Made in Germany

www.lenord.com



Technical Information

GEL 2477

Incremental Bearingless Rotary Encoders

1-/2-Channel Speed Sensor with Pulse Multiplication

D-51T-2477 | Status 2026-07-07

LENORD +BAUER

Finding solutions.
Founding trust.

Motion sensors and integrated drive technology

General Information

- Maintenance- and wear-free Speed Sensor based on magnetoresistive sensing
- Detection of measurement elements (e.g., target wheels made of ferromagnetic materials)
- High signal frequency (up to 200 kHz) achieved through 2-, 4-, or 8-fold pulse multiplication
- Most reliable rotation direction detection through evaluation of two channels
- Robust and compact stainless steel housing for use in harsh and confined applications



Features

- 1- or 2-channel incremental Speed Sensor based on the magnetoresistive principle
- Highest signal quality with pulse multiplication for precise evaluation in control systems
- 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 7

Advantages

- Optimized lifecycle cost
- Maintenance-free and wear-free
- Reduced torque ripple in drives
- Higher energy efficiency due to high control quality
- Easy integration
- Wide range of configuration options
- Compact and robust construction type
- Easy to install
- 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 Overspeed)

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

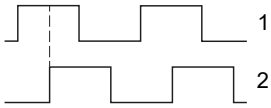
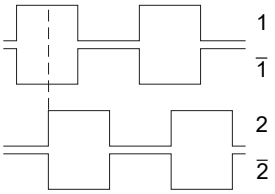
Crane Systems:
- Hoist and Traverse Control

Technical Data

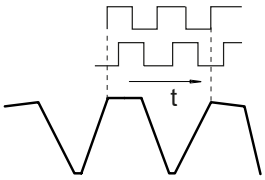
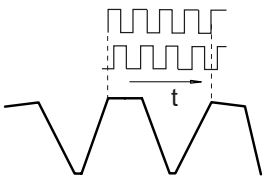
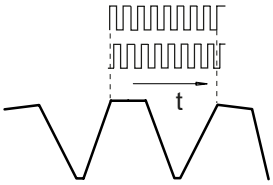
Pulse Multiplication	Factor 02	Factor 04	Factor 08
Electrical Data			
Supply voltage U_B (reverse-polarity protected)	10 ... 30 V DC		
Current consumption per channel I_B (no load)	≤ 50 mA		
Output signal (short-circuit-proof)	Square-wave signals		
Output signal level (High) (1)	≥ U_B - 1.5 V		
Output signal level (Low) (1)	≤ 1.0 V		
Output current per channel	≤ 20 mA		
Frequency range (output)	0 ... 50 kHz	0 ... 100 kHz	
Duty cycle	50% ± 20% (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			
Connection	Straight outlet, flying lead		
Cable length	≤ 100 m		
Note on shielding	Cable shield directly attached to the sensor or optionally capacitively attached		
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 7*			
Requirements for the target wheel			
Material	ferromagnetic steel		
Tooth Profile	Involute teeth per DIN 867 Rectangular teeth, typically 1:1 (other ratios available upon request)		
Width	≥ 10 mm (smaller widths available upon request)		
Module m	1.00 / 2.00	1.00	
Air gap	typ. 0.7 mm (0.4 ... 1.0 mm)		

(1) Depends on output current and temperature
(2) Depends on the target wheel and air gap

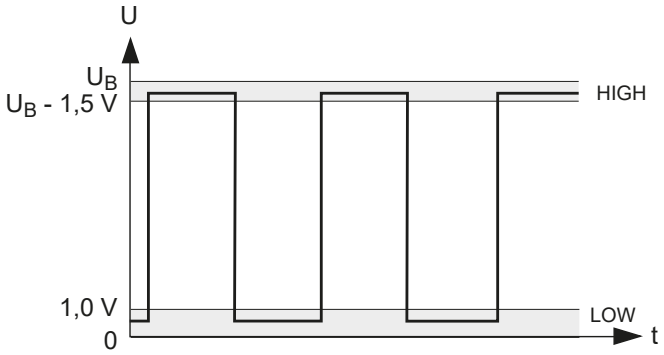
Output Signals

Signal Pattern			
Output signals		**Supply voltage**	**Pulse diagram**
E-	1 channel	10 ... 30 V DC	
V-	2 channels, 90° phase offset	10 ... 30 V DC	
X-	2 channels, 90° phase offset, with inverted channels (only for Module 1.00)	10 ... 30 V DC	

Output signals with pulse multiplication

Factor 02	Factor 04	Factor 08
		

Output signal level – voltage output



Voltage Output - Connection

Standard cable		
Signal Pattern	**E, V,**	**X-**
Cable	halogen-free and Shielded (specifications available upon request)	
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	16 mm (static) 27 mm (dynamic)	20 mm (static) 33 mm (dynamic)

Pin Assignment

Follow the EMC instructions in the accompanying documents.

Flying lead			
Signal	**E-**	**V-**	**X-**
Channel 1	YE	YE	YE
Channel 2		WH	WH
Channel 1 inverted			BK
Channel 2 inverted			BN
GND (0 V)	BU	BU	BU
$+U_B$	RD	RD	RD
Cables / Shields	1 / 1	1 / 1	1 / 1
Cable shield directly attached to the sensor or, optionally, capacitively attached. Wire color codes: **BK** black, **BN** brown, **BU** blue, **GY** gray, **PK** pink, **RD** red, **WH** white, **YE** yellow			

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.

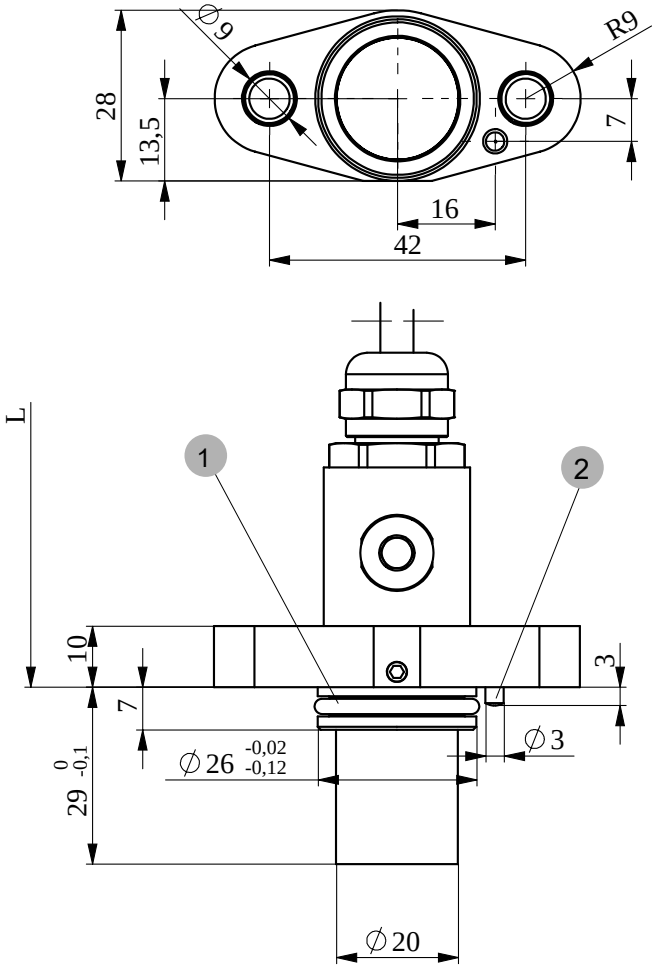
If you have additional requirements regarding standards and approvals, please feel free to contact us.

	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

Mechanical Properties

Cable outlet
Straight cable outlet Option **S** (see Type Code)
Additionally, the straight cable outlet can be connected at an angle: *„**Straight cable exit**“, page 9*



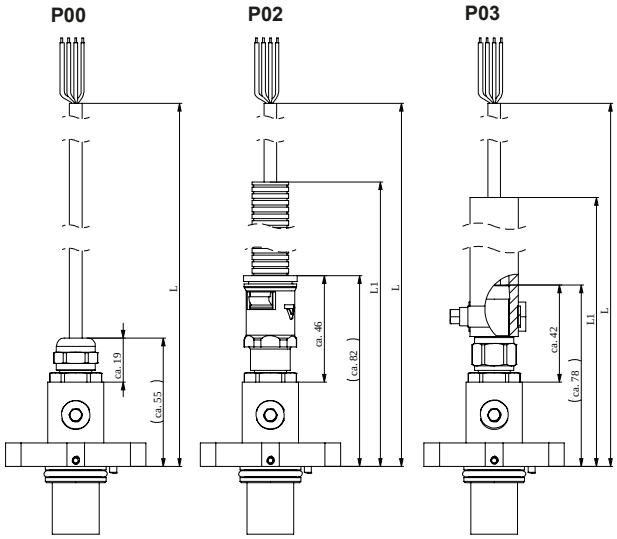
1	Sealing ring: O-ring 21 x 2.5 mm; NBR
2	Index pin
L	Cable length **L** is determined by the Type Code (Tolerance depends on the assembled cable length)

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.	
Selection **P00**	No cable protection
Option **P02**	Corrugated tube NW12
Option **P03**	Hydraulic hose DN12

Technical Data for Cable Protection		
Option	**P02**	**P03**
Type	Corrugated tube NW12	Hydraulic hose DN12
Material	Polyamide, halogen-free	Rubber compound
Outer diameter	15.8 mm	19.5 ± 0.5 mm
Minimum bend radius	35 mm (static) 80 mm (dynamic)	70 mm

Straight cable exit

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

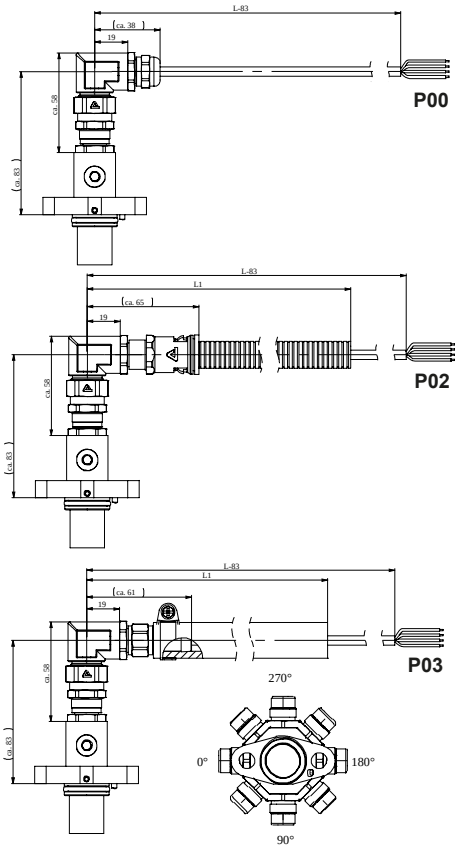


P00	Without cable protection
P02	Corrugated tube NW12
P03	Hydraulic hose DN12
L	Cable length **L** is determined by the Type Code (Tolerance depends on the assembled cable length)
L1	Protective hose length L1; depending on the cable connection and assembly, the protective hose length L1 corresponds to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

Straight Cable Exit with Angle

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

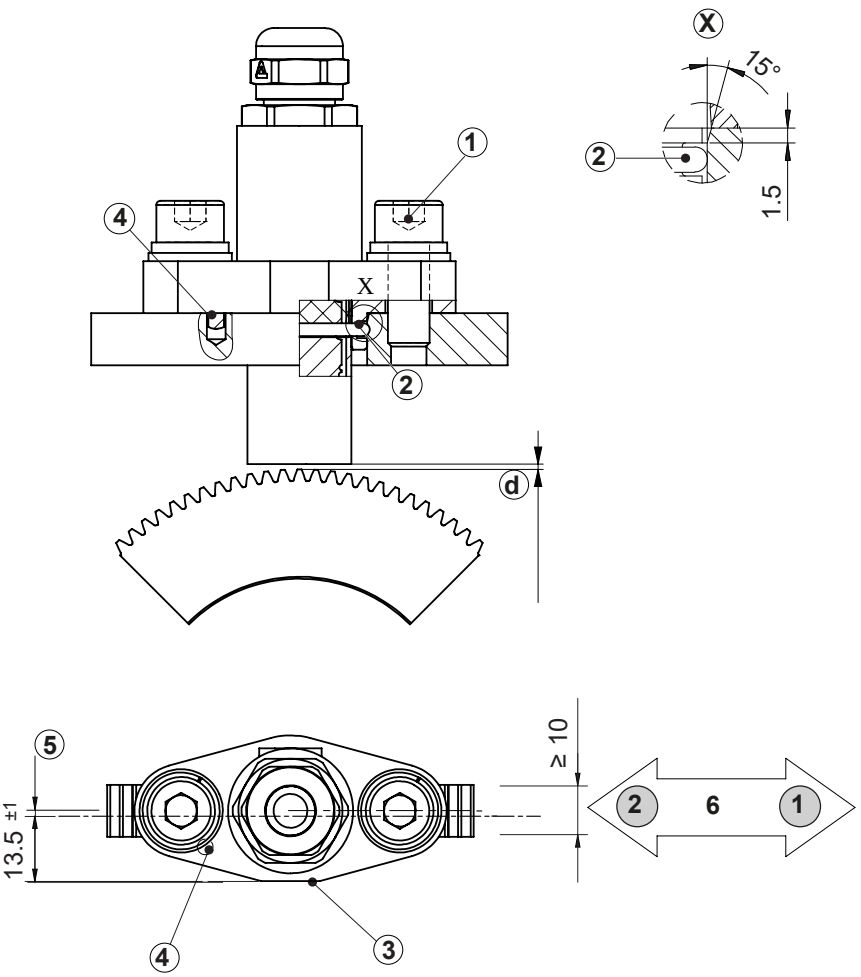
The selection can be made in 45° increments: 000°; 045°; 090°; 135°; 180°; 225°; 270°; 315° (tolerance ± 10°) (see Type Code).



P00	Without cable protection
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 - 100 mm

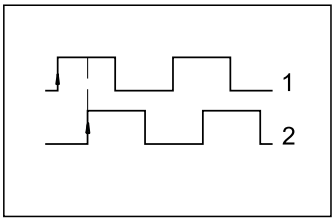
Installation Drawing

All dimensions in mm; general tolerance DIN ISO 2768 mK

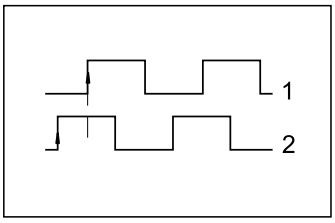


X Entry chamfer
d Air gap
typ. 0.7 mm (0.4 ... 1.0 mm)
1 Hex socket screw (recommended: M8 x 20, EN ISO 4762)
2 O-ring seal
3 Reference surface
4 Index pin
5 Axial offset
6 Direction of rotation of the Target wheel

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 sensor center toward the index pin, this is **rotation direction 2**.

Reference surface

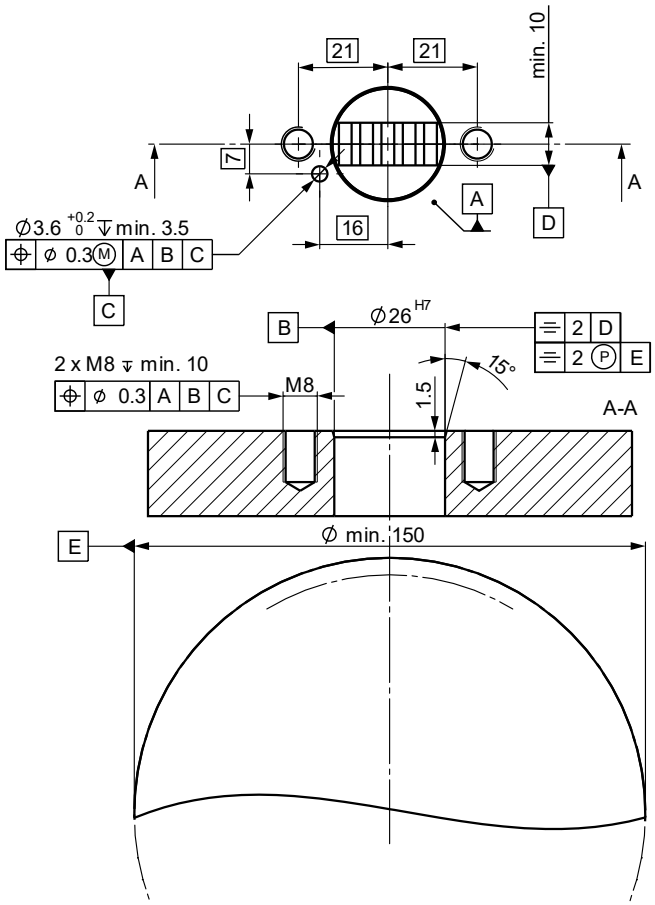
- If the Target wheel rotates clockwise when viewed from the reference surface, this is **rotation direction 1**.
- If the Target wheel rotates counterclockwise when viewed from the reference surface, this is **rotation direction 2**.

Despite its high immunity to interference, the sensor must be integrated into a shielding concept to ensure EMC immunity.

Follow the EMC guidelines in the accompanying documentation.

Drilling Pattern

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



Type Code GEL 2477

2477	**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 signals							
			Factor							
			02	Multiplication factor 2						
			04	Multiplication factor 4						
			08	Multiplication factor 8						
				Screen support						
				SD	directly attached					
				SC	capacitively attached					
				SI	isolated from the housing (1)					
					Module		**Module**			
					M01	m = 1.00, steel, involute	**M12**	m = 1.00, steel, rectangular		
					M05	m = 2.00, steel, involute	**M16**	m = 2.00, steel, rectangular		
						Cable outlet				
						S	Straight cable outlet			
							angle			
							0	without angle		
							1	With angle, 0 degrees		
							2	with angle, 45 degrees		
							3	with angle, 90 degrees		
							4	with angle, 135 degrees		
							5	with angle, 180 degrees		
							6	with angle, 225 degrees		
							7	with angle, 270 degrees		
							8	with angle, 315 degrees		
								Cable protection		
								P00	None	
								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	8,000 mm
▼	▼	▼	▼	▼	▼	▼	▼	▼	▼	
2477	__	__	__	__	___	_	_	___	__	**◄ Product code**

(1) Not available for all Signal Patterns

Accessories

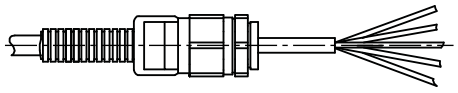
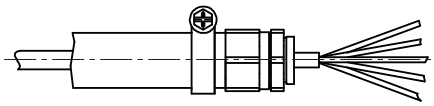
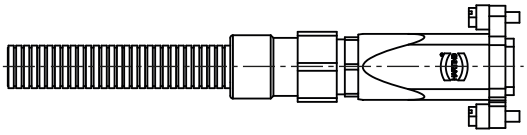
ZB247XM8	2 M8 x 20 screws (EN ISO 4762) with washer and spring washer

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.

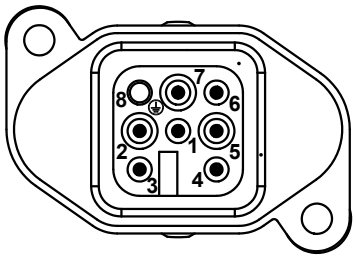
Examples of Preferred Types

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 and flying lead	 Rubber hose and flying lead
 Corrugated tube with Harting HAN HPR connector	

Pin assignment for Harting HAN HPR connector, preferred type

Pin assignment	PIN	E-	V-	X-
	1	$+U_{B1}$	$+U_{B1}$	$+U_{B1}$
	2	GND1	GND1	GND1
	3	Channel 1	Channel 1	Channel 1
	4	-	Channel 2	Channel 2
	5	-	-	Channel 1 inverted
	6	-	-	Channel 2 inverted
	7	-	-	-
	8	Shield	Shield	Shield

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.

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