Made in Germany

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Technical Information

GEL 2475CM

CombiCODER

with speed, vibration and temperature measurement

D-51T-2475CM | Date of issue 2025-12-09

LENORD +BAUER

Finding solutions.
Founding trust.

Motion sensors and integrated drive technology

General

Description

The **CombiCODER**is an advanced sensor that has been specially developed for Condition Monitoring applications in railway vehicles. The speed sensor combines several important functions in a compact housing that resembles that of a conventional speed sensor.

Besides the proven speed signals already familiar from the GEL 2475 series, the **CombiCODER**GEL 2475CM offers additional measuring options. The installation site can remain the same. However, acceleration signals are also recorded in three axes and the temperature is measured. This significantly increases the efficiency and reliability of Condition Monitoring without any additional effort.

Features

- Vibration measurement up to 2.4 kHz in 3 axes with analog signal output
- Electrically isolated speed signals for supply of anti-skid protection, traction monitoring, Automatic Train Protection, etc. without feedback
- In accordance with a range of standards and requirements for a variety of applications:
see "Technical data - Environmental test", page 7

Sensor combinatorics with analog interface

- Speed measurement by magnetic scanning
- Vibration measurement by MEMS device in 3 axes
- Temperature monitoring by Pt-1000

Advantages

- Output signals insensitive to electromagnetic interference fields
- Cable break monitoring via voltage output with standstill voltage
- Easy to install due to large measuring distance

Do you have special requirements regarding flange shape, shaft length, number of channels, cable protection, cable outlet, connector assembly or EMC concept? Talk to us. Our experts can design the optimal solution for your application from an extensive modular system and will be pleased to advise you how to customize your solution in the most cost-efficient way.

Write to support@lenord.de or call +49 208 9963-215.

Fields of application

Railroad technology

- Speed, vibration, and temperature analysis on traction motors and gear units
- Condition monitoring of bogies for early detection of bearing damage
- Collection of operating data for predictive maintenance

Maritime applications

- Speed, vibration, and temperature analysis on marine engines and generators
- Condition monitoring of engines, gear units and turbochargers
- Early detection of mechanical deviations for maintenance optimization

Commercial vehicles

- Speed, vibration, and temperature analysis on motors and gear units
- Condition monitoring of axles and drive trains
- Early detection of wear to reduce downtimes

Industrial applications

- Speed, vibration, and temperature analysis on pumps, compressors, and fans
- Condition monitoring of rotating machines for process reliability
- Detection of imbalances and bearing wear for preventive maintenance planning

Power generation

- Speed, vibration, and temperature analysis on turbines and generators
- Condition monitoring to prevent unplanned downtimes
- Detection of thermal and mechanical anomalies to increase efficiency

Chemical and process industry

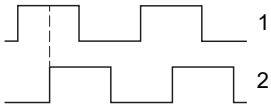
- Speed, vibration, and temperature analysis on pumps, agitators, and compressors
- Condition monitoring to ensure stable process conditions
- Predictive maintenance to minimize production downtimes

Technical data

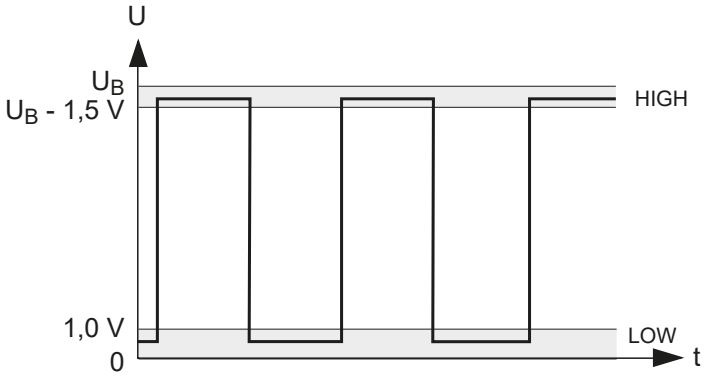
Signal pattern	E-	V-	EM	VM
Electrical data				
Supply voltage U_B(reverse polarity protected)	10 to 30 V DC		10 to 20 V DC	
Current consumption I_B(without load)	≤ 30 mA		≤ 12 mA per channel	
Output signal (short-circuit-proof)	Square-wave signals			
Output signal level High(1)	≥ U_B- 1.5 V		≥ U_B- 1.8 V	
Output signal level Low(1)	≤ 1.0 V		≤ 1.5 V	
Output current per channel	≤ 20 mA		≤ 10 mA	
Frequency range	0 to 20 kHz		0 to 8 kHz	
Duty cycle	50 % ± 20 %(2)			
Phase offset	–	typ. 90°	–	typ. 90°
Electrical data VIB signal				
Supply voltage U_B(reverse polarity protected)	10 to 30 V DC			
Technical data MEMS device	*"Technical data MEMS device"*			
Electrical data Pt1000 temperature sensor				
Measuring current	1 mA			
Measuring range	-50 °C to +130 °C			
Measurement tolerance	Accuracy class B(3)			
Mechanical data				
Sensor tube material	Stainless steel			
Flange material	Stainless steel			
Sensor weight (incl. 2 m cable)	500 g			
Environmental tests				
The speed sensor complies with a range of standards and requirements for a variety of applications: *see "Technical data - Environmental test", page 7*				

(1) depending on output current and temperature
(2) applies to operation with nominal air gap and toothing as per DIN 867
(3) applies only to the sensor element

Output signals and connection

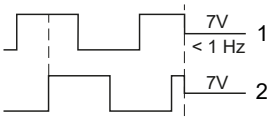
Signal pattern for voltage output (E-, V-)			
Output signals		**Supply voltage**	**Pulse diagram**
E-	1-channel square-wave signal	10 to 30 V DC	
V-	2-channel square-wave signals with 90° phase offset	10 to 30 V DC	

Output signal level – voltage output (E-, V-)

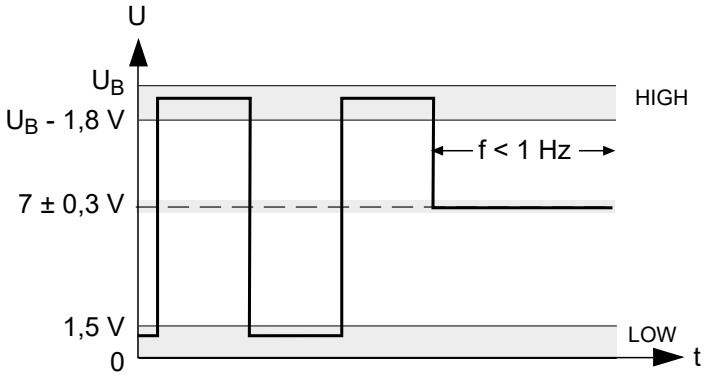


Assignment – voltage output (E-, V-)		
Cable 1 Signal	**E-**	**V-**
Rotational speed channel 1	YE	YE
Rotational speed channel 2	-	WH
GND (0 V)	BU	BU
$+U_B$	RD	RD
PT+	BN	BN
PT-	BK	BK
Cable 2 Signal	**E-**	**V-**
VIB x axis	YE	YE
VIB y axis	WH	WH
VIB z axis	BK	BK
VIB GND (0 V)	BU	BU
VIB $+U_B$	RD	RD
Cables/Screens	1/1	1/1
Cable screen is connected directly or, as an option, capacitively in the sensor Core identifier: **BK** black **BN** brown **BU** blue **GY** gray **PK** pink **RD** red **WH** white **YE** yellow		

Output signals and connection

Signal pattern with standstill voltage (EM, VM)			
Output signals		**Supply voltage**	**Pulse diagram**
EM	1-channel square-wave signal and standstill voltage	10 to 20 V DC	
VM	2-channel square-wave signals with 90° phase and standstill voltage	10 to 20 V DC	

Output signal level – voltage output (EM, VM)



Assignment – voltage output (EM, VM)		
Cable 1 Signal	**EM**	**VM**
Rotational speed channel 1	YE	YE
Rotational speed channel 2	-	WH
GND (0 V)	BU	BU
$+U_B$	RD	RD
PT+	BN	BN
PT-	BK	BK
Cable 2 Signal	**EM**	**VM**
VIB x axis	YE	YE
VIB y axis	WH	WH
VIB z axis	BK	BK
VIB GND (0 V)	BU	BU
VIB $+U_B$	RD	RD
Cables/Screens	1/1	1/1
Cable screen is connected directly or, as an option, capacitively in the sensor Core identifier: **BK** black **BN** brown **BU** blue **GY** gray **PK** pink **RD** red **WH** white **YE** yellow		

Technical data - Environmental test

Speed sensors fromLenord+Bauerare designed for many different areas of application. During the design and manufacture of the sensors, attention is always paid to reliability and compatibility with a range of standards, and continuous testing is performed.

As a result of continuous development and optimization of sensors in a range of applications,Lenord+Bauerhas extensive experience in this field.

Only the minimum standards for all sensors are listed below.
If you have any further requirements regarding standards and approvals, please feel free to contact us.

	Rail vehicle industry	Maritime applications	Industrial applications
Working and operating temperature	-40 °C to +120 °C		
Storage temperature	-40 °C to +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 measuring side(1)	IP68		
MTTF value	2,000,000 at 55 °C		

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

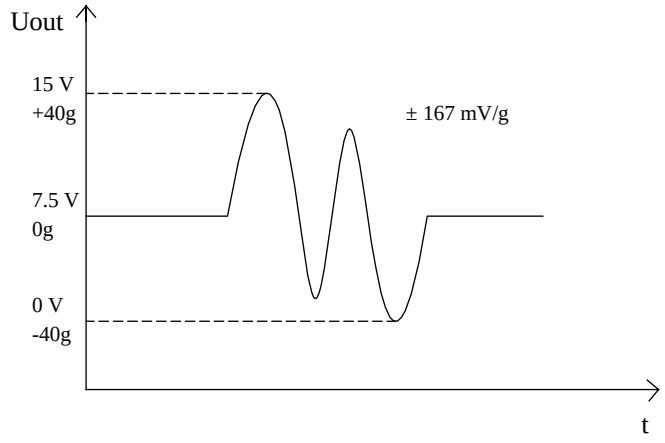
Vibration sensor (MEMS device)

Technical data MEMS device

MEMS device	
Acceleration range	±40 g
Total bandwidth	2.4 kHz
Resonant frequency	5.5 kHz
Non-linearity	1.3% FSR
Measuring sensitivity	167 mV/g

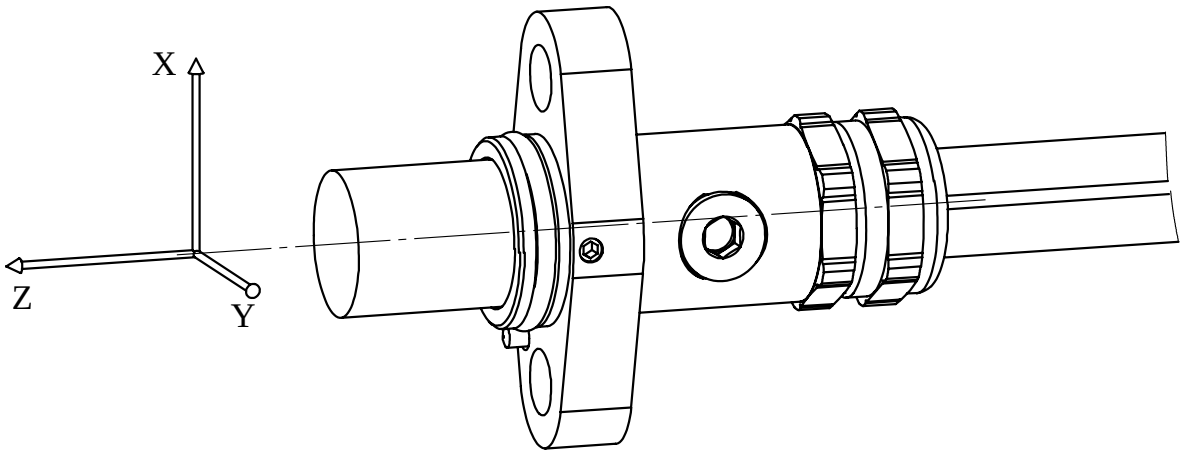
Functionality of MEMS device

A MEMS device is installed in the sensor for vibration and acceleration measurement.
The MEMS devices consist of tiny, comb-shaped fingers made of silicon that interlock. In the event of a sudden change in pulse or movement, the combs are pushed against each other. This changes the distance between the fingers, which has an effect on the electrical voltage. This change can be measured and converted into an electrical signal that is transmitted by the sensor.



Reference system for installation

The directional axes of the measured vibrations depend on the installation position of the sensor and are defined as follows:



Mechanical properties

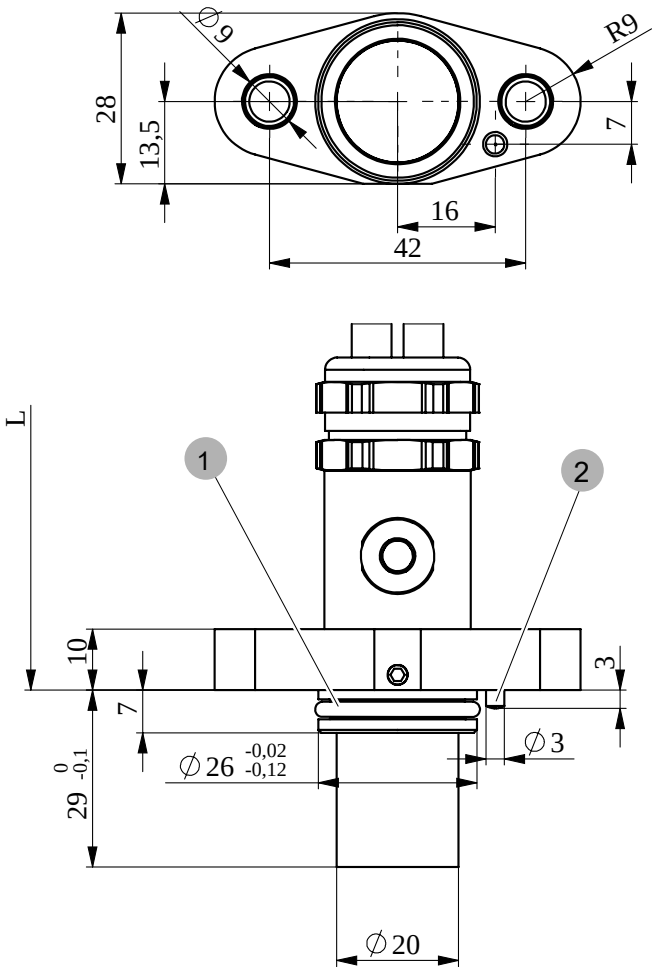
Target wheel	
Requirements for the target wheel	
Material	Ferromagnetic steel
Tooth form	▪ Involute gear teeth in accordance with DIN 867 (see type code) ▪ Square gear teeth (see type code)
Width	≥ 15 mm (smaller upon request)
Module m	The standard module size is 2.00. Others upon request.
Air gap (nominal air gap)	0.2 to 1.5 mm (0.7 mm)

Screening concept	
Screen connection selection (see type code, others available on request)	**Screen connection at encoder housing**
Option **S1**	Both cables connected directly
Option **S2**	Cable 1 (speed) connected capacitively Cable 2 (VIB) connected directly
Despite the high electromagnetic immunity, integration into a screening concept is required for the sensor to ensure EMC stability.	
Should the electromagnetic environment require special screening concepts, Lenord+Bauer offers support based on extensive knowledge and experience in integrating the sensor into the screening concept of the application.	
Observe EMC notes in the relevant documents.	

Cable outlet

Cable outlet straight
Option **S** (see type code)

The straight cable outlet can also be connected via an angle:
"Cable outlet straight with angle"



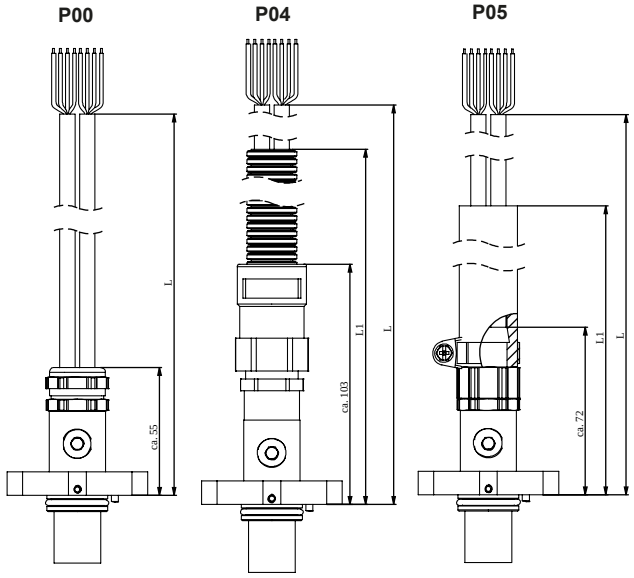
1	Sealing ring: O-ring 21 x 2.5 mm; NBR
2	Index pin
L	Cable length **L** is determined by type code (Tolerance depends on the preassembled cable length)

Cable protection at cable outlet	
The GEL 2475CM can be equipped with different types of cable protection at the cable outlet as required.	
Selection **P00**	Without cable protection
Selection **P04**	Flexible conduit NW17
Selection **P05**	Hydraulic hose DN16

Technical data for cable protection			
Option	**P00**	**P04**	**P05**
Type	2 cables: 6 × 0.5 mm²	Flexible conduit NW17	Hydraulic hose DN16
Material	Halogen-free (specification upon request)	Polyamid, halogen-free	Rubber compound
Outside diameter	6.5 ± 0.3 mm	21.1 mm	24.9 mm
Minimum bending radius	20 mm (static) 33 mm (dynamic)	35 mm (static) 85 mm (dynamic)	90 mm

Cable outlet straight

Cable protection cable outlet straight - If option **S** is selected for cable outlet (see type code)

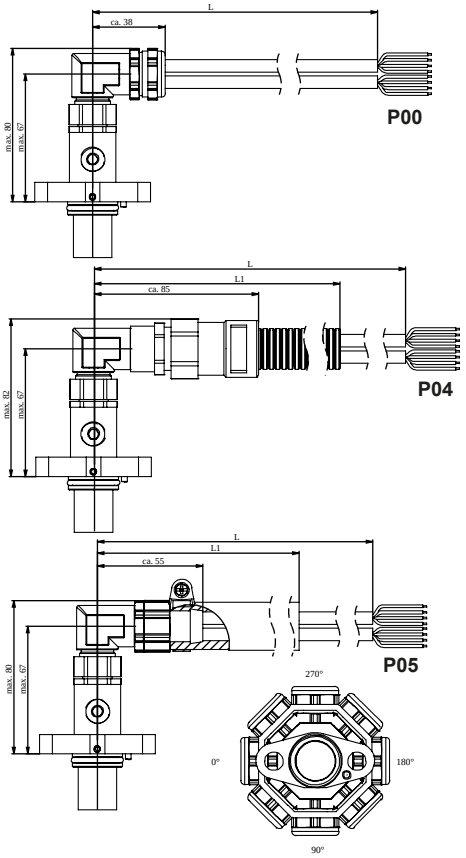


P00	Without cable protection
P04	Flexible conduit NW17
P05	Hydraulic hose DN16
L	Cable length **L** is determined by type code (Tolerance depends on the preassembled cable length)
L1	Protective sleeve length L1; depending on the cable connection and assembly, the protective sleeve length L1 corresponds to thecable length L - 100 mm

Cable outlet straight with angle

Cable outlet straight with angle - If option **S** is selected for cable outlet (see type code)

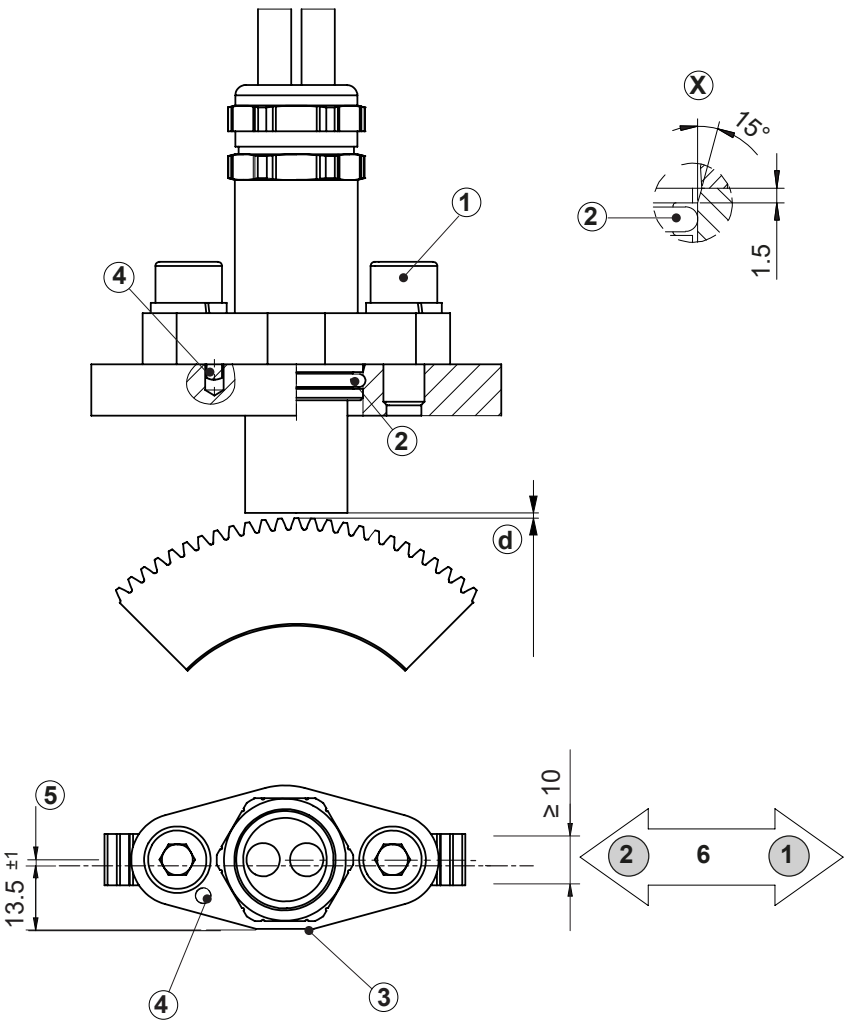
The selection can be made in 45° increments 000°; 045°; 090°; 135°; 180°; 225°; 270°; 315° (Tolerance ± 10°) (see type code).



P00	Without cable protection
P04	Flexible conduit NW17
P05	Hydraulic hose DN16
L	Cable length **L** is determined by type code (Tolerance depends on the preassembled cable length)
L1	Protective sleeve length L1; depending on the cable connection and assembly, the protective sleeve length L1 corresponds to thecable length L - 100 mm

Assembly drawing

All dimensions in mm, general tolerance DIN ISO 2768 mK

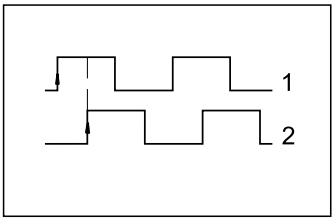


X Insertion chamfer

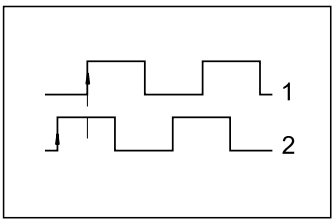
d Air gap: 0.2 to 1.5 mm
Nominal air gap: max. 0.7 mm
Permissible radial runout: ± 0.3 mm

1 Fastening screw (recommended: M8 x 20 DI-N EN ISO 4762)
2 Sealing ring
3 Reference surface
4 Index pin
5 Axial offset
6 Direction of rotation of target wheel

Signal for direction of rotation 1



Signal for direction of rotation 2



During installation, the reference system must be observed for vibration measurement.
"Vibration sensor (MEMS device)", page 8

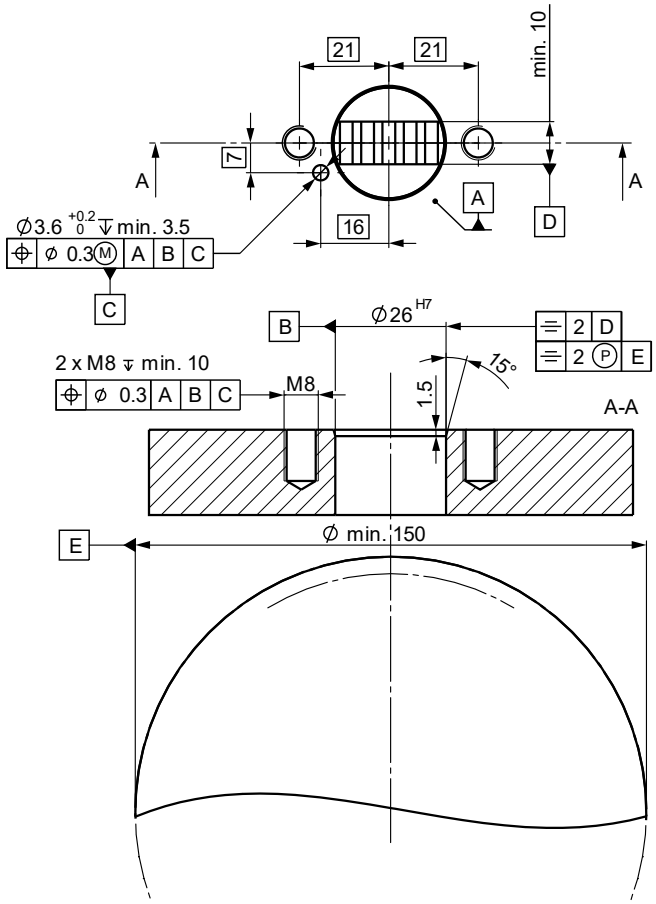
The direction of rotation is determined by the reference surface (3) or the index pin (4).

Index pin
- If the target wheel rotates from the index pin to the center of the sensor, this is **Direction of rotation 1**.
- If the target wheel rotates from the center of the sensor to the index pin, this is **Direction of rotation 2**.

Reference surface
- If the target wheel rotates clockwise with view to the reference surface, this is **Direction of rotation 1**.
- If the target wheel rotates counterclockwise with view to the reference surface, this is **Direction of rotation 2**.

Hole pattern

All dimensions in mm, general tolerance DIN ISO 2768 mK



During installation, the reference system must be observed for vibration measurement.
"Vibration sensor (MEMS device)"

Type code GEL 2475CM

2475CM	Product type						
	Signal pattern						
	E- 1-channel square-wave signals						
	V- 2-channel square-wave signals with 90° phase offset						
	EM 1-channel square-wave signal and standstill voltage						
	VM 2-channel square-wave signals with 90° phase and standstill voltage						
		Screen connection(1)					
		S1 Both cables connected directly					
		S2 Cable 1 (speed) connected capacitively Cable 2 (VIB) connected directly					
			Module(2)				
			M05 m = 2.00, steel, involute				
			M16 m = 2.00, steel, rectangular				
				Cable outlet			
				S Cable outlet straight			
					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 without	
						P04 Flexible conduit NW17	
						P05 Hydraulic hose DN16	
							Cable length L
							L2 2000 mm
							L3 3000 mm
							L4 4000 mm
▼	▼	▼	▼	▼	▼	▼	▼
2475CM	__	__	___	_	_	___	__

◀Product code

(1)Other screen connections upon request

(2)Other modules upon request

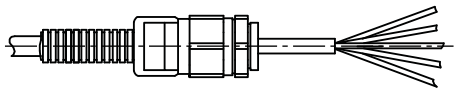
A Y-number is assigned for a customer-specific version. A special version is manufactured according to drawing or application description and may deviate from the standard technical specifications.

Preferred types, examples

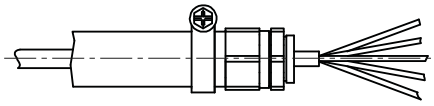
We can manufacture according to your specifications:

In addition to the extensive selection options for the cable outlet and cable protection (see type code), various configurations are also available for the flying lead.

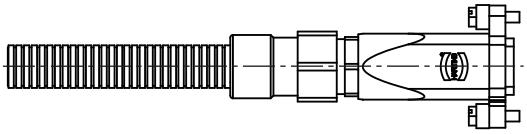
Examples for the flying lead, preferred types



Flexible conduit and flying lead

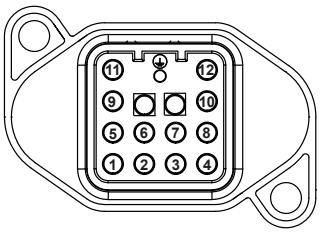


Rubber sleeve and flying lead



Flexible conduit with Harting connector HAN HPR

Assignment Harting connector HAN HPR, preferred type



PIN	E-	V-	EM	VM
1	VIB x axis	VIB x axis	VIB x axis	VIB x axis
2	VIB $+U_B$	VIB $+U_B$	VIB $+U_B$	VIB $+U_B$
3	GND (0 V)	GND (0 V)	GND (0 V)	GND (0 V)
4	Rotational speed channel 1	Rotational speed channel 1	Rotational speed channel 1	Rotational speed channel 1
5	VIB z axis	VIB z axis	VIB z axis	VIB z axis
6	VIB y axis	VIB y axis	VIB y axis	VIB y axis
7	-	Rotational speed channel 2	-	Rotational speed channel 2
8	$+U_B$	$+U_B$	$+U_B$	$+U_B$
9	VIB GND (0 V)	VIB GND (0 V)	VIB GND (0 V)	VIB GND (0 V)
10	PT+	PT+	PT+	PT+
11				
12	PT-	PT-	PT-	PT-

If you decide to have our speed sensors assembled with cable protection and connectors, we recommend using the preferred types shown in the figure. The required materials are field-tested in large quantities and are always in stock. This guarantees the fastest delivery times with the best material availability and the lowest prices due to large purchasing volumes. If you need help in finding the product you need, please contact our internal sales team at support@lenord.de or call +49 208 9963-215.

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