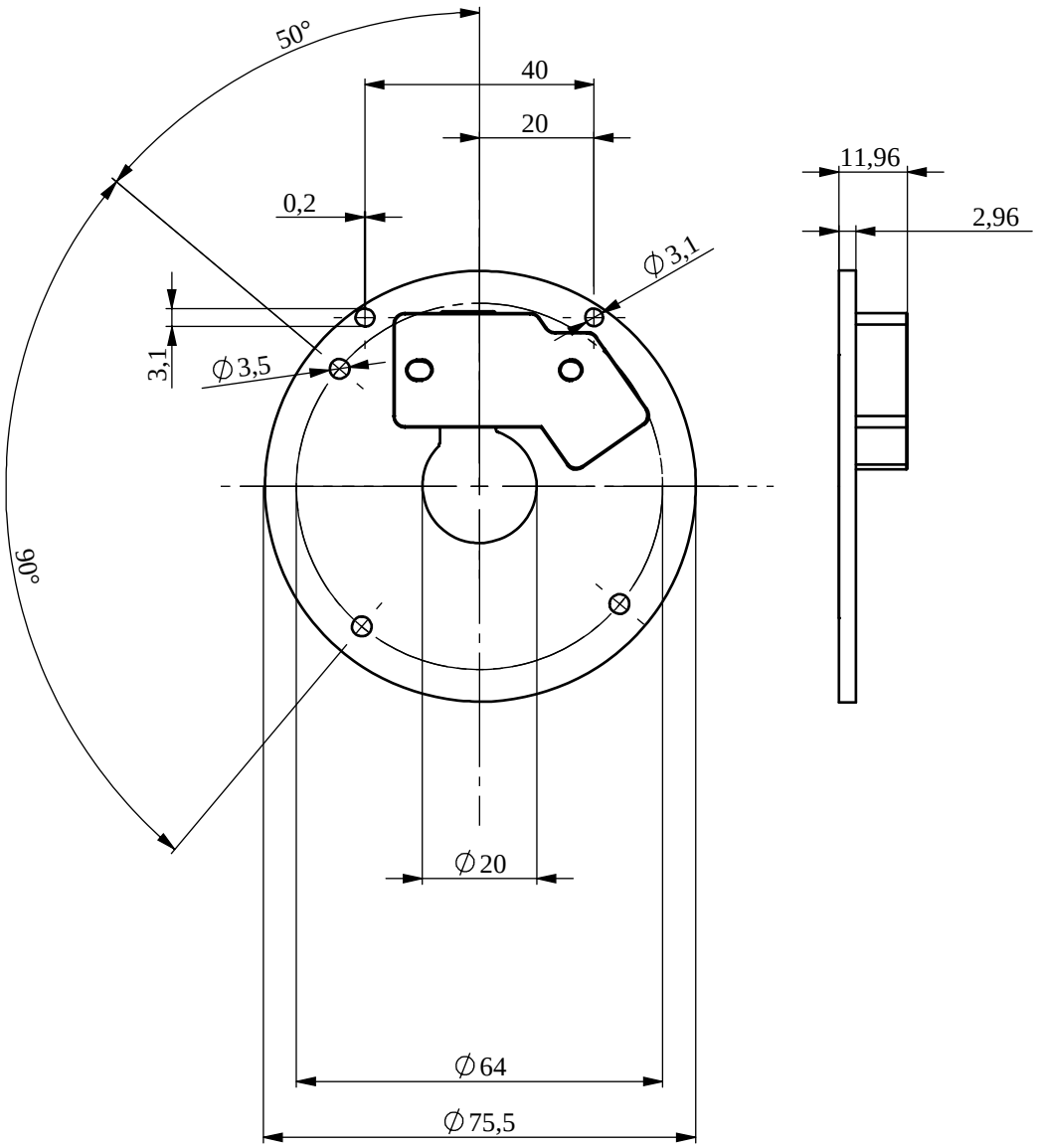
Tangential connector outlet

Example with 3 mounting holes (spaced 120° apart)



Transverse connector outlet

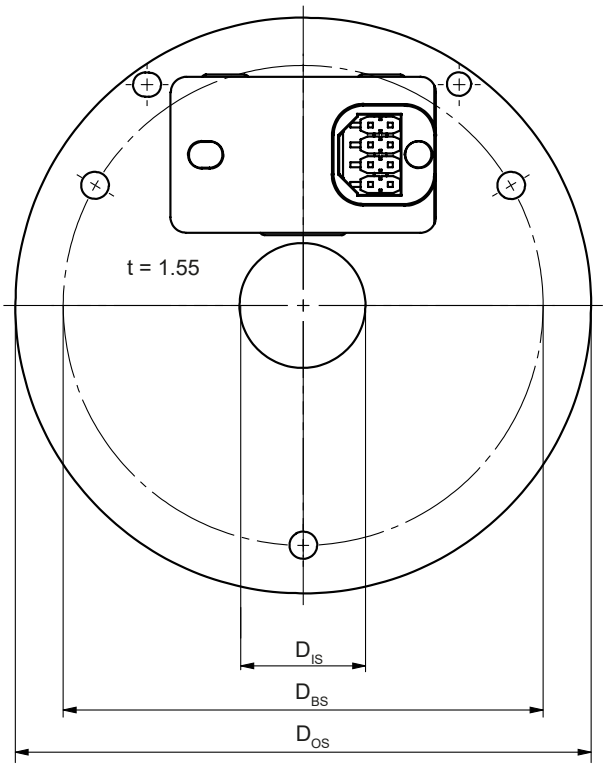
Example with 4 mounting holes



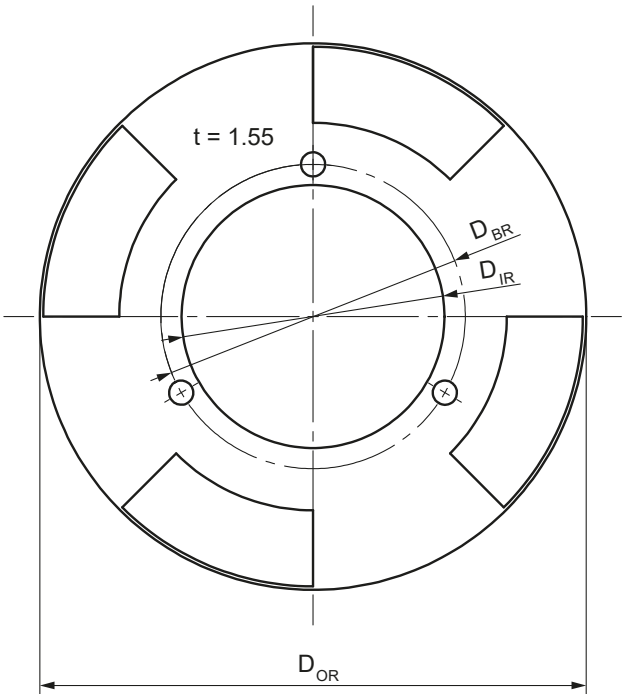
Configurable diameters

Example with 3 mounting holes

Stator



Rotor



Dimensions

Stator		Rotor	
D_{OS}	49 … 200 mm	D_{OR}	31 … 179 mm
D_{BS}	42 … 190 mm	D_{BR}	8 … 144 mm
D_{IS}	6 … 176 mm	D_{IR}	2 … 140 mm

Do you have specific requirements regarding shaft diameters, mounting solutions, encoder design, number of pole pairs, cable protection, cable exit, connector assembly, or sensing of conductive structures on a rotor shaft? Please contact us. We'll work with you to develop the optimal solution for your application and provide guidance on how to customize it as cost-effectively as possible. Contact information: support@lenord.de or +49(0)208 9963-215

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