Made in Germany

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Technical Information

GEL 2471

Incremental Bearingless Rotary Encoders

1-/2-Channel Inductive Speed Sensor for Electrically Conductive Target Wheels

D-51T-2471 | Status 2026-08-04

LENORD +BAUER

Finding solutions.
Founding trust.

Motion sensors and integrated drive technology

General Information

- Maintenance- and wear-free Speed Sensor based on inductive sensing
- Detection of measuring elements (such as target wheels made of electrically conductive materials)
- Reliable detection of high rotational speeds down to creeping movements (0 Hz…20 kHz)
- Most reliable rotation direction detection through evaluation of two channels
- Robust and compact stainless steel housing for use in harsh and confined applications



Side or straight cable outlet

Features

- Incremental, magnet-free 1- or 2-channel Speed Sensor based on the eddy current principle
- Highest signal quality for reliable evaluation in control systems
- Robust stainless steel housing available with sensor tubes in 16 mm and 20 mm diameters
- High EMC immunity for interference-free signal transmission in demanding industrial environments
- Configuration flexibility thanks to freely selectable cable exit, cable protection, and connector options
- Compliant with a wide range of standards and requirements for a variety of applications:
see „Technical Data - Environmental Testing“, page 5

Advantages

- Optimized lifecycle cost
- Maintenance-free and wear-resistant
- Wide range of configuration options
- Compact and robust construction type
- Reinforced walls in the 20-mm-diameter sensor tube provide enhanced protection against impacts from stones and foreign objects
- No adhesion or accumulation of magnetizable particles on the sensor head
- Weight reduction when using aluminum measurement bodies
- Easy to install
- Easy integration
- High signal quality

Do you have specific requirements regarding the flange shape, tube length, number of channels, cable protection, cable outlet, connector assembly, or the EMC design? Please contact us. Our experts can create the optimal solution for your application from an extensive modular system and will be happy to advise you on the most cost-effective custom adaptation.

support@lenord.de or +49(0)208 9963-215

Applications

Industry & Automation

Printing & Packaging Machines:
- Synchronization of Conveyor Belts
- Register control in printing

Automotive & Commercial Vehicles

Vehicle Drivetrains:
- RPM measurement on crankshafts and camshafts for engine control units
- Rotor position detection in electric motors (BLDC, PMSM)
- Input/output speed in the transmission for shift strategy

Vehicle Dynamics Systems:
- Wheel speed sensors for ABS/ESP
- Torque distribution in all-wheel-drive systems

Commercial Vehicles & Agricultural Machinery:
- Speed monitoring on PTOs, hydraulic pumps
- Harvesting Machinery: Conveyor screws, threshing drums

Rail Technology & Transportation

Rail vehicles:
- Wheel speed sensors for slip control and brake control
- Drive control for electric locomotives and railcars

Conveyor and cable cars:
- Speed monitoring on idler pulleys
- Synchronization of drives in multi-motor systems

Marine applications

Drive:
- Speed measurement on marine engines, turbochargers, gearboxes, and generators

Auxiliary units:
- Input/output speed measurement for slip monitoring

Energy & Utilities

Wind turbines:
- Rotor speed for power control
- Pitch adjustment (blade angle control)

Hydroelectric Power Plants / Turbines:
- Speed control for synchronization with grid frequency

Generators & emergency power systems:
- Speed measurement for frequency monitoring and load management

Building Services & Infrastructure

Elevators & escalators:
- Cabin speed and position
- Safety Systems (Emergency Stop in Case of Over-speed)

Building equipment:
- Pump and fan speeds in large HVAC systems

Logistics & Conveyor Technology

Conveyor belts:
- Speed control in distribution centers

Automated Storage Systems:
- Positioning of Storage and Retrieval Machines

Crane Systems:
- Hoist and Traverse Control

Technical Data

Signal Pattern	E-	S-	V-	X-
Electrical Data				
Supply voltage U_B (reverse-polarity protected)	10 ... 20 V DC (10 ... 30 V DC upon request)			
Current consumption I_B (no load)	≤ 40 mA			
Output signal (short-circuit-proof)	Square-wave signals			
Output signal level (High) (1)	≥ U_B - 1.8 V			
Output signal level (Low) (1)	≤ 1.5 V			
Output current per channel	≤ 20 mA			
Frequency range	0 ... 20 kHz			
Duty cycle	50% ± 25% (2)			
phase offset	–		typ. 90°	
Mechanical Data				
Sensor tube material	Stainless steel			
Flange material	Stainless steel			
Sensor weight (including 2 m cable)	500 g			
Cable Data				
Cable	halogen-free and shielded (3)			
Cable diameter	5.4 ± 0.2 mm			6.5 ± 0.3 mm
Cable cross-section	4 × 0.5 mm²			6 × 0.5 mm²
Minimum bending radius (static/dynamic)	16 mm / 27 mm			20 mm / 33 mm
Environmental Testing				
The Speed Sensor complies with a wide range of standards and requirements for a variety of applications: *see „Technical Data - Environmental Testing“, page 5*				
Requirements for the target wheel				
Material	Steel, aluminum (others available upon request)			
Tooth Profile	Involute gearing per DIN 867 Rectangular teeth 1:1 or slotted disc (upon request)			
Width	≥ 10 mm (smaller sizes available upon request)			
Module m	2.00 / 2.25 / 2.50 / 2.75 / 3.00			
Air gap *	*see „Air Gap Table“, page 11*			

(1) depending on output current and temperature
(2) Applies to operation at the rated air gap and with gear teeth in accordance with DIN 867
(3) Specifications available upon request
(*) Air gap for modules 2.25 / 2.50 / 2.75 / 3.00 t.b.d.

Technical Data - Environmental Testing

Lenord+Bauer's Speed Sensors are designed for a wide range of applications. During design and manufacturing, we consistently ensure the reliability and compatibility of the Speed Sensors with a wide variety of standards, and these are continuously tested.

Through the ongoing development and optimization of sensors for a wide range of applications, Lenord+Bauer has extensive experience in this field.

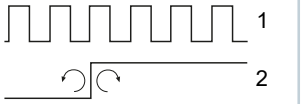
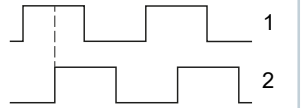
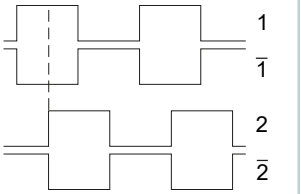
Only the minimum standards for all sensors are listed below.

If you have additional requirements regarding standards and approvals, please feel free to contact us.

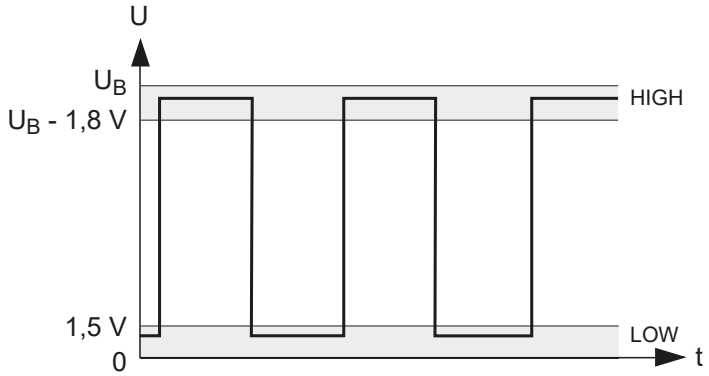
	Rail Vehicle Industry	Maritime Applications	Industrial applications
Operating and working temperature	-40 °C … +120 °C		
Storage temperature	-40 °C … +120 °C		
General Industry Standard	DIN EN 50155:2022-06	DNV-CG-0339	Depending on the application
Dielectric strength	500 V AC / 750 V DC DIN EN 50155:2022-06	DNV-CG-0339	500 V AC
Electromagnetic compatibility	DIN EN 50121-3-2:2017-11	DNV-CG-0339	IEC 61000-6-2:2016 IEC 61000-6-4:2016
Vibration Resistance	DIN EN 61373:2011-04 Cat. 3	DNV-CG-0339	IEC 60068-2-64:2008 IEC 60068-2-6:2008
Shock resistance	DIN EN 61373-2011-04 Cat. 3	DNV-CG-0339	IEC 60068-2-27:2008
Fire protection	DIN EN 45545-2:2023-12 NFPA 130 upon request	IMO 2010 FTP	Upon request
Degree of protection on the measurement side (1)	IP68		
MTTF value	> 2,000,000 h at 55 °C		

(1) The degree of protection on the cable outlet side depends on the cable gland or cable protection

Output Signals and Connectors

Signal Pattern		
Output Signals		**Pulse Diagram**
E-	1 channel	
S-	1 channel with direction signal ↻ : Forward rotation ↺ : Reverse rotation	
V-	2 channels, 90° phase offset	
X-	2 channels, 90° phase offset, with inverted channels	

Output signal level – Voltage output



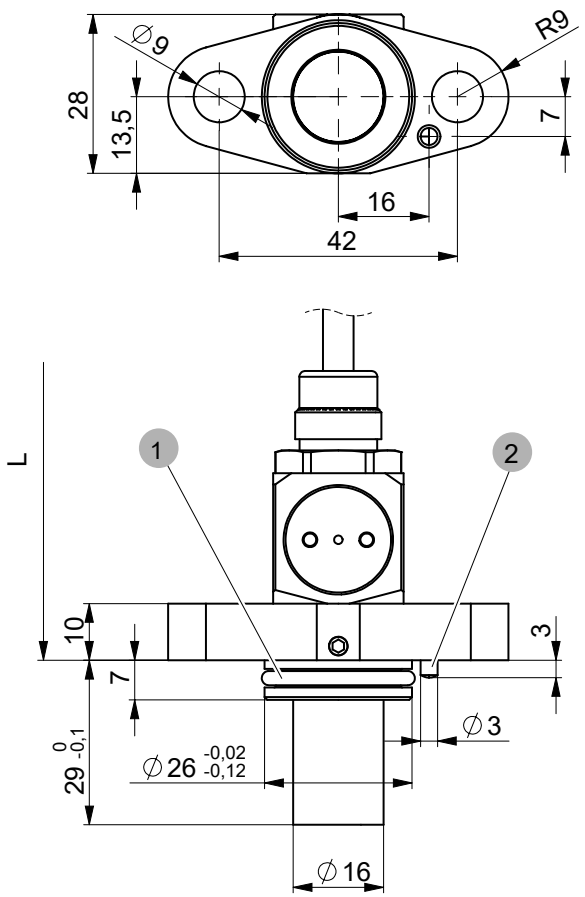
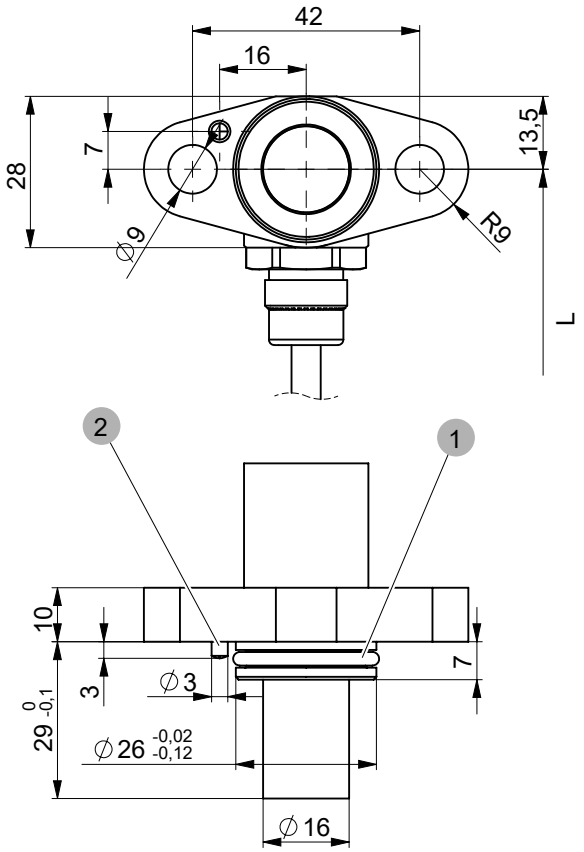
Pin Assignment

Observe the EMC notes in the accompanying documents.

Flying lead				
Signal	**E**	**S**	**V**	**X**
Channel 1	YE	YE	YE	YE
Channel 2		WH	WH	WH
Channel 1 inverted				BK
Channel 2 inverted				BN
GND (0 V)	BU	BU	BU	BU
$+U_B$	RD	RD	RD	RD
Cables / Shields	1 / 1	1 / 1	1 / 1	1 / 1

Cable shield directly attached to the sensor or capacitively attached.
Wire color codes: **BK** black, **BN** brown, **BU** blue, **GY** gray, **PK** pink, **RD** red, **WH** white, **YE** yellow

Mechanical Properties

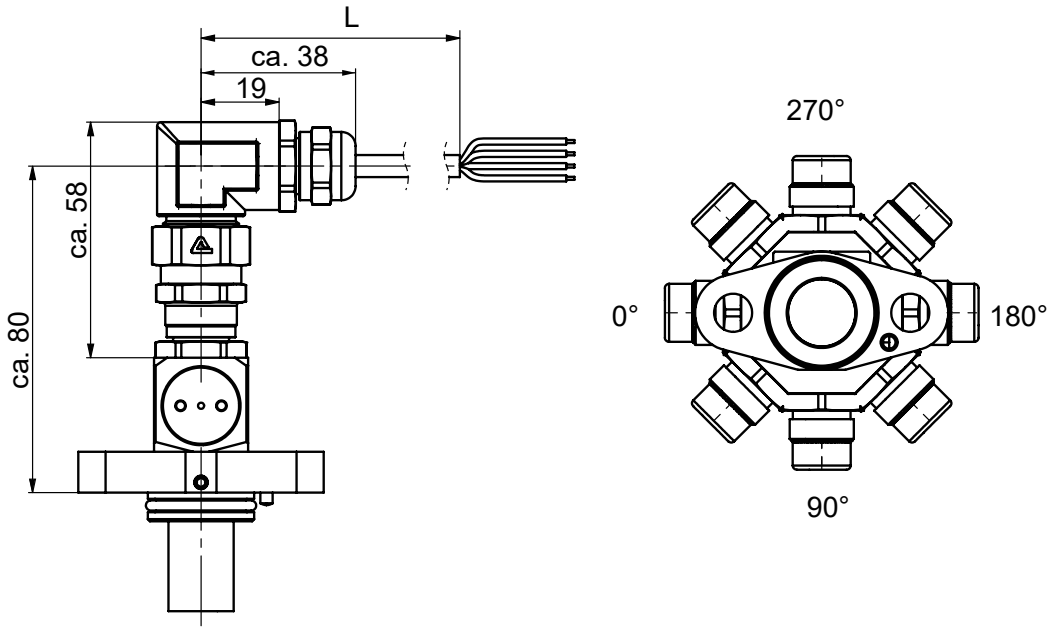
Cable Outlet	
All dimensions in mm; general tolerance per DIN ISO 2768 mK	
Straight cable outlet Option **S**	**Side cable outlet** Option **L**
Additionally, the straight cable outlet can be connected at an angle: *„**Straight Cable Exit with Angle**“, page 8*	Additionally, the side cable outlet can be connected using an angle: *„**Side cable outlet with angle**“, page 8*
	

1	Sealing ring: O-ring 21 x 2.5 mm; NBR
2	Index pin
L	Cable length L is determined by the Type Code (Tolerance depends on the assembled cable length)

Straight Cable Exit with Angle

Straight cable outlet with angle – When option **S** is selected for the cable outlet (see Type Code)

The selection can be made in 45° increments: 000°; 045°; 090°; 135°; 180°; 225°; 270°; 315° (tolerance ± 10°) (see Type Code).

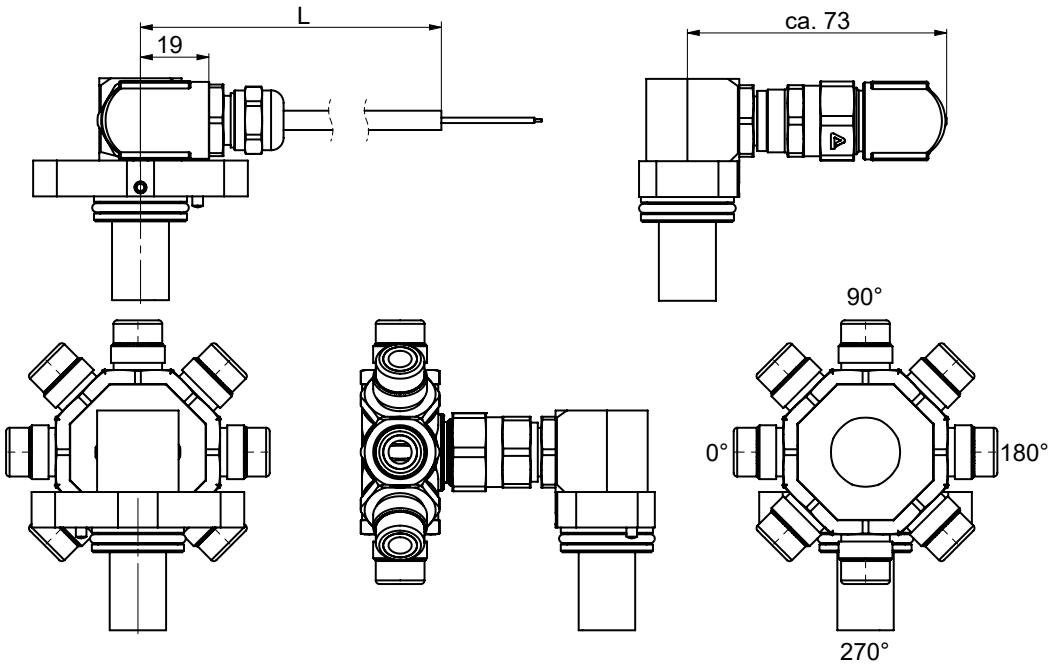


Cable length **L** is determined by the Type Code
(tolerance depends on the assembled cable length)

Side cable outlet with angle

Side cable outlet with angle – When selecting option **L** for the cable outlet (see Type Code)

The selection can be made in 45° increments: 000°; 045°; 090°; 135°; 180°; 225°; 270°; 315° (tolerance ± 10°) (see Type Code).



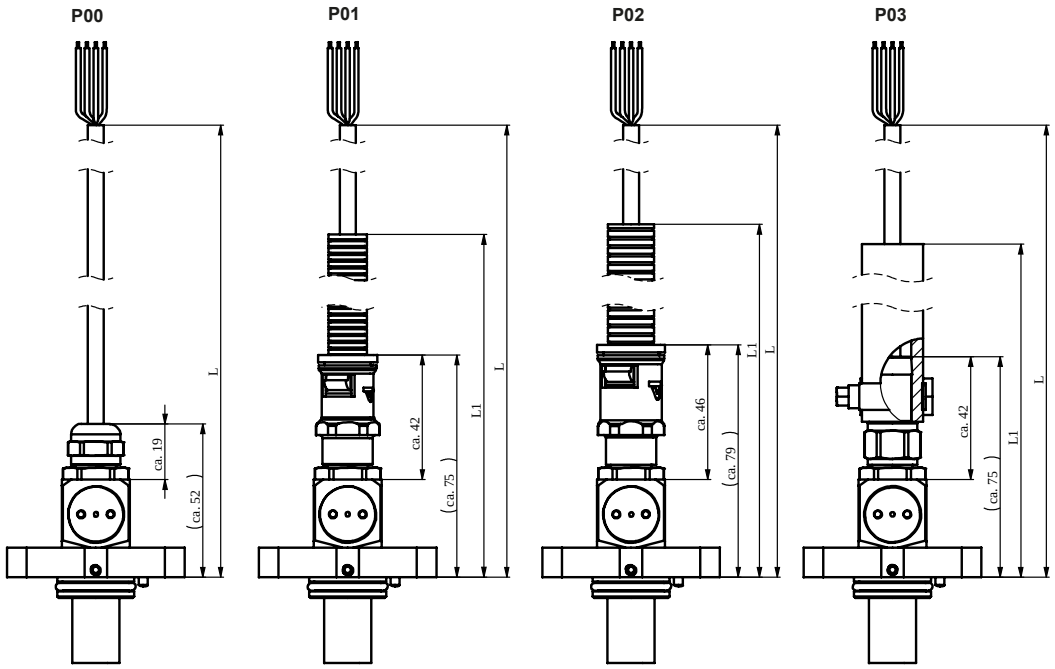
Cable length **L** is determined by the Type Code
(tolerance depends on the assembled cable length)

Cable Protection at the Cable Exit	
Depending on requirements, the Speed Sensor can be equipped with various types of cable protection at the cable outlet.	
▪ Dimensional drawings for straight cable outlet: *„**Straight cable outlet**“, page 9* ▪ Dimensional drawings for side cable outlet: *„**Side Cable Exit**“, page 10*	
Selection **P00**	Without cable protection
Option **P01**	Corrugated tube NW10
Option **P02**	Corrugated tube NW12
Option **P03**	Hydraulic hose DN12

Technical Data for Cable Protection			
Option	**P01**	**P02**	**P03**
Type	Corrugated tube NW10	Corrugated tube NW12	Hydraulic hose DN12
Material (Specifications available upon request)	Polyamide, halogen-free	Polyamide, halogen-free	Rubber compound
Outer diameter	13.0 mm	15.8 mm	19.5 ± 0.5 mm
Minimum bending radius	25 mm (static) 60 mm (dynamic)	35 mm (static) 80 mm (dynamic)	70 mm

Straight cable outlet

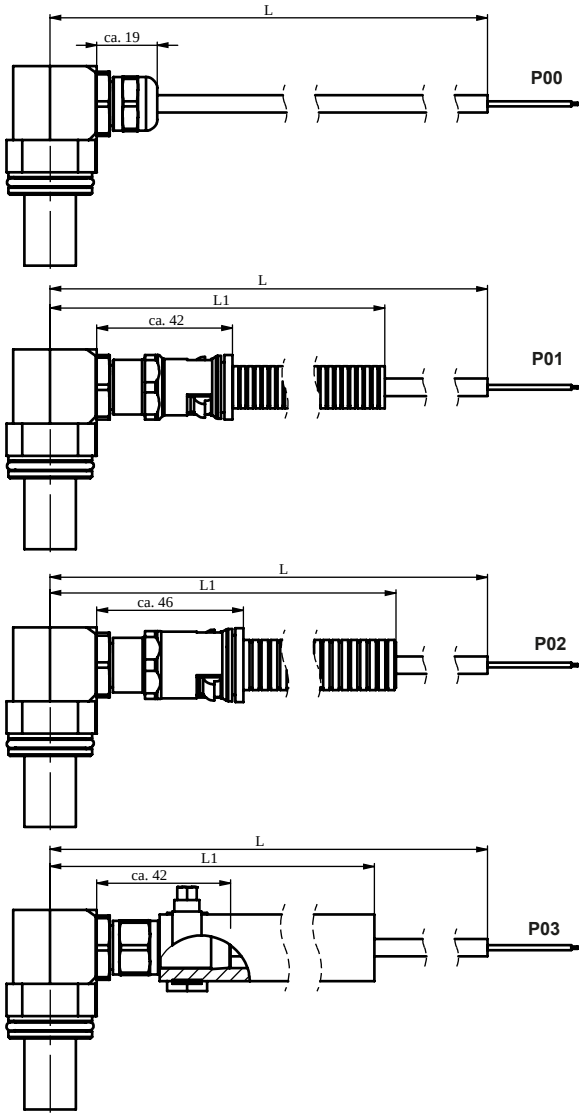
Cable protection for straight cable outlet—when option **S** is selected for the cable outlet (see Type Code)



P00	Without cable protection
P01	Corrugated tube NW10
P02	Corrugated tube NW12
P03	Hydraulic hose DN12
L	Cable length **L** is determined by the Type Code (Tolerance depends on the assembled cable length)
L1	Protective hose length L1; depending on the cable connection and assembly, the protective hose length L1 corresponds to the cable length L minus 100 mm

Side Cable Exit

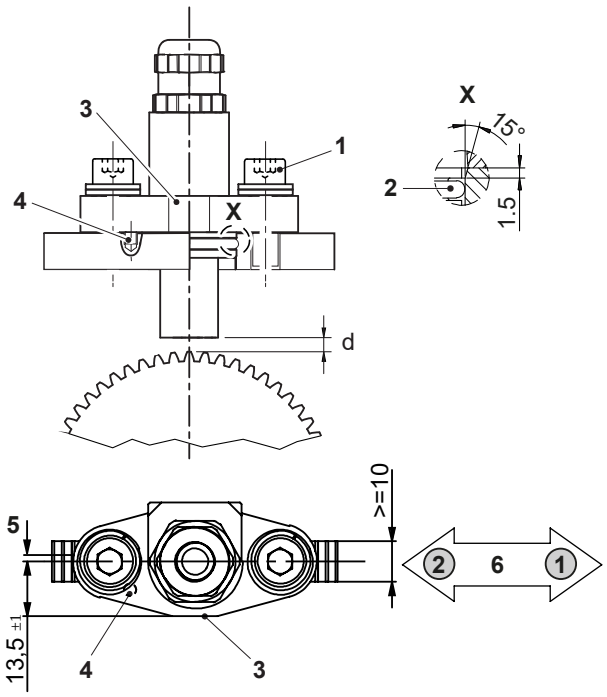
Cable protection for side cable outlet—when option **L** is selected for the cable outlet (see Type Code)



P00	Without cable protection
P01	Corrugated tube NW10
P02	Corrugated tube NW12
P03	Hydraulic hose DN12
L	Cable length **L** is determined by the Type Code (Tolerance depends on the assembled cable length)
L1	Protective hose length L1; depending on the cable connection and assembly, the protective hose length L1 corresponds to the cable length L minus 100 mm

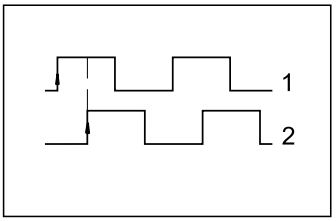
Installation Drawing

All dimensions in mm, general tolerance DIN ISO 2768 mK

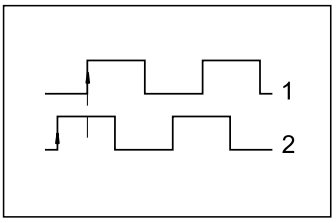


X Entry chamfer
d Air gap (see air gap table)
1 Hex socket screw (recommended: M8 x 20, EN ISO 4762)
2 Sealing ring: O-ring 21 x 2.5 mm; NBR
3 Reference surface
4 Index pin
5 Axial offset
6 Direction of rotation of the Target wheel

Signal for direction of rotation 1



Signal for direction of rotation 2



Other mounting orientations (such as rotated by 45°) are available upon request.

The reference surface (3) or the index pin (4) are used to determine the direction of rotation.

Index pin

- If the Target wheel rotates from the index pin toward the center of the sensor, this is **rotation direction 1**.
- If the Target wheel rotates from the center of the sensor toward the index pin, this is **rotation direction 2**.

Reference surface

- If the Target wheel rotates clockwise when viewed from the reference surface, this is **rotation direction 1**.
- If the Target wheel rotates counterclockwise relative to the reference surface, this is **rotation direction 2**.

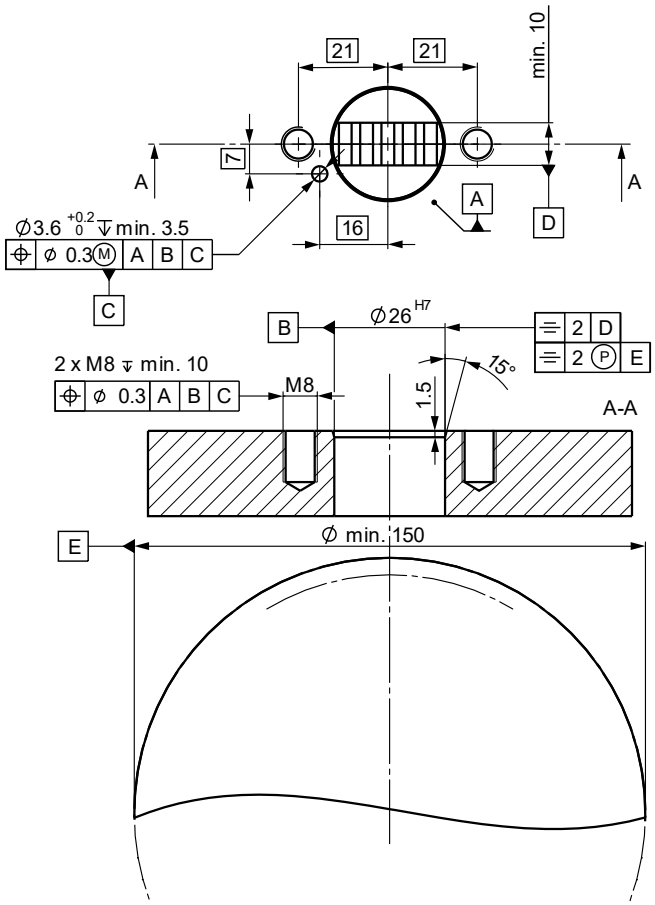
Air Gap Table

Module	Permissible air gap	Nominal air gap	Max. permissible runout
2.00 Steel	0.1 … 1.3 mm	0.7 mm	± 0.3 mm
2.00 Aluminum	0.5 … 1.1 mm	0.8 mm	

(*) Air gap for module 2.25 / 2.50 / 2.75 / 3.00 t.b.d.

Drilling Pattern

All dimensions in mm; general tolerance per DIN ISO 2768 mK



Type Code GEL 2471

2471	Product Type								
	Application								
	RA	Rail Vehicle Industry							
	MA	Maritime Applications							
	IA	Industrial Applications							
		Signal Pattern							
		E-	1-Channel Square Wave Signal						
		V-	2-Channel Square-Wave Signals with 90° phase offset						
		X-	2-channel square-wave signals with a 90° phase offset and their inverse channels						
		S-	1-channel square-wave signal with direction signal						
			Shield contact						
			SD	directly attached					
			SC	capacitively attached					
				Module					
				M05	m = 2.00, steel, involute	**M27**	m = 2.00, aluminum, involute		
				M06	m = 2.25, steel, involute	**M28**	m = 2.25, aluminum, involute		
				M07	m = 2.50, steel, involute	**M29**	m = 2.50, aluminum, involute		
				M08	m = 2.75, steel, involute	**M30**	m = 2.75, aluminum, involute		
				M09	m = 3.00, steel, involute	**M31**	m = 3.00, aluminum, involute		
				M16	m = 2.00, steel, rectangular	**M38**	m = 2.00, aluminum, rectangular		
				M17	m = 2.25, steel, rectangular	**M39**	m = 2.25, aluminum, rectangular		
				M18	m = 2.50, steel, rectangular	**M40**	m = 2.50, aluminum, rectangular		
				M19	m = 2.75, steel, rectangular	**M41**	m = 2.75, aluminum, rectangular		
				M20	m = 3.00, steel, rectangular	**M42**	m = 3.00, aluminum, rectangular		
					Cable outlet				
					S	Straight cable outlet			
					L	Side cable outlet			
						angle			
						0	without angle		
						1	With angle, 0 degrees	**5**	with angle, 180 degrees
						2	with angle, 45 degrees	**6**	with angle, 225 degrees
						3	with angle, 90 degrees	**7**	with angle, 270 degrees
						4	with angle, 135 degrees	**8**	with angle, 315 degrees
							Cable protection		
							P00	None	
							P01	Corrugated tube NW10	
							P02	Corrugated tube NW12	
							P03	Hydraulic hose DN12	
								Cable length L	
								L1	1000 mm
								LX	X=2: 2000 mm, X=3: 3000 mm ... X=7: 7000 mm
								L8	8000 mm
▼	▼	▼	▼	▼	▼	▼	▼	▼	
2471	__	__	__	___	_	_	___	__	◄ **Product code**

Note on coated target wheels

In principle, all target wheels made of conductive materials such as steel or aluminum can be used. However, surface coatings may affect the sensor's operation. To ensure proper operation, the sensor must be calibrated for certain coatings on the wheel. For steel gears with a coated surface, functional approval from Lenord+Bauer is required.

Accessories

ZB247XM8	2 M8 x 20 screws (EN ISO 4762) with washer and spring washer

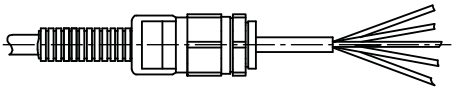
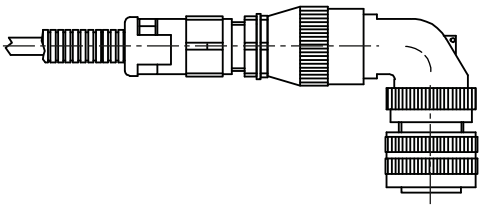
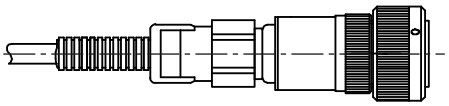
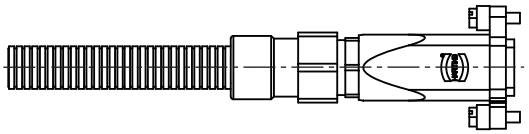
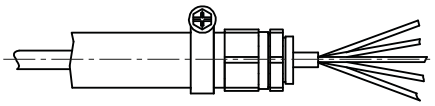
Custom Special Designs

A Y-number is assigned for customer-specific designs. Custom designs are manufactured according to drawings or application descriptions and may differ from the standard technical specifications.

Recommended Types, Examples

We can assemble the following for you upon request:

In addition to the extensive selection of cable exits and cable protection options (see Type Code), various configurations are also available for the cable end.

Examples of cable ends, preferred models	
 Corrugated tube with flying lead	 Corrugated tube with round connector, angled
 Corrugated tube with round connector	 Corrugated tube with Harting HAN HPR connector
 Rubber hose and flying lead	

If you decide to have us assemble our Speed Sensors with cable protection and connectors, we recommend using the preferred types shown here. The necessary materials have been field-tested in large quantities and are always in stock. This allows us to achieve the fastest delivery times thanks to optimal material availability and the lowest retail prices due to large purchasing volumes. If you need assistance defining your desired product, please contact our sales team atsupport@lenord.deor +49(0)208 9963-215.

Europe

Germany

Lenord, Bauer & Co. GmbH
Dohlenstrasse 32
46145 Oberhausen
Tel. +49 (0)208 9963 0
Email info@lenord.de
www.lenord.de

Italy

Lenord+Bauer Italia S.r.l.
Via Gustavo Fara, 26
20124 Milan
Tel. +39 340 1047184
Email salesitaly@lenord.com
www.lenord.com

Spain

Lenord Bauer Iberica, S.L.
Carrer de Balmes, 150, 5°
08008 Barcelona
Tel. +34 603 607 499
Email info@lenord.es
www.lenord.com

North America

USA

Lenord+Bauer USA Inc.
32000 Northwestern Highway, Suite 150,
Farmington Hills, MI 48334
Tel. +1 248 446 7003
Email orders@lenord.com
www.lenord.com

Asia

China

Lenord+Bauer Automation Technology (Shanghai) Co., Ltd.
Block 42, Room 302, No. 1000,
Jinhai Road, 201206 Shanghai
Tel. +86 21 50398270
Email Info@lenord.cn
www.lenord.cn

India

Lenord+Bauer India Private Limited
417 Golden Square Prime Serviced Office
Davanam Sarovar Portico Suites
Hosur Main Road, Bengaluru 560068
Karnataka
Tel. +919901516814
Email info@lenord.co.in
www.lenord.co.in

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