

CombiCODER

with speed, vibration and temperature measurement

GEL 2475CM

Technical information

Version 2024-11-05

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 DIN EN 50155:2022-06

Sensor combinatorics with analog interface

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

Advantages

- Current output signals insensitive to electro-magnetic interference fields
- Cable break monitoring via current output or voltage output with standstill voltage
- Easy to install due to large measuring distance

Field of application

- Rail vehicle industry
 - Traction monitoring, Anti-slip protection, Motor speed, Wheel slide protection, Automatic Train Protection, Odometry
- Condition monitoring in rail vehicles
 - Detection of vibrations in up to 3 axes with 2.4 kHz bandwidth

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.



Right to technical changes and errors reserved.

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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⁾	$\geq U_B - 1.5$ V		$\geq U_B - 1.8$ V	
Output signal level Low ⁽¹⁾	≤ 1.0 V		≤ 1.5 V	
Output current per channel	≤ 20 mA		≤ 10 mA	
Frequency range	0 kHz to 20 kHz		0 kHz to 8 kHz	
Duty cycle	50 % \pm 10 % ⁽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	(see Page 5)			
Electrical data Pt1000 temperature sensor				
Measuring current	1 mA			
Measuring range	-50 °C to +130 °C			
Measurement tolerance	Accuracy class B			
Mechanical data				
Sensor tube material	Stainless steel			
Flange material	Stainless steel			
Sensor weight (incl. 2 m cable)	approx. 500 g			
Environmental testing				
Working and operating temperature	-40 °C to +120 °C			
Storage temperature	-40 °C to +120 °C			
Dielectric strength	500 V AC/750 V DC (DIN EN 50155:2022-06)			
Electromagnetic compatibility ⁽³⁾	DIN EN 50121-3-2:2017-11; DIN EN 50121-3-2/A1:2020-11			
Degree of protection on measuring side ⁽⁴⁾	IP 68			
Vibration resistance	DIN EN 61373:2011-04 cat. 3			
Shock resistance	DIN EN 61373-2011-04 cat. 3			
MTTF value	2,000,000 h at 55 °C			

(1) depending on output current and temperature


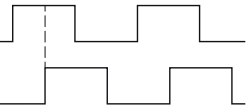
(2) applies to operation with nominal air gap and toothing as per DIN 867

(3) Observe EMC notes in the mounting/operating instructions

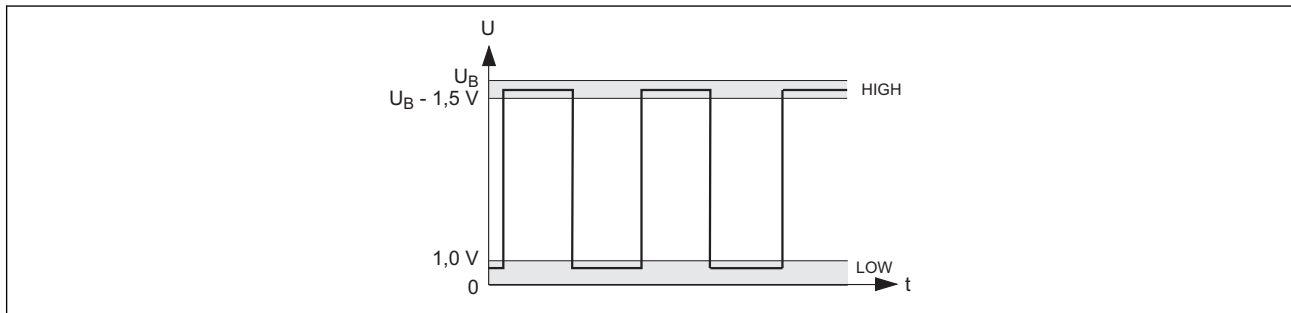
(4) Degree of protection on the cable outlet side depends on cable gland or cable protection

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-)



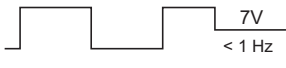
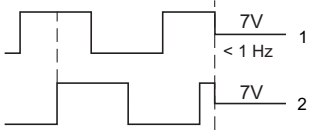
Assignment – voltage output (E-, V-)

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
Cables/Screens	1/1	1/1
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

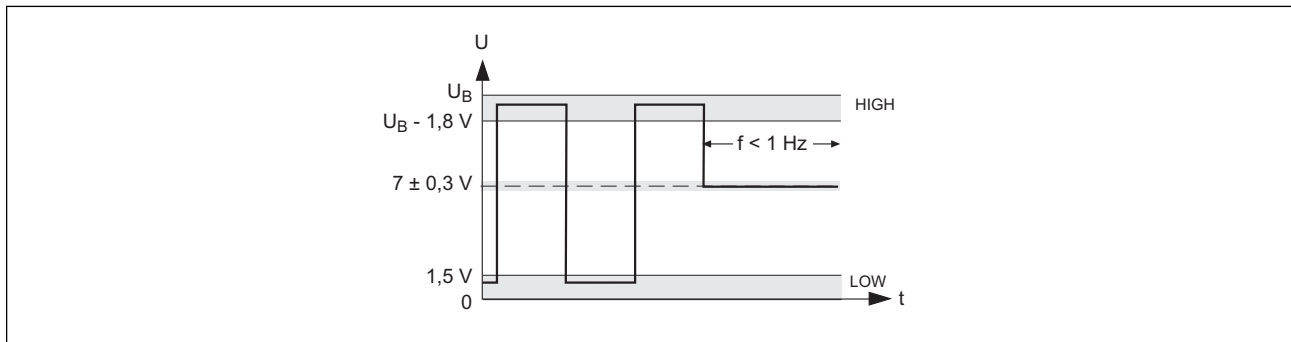
Cable screen is connected directly or, as an option, capacitively in the sensor (see type code, others upon request)
 Core identifier: **BK** black, **BN** brown, **BU** blue, **GY** gray, **PK** pink, **RD** red, **WH** white, **YE** yellow

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
Cables/Screens	1/1	1/1
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 (see type code, others upon request)
 Core identifier: **BK** black, **BN** brown, **BU** blue, **GY** gray, **PK** pink, **RD** red, **WH** white, **YE** yellow

Vibration sensor (MEMS device)

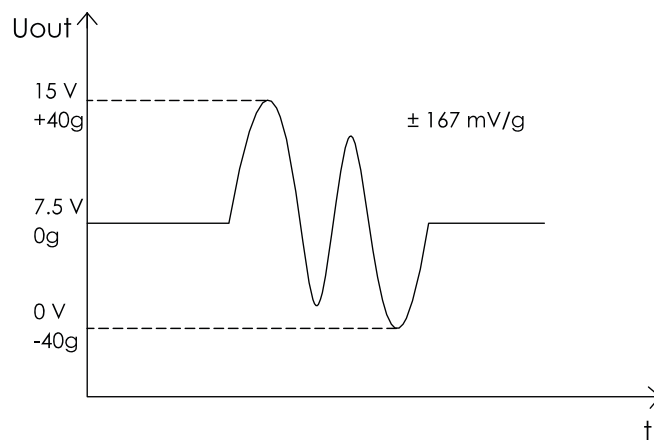
Technical data

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

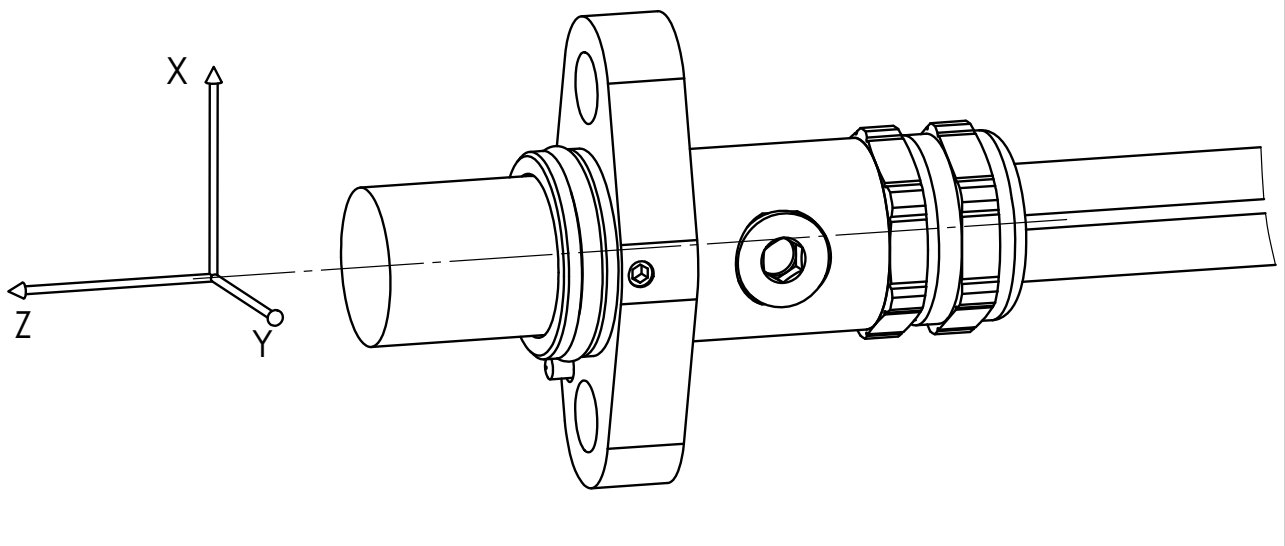
A MEMS device is installed in the sensor for vibration and acceleration measurement.

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	<ul style="list-style-type: none"> ▪ 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

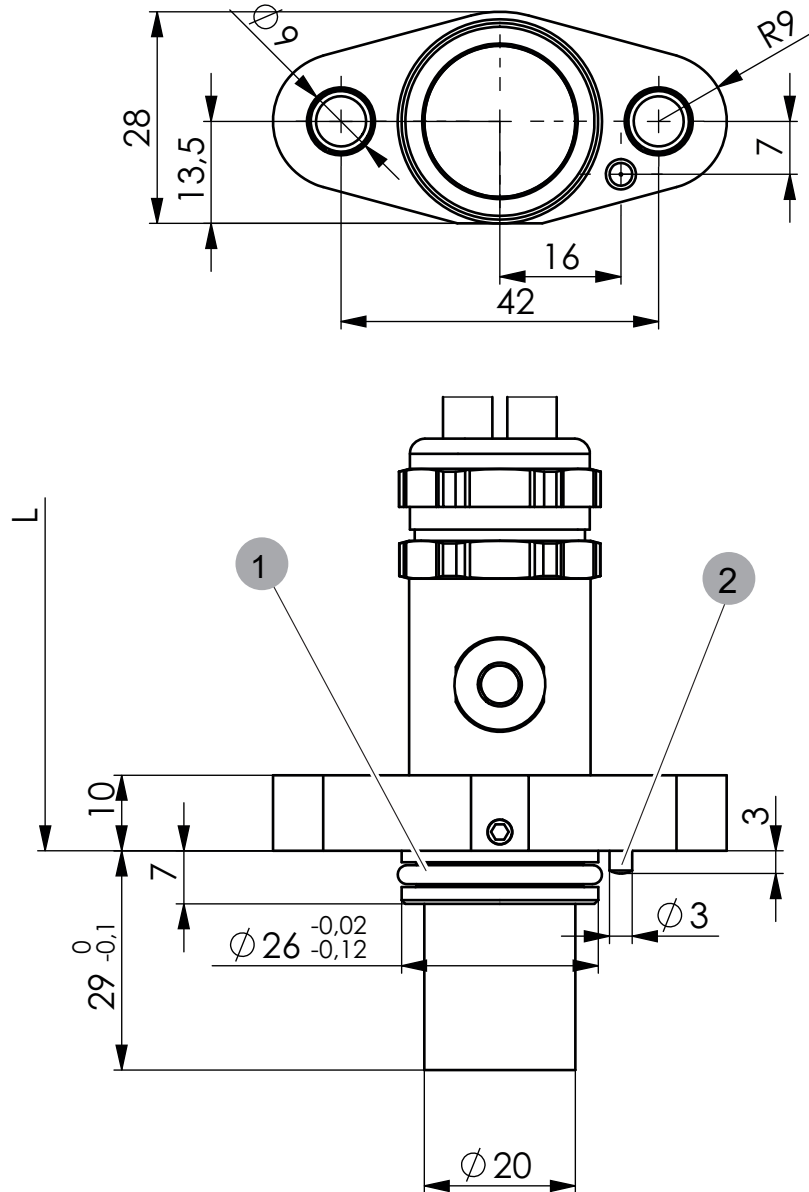
Selection of screen connection (see type code, others available on request)	Screen connection at encoder housing
Option S1	Both cables connected directly
Option S2	Cable 1 (speed) connected capacitively Cable 2 (VIB) connected directly
Despite the high electromagnetic immunity, integration into a screening concept is required for the sensor to ensure EMC stability.	
i 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.	
i Observe EMC notes in the relevant documents.	

Mechanical properties

Cable outlet

Cable outlet straight
Option S (see type code)

The straight cable outlet can also be connected via an angle: → [page 9](#)



- 1 Sealing ring: O-ring 21 x 2.5 mm; NBR
- 2 Index pin

L Cable length $L^{(1)}$ depending on type code (see type code)

⁽¹⁾ Tolerance ± 50 mm

Mechanical properties

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: $6 \times 0.5 \text{ mm}^2$	Flexible conduit NW17	Hydraulic hose DN16
Material	halogen-free ⁽¹⁾	Polyamid, halogen-free	Rubber compound
Outside diameter	$6.5 \pm 0.3 \text{ mm}$	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 straight cable outlet – If option S is selected for cable outlet (see type code)	
<p>P00 Without cable protection P04 Flexible conduit NW17 P05 Hydraulic hose DN16</p> <p>L Cable length $L^{(2)}$ depending on type code (see type code) L1 Protective sleeve length $L1$; depending on the cable connection and assembly, the protective sleeve length $L1$ corresponds to the cable length $L - 100 \text{ mm}$</p>	

(1) Specification upon request

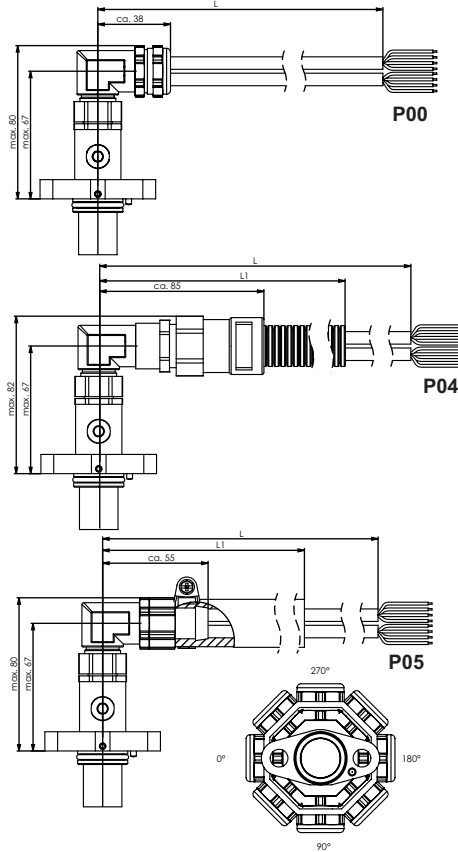
(2) Tolerance $\pm 50 \text{ mm}$

Mechanical properties

- Cable outlet straight with angle

Straight cable outlet 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°)⁽¹⁾ (see type code).



P00 Without cable protection

P04 Flexible conduit NW17

P05 Hydraulic hose DN16

L Cable length L⁽²⁾ depending on type code (see type code)

L1 Protective sleeve length L1;

depending on the cable connection and assembly, the protective sleeve length L1 corresponds to the cable length L - 100 mm

⁽¹⁾ Tolerance ± 10°

⁽²⁾ Tolerance ± 50 mm

Mechanical properties

Assembly drawing

X Insertion chamfer

d Air gap: 0.2 to 1.5 mm
Nominal air gap: 0.7 mm
Maximum permissible radial runout: ± 0.3 mm

1 Fastening screw (recommended: M8 x 20, DIN 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

i During installation, the reference system must be observed for vibration measurement. → [page 5](#)

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

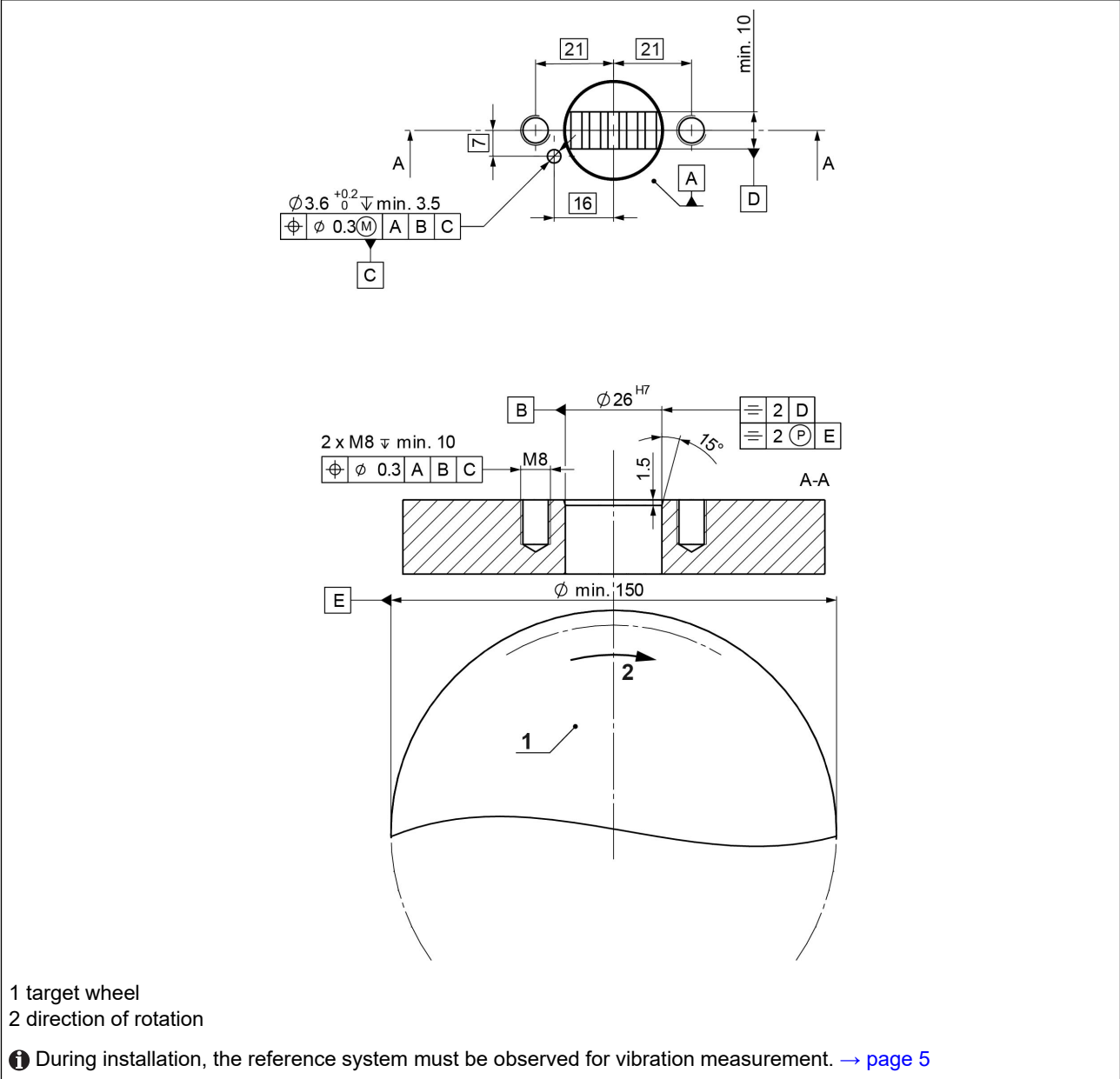
Index pin

- 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



Type code GEL 2475CM

Type code GEL 2475CM

2475CM	Signal pattern		
	E-	1-channel square-wave signal	
	V-	2-channel square-wave signals with 90° phase offset	
	EM	1-channel square-wave signals 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 m⁽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		

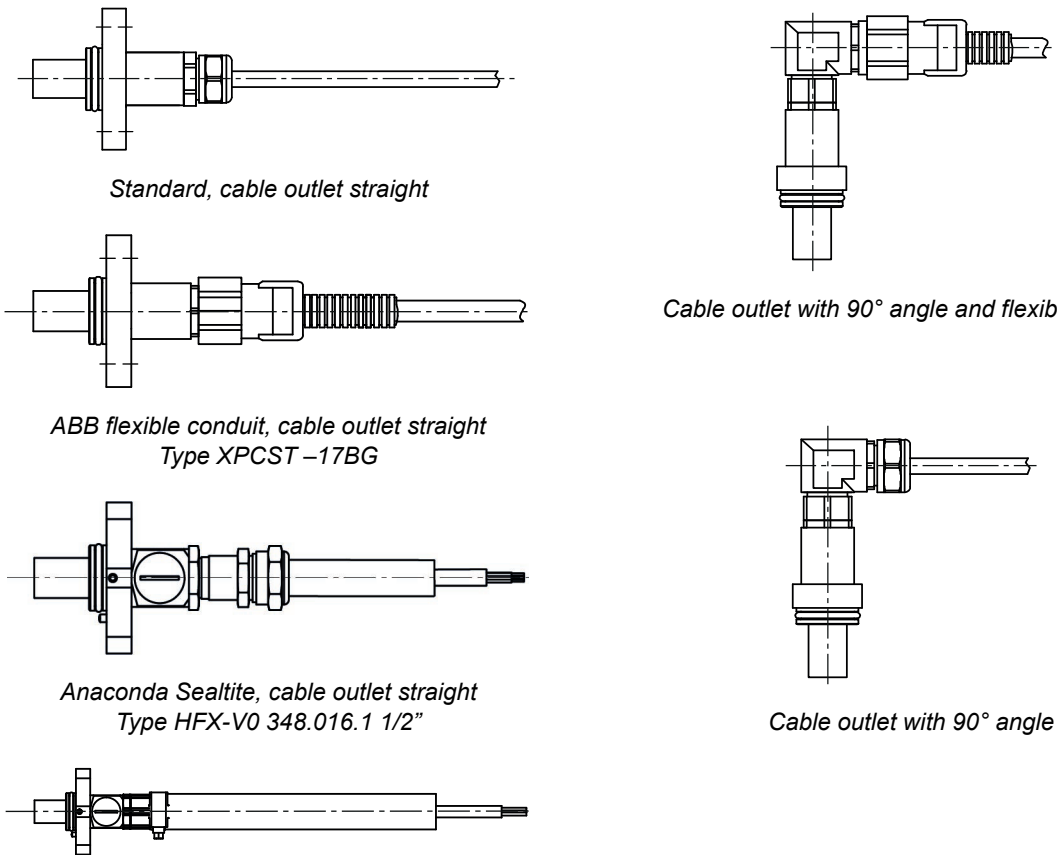
Note: A Y-number is assigned for a customer-specific special version. A special design GEL 2475CMYxxx is manufactured according to drawing or application description.

(1) Other screen connections upon request

(2) Other modules upon request

We can manufacture according to your specifications:

Examples for the sensor side, preferred types



Standard, cable outlet straight

ABB flexible conduit, cable outlet straight
Type XPCST-17BG

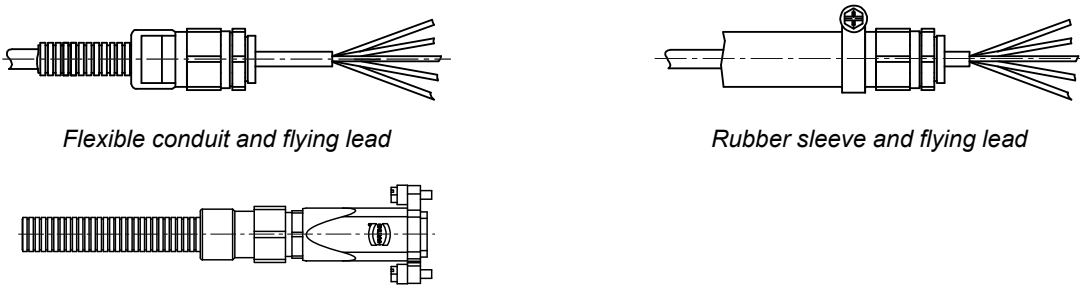
Anaconda Sealite, cable outlet straight
Type HFX-V0 348.016.1 1/2"

Hansaflex protective sleeve, straight cable outlet
TE 216 Rail

Cable outlet with 90° angle and flexible conduit

Cable outlet with 90° angle

Examples for the flying lead, preferred types



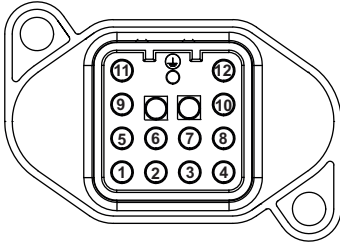
Flexible conduit and flying lead

Rubber sleeve and flying lead

Flexible conduit with Harting connector HAN HPR

Examples

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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